Towards sustainable volume housing:
A tale of three builders

A thesis submitted in fulfilment for
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“As building workers you have a legitimate concern with the types of building that you construct. Your working experience allows you to identify safe and unsafe dwellings, desirable and undesirable buildings, good and bad environments. Construction workers need to consider the social implications of buildings. Rather than seeing a building project as just so many jobs, you have to ask who gains and who loses; construction jobs at any price is too high a price to pay. I am asking you to consider the social consequences of your labour. Construction workers have a duty and a right to be concerned with the types of city they are building. You and your families have to live in the cities you build.”

- Extracted from an address to building workers by US academic John Short (Short, 1989, p. 140).
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“The core requisites for qualitative analysis seem to be a little creativity, systematic
doggedness, some good conceptual sensibilities, and cognitive flexibility – the capacity
to rapidly undo your way of construing or transforming the data and to try another, more
promising tack. (Those, and a little help from your friends...)

- Miles & Huberman, 1994, p. 309

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Prologue

What is research but a blind date with knowledge?
- Will Harvey

The research presented in this thesis arguably originated in a hardware shop. It began with me, as a twenty-something year old renovating a house early in the new millennium, trying to do so with consideration of environmental sustainability. Standing in the store aisles, trying to make decisions about which timber had been harvested sustainably or which paint stripper was least toxic but still effective, I realised that even with the benefit of a four year environmental engineering degree, and several years of work experience in environmental management, that this was still extremely difficult.

I reasoned that if it was difficult for me, it would be far more challenging for others with limited environmental awareness or interest. Subsequent informal investigation revealed that while many sectors of industry had already steadily improved their environmental performance (with regards to compliance at least, if not full-blown ‘sustainability’), there was still considerable potential to improve the sustainability performance of the construction industry.

Further, I came to understand just how significant the potential sustainability gains could be, given the magnitude of environmental and social problems created by the construction industry (Organisation for Economic Co-operation and Development, 2003). These impacts stem from the construction, operation and refurbishment of buildings, as well as the wider infrastructure supporting it such as transport, drainage and services (Palmer et al., 2006), and are far-reaching and long-lasting. Because buildings typically have long lives compared to most other products and the cost of modification after construction is high compared with getting it right during the process, it is particularly important to ensure that they are designed to have minimal adverse environmental or social impacts throughout their life cycle, from design and construction through to operation and eventual demolition (Wilson and Smith, 2006).

The built environment, through its construction and operation, has the dubious distinction of consuming as a percentage of total annual global consumption, 40 per cent of energy, 25 per cent of virgin wood and 16 per cent of total water withdrawals (Roodman and Lenssen, 1995). Construction and demolition also produces up to 40 per cent of all solid

Social impacts include adverse effects on occupant health, with terms such as ‘sick building syndrome’ becoming commonplace. Indoor air pollutants include volatile organic compounds (VOCs) emitted from building materials, paint and varnishes, furnishings and carpets; as well as nitrogen dioxide, emitted from unflued gas heaters; and dust mite allergens (Brown, 1998). The US Environmental Protection Agency (2005) claims that levels of air pollutants in indoor air may be two to five times higher than outdoor air, and given that people spend more than 90 per cent of their time indoors, considers indoor air pollution to be one of the top five environmental risks to public health. In Australia, the national research organisation CSIRO estimated that poor air quality in houses, offices, factories and other buildings costs the nation up to $12 billion annually, due to ill-health and lost production. It claimed the cost is closer to $170 billion annually in the United States (Brown, 1998).

Birkeland (2008, p.3) makes the disturbing claim that “...[p]oor urban design and architecture kills more people each year than terrorism”. She notes that in two weeks of extreme heat in Europe a few years ago, up to 35,000 deaths resulted from the ‘urban heat island effect’, whereby cities are several degrees hotter than their surrounds. She also claims that more people died on one day during this event than were killed in the 9/11 attack on the World Trade Centre. The physical construction of buildings also accounts for a range of workplace health and safety problems. In Australia, around 50 building and construction workers are killed at work each year, and the fatality rate is more than twice the average for all Australian industries (Durham et al., 2002). Wadick (2010) cites Worker’s Compensation statistics showing the construction industry of the Australian state of New South Wales (NSW) has the highest number of work-related fatalities and the fourth highest incidences of employment injuries. Employees in the construction industry were also more likely to have received a recent injury at work than adults in all other industry groups (Australian Bureau of Statistics, 2006). Further, the industry is notorious for high levels of occupational stress and adverse impacts to psychological wellbeing, particularly amongst construction project managers (Love & Edwards, 2005).
Focussing more specifically on housing, as a sub-set of the wider built environment, there are still significant environmental and social impacts, which in some instances are projected to increase. For example, the average Australian household emits around 14 tonnes of greenhouse gases per house each year (Reardon et al., 2011), excluding emissions associated with the embodied energy in the home. Residential energy sector consumption increased from about 299 petajoules (PJ) in 1990 to about 402 PJ by 2008 and was projected to increase to 467 PJ by 2020 under current trends – an increase of 56 per cent between 1990-2020 (Energy Efficient Strategies, 2008).

Household water consumption accounts for 13 per cent of Australia’s overall water consumption (Gill, 2011), estimated to be 103 kilolitres per person per year in 2004/05 (but down from 117 kilolitres per person in 2000/01 (Australian Bureau of Statistics, 2010b)). According to figures provided by the National Land and Water Resources Audit (2001, p.8), Australian households consumed somewhere between 3.5 to 7 times that consumed in Asia, Africa and Latin America. Australia consumes the second highest amount of freshwater per person of OECD nations and the third highest in terms of household use despite the fact that it is the driest inhabited continent (Gill, 2011). However, there are some positive signs. Since 2004/05, household water consumption fell by 16 per cent, attributed to lifestyle changes such as taking shorter showers, or water-efficient devices such as showerheads, as well as by reducing outdoor use on gardens. This may be attributed in part to water restrictions imposed during the last decade of drought and price rises (Gill, 2011). Sydney has reduced its total water consumption so it again compares to 1970s levels of consumption, despite its population increasing by 1.3 million people since that time.

Workplace health and safety is also a significant issue within the housing sub-sector of the construction industry. For example, Wadick’s interviews of workers in the domestic housing industry in NSW found that all of those aged over 40 years old had a chronic injury from excessive and/or repetitive manual handling, with 6 out of 11 interviewed claiming they were trying to find a new career because “…this job is killing me” (2010, p. 113).

It is not just the way that houses are built which is arguably unsustainable; it is also the broader urban planning processes which influence entire communities, as well as the way that we subsequently live within our houses, which contribute to their cumulative impacts. The tendency towards ‘urban sprawl’, namely the spreading of low-density
housing into formerly agricultural or natural environments, is particularly problematic in this regard. According to the US Center for Sustainable Systems (2005, cited in Hoffman and Henn, 2008, p.5), the rate at which land urbanisation in America consumes natural or agricultural land exceeds the rate of population growth by 2.6 times. Urban sprawl is also widely blamed for increased reliance on the use of vehicles and associated fossil fuel consumption and traffic pollution (producing toxic substances and greenhouse gases). Critics of urban sprawl such as Reardon et al. (2011) also accuse it of contributing to social problems such as increased alienation and inequity. A number of housing trends, particularly that until very recently towards growing house sizes combined with decreasing occupancy rates (described in more detail in Chapter 3), has contributed to this trend and the overall environmental burden of housing.

With regard to eventual occupation of the houses, it has been suggested that in most countries, household consumption determines 60 per cent or more of all life cycle impacts of final consumption (Liedtke et al., 2012). Simply put, we build large houses, then we tend to fill them with clutter that is rarely or never used (Fear, 2008). Given that Reid & Miedzinski (2008) note that 95 per cent of extracted natural resources are wasted before the finished goods even reach the market, let alone the subsequent resource consumption needs of goods (for example, energy to operate them), the cumulative implications of resource consumption related to housing become apparent.

The above examples strongly support the conclusion that the housing industry in its present form is not environmentally or socially sustainable. However, despite these concerns, shelter is an essential human need. While we may be able to curb our demand for non-essential products such as large flat-screen televisions and international flights in an attempt to become a more sustainable society, ceasing to build housing altogether is not a realistic option, particularly at a time when the Australian population is increasing significantly (at a record level of 1.7 per cent by end June 2008 compared to the previous year (Australian Bureau of Statistics, 2008)). At a larger scale, internationally as the global population continues to increase, with an anticipated population increase from seven to more than nine billion by 2050 (United Nations, 2009), housing this population will place major additional stresses on the earth’s resources. This will particularly be the case if those in developing countries reasonably expect that they are entitled to a similar standard of living as that of those in developed countries. The World Economic Forum recently put this in perspective when they warned that as the global urban population will have doubled to nearly 6.2 billion by 2050, requiring an increase in urban capacity by
that time that is equivalent to all of that built in the past 4,000 years “...but somehow without the accompanying environmental destruction and failure” (Crawford, 2012).

Further, the housing industry makes a major contribution to the economy and to employment. In Australia, it was responsible for $42.9 billion of work in 2008/09, significantly higher than non-residential building which undertook $33.0 billion of work in the same period (Australian Bureau of Statistics, 2010a). A US study by Harvard University estimated that once all housing-related costs are considered, the housing sector represents approximately 20 per cent of GDP (Hassell et al., 2003). The housing industry is also a major employer, directly responsible for employing some 73,000 persons in Australia as at May 2009 (Australian Bureau of Statistics, 2010a). In total, some 984,100 persons, or 9.1 per cent of the total workforce, were employed in the overall construction industry (Australian Bureau of Statistics, 2010a), making it the fourth largest employing industry in Australia.

Consequently, finding a more harmonious balance between the economic, environmental and social performance of this industry is essential.

Housing has long been a source of fascination to Australians, to the extent that the term ‘The Great Australian Dream’ refers to the dream of owning a home. It should be noted that throughout this thesis ‘house’ and ‘home’ will be used reasonably interchangeably, even though a house refers to a physical structure while a home is a much more nuanced term, indicating a personal relationship with a dwelling. Houses are the major economic investment for many Australians, and obviously a source of shelter, but they go beyond this to meet a range of psychological needs, including expression of identity and communication of status and aspirations.

My increasing awareness and interest in sustainable housing coincided with a growing momentum of public interest in housing and the early stages of another housing ‘boom’. This appeared to manifest itself in examples such as the raft of home renovation television programs which were proliferating at the time. For example, in 2003, the final episode of a ‘reality’ television program named “The Block”, which showcased a competition to renovate apartments to maximise auction price, was watched by 53.2 per cent of Australian television viewers (more than three million people) when it went to air in August 2003. This made it the top Australian television program since the 2000 Olympic Games (The Age, 19 August 2003) and led Channel Nine, which screened it, to describe it as the most successful Australian television series ever.
One of the biggest challenges I have faced throughout my career in environmental management and sustainability is finding the most effective ways to engage with people on these topics. I can certainly relate to the comment made by the CEO of a leading environmental non-profit group (cited in Rocky Mountain Institute et al., 1998, p. viii) who said “…[t]he greatest challenge facing environmentalists is not global warming, or toxic waste, or habitat loss…[it is] talking to people who are not environmentalists.”

I reasoned that the public interest in housing presented a potentially highly successful forum through which to engage with the wider public on sustainability, via a tangible example that people can relate to personally, as opposed to industry-type issues which the public generally expect will be dealt with by someone else. Better integrating sustainability considerations within the context of homes presents an accessible means by which Australians can better engage with the wider concept of sustainability and how they can ultimately adopt more sustainable lifestyles.

Thus, when the opportunity to become involved with a research project focussed on the ‘Cairnlea Ecohome’ in Melbourne (described in more detail in Chapter 2) presented itself shortly after, I jumped at it.

I have started my thesis with this personal introduction to my research because a fundamental tenet of social science research is to acknowledge that, as a researcher, one is not an objective observer of the research topic but rather brings one’s experiences and biases, seeing the world from the perspective of one’s particular background and theoretical frameworks (Miles & Huberman, 1994). I made a decision to undertake this research because I wanted to learn how to be a better sustainability practitioner myself, and to gain insights which might help others similarly. There was, and very much remains, an end goal for me of influencing greater uptake of more sustainable ways of living and working, with less adverse environmental and social consequences. More specifically, my motivation for embarking on this research project was to identify strategies which could be effectively adopted by the wider volume housing industry to build more sustainable houses on a mass scale.

At the time I started this research, I had minimal exposure to the construction sector beyond my own limited personal experience with renovating and a large stack of well-thumbed house and garden magazines. Some years after starting this research, I started working in the construction industry, albeit in commercial construction. This has helped
to illuminate and frame many of the observations that I made in my early research. It provides me with some context to better understand how building practitioners tend to approach problems. Where pertinent, while presenting and analysing the findings of this research, I will incorporate my personal thoughts based on my own relevant professional experience.

It should be noted that the final document presented here represents the culmination of ten years of work (albeit of varying degrees of intensity). Ideally research should be as current as possible and therefore it could be argued that ten years is far too long for such a project to continue. I would counter this claim by noting that without the benefit of this extended period to reflect on my findings, I would not have had the opportunity to formulate many of the insights that I was able to specifically because of the length of this period, and my ongoing involvement in the industry. The duration of this research has also allowed for observation of the cycles that the industry moves in, including its chequered engagement with sustainability, in a way which would not have been possible in just a few years. I trust that the benefits outweigh any disadvantages.
Chapter 1
Introduction

"Knowledge must come through action;
you can have no test which is not fanciful, save by trial"
- Sophocles

This thesis presents and analyses the findings of research into strategies for mainstreaming more sustainable building practices and technologies within the Australian volume housing industry, based on the experiences of several major builders.

As outlined in the Prologue, the problem which has given rise to this research is the need to find ways to reduce the significant environmental and social impacts currently associated with construction, with a focus on volume housing.

As well as investigating and documenting the sustainability practices and technologies being adopted by the volume housing industry, this research also explores and provides insights into the broader adoption of change and innovation generally by the construction industry.

This chapter presents the research questions I have answered, discusses their significance and describes the research method that was used to answer them. It also outlines the structure of this thesis.

1.1 Research Questions and Thesis Structure

The questions I have sought to answer through this research are:

- How have Australian volume house builders responded to the challenge to build more sustainable housing?
- What can we learn from their experiences to better promote and support ongoing effective uptake of more sustainable housing within the industry?

The first question is primarily explanatory and seeks to collect data and document initiatives within an industry which does not typically document issues widely, particularly not within the public realm. It thus creates valuable baseline data which may inform future
sustainable housing research. The second question is more exploratory and seeks to analyse this data to identify trends and themes, particularly with regard to drivers or barriers experienced by the builders; to compare and contrast this with information revealed from the literature review; and then to extrapolate this to the industry more widely to inform future strategies to promote sustainable housing.

To answer these questions, I used a qualitative research framework, basing the research on real-life examples by exploring the experiences with sustainable building within three volume house building organisations. Semi-structured interviews were the principal source of data. The research method is elaborated further in Section 1.3.

The research questions were developed following a literature review, which also informed the development of the interview questions that I asked of thirteen building practitioners working for these three case study organisations. The literature review covered three quite separate disciplines: the theory underlying sustainability and sustainable building in general terms; the socio-economic context for the construction industry and volume housing industry, covering housing trends, industry characteristics and the house building process; and finally literature specifically on barriers to sustainable building and innovation more generally with the construction industry was reviewed. The key findings of this review are summarised in Chapters 2 to 4.

Chapter 5 provides a background of each of the three case study organisations and their experiences with sustainable housing, while Chapters 6 and 7 present the key results from the research, summarising building practitioner perspectives with regard to their understanding of sustainable building and the key forces that have influenced their experiences. Chapters 8 and 9 present a discussion and analysis of these findings with reference to the original literature, but also updating the review to reflect more recent developments since the interviews were conducted. Finally, Chapter 10 draws conclusions and identifies areas requiring additional research. More specifically:

Chapter 2 - seeks to explore various definitions of sustainability broadly, and sustainable housing in particular, and to provide some context as to how sustainable housing has evolved as a movement. It then outlines the drivers which are positively influencing the adoption of sustainability in housing, particularly the regulatory and non-regulatory approaches by government within Australia to encourage greater uptake of sustainability, and efforts by non-government stakeholders to similarly promote this. Finally, this chapter summarises the current status of sustainable housing within Australia.
Chapter 3 provides a context to housing in Australia, summarising housing trends in both quantitative terms but also in terms of changing consumer preferences. In particular, it charts the phenomenon in recent times towards increasingly large freestanding homes colloquially known as ‘McMansions’ and discusses some of the implications, including for sustainability. The chapter then outlines the characteristics of the Australian housing industry, and more specifically, the volume housing sector, as well as illustrating the complexity of the house building process and the wide network of stakeholders participating in this process.

Chapter 4 outlines the barriers impacting on adoption of innovation generally, and more specifically of sustainability, by the volume housing sector. It summarises the literature on adoption of innovation within the construction industry overall, and where relevant literature exists, specific to the volume housing sector. It then presents more specific research findings from the literature relating to barriers that have been identified for sustainable building, and for sustainable volume housing.

Chapter 5 provides a background of the three organisations featuring as case studies and summarises the sustainability initiatives they had already implemented prior to the interviews being conducted. It then briefly updates the content by describing more recent subsequent sustainability developments, which occurred after the interviews were conducted, based on publicly available information.

Chapter 6 summarises the results from the interviews relating to how building practitioners appear to understand sustainability, both in general terms and within the context of volume housing, and more specifically, as it relates to the products their own organisation produces. It also outlines how they have learnt, and continue to learn, about sustainable housing, and the information sources they find most useful.

Chapter 7 summarises the interviewed building practitioners’ perceptions of a range of forces, both external and internal, affecting their operations relating to sustainable housing construction. Externally, this includes their perception of customers; of government; of their supply chain; of other builders; of developers; of industry associations and of various other external forces such as the influence of market cycles and research organisations. Internally, it explores perceptions of the various individuals and organisational processes that have influenced, positively or negatively, the adoption of sustainability within their organisation.
Chapter 8 identifies a range of potential strategies by which wider adoption of sustainable building practices by the industry may be encouraged; exploring the contributing roles of builders, government and customers in particular.

Chapter 9 presents possible strategies which may help to ensure the successful and ongoing implementation of sustainable building practices, as well as ways in which builders might be encouraged to further innovate and continually improve within the context of sustainable building.

Chapter 10 provides concluding thoughts, comparing translational and transformational change in the context of this research; exploring how housing paradigms might need to change in the future; and finally exploring what the potential journey towards sustainability, even for the firms which currently appear to be leaders in this area, might look like.

1.2 Significance of this Research

The magnitude of environmental and social issues associated with housing construction, and the construction industry more broadly, were outlined in the Prologue. A transformation towards more sustainable housing stock will need to address not only new houses, but also how the large number of existing homes (many of which are inefficient in terms of energy and water input requirements and may contain various hazardous materials), can be retrofitted to become more sustainable. For example, the Department of Environment and Heritage (2006) claims that new houses contribute approximately 3.8 per cent to the residential building stock each year, thus significant improvement in the energy efficiency of existing stock is critical if housing is to be able to counter climate change problems. While addressing existing housing is of enormous importance, it is beyond the scope of this research to explore in any depth.

The reasons for primarily focussing this research upon new housing construction by the volume housing sector include:

- Of the average number of 147,200 new private sector dwellings completed in Australia each year between 2003 and 2012 (based on analysis of data from Australian Bureau of Statistics (2012b) and ranging from a low of 130,600 in 2003 through to a high of
159,600 in 2005), a significant percentage are built by volume house builders (hereafter simply referred to as ‘volume builders’). For example, 36 per cent of houses started in 2009/10 were built by the nation’s top 100 builders in terms of number of building starts (Housing Industry Association, 2010), and this proportion has been as high as 44 per cent (in 2000/01) (Housing Industry Association, 2001). Therefore, influencing the designs and practices of these larger builders to be more sustainable has the potential for significant environmental and social gain by virtue of the sheer volume they produce. It also has potential to influence a much larger number of clients;

- The volume housing sector has significant scope to positively influence the rest of the housing industry by demonstrating sustainable practices, and by testing and ‘debugging’ sustainable technologies; and
- By virtue of its scale of operations, the volume housing sector is in a powerful position to drive down prices of sustainable building components and materials by creating significant market demand, applying pressure to contractors to gain relevant skills, and allowing for better economies of scale, which may also benefit smaller builders.

The volume housing sector provides a microcosm within which to explore how ‘sustainability’ is practiced in reality by organisations, and the drivers and barriers encountered in the process. Large-scale transformation of housing stock to be more sustainable will not be possible without the engagement of this sector. Further, Edwards (2009) argues that as organisations grow larger and more significant in terms of their impacts including use of labour and natural resources, their responsibility also broadens.

The research is significant because it documents the experience of residential volume builders and helps to fill what was, and still largely remains, a gap in the literature. While there is a growing body of literature focussed on sustainability within the commercial construction sector, at the time this research commenced there was limited literature on sustainability and housing, particularly with a focus on the experiences of building practitioners. This is particularly the case within the volume housing sector and the Australian market context, which even more broadly is not well represented in the literature (Dalton et al., 2011b). It was therefore felt that there would be value in comparing and documenting the achievements and experiences of a range of Australian volume building companies adopting sustainability. This research also provides a number of suggestions for means of better promoting more widespread adoption of sustainability within this sector and identifies future research which would be beneficial. Part of its contribution to the body of knowledge on this topic is the fact that it is so multi-disciplinary.
in nature, drawing on literature from a wide range of disciplines and identifying relationships and synergies, such as the potential applicability of approaches adopted for implementing better occupational health and safety outcomes in housing to a sustainability context.

1.3 Research Approach

As mentioned earlier, the overall aim of this research was to better understand, and document examples of, the ways in which volume builders had adopted sustainability. It was also intended to explore their thoughts and feelings about these experiences, to deconstruct these and to identify themes, providing clues to support the wider housing industry in adopting sustainable housing principles and practices.

This research underwent significant changes in scope and focus since its commencement. Initially, it was intended to focus on the technical monitoring and analysis of the sustainability performance of the 'Cairnlea Ecohome', a volume, or 'project' home being built by a volume builder (referred to throughout this thesis as 'Company A') in western Melbourne. This home, while being similar in appearance to a conventional volume home, had been designed to be more sustainable both in its construction and operation. This home was in the early stages of construction when I started my involvement in this project, and the early stages of the research focussed on designing a monitoring strategy (covering parameters such as internal and external temperatures, air quality, electricity and water consumption and the like) to evaluate performance.

However, as the work progressed, a number of major constraints to the research were identified. Firstly, the house took much longer to build than had been originally planned, meaning it would not be completed until more than twelve months after the research commenced. Secondly, the house was then to be used as a display home for approximately twelve months after construction, meaning it would not be used in the same way as a conventional home, and thus its actual sustainability performance would not be very pertinent. Finally, there was no appropriate ‘control’ to allow for any sort of meaningful comparison of results.

As the full extent of the research limitations revealed themselves, I instead became more interested in the problems experienced in the finalisation of this home, and the reasons for them. As mentioned in the Prologue, I have professionally encountered numerous
barriers to driving improved sustainability performance within organisations and I was keen to explore this aspect further. Consequently, the research focus was adjusted to use the Cairnlea Ecohome experience, and its builder’s wider experiences with sustainable construction, as a case study within a qualitative research framework. Two other case study organisations were also selected to broaden the perspective of this research.

The intention of this research was to explore in-depth the experiences of a small number of people within their context, as opposed to a more quantitative approach where a larger number of cases are studied for statistical significance but largely stripped of their context (Miles & Huberman, 1994), with resultant limited ability to make attitudes explicit (Wadick, 2010). As Miles & Huberman (1994, p. 4, citing Erickson 1977) observe, social meaning is embedded in what people actually do in everyday life, and these meanings are most often discovered “…by hanging around and watching people carefully and asking them why they do what they do…”[Given] this orientation toward social meaning as embedded in the concrete, particular doings of people, qualitative researchers are reluctant to see the attributes of the doing abstracted from scene of social action and counted out of context”.

Qualitative research can provide a “…source of well-grounded, rich descriptions and explanations of process in identifiable local contexts…[and] preserve chronological flow, [illustrate] precisely which events led to which consequences, and derive fruitful explanations” (Miles & Huberman, 1994, p.1). It also offers a greater chance of leading to ‘serendipitous’ findings and moving beyond initial conceptions. Given the limited available data or documentation specifically pertaining to Australian volume builders, this in-depth investigation and the recounting of building practitioners ‘stories’ was felt to be a significant contribution to the body of knowledge on sustainable housing at a mass scale.

It is acknowledged that there is also considerable criticism of the qualitative research approach, particularly relating to the reliability and validity of its results. This needed to be factored into the research design. The area of greatest criticism seems to be the potential for introducing researcher bias. While it is true that my own biases are likely to have been introduced to some extent in the discussion of the results; and indeed, I have actually woven my own professional interpretations of challenges and solutions based on my own experiences within the construction industry; I have attempted to make this explicit where I have done so. Besides, as Miles & Huberman (1994, p. 2) note, many researchers acknowledge that there is no “unambiguous social reality ‘out there’ to be accounted for, so there is little need to evolve methodological canons to help explicate its laws...social
processes are ephemeral, fluid phenomena with no existence independent of social actors’ ways of construing and describing them."

Other potential limitations of qualitative research methods include the labour intensiveness of data collection and subsequent coding and analysis; the adequacy of sampling when using only a few cases and the generalisability of the findings (Miles & Huberman, 1994). In the case of this research, these have been overcome to some extent by limiting the case studies to three organisations based within the same city, and speaking to a relatively small number of people; which facilitated a manual and more nuanced process of data analysis rather than an elaborate coding system.

1.3.1 The use of Case Studies

A case study may be defined as:

“...an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used” (Yin, 1989, p. 23).

A case study approach was deemed the most appropriate approach for answering my research questions as they can provide “...considerable insight in fields where there has been little previous research” (Yin, 2003, cited in Manley, 2008, p. 233), which was the situation with this research topic. Case studies are usually preferable when ‘how’ or ‘why’ questions are being posed and when the investigator has little control over events, which was also the case.

Further refining of the research strategy determined that a multiple-case study approach would be beneficial, to allow for comparison of findings across several organisations and to allow for better testing of the validity of the findings. Given the complexity of the construction process and industry context, as well as of sustainable building itself, a wider range of case studies with similar and contrasting characteristics offers a better opportunity to test and ramify resulting conceptualisations and establish their analytic generality, as well as how they vary under different conditions (Miles & Huberman, 1994). Consequently, two additional large volume building organisations operating within Victoria (and, as for Company A, in other States also) were selected as further case study organisations, discussed further below.
To increase the robustness of the data and its ability to be replicated, a protocol was followed which included using the same list of questions for all organisations (noting some minor adjustments which were required to respond to field conditions outside the interviewer’s control; discussed later) and verbatim transcription of answers. As the research population was narrowed to three organisations undertaking reasonably comparable activities (although noting they were broader for Company C), the potential to generalise the findings is increased (Manley, 2008). The fact that the broader application is limited by variations in the nature of building organisations remains a limitation of this research.

Interview outcomes were analysed mainly by comparing the answers to each question across all interviewees to identify themes or areas of disagreement in an informal version of content analysis. Themes were captured and added to by identifying answers to other questions which related. The process of expanding on these themes was highly iterative, involving multiple reviews of the same information.

1.3.2 Case Study Selection

Company A, a large volume building company operating in a number of Australian States and which had built the Cairnlea Ecohome, was always intended to be a principal focus of this research and had agreed to participate in the research before I came to be involved with this project. Two additional companies, B and C, were selected for invitation to participate in the research because they built homes on a comparable scale and had also attempted in various ways to differentiate themselves from their competitors through implementation of various sustainability initiatives, and were promoting their leadership. They were contacted by telephone to gauge their interest in participating in the research, which was followed up by written communication.

Company B was invited to participate in the research because it was the first builder in the State of Victoria to offer 5 star energy-rated homes as standard, some five years before it was required by legislation. Company C was invited because of its wide range of sustainability initiatives and its more formalised approach to delivery of sustainability through a dedicated team with specialists employed in-house. A relatively limited number of comparable organisations were identified as doing particularly interesting work with regard to sustainability initiatives, but within this small sub-set, the decision to approach Company B and C initially was reasonably random.
Company C is quite a different organisation to Companies A and B, both of which at the time of the interviews were privately owned, produced a roughly equivalent number of homes (for a number of years between the 2000/01 to 2009/10 Housing 100 surveys, both hovered around the 3rd to 5th rankings; although in recent times Company A has considerably 'leapfrogged' Company B in terms of housing starts, having been a much smaller builder by comparison a decade ago). By contrast, Company C is publicly owned (with partial overseas ownership), and thus is subject to a different level of scrutiny of its economic and governance processes. It also operates across a range of construction types, including commercial and industrial, and investment property. It is also the only builder of the three to construct apartments, and had larger interests in land development than the other two organisations.

Each of the three organisations was asked to nominate the most appropriate staff who could be interviewed about their processes and experiences with sustainable building. Companies B and C nominated five Melbourne-based staff for interviews, while only three staff members were available to interview at Company A. Apart from explaining the research purpose, I did not have input into who was nominated by each company. Given the time constraints of people working within this industry I felt that it was suitably broad, representing a range of backgrounds and viewpoints.

In summary, the range of role-types and professional backgrounds represented across the 13 interviewees was as follows (not linked to their organisations to increase the anonymity of this process):

- A Managing Director;
- A senior manager and a coordinator with specific responsibility for sustainability;
- Three managers with responsibility for design and/or research & development (one from each organisation);
- Three managers with responsibility for sales or marketing (one from each organisation);
- A corporate operations manager;
- An estimating manager with responsibility for corporate procurement;
- A site manager; and
- A manager with responsibility for corporate occupational health and safety.
In effect, these individuals each represent almost a sub-case study, but no attempt is made to tell a cohesive story about each individual, but simply to present the range of thoughts, attitudes and observations and to contrast them between and across the three organisations.

Miles & Huberman (1994, p. 34) claim that when undertaking case studies, there is a temptation to focus on the “meatiest, most study-relevant sources”, but note that it is also important to work at the peripheries, speaking with people somewhat removed from the topic as well as the “…dissidents and renegades and eccentrics [to]...obtain contrasting and comparative information that may help you understand the phenomenon at hand by ‘de-centering’ you from a particular way of viewing your other cases.” The nominated interviewees represented a diverse range of professional backgrounds and roles within each case study organisation, and varying degrees of prior exposure to sustainability initiatives. This allowed for a more holistic understanding of how the changes within their organisation had been adopted and understood.

It was gratifying that all of the interviewees were generous with their time, noting their extremely hectic schedules. Some interviews had to be cut short because of other commitments, but all of the interviewees appeared to be both genuinely supportive of the research topic and happy to be relatively candid (which in part resulted from an assurance that their responses would not be presented in a way which was attributable to them and which would preserve their anonymity).

1.3.3 Data Sources

The primary data source for this research was from the 13 in-depth semi-structured interviews conducted, recorded on microcassettes (with the permission of the interviewee) and later transcribed verbatim following the interview (the process by which this was done is described further below). These transcriptions were then analysed in depth (also described further below).

Interviews were chosen as the primary method of data collection as the fact that they primarily involve open questions (Wengraf, 2001) allowed the respondents the opportunity to introduce themes or ideas which may not have been considered. Meanwhile, the semi-structured nature, with pre-prepared questions aligned to issues raised by the literature, ensured that identified issues could also be explored in greater depth.
Further, it was considered that a verbal medium would be more likely to elicit more detailed responses than would be the case if respondents had to document their answers.

A more quantitative approach was considered less useful given the fact that sustainability was still a relatively new concept to this industry sector and there were a relatively small number of organisations actively practicing it. It was considered that exploring the issues in some depth, with open questions allowing interviewees to offer any information or express any opinion they chose, would provide richer and more candid data. Despite the small sample size this was felt to be more valuable in this early stage of the evolution of sustainable volume housing.

However, one of the disadvantages of this approach was that it makes analysis of the data more complex, being more difficult to code and analyse. By contrast, closed questions, which force respondents to choose from a range of predetermined responses, are generally easier to code and analyse statistically (O’Leary, 2004). The same would be true of using a technique such as surveying, but again the trade-off would potentially be less rich data and the fact that issues not specifically identified in the questions might be more likely to be missed.

Supplementary data sources included publicly available information, such as company websites, annual reports and information reported in the media.

1.3.4 Interview Design

As mentioned, the decision to use semi-structured interviews meant that the same list of prepared questions was asked of each interviewee, but with scope for clarification or probing if required. There was also a chance for interviewees to raise any other issues they felt had not been adequately covered at the end of the interview. The need to have a consistent question list was considered particularly important to assist comparison across organisations.

The questions were designed to draw out, or confirm the validity of, issues identified from the literature review. (In reality, as is typical with qualitative, inductive inquiry, the process of literature review and analysis of the interview results continued simultaneously right up to the end of this project in what Flint and Golicic (2009) describe as a ‘tacking back and forth’ manner).
Firstly, some higher level questions which would help to answer the research questions were developed (‘theory’ questions as Wengraf (2001) refers to them). These questions were as follows:

a) What backgrounds do people have with regard to their professional/trade training and experiences in industry?
b) How well do volume building practitioners understand sustainability in broad terms, and how have they learnt about it?
c) How deep an understanding do volume building practitioners have of sustainable housing, and how have they learnt about it?
d) How important do they think sustainability is to their company, and is this changing?
e) How important do they think sustainability is to their customers, and is this changing?
f) What are the current key drivers?
g) How straightforward is it for them to adopt as a standard practice?
h) What are the key barriers?
i) How are volume builders building upon their experiences to make sustainable building common practice?

Based on these theory questions, a number of more specific interview questions were developed to tease out answer. The theory questions, with corresponding interview questions actually asked, are listed in Appendix 1.

As mentioned, the questions were primarily open in nature. Care was taken in their wording to avoid them being confusing, leading or otherwise problematic (O’Leary, 2004). For example, interviewees were asked about the impacts that regulation had had on their practices rather than being asked ‘is regulation a barrier?’. The questions were reviewed prior to the interviews to ensure they avoided ambiguity, double negatives or double-barrelled questions. An attempt was also made to avoid questions with assumed knowledge, questions which would encourage answers thought to be socially desirable (such as “I support sustainability”) or questions containing unwarranted assumptions (O’Leary, 2004). Questions were worded in language felt to be appropriate to persons working in the construction industry (that is, they were not overly academic and did not use social science jargon). The questions were typically specific but avoided being closed in style (that is, yes/no type questions), but rather encouraged examples and discussion of thoughts and perspectives. In some instances, the questions were re-asked with
different wording, or otherwise clarified, when they were not understood at first or not otherwise answered. Additional probing questions were sometimes asked to seek deeper insights where the answers appeared to be a rich source of data. To avoid introducing bias to the interview, an attempt was made to order the less specific questions first, to avoid priming answers to more open questions later. However, very open questions were also asked at the end of the interview to allow for synthesis of the various matters discussed and to capture ideas or perspectives not anticipated from the literature and reflected in the fixed questions.

The questions were structured to ease the interviewee into the process (O’Leary, 2004), generally move from broader inquiry as to the person’s background (trade and/or profession, training history and role within the company), to provide context but also to act as somewhat of an icebreaker. The interview next moved to questions about each individual’s perceptions of sustainability and sustainable housing in general terms, before delving into specifics about that person’s involvement with, and perceptions of, green building initiatives undertaken by their organisation. As mentioned, time was allowed for open discussion at the end of the interview.

It should be noted also, that, while the same set of questions was to be asked of all interviewees, in a small number of instances this was not possible, as the interviewee’s available time was too limited to allow all questions to be asked. In these cases, the questions felt to be less pertinent to the interviewees’ experiences and backgrounds were omitted. This was a rather subjective process, but one of the limitations of the real-world demands which can impact on research conducted in the field (Miles & Huberman, 1994). The very busy work lives of the interviewees also meant that detailed probing did not typically occur, unless the interviewee appeared to be particularly relaxed about time.

More specifically, the topics discussed progressed in the sequence illustrated by the interview questions shown in Appendix 1.

1.3.5 Conducting the Interviews

Formal interviews were pre-arranged and held in each organisation’s Victorian State office over several days in March 2005. Interviews were conducted one-on-one, with one exception, where a second party sat in on an interview and occasionally contributed. The tone of the interviews was professional in manner. The views of this second party were not incorporated into the analysis of responses. Interviews lasted for between roughly 45
minutes to two hours, depending on the availability of the interviewee and their degree of talkativeness.

Multiple interviews were held on each day, due primarily to reasons of cost and logistics as I had by this stage moved interstate and was visiting Melbourne. Unfortunately, a side effect of this was that there was limited time between interviews to reflect on discussions or to take copious notes on each interview, which may have assisted with later interpretation of results (Wengraf, 2001).

Before each interview commenced, each interviewee was provided with an ethics statement outlining the purpose of the research and describing how their interview responses would be managed, including how security of the data would be maintained and the fact that their responses would not be attributable to them. They were required to sign this statement prior to the interview start. Interviewees were also asked if they objected to the interview being recorded onto an audio cassette, to which no one objected.

Although the set question list was largely followed, the interviews moved in a reasonably conversational manner. I attempted to build rapport with each interviewee from the start by shaking their hand, introducing myself and the project, and expressing appreciation for their time (O'Leary, 2004). I also adopted a friendly tone and occasionally joked with them. I also tried to assume a neutral tone throughout, avoiding a judgemental tone. Although the style of interviews leaned more towards what Wengraf (2001) would describe as ‘assertive’ (meaning that I largely controlled the pace of the interview and clarified any incongruences I detected, or picked up on related points made earlier in the interview) rather than ‘receptive’ (meaning that the interviewee was largely free to talk as they wished, with limited open questions); this did not appear to cause obvious discomfort to anyone. This may have been in part due to the fact that nearly all of the interviewees were quite senior and had a higher professional status than me as the interviewer (at that time), something which is not often the case in social science research (Wengraf, 2001).

Prompts were used to keep the conversation flowing, which included the use of phrases such as ‘ok’ or ‘hmm?’; or asking clarifying questions. At times I also had to more directly keep the interview on track by allowing for tangents to be explored, but not indefinitely. It is acknowledged that these processes would have, to some extent, influenced the conversation (O'Leary, 2004), but as I have already stated, I accepted that there was a
certain amount of subjectivity involved in the interview process, which I allowed for as best I could.

1.3.6 Transcribing the Interviews

The interviews were transcribed verbatim from cassette tapes through a manual process (conducted entirely by myself). It is noted that any approach to preparing transcripts will only be a partial representation of speech, and will also represent a transformation (Wengraf, 2001). A limitation of this research method was that non-verbal cues such as body language, facial expressions, speed of delivery, silence, hesitations and the like were not systematically recorded. As Wengraf (2001) notes, these can significantly alter the meaning attached to words, particularly when sarcasm or ironical tones are being used. However, auditory cues such as laughter were transcribed to make it clear when people were joking.

I relied on my memory of the tone of interviews when analysing the transcriptions and do not believe that it has significantly altered any observations or conclusions, as the tone of the interviews and the subject matter were largely professional, and not as highly emotive as other social science research topics can be. Unfortunately, because I took some leave from my studies not long after the interviews, the transcribing occurred many months after the interviews, which hindered the accuracy of my memory. Listening to each recording of each interview multiple times assisted somewhat in verifying if my transcriptions seemed to accurately reflect the messages. Because the end result is voluminous, and because of my assurances I would preserve the anonymity of responses, I have not included all transcripts within this thesis, but have quoted from them extensively throughout this document.

In quoting from transcriptions, I did attempt to ‘tidy them up’ by removing pauses, ‘ums’ and ‘ahs’ and partial sentences which were then rephrased, as well as adding punctuation. In retrospect, this may also have been an error of judgement, because as Wengraf (2001) notes, the passion or other emotions of the discussion can be lost in the process, and the distinctive ways of speaking can be lost. The benefit is that it makes comprehension of the key messages easier for the reader.
1.3.7 Analysing the Results

Transcription contents were analysed in depth to identify the themes relating to the ways in which the building companies had successfully implemented sustainability initiatives. Content analysis was conducted manually given the limited number of case study organisations and relatively narrow focus of the research, and because doing so provided greater capacity to identify connections through observation that may have been sacrificed had computational analysis been used (Manley, 2008). It should be noted also that computational software was less commonly used at the time of the interviews than it is now.

Themes were identified and observations correlated after repeated re-examination of the interview transcripts. Keywords were not used for the categorisation of themes, but rather a more intuitive process of content analysis was adopted. This involved going back to the theory questions and looking for answers which helped to answer them (which were typically derived from the corresponding interview questions but not always). Both commonalities and contrasts were identified. Rather than use a manual content analysis process such as a colour-coded highlighting system as some have suggested (for example, O’Leary, 2004); relevant quotes were cut and pasted into a separate electronic document, which was then edited over many iterations to produce a number of separate documents on particular themes of interests. Finally, these separate themes were combined into one document which eventually morphed into this final thesis.

Where publicly available supporting information was accessible, such as company websites or brochures or, in the case of Organisation C, through public Annual Reports, it was used as relevant to augment the interview data. Limited internal archival data was obtained, although documentation pertaining to the design of the Cairnlea Ecohome, such as building specifications, was obtained from Company A and a copy of a flowchart pertaining to sustainability within the land acquisition process was provided by Company C.

Some discussion and conclusions presented herein also factor in my personal reflections based on some seven years of employment within the construction sector (working for commercial contractors and also for major construction clients) following the conduct of the interviews.
1.3.8 The Pros and Cons of Preserving Anonymity of Responses

In designing the research, it was deemed preferable to maintain the anonymity of interviewees as I anticipated that this would lead to more open and candid information being provided. The downside of maintaining interviewee anonymity is that it is then difficult to provide a great deal of context about the individuals who make various comments which might otherwise allow for differences between different professional backgrounds, specific experiences to date and industry roles to be better compared. Initially, it was intended to at least code each interviewee to allow comments to be attributed to some extent, but as work proceeded it became apparent that this did pose some significant risk of the interviewee being identified.

It was not originally intended nor promised to interviewees that the anonymity of the individual companies acting as case studies (as opposed to the individuals) would also be preserved. However, during analysis of the data I decided that it was responsible to not refer to each by name, but simply as Companies A, B and C. I felt that this would allow for more of a focus on the actual experiences and issues rather than any stereotypes or mental associations relating to each organisation that each reader may bring. It also reduces the possibility of my discussion and observations sounding like I am either praising or criticising a specific organisation, when the intention is to focus on the initiatives. A sufficient level of detail has been provided that would allow identification of the three organisations, but this is not felt to be a significant enough concern to justify the loss of the richness of data which would otherwise be required to be stripped out.

1.4 Chapter Overview

This chapter has presented the research questions to be answered by this thesis and outlined the process by which answers were formulated. It has also described the significance of the research topic, given the enormous magnitude of environmental and social impacts associated with housing, and the socio-economic context demanding that practical, effective responses be developed which support the industry.

The following chapter presents the first component of the literature review, summarising sustainability in broad terms and then exploring definitions of sustainable housing, describing how this field has evolved, and the drivers. It finally provides a synopsis of the current status of implementation of sustainable housing within Australia.
Having just presented the purpose and approach for data collection through the interviews it may seem strange to be returning the reader to the context for the research. Yet it is this more detailed background which is important for setting the scene for the evolution of sustainability in the Australian housing industry. It is against this ‘scene’ that the interviewees’ insights and the activities of the housing industry will be discussed in later chapters, and from which my conclusions and proposals have been drawn.
Chapter 2
The Need: ‘Sustainable’ Housing

“No one suggests that buildings should be structurally unsound, yet we still allow buildings that are ecologically unsound” (Birkeland, 2008, p. xvi)

It is necessary to clarify what sustainability actually is before discussing it in further detail in the context of housing, or how builders are adopting it. We cannot expect to see greater numbers of more sustainable houses being built if it is not understood in practice. However, defining the characteristics that might allow a house to be called ‘sustainable’ in any sense is difficult, given that even the wider concept of sustainability itself is still contested.

This chapter summarises the literature on how sustainable housing might be defined, also considering sustainability more broadly. It briefly outlines the evolution of sustainable housing and its various drivers, both regulatory and voluntary. Finally, it summarises the current status of sustainable housing (as at 2013), with an emphasis on the Australian context.

2.1 Defining ‘Sustainable’ Housing

In broad terms, if something is sustainable it means that it is able to be sustained, that is, to continue indefinitely in its current state or mode of operation. Thus, sustainable development would be development that was able to continue in a similar manner indefinitely. Referred to more accurately as ecologically sustainable development, to reinforce that the development relies on the environment’s ongoing ability to support it, one of the best-known definitions comes from the 1987 World Commission on Environment and Development Report Our Common Future (World Commission on Environment and Development, 1987), also known as the Brundtland report, which defines it as:

“….development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (p. 43)

The Australian Government has defined ecologically sustainable development as:
“…using, conserving and enhancing the community’s resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased” (Department of Sustainability, Environment, Water, Population and Communities, 1992).

The concept of sustainability has, since the 1980s, also become increasingly associated with a concept of integrating the economic, social and environmental spheres of human activity, also referred to as the ‘triple bottom line’ (Elkington, 1998). The rationale behind this is that an activity can only be considered truly ‘sustainable’ if due consideration is given to economic viability, social considerations and protection of the environment. In the context of buildings, ‘sustainable’ must encompass consideration of not just environmental impacts, but also social impacts for builders, neighbours and occupants, and the need to be economically viable during construction but also ongoing operation.

Many and varied attempts to define sustainable housing have been made. The environmental aspects of sustainability continue to be by far the most common aspect of sustainability to be considered, as compared to the economic or social benefits of a potential construction project (Bourdeau et al., 1998; Essa & Fortune, 2008). This in part explains why the terms ‘sustainable’ and ‘green’ are often used seemingly interchangeably.

For example, Hoffman and Henn (2008, p. 5) emphasise the environmental dimensions of sustainability in their definition of ‘green’ (or sustainable) building noting it is:

“…a term encompassing strategies, techniques and construction products that are less resource-intensive or pollution-producing than “regular” construction. In some cases, this involves merely ‘doing without’ extra spaces, finishes or appliances. In others, it substitutes a less polluting product for more polluting ones (e.g., low-VOC paint). More integrated strategies reconfigure a space to take advantage of unique site attributes (e.g., facing glass towards the sun path to use natural or ‘passive’ solar heat gain instead of using natural gas or electricity to heat a space) or reconfigure design parameters to take advantage of building system synergies (e.g., downsizing the boiler after extra insulation has been added to the exterior shell)” (Hoffman and Henn, 2008, p.5).

The definition provided by Kats et al. (2003, p1) is more holistic, suggesting that sustainable buildings should be sensitive to:
“...environment; resource & energy consumption; impact on people (quality and healthiness of work environment); financial impact (cost-effectiveness from a full financial cost-return perspective); the world at large (a broader set of issues, such as ground water recharge and global warming, that a government is typically concerned about).”

Such conceptual definitions, however, provide little practical guidance to assist building designers and contractors to actually design and build such homes. Government and industry bodies have attempted to increase the uptake of more sustainable building practice by fleshing out these definitions, either through regulatory mechanisms or sustainable building rating tools which articulate specific elements or performance criteria of sustainable buildings. Particularly active in this regard have been the various Green Building Councils which have been established around the world and which have developed voluntary rating tools for various building types. These tools, which were developed both to standardise assessment methods and to reduce the scope for ‘green washing’ by allowing a mechanism for independent verification of sustainability claims, tend to focus on the building designs rather than actual performance. The tools typically provide ‘checklists’ of elements that can be adopted, with a certain number of points to be obtained to achieve a particular rating. These various mechanisms are elaborated on further in section 2.3.

While the various tools and regulatory mechanisms provide somewhat different interpretations of sustainability in a context of buildings, there are numerous areas of commonality. Kats et al. (2003) claim that there is a broad general agreement of the attributes a sustainable building should embody, even if there is still not consensus on their exact weightings, which are typically based on consensus best judgement rather than scientific determination. Of course, it is extremely difficult to prescribe universal criteria or weightings given that different regions will have widely varying climatic zones, locally available materials and the like. For example, conservation of water is more important in countries with highly variable rainfall such as Australia, than it is in places such as Europe.

However, Woolley (2005) notes that few attempts to interpret green building are holistic in their approach, and argues that greater harmonisation and development of common baseline standards and methods is required before promulgating further tools and assessment methods.
Martin and Pears (2005) analysed several of the earlier versions of Australian and international sustainable housing rating schemes to identify themes and common criteria. They aggregated the commonly recurring concepts, see Table 1. Additional, less commonly acknowledged criteria, are discussed following the table.

**Table 1 – Summary of typical sustainable housing criteria in rating tools** (adapted from Martin and Pears, 2005)

<table>
<thead>
<tr>
<th>Theme</th>
<th>Commonly occurring criteria</th>
</tr>
</thead>
</table>
| Land/site | • Selecting sites that are less environmentally sensitive or have lower ecological value (for example, selection of brownfield sites over agricultural or purpose-cleared land) and/or sites that do not worsen urban sprawl (i.e. favouring denser urban environments)  
• Maintaining and/or planting as high a ratio as possible of either native/localised and/or productive plants (fruits/vegetables) on unbuilt areas of the site  
• Reducing the percentage of impermeable surfaces as much as possible to minimise impacts to hydrological cycles  
• Reducing the floor plan of the building as much as possible |
| Water     | • Reducing water consumption per person/per bed space  
• Using water conservation fixtures (eg AAA-rated or 3 WELS rated shower heads)  
• Collecting rainwater on-site |
| Energy    | • Reducing greenhouse gas emissions  
• Encouraging the highest possible use of renewable energy  
• Ensuring building envelope performance is optimal  
• Providing a clothesline/drying space  
• Providing energy efficient appliances (such as white goods) or, if not provided, providing education material on energy efficient appliances to occupants  
• Reducing energy use for hot water production  
• Providing energy efficient lighting |
| Materials | • Choosing building materials from ‘better’ sources; that is, in accordance with relevant publications in that country (eg the *Your Home Technical Manual* in Australia)  
• Using timber from reliable low-impact sources (preferably with |
<table>
<thead>
<tr>
<th>Theme</th>
<th>Commonly occurring criteria</th>
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<tbody>
<tr>
<td>Forestry Stewardship Council certification)</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>• Building within close proximity to facilities (such as convenience store, post office, bank, medical facilities, parks/play areas)</td>
</tr>
<tr>
<td></td>
<td>• Ensuring proximity to adequate public transport for travel to work/school</td>
</tr>
<tr>
<td>Interior/indoor environmental quality</td>
<td>• Using low volatile organic compound (VOC) products such as paints</td>
</tr>
<tr>
<td></td>
<td>• Managing combustion products (such as appropriate use of flues)</td>
</tr>
<tr>
<td></td>
<td>• Maximising daylighting in the home while avoiding glare and excessive heat</td>
</tr>
<tr>
<td>Waste</td>
<td>• Providing recycling facilities</td>
</tr>
<tr>
<td></td>
<td>• Providing composting facilities</td>
</tr>
<tr>
<td></td>
<td>• Reducing sewage production and potable water use (such as waterless sewage systems)</td>
</tr>
<tr>
<td></td>
<td>• Treating wastewater on-site or using for landscaping</td>
</tr>
<tr>
<td></td>
<td>• Implementing waste management strategies during construction</td>
</tr>
<tr>
<td>Other</td>
<td>• Providing adequate outdoor space (such as patios)</td>
</tr>
</tbody>
</table>

It is apparent from Table 1 that a noticeable gap in the various tools and checklists analysed at that time was any recognition of issues relating to the social (as opposed to environmental) dimension of housing, or exploration of the economic dimension relating a triple bottom line approach. This narrow interpretation of ‘sustainable’ to emphasise the environmental dimension of sustainability, while neglecting the social and economic aspects, remains a limitation of the majority of sustainable building definitions and approaches. A building with minimal environmental impact but that later adversely impacted the health of future occupants can hardly be considered to be a truly sustainable proposition. Similarly, in the case of housing in Australia, affordability is also regularly raised as an issue of concern from a social equity perspective (Senate Select Committee on Housing Affordability, 2008; Housing Industry Association, 2008a; Australian Bureau of Statistics, 2010a).

The *Your Home Technical Manual* (Reardon et al., 2008) is an exception to the above observation, addressing a number of social considerations associated with sustainable housing, which it notes include:
• **Adaptability** – the need to design houses which are flexible and can respond to changing needs of occupants, without complicated and costly alterations. This may include features such as home offices or designing a larger family home that can be easily divided into smaller units when children move away. In addition, as much as possible, houses should be designed to be ‘universal’, meaning they can be used by as many people as possible without the need for specialisation, and ‘accessible’ to allow for access and mobility (including by disabled persons); or at least able to be adapted if required. This includes features such as avoiding stairs, having wide openings, and shelves and benches at an appropriate height (Palmer & Ward, 2011);

• **Safety** – a significant proportion of accidents and injuries occur in the home. Safety considerations such as unobstructed access, guarding, slip resistant surfaces, electrical safety, night lighting, hot water system settings, avoiding level changes and the like, should be paramount during design and retrofitting (Woodcock et al., 2011); and

• **Security** – helping to prevent crime by facilitating surveillance through window placement; installation of appropriate locks, screens, alarms; controlling access, such as with fences or gardens; and designing outdoor spaces to foster a sense of communality (Woodcock et al., 2011).

Other less commonly identified sustainability criteria in the various tools include designing for local environmental risks. For example, in many parts of Australia, it is important to design a home that can withstand bushfires, as was tragically reinforced during the major bushfires in Victoria in early 2009 (Building Commission, 2010). This may include considerations such as a fire resistant building envelope, selection of appropriate vegetation for landscaping, provision of evacuation paths and defensible spaces and selection of non-combustible materials (Prelgauskas, 2011). In future, given expectations of rising ocean levels and increased extreme weather events associated with climate change, designing homes in appropriate locations and that are better able to withstand extreme climatic conditions could also be considered to be an important form of insurance.

The above discussion lists a range of points that can be considered when designing a sustainable house. However, it is important to stress that a ‘sustainable’ building should be holistic in its approach, with its focus not confined to individual factors such as energy, water or indoor air quality, in isolation (such as ‘passive solar’ buildings). The interdependence of, and potential for synergies between, sustainable features should be
understood. It is also critical that sustainability features should be fully integrated with the design, rather than a series of ‘tack-ons’, or what Barnett and Browning (2007) refer to as a ‘50 stupid things’, piecemeal approach to building. This allows sustainable buildings to compete on cost and to avoid sustainability features being removed during cost-cutting exercises (Kats et al., 2003).

As an example, Rocky Mountain Institute et al. (1998) cite a New Zealand developer who used to offer a package of ‘green specification’ options including double-glazed windows, heat-recovery ventilation, energy conservation features, water-efficient plumbing and solar hot water, adding about $10,000 in cost to the original $220,000 standard price. However, because these features were not implemented in an integrated manner, the ability to realise potential cost-savings such as the ability to downsize or eliminate mechanical systems, was lost.

2.2 The Evolution of Sustainable Housing

It has been suggested that sustainable design of houses “….is not a recent concept - it’s a recently lost one” (Reardon & Downton, 2011, p. 6). Indeed, some elements of sustainable building, such as thermal chimneys, go back thousands of years (Barnett and Browning, 2007). Reardon and Downtown (2011) note that vernacular architectural styles (that is, styles developed locally over periods of time) have evolved in response to natural environments and available building materials. They provide examples including the lightweight shelters allowing airflow built by indigenous Australians; rendered rock dwellings with reed roofs in Nepal with high thermal mass and high insulation properties; and the hollowed out volcanic rocks in Cappadocia, Turkey, which are part of the landscape, have high thermal mass and feature thermal flues to allow ventilation in summer. The Hanging Gardens of Babylon and Europe’s Viking homes were early examples of green roofs, and Kats et al. (2003) suggest that the thousand-year-old North American Hopi Indian structures are another example of green building. Early European settlers in Australia made use of features such as verandahs and roof vents to protect homes from, and allow expulsion of, the heat; or dug out underground homes in outback mining areas such as Coober Pedy in South Australia.

It has been claimed (for example, by Barnett and Browning, 2007) that it was only in the last century or so, when inputs such as glass and energy became affordable and readily available, that architecture evolved to forget its sense of place and local climate. However, such comparisons are also rather simplistic and overly romanticised. Ancient
dwellings, and even those not-so-old, are not necessarily well sealed or insulated, and
didn’t necessarily factor in sound passive design principles. Keeping warm right through
to the nineteenth century was very difficult in anything but temperate climates. Bryson
(2010) cites Thomas Jefferson complaining that he had to stop writing one evening
because the ink in his inkwell had frozen. Similarly, until very recently, buildings were
constructed from locally available materials more out of practicality rather than concern for
‘sustainability’ per se. Indeed, as Bryson (2010) points out, the construction of largely
wooden homes contributed significantly to the deforestation of the UK. By as early as
1086, just 15 per cent of the English countryside was wooded, and by 1600, supply of
wood was in critically short supply. The average farmhouse of the fifteenth century
required the wood of 330 oak trees, and the half-timbered homes associated with that
period in England reflected the scarcity of timber rather than its abundance.

It is claimed that the first modern ‘solar’ house was built in Chicago in the 1930s (Reardon
& Downton, 2011). In Australia, a range of sustainable housing initiatives were underway
around the middle of the last century. For example, after World War II, the Experimental
Building Station conducted research and developed advisory materials on appropriate
design for Australian climates, covering ventilation strategies, insulation and orientation
and floor plans, culminating in a book, Designing houses for Australian climates, which
was first published in 1952 (Drysdale, 1952). Around this time also, the mud-brick building
movement in Melbourne emphasised the use of natural and alternative building materials
(Nillumbik Mudbrick Association Inc, 2013). However, such homes did not necessarily
consider other sustainability criteria, such as being energy efficient, and today mud-brick
homes struggle to achieve required energy ratings (Thomas, 2011). According to Pears
(2008), other examples of early Australian sustainable housing initiatives included
research by the CSIRO and some universities into areas such as solar hot water and
building technologies throughout the 1950s to 1970s, with some of their approaches
subsequently adopted from the 1970s by commercial builders such as Merchant Builders,
Landmark Homes and Fasham Johnson (Pears, 2008).

It took the energy crisis of the 1970s to see a growing emphasis on passive design
principles in buildings (Zalejska-Jonsson et al., 2012). In Australia during the 1980s, the
CSIRO built a demonstration house featuring passive solar design and an underfloor
horizontal rockbed linked to a low cost solar air heater in Highett, Victoria (Pears, 2008).
The further extension of this concept to ‘passive housing’ has been particularly impressive
in countries such as Germany and Austria, where ‘passivhaus’s’ (passive houses) are so

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well designed and insulated that they do not require active heating or cooling systems to maintain a comfortable temperature (Monbiot, 2007).

Kats et al. (2003) suggest that the first references to ‘green architecture’ and ‘green building label’ as a modern design philosophy were made in 1990, first in The Independent in London and later in American on the editor’s page of Architecture magazine. The first green building program in the United States started in Austin, Texas in 1991 and a Green Building committee of the American Society for Testing Materials was formed in the same year. The Australian Conservation Foundation (ACF) published the ACF Green Home Guidelines in 1992.

Despite such examples, most commentators seem to agree that despite strong interest from some groups and the implementation of various policy instruments and government support, progress internationally towards delivering sustainable buildings in significant volume, including housing, has been slow (Bryant and Eves, 2012).

However, over the duration of this research project there has been a significant evolution. When this research commenced in 2003, the concept of sustainable construction was still evolving (if not being rediscovered) and was arguably poorly understood. Articles in the popular media relating to sustainable housing were somewhat noteworthy, and there was a relatively weak legislative framework governing sustainability with regard to both residential and commercial construction. Not quite ten years later, there has been exponential growth in public awareness of a range of environmental issues, and in the evolution of sustainable building. It is now unusual not to find daily references to sustainability and related issues (particularly relating to climate change and greenhouse gases) in newspapers and magazines, driven by major government reforms such as energy regulation and the implementation of a carbon price in Australia. While the significantly increased focus on the issue of sustainability is heartening, it is still of concern that it appears that there is an often superficial understanding of the fundamental industrial, societal and lifestyle changes that will be required, particularly in developed countries, to result in a truly sustainable society. This gap between rhetoric and reality will be explored throughout this thesis.

It is also of concern that there are signs of somewhat of a backlash against sustainability, and a decline in interest from what appeared to be a peak in the few years leading up to the Global Financial Crisis; a period in which former US Vice President Al Gore released his well-known documentary on climate change, An Inconvenient Truth, and there
appeared to be growing public consensus that measures to curb greenhouse gas emissions were required. Klein (2011) describes the backlash to climate change and the mechanisms employed by various conservative think-tanks and lobby organisations, such as the Heartland Institute, to thwart progress on climate change. She succinctly illustrates this wider societal shift with this example:

“Five years ago, celebrities were showing up at the Academy Awards in hybrids, Vanity Fair launched an annual green issue and, in 2007, the three major US networks ran 147 stories on climate change. No longer. In 2010 the networks ran just thirty-two climate change stories; limos are back in style at the Academy Awards; and the “annual” Vanity Fair green issue hasn’t been seen since 2008.”

While this could suggest that public interest in sustainability, or ‘green’, has waned, in parallel we see concern expressed about the ways in which business and government talk about these concepts. A significant criticism of the use of the terms ‘sustainable’ (and related terms such as ‘green’ or ‘eco’) is that they are often used to ‘greenwash’ activities, that is to give an impression of environmental benefits that may not exist in reality. As AtKisson (2008, p.304) bemoans:

“Sustainable development – a term so misapplied as to be nearly beyond rescue – is not development-as-usual with a few green-looking additions or nods to social equity; but that is what it has often been reduced to in practice.”

Woolley (n.d., p.1) similarly notes that almost anything can be labelled sustainable because no-one is clear on the definition, noting also that sustainability “...is becoming an overused word and it is in danger of becoming a marketing device rather than a genuine commitment.” Mays (2003) also concluded that a lack of understanding is one of the barriers to greater uptake of sustainable practices.

More cynically, however, it could also be suggested that claims of confusion become a convenient excuse to avoid the difficult critical reflection and to maintain a business-as-usual approach. One of the inherent problems is that modern economies are based around consumption, and to live in a truly sustainable fashion would require massive reductions in levels of consumption (Smith, 2007), something that the majority of businesses have not so far been able to adequately reconcile. Professor William Rees from the University of British Columbia provides the evocative analogy of an overloaded
cargo ship, which as he notes, will sink with any more goods added to it, even ‘efficient’
one (as illustrated in Figure 1).

**Figure 1 – The sustainability merits of efficient goods** (Rees, 2007)

![Cargo ship overloaded with inefficient autos, appliances, electronic gadgets, etc.](image1)

![Cargo ship overloaded with efficient goods (but sinking just the same and possibly faster)](image2)

It is still common for the label of ‘sustainable’ or ‘eco’ to be used to describe anything as
simple as an otherwise ‘typical’ building with a couple of additions such as a rainwater
tank and some energy-efficient or solar-energy fixtures. One of the most significant
criticisms is that while many claim that a number of small differences will add up, it is
unlikely to be enough. As Woolley (n.d., p.1) puts it:

> “Just because you can come up with a product or a solution which helps to save
some energy and is financially viable, it doesn’t necessarily mean that it is going to
save the planet.”

He further notes that sustainability may involve a number of trade-offs. For example, in
the context of sustainable construction, many energy efficient buildings badged as
‘sustainable’ achieve this with fossil fuel-based insulation products and also “…rely far too
much on glues, sealants, membranes and so on which are synthetic, toxic, pollute the
environment and make disassembly very difficult”.

### 2.3 Drivers of Sustainable Housing

#### 2.3.1 Regulatory Drivers

Governments around the world have attempted to drive more sustainable housing through
various regulatory and incentive programs. For example, Denmark has demonstrated
leadership with regard to sustainable housing, having introduced mandatory requirements for stringent energy certification of homes and buildings as early as 1997. In 2002, the European Parliament developed the Energy Performance of Buildings Directive, requiring all EU member states to establish mandatory schemes for homes and buildings (Burr and Faesy, 2012). The Netherlands was one of the first to implement this, albeit in a semi-mandatory way (Brounen and Kok, 2010).

Another international leader, at least initially, was the UK Government, which in 2006 announced that all new homes would be required to meet ‘zero carbon’ requirements by 2016. It later broadened this requirement to apply to all non-domestic buildings from 2019 (UK Green Building Council, 2013). This announcement has apparently had a significant impact on driving sustainability innovation amongst the house building industry (UK Green Building Council, 2013). However, there is still no final definition as to what ‘zero carbon’ will mean in practice. It was originally intended to include all emissions a home was responsible for, both regulated and unregulated energy, but non-regulated energy use from appliances and the like was later removed by the incoming Coalition Government in 2011 (UK Green Building Council, 2013).

The UK Government also introduced the Code for Sustainable Homes against which all new homes were to be rated. This was based on the earlier voluntary EcoHomes tool, which later became a mandatory requirement to achieve a minimum “Very good” rating for government grant funding of social housing projects (Essa and Fortune, 2008). In 2012, the Government announced the “Green Deal” policy aimed at retrofitting 14 million homes in the UK to make them more energy efficient (Jowit, 2012).

In Australia, government at all levels has attempted to promote greater uptake of sustainable housing through a range of regulatory approaches with varying degrees of effectiveness. Some of these date back to as early as the 1970s. For example, the Victorian Parliamentary Inquiry recommended home insulation regulations in 1976, which were subsequently discussed or promised by later governments but not actually introduced in Victoria until 1991 (Pears, 2008).

Until 2003, individual States controlled the integration of sustainability into residential building regulations, but to introduce greater consistency this was brought under Building Code of Australia (BCA, now part of the National Construction Code), controlled by the Australian Building Code Board in 2004 (Bryant and Eves, 2012). This included mandating minimum energy and water standards (primarily relating to the building
envelope, including roof, walls, windows and floors), while other parts cover fittings such as hot water systems and cooling and heating system ducts and pipes (Department of Climate Change and Energy Efficiency, 2013b).

All States and Territories except the Northern Territory administer the implementation of the National Construction Code (formerly the Building Code of Australia) through State regulatory requirements which prescribe compliance as part of the building approval process for all new homes and significant renovations (Department of Climate Change and Energy Efficiency, 2013b). From the 2012 version of the BCA, energy ratings, using software accredited under NatHERS software protocol, is a compliance option for housing. New dwellings require a minimum rating of 6-stars (Australian Building Codes Board, 2013), subject to State and Territory variations.

A rating through NatHERS rates the heating and cooling thermal energy requirements to maintain a given level of comfort of Australian homes on a scale of zero to ten stars (in the early stages the scale went up to six). Zero stars indicates that the building shell does almost nothing to reduce the discomfort of hot or cold weather, while ten stars means a home is unlikely to need any artificial heating or cooling (Department of Climate Change and Energy, 2013a). The rating includes consideration of the house layout, construction methods of the building envelope including insulation, mass, ventilation, the orientation of windows and sun shading. Fixtures such as hot water systems, lights or household appliances are not considered under NatHERS as they are likely to be replaced several times over the life of a building (Department of Climate Change and Energy, 2013a).

However, the National Construction Code does now require that hot water services meet a minimum of 100 grams of carbon dioxide equivalent emissions per megajoule of heat produced, based on standard emission factors for energy sources. A requirement that the average installed lighting power density should not exceed 5 watts per square metre has also been applied in the latest National Construction Code requirements, as well as requirements relating to insulation of hot water pipes and heating/cooling ducts. If the software-based house energy rating is not used, compliance with requirements can also be met by constructing the house using prescriptive methods contained in the Deemed-to-Satisfy provisions of the National Construction Code. States and Territories are implementing these requirements into their respective legislation at different rates and using slightly different approaches.

A criticism of the design of these regulatory approaches is that they have predominantly focussed on energy implications associated with the building fabric’s thermal
performance, and, to a lesser extent, on water efficiency. Efforts have been made to expand coverage to energy use and emissions of lighting, hot water and water efficiency. However, they are not designed to address wider sustainability criteria such as materials selection, energy consumption of appliances, indoor environmental compliance and the like. Another significant criticism is that the calculation software that supports these regulations does not transparently demonstrate the assumptions that are made and provides limited diagnostic feedback, thus making it a matter of trial and error for designers attempting to optimise their home designs (Arnold, 2011).

In addition to the performance-based rating, a lack of enforcement/inspection during construction and lack of methods to non-destructively assess final outcomes reduces confidence that claimed performance will be achieved for new homes. While proposed mandatory energy disclosure schemes provide an opportunity to consider actual billing data, concerns about privacy, variability of occupancy and user behaviour mean that this may not occur. However, developments such as the availability of cheaper thermal imaging cameras and smart meters may allow thermal weaknesses to be identified and energy usage to be better analysed (A. Pears, Melbourne, pers. comm, 15 June 2012).

Acknowledging the potential to increase customer demand for sustainability through more transparency, in 1999 the Australian Capital Territory (ACT) became the first Australian jurisdiction to introduce mandatory energy disclosure for all houses on the market, with houses required to obtain an energy efficiency rating (EER) by an accredited assessor (Bryant and Eves, 2012). A recent study by the Australian Bureau of Statistics based on house sales in the ACT in 2005 and 2006 found that there is a statistically significant relationship between the EER of a house and its sale price in the ACT. This report claimed that an increase in energy performance of a house of one star increases market value by about 3 per cent, equivalent to $8,979 in a house that sold in 2005 for $365,000 (Department of Environment, Water, Heritage and the Arts, 2008). This is consistent with the findings of RICS Research (part of the Royal Institution of Chartered Surveyors) in the UK, which found in the Netherlands that there was a 2.8 per cent or higher premium transaction price for houses demonstrating high levels of energy efficiency (Brounen and Kok, 2010). However, Bryant and Eves (2012) noted several limitations associated with the Australian Bureau of Statistics study, in that it is assumed erroneously that there is otherwise homogeneity across the housing stock; that the study was based on only two years of sales data even though the scheme had been in place for six years, and that the focus is only on building fabric thermal qualities and not usage factors such as lighting, hot water, heating, air-conditioning or appliances.
Mandatory sustainability disclosure requirements for all dwelling sales were also introduced by the Queensland Government on 1 January 2010; (subsequently repealed in 2012, as discussed later in this chapter). All residential sellers were required to complete a declaration at the time of sale outlining their home’s sustainability features with regard to energy, water, safety and access. Selling agents were not permitted to complete the form on the seller’s behalf, but were required to advertise the availability of the declaration. Prospective buyers were required to proactively request a copy, and if they did not, the selling agent was not obliged to provide it (Bryant and Eves, 2012). Similar disclosure requirements were being considered across the rest of Australia, with the goal of raising the profile of building energy performance for buyers of existing homes and apply pressure to new home builders and buyers to consider energy performance when considering resale value (A. Pears, Melbourne, pers. comm, 15 June 2012), however, progress seems to have stalled with a number of States delaying implementation (Perinotto, 2012).

Government has also sought to consider a wider range of sustainability issues beyond energy and water. For example, in 2006 the Australian Greenhouse Office, within the Commonwealth Department of Environment and Heritage, commissioned a scoping study investigating measures for improving the environmental sustainability of building materials with a view to incorporation into the (then-named) Building Code of Australia (Centre for Design at RMIT University et al., 2006).

Approaches by local government have been more ad hoc and typically involve simply applying State planning instrument requirements. One of the more notable examples of a local government sustainability initiative tied to a regulatory framework is the STEPS program (Sustainable Tools for Environmental Performance Strategy) developed by Moreland City Council and also used by the City of Port Philip Council in Victoria. This is an interactive, web-based residential building sustainability rating tool which is to accompany a building planning application, and is intended to streamline the approval process for new buildings. It covers greenhouse emissions from operating energy, peak energy use, mains (drinking) water use, stormwater quality impacts and building materials impacts. It also calculates bicycle places required and waste recycling area needs (Moreland City Council, 2013).
In the last couple of years, however, there appears to be somewhat of a move away from sustainability-focused regulation by government, both in Australia and overseas. As mentioned previously, the newly elected State Government in Queensland (in 2012) reversed the mandatory disclosure regulations for domestic real estate transactions shortly after taking power (Perinotto, 2012), while the State Government in Victoria was, at one point, considering abandoning a national commitment to roll out mandatory 6 star energy ratings for new homes with a view to reducing bureaucratic ‘red-tape’, although it later rule out doing so (Morton and Millar, 2012).

Earlier, a review of mandatory energy efficiency disclosure for the Australian Government in 2005 found that Denmark, despite its international leadership in this area, did not think that further voluntary improvements in the environmental performance of buildings was likely as “sustainability issues have lost popularity” (Faber Maunsell & Aecom, 2005, p. 39). Similarly, the UK Government announced in October 2012 that it would undertake a ‘radical and fundamental review’ of the entire framework of Building Regulations and voluntary housing standards (UK Green Building Council, 2013), which will include Part L of the Building Regulations dealing with energy efficiency and the Code for Sustainable Homes. The driver behind these reforms is to cut costs for the industry and boost the economy through investment in homebuilding, in response to the ‘doldrums’ facing the construction industry, where the levels of new home construction having fallen to the lowest level since the 1920s (Jowit, 2012). However, concerns have been expressed about the implications for sustainability by lowering standards and encouraging further self-regulation, particularly relating to the standards on energy efficiency, as well as for broader sustainability-related considerations such as water, security, accessibility, fire safety and wheelchair access (Jowit, 2012).

2.3.2 Voluntary Drivers – Government Led

Beyond regulatory approaches (often referred to as ‘sticks’), the role of government in encouraging sustainable building is more complex and may also include ‘carrot’-type approaches (such as by providing incentives to various stakeholders or by implementing educational programs and demonstration projects). The role of government is particularly significant because it influences not only builders, but most of the other stakeholders as well.

As early as the 1970s, governments have implemented various incentives promoting more sustainable housing practices. According to Pears (2008), in 1976, the Gas & Fuel
Corporation of Victoria began selling home insulation, allowing buyers to pay it off over time through a surcharge on their gas bills, while in the late 1970s, the Fraser Liberal Federal Government offered a tax rebate on home insulation, subsequently repealed by the Hawke Labour Government. The Gas & Fuel Corporation and subsequent organisations also promoted solar-efficient housing through display homes and villages during the 1970s and 1980s (Pears, 2008).

The first energy rating scheme in Australia was established during the 1980s by the GMI (Glass Mass Insulation) Council, and was used in Victoria, New South Wales and South Australia, although it was not widely accepted by the building industry as it was seen to be restrictive. Individual States subsequently adopted their own approaches during the 1990s (Kordjamshidi, 2011).

In parallel, various agencies and research organisations including the CSIRO also developed a range of computerised thermal performance simulation tools such as CSIRO ZSTEP or TEMPAL developed by Melbourne University (Pears, 2008). Much later, similar tools included NatHERS, VicHERS (FirstRate) and BERS (Pears, 2008).

More recently (in 2001), the Commonwealth Government first published and widely distributed (including freely on the internet) the Your Home Technical Manual (Reardon et al., 2011), a comprehensive guide to sustainable building that was aimed at home buyers and occupants, builders and building professionals. As at 2011, this publication was in its 4th edition, with a fifth edition currently (2013) in preparation.

To further assist building designers and operators, in the early 2000’s, the Australian Government developed a tool to rate the sustainability performance of existing houses called ‘NABERS’ (National Australian Built Environment Rating System). Its initial development stage took some four years at a cost of about $600,000 (Perinotto, 2010), with the intention to produce a comprehensive tool which could rate the overall impact of a building on land which had been previously undeveloped. However, there was opposition from industry and eventually management of the tool was taken over by the NSW Government after a tender process, against competition from the Green Building Council of Australia. The NSW Government amalgamated it with its own Australian Building Greenhouse Rating tool to develop a national online calculator which allows benchmarking through formal ratings of offices, retail buildings, hotels and data centres (NSW Government Office of Environment & Heritage, 2013). Input to the calculator is based on historical (actual) performance data relating to energy and water consumption,
waste generation and indoor air quality by qualified assessors. This tool now forms the basis of the implementation of the mandatory energy disclosure requirements for commercial buildings. By 2010, more than 60 per cent of the Sydney CBD and 50 per cent of all Australian CBDs have NABERS rating, equivalent to some 10.5 million square metres of rated commercial space in more than 1000 buildings (Perinotto, 2010). Households can also input energy and water data to get a home rating, but with a significantly reduced scope of coverage.

Recognising the need to tackle sustainability performance of existing homes, but the greater political and logistic challenges in doing this through regulatory approaches, the Commonwealth Government introduced two ground-breaking, but ill-fated, voluntary programs in 2009. The ‘Green Loans’ program commenced in July 2009 and was administered by the Department of Environment, Water, Heritage and the Arts. Initially it provided free Home Sustainability Assessments and access to subsidised ‘Green Loans’ of up to $10,000 for energy and water efficient systems and solutions to improve the sustainability of homes. However, the program was dogged by criticisms about the appropriateness and efficiency of the procurement processes and a lack of documentation, and was the subject of a number of reviews and audits (for example, Department of Environment, Water, Heritage and the Arts & Protiviti 2009; Faulkner and KPMG, 2010). Although intended to run to 2013, the program was converted to a Green Start program emphasising the assessments but not the loans, and ceased completely in early 2011. In an attempt to reduce criticism over its handling of the program, the Government allocated $15 million to a professional development scheme to provide financial assistance to assessors who had invested in training but were not subsequently contracted to deliver services (Combet, 2010a).

The second example, the Home Insulation Program was a more dramatic failure. This program had dual aims: of delivering enhanced sustainability performance of existing homes; but also stimulating the national economy following the Global Financial Crisis. The program was a component of the Energy Efficient Homes Package, an element of the Commonwealth Government’s $42 billion Nation Building and Jobs Plan. It was originally intended to provide insulation to 2.7 million homes (comprising 2.2 million owner-occupied homes and 0.5 million rental properties) that had no insulation or were inadequately insulated, with a goal of reducing energy bills and greenhouse gas emissions. Low income households were a priority of the scheme. The rebate of $1,600 initially offered (later dropped to $1,200) meant many homes could be insulated free of charge. Given the desired outcome of stimulating the economy and creating jobs, the program was
“unprecedented in its scale and speed of implementation” (Hawke, 2010, p.v). Take up of the program was “extraordinary and unexpected” (Hawke, 2010, p.xi), with claims peaking at 180,000 per month. At the peak of the program there were over 10,000 registered installers employing thousands of largely low-skilled workers, and a national training program provided training to over 3,700 people.

It appears that the Government inadequately anticipated the demand, did not resource the implementation of the program adequately (including with adequate staff to manage it) and did not fully anticipate the potential for fraudulent abuse by unscrupulous organisations. Nor did it strike an appropriate balance between wanting to get the program happening quickly while ensuring that installers had adequate training to work competently and safely. After over 100 house fires linked to the installation of the insulation and the deaths of four installers, coupled with fraud-related concerns, the Government responded to widespread public criticism and a number of damning investigation reports and ceased the insulation rebate in early 2010 (Combet, 2010b).

Although widely criticised as failures of public policy in the media, there were environmental gains from these two programs. For example, the proportion of households with insulation increased from 61 per cent in 2008 to 69 per cent in 2011, although the extent that this was directly attributed to the Home Insulation Program is unclear (Australian Bureau of Statistics, 2011).

At a State level, one of the key incentives offered to encourage sustainability is through the provision of rebates. For example, during the drought (2003-09), there were 65 rebate schemes in place to encourage installation of rainwater tanks, although with the drought proclaimed over, only four rebates remained by 2011 (Gill, 2011). Some States have offered various incentives to upgrade insulation and buy energy-efficient equipment, such as heaters and hot water services, such as the Victorian Energy Efficiency target and the New South Wales Energy Savings Scheme. These are targeted more at existing homes, but can assist new home buyers when they buy eligible equipment.

2.3.3 Voluntary Drivers – Non-Government

Industry groups and non-government organisations have also attempted to drive the agenda by developing rating tools or sustainability assessment techniques to inform and recognise sustainable housing attempts. Manley (2008) notes that these schemes have high profiles and significant impact on organisational reputations. However, Georgiadou &
Hacking (2012) also suggest there is generally consensus that no single tool yet addresses sustainability holistically.

The tools or techniques may take one of three forms: **impact assessment techniques** (such as environmental impact assessments), designed to predict the nature of impacts (social, economic and/or environmental) prior to decisions being made with an emphasis on precautionary thinking; **analytical techniques** (such as life cycle assessments) which compare benefits against costs or impacts; and **building environmental assessment methods** which may focus on particular areas such as energy and may range in scale from global to local (Georgiadou & Hacking, 2012). The latter category may be broken down further into knowledge-based tools (eg manuals, guides); performance-based tools (for example, simulation or modelling tools); and building rating tools (checklists of features or calculators and the like such as LEED (Leadership in Energy and Environmental Design) for Homes tool developed by US Green Building Council and the Code for Sustainable Homes in the UK developed by the UK BRE (Building Research Establishment)). Such tools allow an element of flexibility through a requirement to obtain a number of points across a range of categories.

Although building environmental assessment methods are typically voluntary, some, such as the Code for Sustainable Homes in the UK, which superseded the voluntary EcoHome rating tool, have subsequently become mandatory (Georgiadou & Hacking, 2012).

A key criticism of building environmental assessment methods is that as they are “…designed to evaluate the environmental performance of buildings at the (later), detailed design stage, which may be too late to consider sustainability issues” (Georgiadou & Hacking, 2012, p. 169). They also may not effectively take into account the impact of occupant behaviour, which is noted to significantly impact on outcomes (Hurst, 2012).

There is not currently a directly comparable rating tool for housing in Australia, with the Green Building Council of Australia having developed a tool that covers only apartment blocks or community-scale developments. The Australian Housing Industry Association (HIA) developed the **GreenSmart** program, a training program aimed primarily at builders rather than a tool. The Victorian Environment Protection Authority developed the EPA Greenhouse Calculator (Victorian Environment Protection Authority, 2013), but this is not holistic, focussing only on greenhouse gas emissions.
Earlier attempts to provide a similar tool included the development of the Australian Conservation Foundation’s (ACF’s) *Green Home Guidelines* in 1992, which are no longer readily available, and the Australian Greenhouse Scorecard developed during the mid-1990s with support from the Victorian Environment Protection Authority (Pears, 2008). More recently, the ACF has been operating an environmental education program called ‘GreenHome’ for a number of years. While initially this was a holistic sustainable living program that involved workshops, focussed events and a website, it appears to have reduced in scale and as at 2013 is simply a web-based information source, described as “an online community of people with an interest in sustainable living” (Australian Conservation Foundation, 2013). Documents such as the Green Home Guide can be located via an internet search, but not easily from the ACF website.

One of the most ambitious voluntary sustainable building schemes in terms of its goals, is the Living Building Challenge, an advocacy tool and certification program for buildings at all levels. Owned by the International Living Future Institute, this tool is designed to promote the construction of self-sufficient buildings with renewable resources, water capture and treatment and with an emphasis on concepts such as being socially just and ecologically restorative. It comprises of seven performance areas: site; water; energy; health; materials; and perhaps most interestingly and uniquely, equity and beauty (which includes a spiritual dimension) (International Living Future Institute, 2012). One of the features which sets it apart from many other home rating tools is the need to demonstrate all program requirements have been met after twelve months of continued operations and full occupancy. A partial program certification (“petal recognition”) may also be achieved subject to certain criteria being met. However, perhaps reflecting the ambitious goals of this program, as well as the fact that the program only commenced in late 2006, as at early 2013 only three projects internationally (all in the USA) have achieved ‘Living’ status by meeting all requirements; two projects internationally have achieved petal recognition; and two projects have achieved certification as Net Zero Energy Buildings. Approximately 90 other projects are part-way through the registration process (International Living Future Institute, 2013).

Other groups attempting to drive more sustainable housing in Australia, particularly through providing advice and support on alternative technologies, have included ANZSES (now the Australian Solar Council) and the Alternative Technology Association (Pears, 2008).
Another potential non-government driver for sustainability is clients/customers, by expressing preferences for sustainability features or specifying performance requirements to marketers, architects, designers and builders (Reardon et al. 2011). Given that housing consumers are often also the building operators, they are also in a position to significantly reduce the operational impacts of their home, particularly with regard to energy and waste, by seeking out sustainably designed new homes and understanding how to operate the home efficiently (Reardon et al. 2011). According to Koebel & Cavell (2006, p.28), clients certainly may prove to be a greater driver for sustainability where rising energy costs are concerned, which they suggest is likely to be a major driver of innovation in construction:

“Perhaps the single most important trend that could affect future innovation in building technology is the increase in energy costs. Seven of ten [volume builder] respondents rated energy costs as influencing building technology innovation over this time span. In addition, our qualitative interviews with builders confirmed that energy costs will likely play a major role in pushing technology innovations into the market.”

However, the literature generally suggests that clients/customers are more likely to be barriers to sustainability, or innovation more broadly, discussed further in Chapter 4.

Some research (such as Gann, 1997, p.9 cited in Manley, 2008, p.230) claims that manufacturers are “…key drivers of technical innovation in the construction industry. They invest far more in research and development (R&D) than contractors or consultants, and are subsequently more likely to develop product and process innovations.” However, as Manley notes, the effectiveness of this is dependent upon the strength of their relationships with project participants and end-users, and associated knowledge flows.

2.4 Status of ‘Sustainable’ Houses

Despite a number of government and industry programs to promote and encourage ‘sustainable’ housing, described in Sections 2.2 and 2.3, good examples are still the exception rather than the norm both internationally and within Australia. For the most part, the mainstream housing sector (particularly the volume building industry) has been slow to embrace the concept of sustainability and apply it to their processes and products. Birkeland (2008) notes that although resource-autonomous houses have been around for a long time, they are still scarce.
Internationally, noteworthy examples of sustainable housing projects include the previously mentioned passivhaus’s in Europe. These are buildings designed to reduce heat losses so much that they use some 75 per cent less energy for heating and cooling, whilst ensuring a high level of occupant comfort. This is done through features such as high levels of insulation, high performance windows with insulated frames, airtight building fabric, construction avoiding thermal bridges, and a mechanical ventilation system with efficient heat recovery. The result is that a large part of the heating demand can be met by passive sources such as the sun, human occupants, appliances and heat from the extracted air (Passivhaus Trust, 2013).

The Village Homes subdivision in Davis, California, is held up as an exemplar of sustainable housing, considered “…one of the first modern-era development projects to successfully create an environmentally sensitive, human-scale residential community” (Rocky Mountain Institute et al., 1998, p. 37). It featured use of water-sensitive urban design principles, which resulted in significant development cost savings (nearly $200,000 in 1980 dollars) that were used to provide public amenities such as parks and gardens. Narrower streets also allowed for additional trees, lowering ambient temperatures in the neighbourhood. Houses in this development reportedly continue to sell faster when they come on the market, and for a premium (Rocky Mountain Institute et al., 1998). Another ground-breaking example is BedZED (Beddington Zero Emission Development), built in 2002. It was the UK’s largest mixed use, carbon-neutral development, with 82 affordable dwellings and some 2,500m2 of workspace/office. In addition to energy-efficient design, the development includes a biomass heat and power plant, on-site sewage treatment and wind-driven ventilation. The development was also designed to cater for a wide spectrum of income levels of residents (zedfactory, 2013).

Focussing primarily on the current status within Australia, there is still a long way to go. Ambrose et al. (2005) claim that for many years, until mandated energy efficiency standards were incorporated across all Australian States and Territories through the former Building Code of Australia (now National Construction Code), the uptake of energy efficient design for Australian residential houses was typically restricted to States with legislated minimum energy efficiency standards. Until the introduction of these regulations in 2003, less than one per cent of Australian houses would have obtained a 5 star rating on the NatHERS scale, while houses built in 1990 would have received an average rating of about 1 Star (Department of Climate Change and Energy Efficiency, 2013a).
These figures support the findings of a study by Tucker et al. (2002, cited in Ambrose et al., 2005), which found that houses being constructed in south-east Queensland rated very poorly in terms of energy efficiency, with 91 per cent of houses studied obtaining only a 1 star rating or worse out of a maximum possible 5 stars, despite the fact that in those climatic conditions it should been quite easy and cost-effective to construct a 3.5-star house. This study also noted that poor energy efficiency was particularly true of project (or volume) houses.

More recently, there is emerging evidence that in spite of new legislative requirements relating to energy and water (and, supposedly, rising levels of awareness of sustainability), the environmental impacts of housing continue to increase. For example, a study conducted in 2007 for the Victorian Department of Sustainability and Environment to investigate the option of establishing greenhouse gas benchmark levels for new housing (Wilkenfeld, 2007) suggested that the energy-related greenhouse gas emissions of the average new dwelling were nearly six per cent higher than the average emissions of existing dwellings. Although the areas targeted by the 5 star legislation, namely heating, cooling and water heating, resulted in lower emissions from these end uses than from existing dwellings, it was noted that these gains were more than outweighed by the growth in emissions from lighting, and from the fact that the average new dwelling was estimated to have a 30 larger net conditioned floor area than the average existing dwelling. Neither lighting nor house size were addressed by the 5 star legislation. However, the authors of this report noted that without the legislation, the annual greenhouse gas emissions were predicted to have been 33 per cent higher than for the average existing dwellings, meaning that the average emissions were about 20 per cent less than if the regulations had not been implemented.

To date, most new houses claiming to be ‘sustainable’ have typically been one-off, architect-designed (or specialty designer) homes, or homes designed to promote sustainable housing or to be used as a focal point for research. There have also been attempts to renovate existing homes to make them more sustainable and less reliant on centralised utilities, with such a project in the inner-city Sydney terrace house of Michael Mobbs one of the better-known and promoted examples (Mobbs, 1998). Apart from meeting minimum legislative requirements, until very recently there have been few examples of volume houses which could be considered to be particularly sustainable. Existing examples fall well short of zero net lifecycle impacts.
For example, in the fourth edition of the *Your Home Technical Manual* (Reardon et al., 2011), 14 case studies of new freestanding houses are included. Of these, all but one were designed by architects and/or specialist building designers (including within government agencies) rather than building companies, and all were built by either owner-builders or by building companies that were either small or produced custom homes rather than off-the-plan homes. One of the builders, Chelbrooke Homes in Brisbane, reportedly builds approximately 100 homes per year, which is comparable in output to a smaller volume builder, but their homes are custom-designed according to Mr M. Hietikko, Design & Service Manager, Chelbrooke Homes, (pers. comm. 15 April 2009).

There are, however, recent signs that there may be a shift in the volume housing market. One significant recent development was the establishment of a project to design, build and monitor Australia’s first zero emission house, through a consortium of government and industry partners including the CSIRO, Sustainability Victoria, Delfin Lend Lease and Company B (this project, and two other sustainable homes built by volume builders, are described further below). At a larger scale, laudable attempts to create urban developments which demonstrate sustainability practices or principles have included:

- **Sydney Olympic Village**, a 90 hectare development in the western Sydney suburb of Newington. It comprises a retail centre, business park and wetlands as well as the residential area which was originally purpose-built to house athletes during the 2000 Olympic Games. At the time of the Games, Newington was the world’s largest solar-powered suburb, with 12 photovoltaic cells and a solar hot water system on the roof of all of the 2,000 houses in the suburb. Other features included passive solar design; good building envelopes; a dual water supply with treated recycled water for toilets; irrigation incorporating the use of wetlands; and good connections (including cycle-ways) to public transport links. It was also claimed that as much as 90 per cent of hard waste and 60 per cent of soft waste from construction was recycled. Innovative products used included low off-gassing paints developed with input from the CSIRO which were reportedly used for the first time at Newington; polypropylene piping instead of PVC for plumbing, and wool insulation in walls and ceilings instead of polyester or fibreglass (Taylor, 2013).

- **‘The New Rouse Hill’, NSW** – a 120 hectare master-planned community in north-west Sydney resulting from a joint venture between two commercial developers with Landcom (the NSW Government’s development agency) and the NSW Department of Planning. This development is noteworthy for featuring Australia’s largest residential water recycling scheme, started in 2001 and incorporating more than 20,000 homes.
(anticipated to increase to about 36,000 homes). Currently, the connected homes are using up to 1.7 billion litres of treated wastewater from bathrooms, laundries, kitchens and businesses for toilet flushing, garden watering and other outdoor uses. This is attributed to have reduced demand for drinking water in the relevant areas by about 40 per cent (Sydney Water, 2013). Within this community, the Rouse Hill Town Centre has been billed by its developer as “Australia’s first regional retail centre to demonstrate a comprehensive approach to world class social and environmental sustainability” (GPT, 2013), with innovative features including reversing the typical shopping centre design to create a series of open streets which assist natural ventilation, and the use of green leases. There is also an emphasis on community engagement through the town centre, and various plans and programs to promote ‘green’ travel to the centre.

- **Aurora, Melbourne, Victoria** – developed by the Victorian Urban Development Authority (VicUrban), as its flagship in sustainable greenfield development, this master-planned development is located some 20 kilometres north of Melbourne’s central business district. Planned to eventually be home to a population of 25,000 with in excess of 8,000 dwellings, by early 2011 it had approximately 1,500 residents (Hurley, 2011). The development will include two town centres, five schools and 148 acres of public space (VicUrban 2007, cited in Hurley, 2011). An unusual feature of this development is that it has its own formalised *Aurora Sustainability Covenant* (2006), a statutory agreement committing to reduce the ecological impact of the development and signed by VicUrban, the Victorian Environment Protection Authority, Yarra Valley Water and the City of Whittlesea. Key sustainability initiatives included 6 star energy rated homes as standard with compulsory gas-boosted solar hot water and a third-pipe system for providing recycled water to homes (a first of this scale in Victoria, estimated to largely contribute to an anticipated 70 per cent less mains water consumption than residents in similar residential developments) (Hurley, 2011). Other features include passive solar design, optional rainwater-fed hot water systems and mandatory use of eco-preferable materials articulated in a building scorecard. VicUrban were also lobbying for a rail link from an existing line but this remains unfunded (Hurley, 2011). Critics of the development have noted community frustration that, despite promises of local services and quality transport infrastructure, residents remain largely dependent on car travel to access basic services (Weymes, 2011, cited in Hurley, 2011).

- **Christie Walk, Adelaide, South Australia** - a medium density co-housing development in Adelaide’s central business district, initiated in 1999 and completed in December 2006. The project was driven by community activism and a small architectural practice
rather than a major developer. With 27 households on 2,000 square metres, encompassing townhouses, apartments and individual cottages, this development was intended to be a demonstration project and practical prototype for development of cities. It showcases a range of sustainability features, with the goal of being a “liveable, affordable and environmentally benign urban community”. In addition to reducing car dependency from its inner-city location, this development promotes shared community rooms, facilities and gardens including an on-site community food garden, storm-water harvesting for toilet flushing and irrigation, passive solar design and natural ventilation, solar hot water, photovoltaic cells, and materials selected for their non-toxicity, recycled nature and low embodied energy. The development was designed to foster social interaction with convivial outdoor places and reportedly has a strong ethos of ‘community’ amongst its residents (Urban Ecology Australia Inc, 2013).

- **GreenSmart village, Queensland** - three houses were built on a south-east Queensland estate by different builders using the Housing Industry Association’s GreenSmart environmental guidelines. The development had strong interest and media coverage, assisted by the fact that the houses were part of a charity fundraising exercise. This project was rated a success, with one of the builders reporting a significant rise in demand necessitating a need to move to larger offices (Ambrose et al., 2005).

Other significant examples of developments emphasising sustainability have included Lochiel Park in South Australia, developed by The Land Management Corporation (outlined by Blaess et al. 2007, cited in Hurley, 2011); Mawson Lakes, also in South Australia, developed by Delfin (Delfin, 2005, cited in Hurley, 2011) and the Melbourne Commonwealth Games Village (CSIRO, 2006).

There are also examples of work at the level of individual houses. Specifically, examples of new Australian houses built with sustainability as a key consideration, which have garnered research attention or been used as public demonstration sites, include:

- **The Research House** in Rockhampton, Queensland, built for the State’s Departments of Housing and Public Works. This was a standard-looking, single-story four bedroom house featuring various sustainability features built with consideration of triple bottom line requirements. It also demonstrated less commonly incorporated, broader sustainability features such as security, safety, accessibility for a wide range of users and cost-effectiveness, as well as incorporation of a home office. In addition to relatively standard sustainability features such as increased thermal mass, passive
solar design and cross-ventilation, an efficient building envelope, heavy insulation, photovoltaic cells, energy and water efficient fixtures and appliances, rainwater collection and low-VOC materials, notable features of this project included the incorporation of flyash into the walls to make effective use of an industrial waste stream, and the inclusion of an energy management system (Szokolay, 2011). The house opened in 2001 and was occupied by a couple. It was the subject of both ongoing technical into its performance, as well as social research looking at occupant experiences (summarised by Barnett and Buys, n.d.; Buys et al., n.d.).

- The *Healthy Home* in Queensland’s Gold Coast; a joint venture between Queensland Government Departments, universities and industry partners, is a two-storey, modern Queenslander-style home, partly clad in reinforced fibre cement and partly corrugated iron. Sustainability considerations included passive solar design, radiant and bulk insulation, natural ventilation and thorough draught-proofing; materials selected for low embodied energy; low toxicity (eg lime wash paints) and/or recycled content; and good daylighting. Other features include a water flow control system, a triple-filtered rainwater storage system with ultraviolet water disinfection; a greywater treatment system; energy-efficient appliances; a grid-connected photovoltaic array; and a permaculture garden including native plants and a recycled-tyre drip filter irrigation system (Hyde, 2011).

- The *Subiaco Sustainable Demonstration Home* in the western suburbs of Perth, Western Australia (WA), was instigated and developed by the local council as a collaborative demonstration of energy efficient housing with participation from various WA Government departments, universities and sponsoring businesses. The house was open for public inspection until it was sold in May 2006. Features include passive solar design; night ventilation and cross-ventilation; insulation and solar hot water; low allergenic materials and landscaping; and adaptability for universal access. Demolition material from the original brick and tile factory on the site was used as a construction material (Baverstock, 2011).

In addition, three specific examples of sustainable houses built by volume builders are important to discuss, these are:

- the ACF Green Home;
- the Cairnlea Ecohome; and
- the Zero Emission House.
These homes were all built in Melbourne, with the last two each built by a building company which features as a case study organisation in this research. The Cairnlea Ecohome in particular is described in some depth, as it was the original catalyst for subsequent research and I had involvement with it from its construction phase through to its eventual sale and occupation. There is otherwise very limited documentation about this home on the public record, and this thesis helps to address this gap.

2.4.1 The ACF Green Home

Described as Australia’s first demonstration ‘sustainable’ home by Okraglik & Pollard (1995), who outlined the project in some depth, this house was built at Roxburgh Park, a housing estate in Melbourne’s north-west, and completed in March 1993. The project was funded by the Australian Conservation Foundation, a national not-for-profit environmental organisation, and the Victorian Government. The ACF was reportedly looking for a way to enhance their public image and be seen as proactive and solutions-oriented. It was also intended that the home would influence the first home market towards achieving environmental sustainability, in part by providing visitors with sustainability ideas that could be used in either new or established homes.

The support of the Victorian Government was obtained for the project, at least in the early stages, with some evidence that a desire to promote the environmental and affordability benefits of more sustainable housing was a major objective behind the Government’s involvement. According to someone who was involved with this project, a change of government in late 1992 led to a change of government priorities regarding sustainable housing (A. Pears, Melbourne, pers. comm., 5 June 2012).

Land for the project was supplied by the Urban Land Authority (ULA), a government agency and predecessor of the Urban and Regional Land Corporation, which was later also a major driver of the Cairnlea Ecohome project. Other project stakeholders included the Victorian Department of Planning and Housing and the Master Builders Association of Victoria (MBAV). The ULA supported the project in part by agreeing to recoup the cost of the land once the home was sold after a period as a display home. Although no written evidence of their objectives for involvement with the project was available, anecdotal evidence from interviews with project stakeholders suggested that a significant objective for their involvement was the opportunity to publicise the estate to potential purchasers (Okraglik & Pollard, 1995).
The home was built in accordance with the requirements of the ACF’s *Green Home Guidelines* (Australian Conservation Foundation, n.d.), developed by consultants on behalf of the ACF in 1992. Amongst other things, the guidelines promoted:

- the use of materials with low environmental impact;
- the minimisation of energy use and the utilisation of low energy greenhouse impact sources;
- the placement of minimal loads on infrastructure such as stormwater, water supply and sewerage, and energy supply;
- features that facilitated an environmentally-sound lifestyle; and

The Government called for expressions of interest to design and construct the ACF Green Home, with over 100 tender documents requested but only three tenders received which met both the tender requirements and the Green Home guidelines. The successful tendering team, Hotondo builders and architect David Oppenheim, offered a combination of mass market and sales experience at Roxburgh Park and energy efficiency credentials. However, the tendered price was much higher than had been originally envisaged, at $134,000 to design and construct rather than the $110,000 or so which had been anticipated. An effect of this, which was not fully understood until much later, was that it effectively priced the home out of the first home buyer category.

The resultant house was designed as a reasonably typical for the market three bedroom, two storey brick veneer house. The block provided by the ULA, at 600 square metres, was larger than the guideline’s required maximum of 500 square metres. The house was set back from the street, apparently in an attempt to show that it could be built on a smaller block of land that conformed to the ACF guidelines (Okraglik & Pollard, 1995).

There was later criticism about the aesthetics of the home from a range of stakeholders that were interviewed by Okraglik & Pollard (1995). The house did not particularly fit with the prevailing aesthetic style in the housing estate for various historically derived elements (such as Georgian, Federation, or Victorian) superimposed on essentially modern buildings.
The Green Home was auctioned in September 1994, and was passed in with a reserve price of $135,000. It was not sold until June 1995, with a purchase price of $105,000, which represented a loss of approximately $60,000 (given that the tender price for design and construct of the house had been $134,000 and at that point in time, the average land price in the area was around $30,000). Perhaps equally disappointing was the limited interest that was shown in the home’s sustainability features. No records were available of either the number of visitors or their adoption of features present in the Green Home, but anecdotal evidence from real estate agents who sold the property indicated that visitation had been extremely poor. The problem could in part have been that, during interviews subsequent to the auction, Okraglik & Pollard (1995) noted that the real estate agents had little awareness of the environmental features of the home, and were therefore unable to explain them to visitors.

They concluded that:

“….as a demonstration project, the Green Home can be seen to be a failure in terms of influencing the housing market towards greater sustainability” (p. 263).

Some of the challenges and problems experienced by this project seemed to be just as relevant almost a decade later with the Cairnlea Ecohome.

2.4.2 The Cairnlea Ecohome

The Cairnlea Ecohome was built in the Cairnlea housing estate in Deer Park in Melbourne’s west by Company A, one of Victoria’s largest volume builders. It was completed in 2004 and officially launched on 16 July 2004 by the (then) Victorian Minister for Major Projects who described it as “Victoria’s first ecologically sustainable house for the mainstream housing market”.

The housing estate itself, developed by the Victorian Government’s urban development agency, the Urban and Regional Land Corporation (URLC, later renamed VicUrban), was also designed with some consideration of sustainability. A former Commonwealth Defence munitions factory, the 460 hectare estate was extensively remediated as part of the development process, with an attempt to restore the natural environment of the area.
such as creek corridors and the use of water-sensitive urban design principles. Other touted sustainability features of the estate include convenient access to public transportation, with three railway stations within a one kilometer radius of the estate. Urban infrastructure such as shops and schools in close proximity were also provided to reduce dependence on cars. A Civic/Education precinct had also been proposed at the time but the exact facilities were being considered at the time.

The house (see Figure 2) is similar in appearance to others in the outer suburbs of Melbourne and other Australian cities. It is a brick veneer and weatherboard-clad two-storey home with two living areas (see Figure 3), four bedrooms and three bathrooms, with a footprint of 190.6m² and built on a 280.8m². However, these similarities belie the efforts to differentiate the home from standard volume homes.

The Cairnlea Ecohome was conceived with recognition of the magnitude of environmental and social problems created by the construction industry, and the need to provide practical and tangible examples to the industry of more sustainable approaches that could be readily and affordably adopted. The idea evolved initially from discussions between the URLC and RMIT University, into ways in which the residential construction industry could be encouraged to operate in a more sustainable manner. The parties felt that a useful approach would be to provide a physical example of an actual house that embodied many desirable products and techniques, with a goal of encouraging further uptake in comparable project homes.

The ultimate goal behind the home’s inception was to drive the uptake of sustainable features in comparable projects homes. More specific goals of the Cairnlea Ecohome were to:

- Construct a marketable sustainable display house that could be reproduced easily across the Cairnlea Estate with minor adaptations;
- Inspire visitors who will eventually buy new houses or retrofit existing

Figure 3 –Ecohome living area and kitchen
Source: Centre for Design, RMIT University
houses to incorporate more environmentally responsible features;

- Act as a marketing device to showcase the many readily available building products, appliances and landscape elements; and
- Associate the project partners with good environmental practice in the built environment (Martin, 2004).

Supported by a research grant from the Australian Research Council, a multi-disciplinary research team, comprising of persons with backgrounds in engineering, social science, architecture, environmental science and policy, was established to research the technical, social and design aspects associated with sustainable volume housing. Company A was encouraged by the URLC to join the project and to contribute by meeting the costs of building the house and agreeing to adopt recommended strategies.

While the URLC maintained involvement throughout the project, a number of other project partners, each with an interest in promoting more sustainable building practice, were also brought into the project. These were the Victorian Building Commission (the State’s building regulatory agency), Melbourne Water (a Victorian Government agency responsible for managing Melbourne’s water supply catchment and major waterway and sewage infrastructure), the Sustainable Energy Authority of Victoria (a Victorian Government agency created to lead and coordinate initiatives to expand sustainable energy industries, markets and technologies), Origin Energy (an energy supplier with interests in renewable energy), City West Water (who supply water and sewage services to the Cairnlea Estate) and Hassell (a planning and architectural consultancy which designed the landscapes at Cairnlea Estate and also for the Cairnlea Ecohome). Additionally, a range of technical experts and suppliers of specialist sustainability products had input throughout the home’s conceptual development, design and construction, including researchers from RMIT University and Deakin University.

A positive aspect of the process was that a half-day workshop to encourage discussion of sustainability amongst stakeholders early in the process was held in November 2001. At this workshop, sustainability goals were developed, which are listed in Appendix 2 along with a description of the initiatives later implemented to deliver them. While energy and water issues were most commonly included, it was encouraging to see that concern was also being expressed about waste and indoor air quality amongst other areas.

Unfortunately, the construction of the Cairnlea Ecohome was besieged by problems including extensive delays in the construction time. The original proposal to the Australian
Research Council proposed that the house would be constructed in 2002, and in use as a display home during 2003. In fact, the house was not finished until 2004, with an official Ministerial launch in mid-2004. In part because of these delays, it became increasingly apparent that it would not be possible to obtain either sufficient or suitably relevant technical data to allow meaningful conclusions about the sustainability performance of the house in the allocated time; not least because given that the house was used as a display home for approximately twelve months, and thus did not represent energy and water consumption trends that it might if used by a ‘typical’ household.

After its period of use as a display home, the home was auctioned in late 2005, where there was reportedly a disappointing level of interest shown. According to the real estate agent who managed the sale, few of the auction participants appeared to have much awareness of the sustainability credentials of the home (as reported by Ms D. Hammond of Caroline Springs Real Estate, pers. comm., 4 February 2009). Indeed, the real estate agent also reported that nobody bid on the house and it was passed in, selling privately a number of weeks later.

A member of the research project team who had subsequent involvement with the home’s new owners (but wished to remain anonymous) observed that while the owners considered themselves to be quite environmentally-aware and were initially positive about the home’s sustainability features, they eventually became disenchanted about a range of issues associated with the house, not necessarily specifically related to the sustainability features. Suggesting that the house did not perform quite as well as was aspired to, the new owners ended up installing an evaporative air cooler. This highlights issues with the energy rating scheme, whereby in cooler climates a star rating is dominated by winter performance, so a high-rated house can work fairly poorly in summer, particularly in two-storey houses which have no linkage to the cooler earth, are exposed to high solar radiation and absorb heat rising from the lower level (A. Pears, Melbourne, pers. comm. 5 June 2012).

Several years after the construction of the Cairnlea Ecohome, the builder had never replicated the home, there were limited and relatively superficial references to sustainability on their company website, and the relationship with the home owners and research team had completely disintegrated.
2.4.3 Zero Emission House (AusZEH), Laurimar, Melbourne, Victoria

As mentioned earlier, this home, the first of its kind in Australia and aimed at the mass housing market, had the goal of delivering a residential home with a net zero footprint (Foliente et al., 2011). It was anticipated that the house would use 70 per cent less energy than a similar-sized, 5 star energy-rated traditional house (Foliente et al., 2011).

The AusZEH was built by Company B (based on one of their standard designs with refinements made by CSIRO) as part of a wider consortium that included the CSIRO (Commonwealth Scientific Industrial Research Organisation), Sustainability Victoria, SP Ausnet and the Department of Human Services and commercial developer Delfin Lend Lease (CSIRO, 2012).

Despite the ambitious goals, and launch by a State Minister in 2008 (CSIRO, 2008); as at 2013, it remained surprisingly difficult to find any published technical information relating to the home’s actual performance.

The 8 star energy-rated, 240.9m$^2$, four bedroom house was constructed in the Laurimar development 30 kilometres north of Melbourne’s CBD. To achieve the target of ‘zero emissions’, meaning that no net greenhouse gases would be released into the atmosphere from either construction or operation, the building itself, as well as appliances, were carefully designed and selected to minimise energy consumption using off-the-shelf building and renewable energy technologies. In addition to good orientation and shading, the home featured timber frame double-glazed windows to all windows and sliding doors, R6 insulation in the ceiling and R2.5 in the walls coupled with reflective foil wall wrap and roof sarking to reduce radiant heat transfer into and out of the building. An insulated waffle pod slab foundation was used, and air leakage was minimised through sealing actions and the use of high quality building products and construction methods. Lighting was LED or 15 watt compact fluorescent downlights and a twin flat panel solar hot water system was used to provide up to 70 per cent of the hot water needs for the house. Heating is provided with a ducted inverter heat pump system with a heating capacity of 16.3 kW and cooling capacity up to 15.0 kW, and a 36 solar panel photovoltaic array with output of 6kW is installed (Foliente et al., 2011).

An innovative energy management system (not yet available off-the-shelf), developed by Victoria’s LaTrobe University in partnership with CSIRO, was also installed to track energy and water consumption. Home occupants are able to see usage information via a
touchscreen display which can also be accessed remotely via the internet or mobile phone. This system, which is ‘smart grid’ compatible, also has the capacity to automatically switch devices on and off in accordance with operating schedules (Foliente et al., 2011).

2.5 Chapter Overview

This chapter has presented a variety of definitions of sustainable housing to illustrate the lack of consensus which still seems to prevail. While sustainability in general terms is commonly understood to include the triple bottom line of environmental, social and economic dimensions, most interpretations of sustainable building or housing tend to emphasise the environmental dimensions. Similarly, the majority of rating tools and regulatory mechanisms also tend to take a predominantly environmental focus. Aside from neglecting the social and economic dimensions, another problem is that approaches to sustainable housing are rarely holistic and integrated, instead focussing on particular elements such as energy and water.

Although elements of sustainable housing have been around since ancient times, and certainly to some extent since the 1970s, contemporary examples of sustainable houses still remain far from the norm. This chapter has presented a number of examples of sustainable housing, which have met with varying degrees of success.

A key driver of sustainable housing has been a tightening of regulations, particularly during the noughties. Such regulatory approaches have also tended to emphasise the environmental dimension of sustainability and typically have focussed on specific issues such as energy and, to a lesser extent, water. There has also been a regulatory push in some jurisdictions to increase transparency through mandatory disclosure programs.

Voluntary drivers of sustainable housing have been implemented by both government and the private sector. Government initiatives have included incentive programs, such as through loans, rebates, grants or deferred payment schemes; promotion of display homes and villages featuring sustainability; development of rating schemes; the development of tools by organisations such as CSIRO; and the creation and promotion of information resources and technical support. Non-government voluntary drivers have included the development of rating tools and sustainability assessment techniques, which have been developed both by industry bodies and advocacy groups. Some groups have also focussed on providing reliable information.
Disturbingly, the reality is that many housing trends within Australia in recent years have tended to be counter to a move towards more sustainable homes. To understand this situation better, the following chapter elaborates on the socio-economic context within which the housing industry, and more specifically, the volume housing sector, operates.
Chapter 3
Socio-Economic Context: Housing in Australia

“...the small house, probably more than anything else that man has done, had made the face of Australia and to an extent the faces of Australians. Australia is the small house.”
- Boyd (1952, p.xvii)

This chapter provides a socio-economic context to this research. It does this by describing the broader housing trends in Australia, including the enormous role that housing plays within society for a range of reasons. It also points to some trends of recent years which, without significant intervention by both government and industry, may contribute to ongoing problems with increasing resource consumption and other environmental impacts.

The chapter then explores the characteristics of the housing industry, and more specifically, the volume housing sector, including how it is structured and the nature of its operations. This helps to inform the summary of the literature on the barriers to sustainable housing in Chapter 4.

3.1 The Great Australian Dream

Housing has long been considered integral to Australian culture. The vast majority of Australians (about 98 per cent) live in private self-contained dwellings (such as houses, flats or units) with the remaining people living in institutional settings. Of the 8.4 million households living in private dwellings in 2009/10, 79 per cent lived in separate houses, 11 per cent in flats, units or apartments and 10 per cent in semi-detached, terrace houses or town houses (Australian Bureau of Statistics, 2012a). These figures vary across regions, particularly in capital cities, of which Sydney, Australia’s largest city, has the lowest proportion of households living in separate houses at just 61 per cent.

The three bedroom house is by far the most common dwelling type in Australia, with 40 per cent of all households living in houses with three bedrooms, and another 30 per cent living in houses with four or more bedrooms (Australian Bureau of Statistics, 2012a). However, there has been a steady decline in the proportion of houses and increase in the proportion of apartments or flats in recent years (Dalton et al., 2011a). Some scholars,
such as Randolph (2006), suggest that Australia is on the verge of a major societal shift to higher density, compact cities.

The aspiration to home ownership has been such a dominant part of Australian culture for so long it has been dubbed ‘The Great Australian Dream’. As the well-known social historian and architect Robin Boyd asserted:

“Ownership of [a house] in a fenced allotment is as inevitable and unquestionable a goal of the average Australian as marriage.” (Boyd, 1952, p xvii)

This contention continues to be supported by social surveys which have suggested that almost all Australians say they aspire to own their own home. A review of housing surveys between 1972 and 1991 by Wulff (1993, cited in Baum and Wulff, 2003), revealed that over 85 per cent of respondents preferred owning to renting. From 1966 through to 2006, Australia’s total home ownership rate has been consistently between 68 to 71 per cent of households (Australian Bureau of Statistics, 2012a). However, this rate is disproportionately high among older Australians and disguises the decline in the home purchase rate among younger households, particularly those in the 25-34 age bracket (Baum and Wulff, 2003).

The Australian Bureau of Statistics (2012a) states that the typical pattern of home ownership in Australia is that young people leave the parental home and rent a small flat or unit or share a group house, before renting an apartment or home with a partner while saving for a first home. Many couples buy a first home and pay off a portion of the mortgage before having children. As the number and age of children increase, many families upgrade to a larger house, which most home owners remain in until retirement, where they may downsize. Eventually, if they are too old to live in their own home, they may move into cared accommodation.

The strong aspiration for home ownership, and a preference for houses over units, potentially harks back to early British settlement of Australia, when emigrants were encouraged to the country in the early 1800s with promises they would each have a home (Brown, 2000, citing Macarthur, 1837). It has also been reinforced over time by a number of incentives provided by government to encourage home ownership, such as no capital gains tax payable on a principal residence, as a way of encouraging a form of saving and reducing dependency in old age. Further, loans for housing have traditionally been comparatively easy to obtain. As a consequence, houses are a significant part of both
national and personal wealth, and are often the most valuable asset owned by an individual and a principal means of investment for many people (Australian Bureau of Statistics, 2011). This has generally been considered to contribute towards a relatively egalitarian society in Australia, although there are signs that this egalitarian tendency may be beginning to shift following growing concerns about housing affordability (Australian Bureau of Statistics, 2010a; Housing Industry Association, 2008a).

Despite the fact that people want to own a home, it does not necessarily mean that they will stay put. In fact, each year 16 per cent of Australians move house (Wulff, 1993, cited in Baum and Wulff, 2003), equivalent to moving, on average, approximately every seven years.

A home is not merely a form of shelter or an investment, but fulfils many psychological needs as well: “…a place of self-expression, a vessel of memories, a refuge from the outside world, a cocoon where we can feel nurtured and let down our guard” (Marcus, 1995, p.4). The philosopher de Botton (2006) concludes that our houses influence us more profoundly than we might care to admit, providing not only physical but also psychological sanctuary and a ‘guardian of identity’, with houses growing into the role of a ‘knowledgeable witness’ to the many activities and relationships that occur within them. However, he notes that throughout history, many great thinkers have spurned architecture as a topic not serious enough to warrant serious attention, and adds:

“Reverence for beautiful buildings does not seem a high ambition on which to pin our hopes for happiness, at least when compared with the results we might associate with untiring a scientific knot, or falling in love, amassing a fortune or initiating a revolution. To care deeply about a field that achieves so little, and yet consumes so many of our resources, forces us to admit to a disturbing, even degrading lack of aspiration” (2006, p. 25).

And yet despite this, still, “…we are inconveniently vulnerable to the colour of our wallpaper ...our sense of purpose may be derailed by an unfortunate bedspread” (2006, p. 25).

The notion of the home as a safe haven has undoubtedly been exacerbated by factors such as increased global insecurity (particularly after the major terrorist attacks of the early 2000’s). It has also been suggested that the global financial crisis of 2008-09 contributed to people spending even more time at home rather than going out as much.
Further, constant improvements to telecommunications technology are making it easier not only for people to work at home, with nearly a million Australians estimated to undertake paid work of some sort from home (Brown, 2004), but also to conduct various other activities such as shopping and studying over the internet, and other forms of entertainment.

As Australians have become more affluent, there was been what Farrelly (2007) describes as a growing “obsessive-compulsiveness” of needing to have the ‘perfect’ house as an accessory. She cites US academic Terry Castle’s description of a new neurosis called ‘interiors fanaticism’, or ‘house-porn’, whereby afflicted individuals pore over interior design magazines fantasising about interiors they might have and combining “….the titillation of porn with the sad-proud neediness of narcissism” (Farrelly, 2007, p.156).

The public fascination with houses and associated activities, such as renovating and gardening, is reflected by spending patterns. Sales of home-related products more than doubled between the early 1990’s and the early 2000’s, with Australian Bureau of Statistics figures revealing that $24.8 billion was spent on household goods retailing in the 2002/2003 period, compared to $9.6 billion in 1991/1992 (Brown, 2004). Likewise, Australian Consolidated Press figures show that spending on house and garden magazines increased by 50 per cent between 1997 and 2004 (Brown, 2004).

The early 2000’s also marked the start of a plethora of shows on Australian commercial television dedicated to house-related issues, such as how to renovate or garden, as well as programs showcasing luxury properties or discussing auction strategies¹. As mentioned in the prologue, one of these programs became at the time the highest rating television show after the Sydney Olympic Games.

¹ Examples of relevant Australian television programs around that time included Auction Auction; Auction Squad; The Block, Bourke’s Backyard, Hot Properties; Backyard Blitz; Renovation Rescue; Renovate or Detonate; Better Homes and Gardens; and Changing Rooms, shown on only three commercial television stations. This is not an exhaustive list but merely illustrative.
3.2 McMansions and the New Suburbia

A number of housing trends in Australia and other countries will continue to adversely impact the sustainability of new housing. Perhaps most significant is the trend over the last couple of decades towards significantly larger new homes (a trend which has only just started to reverse, or at least stall, driven by an ageing population and less interest from Generation Y in owning a home according to Cadden, 2011). The average floor area of new homes built in Australia increased by 31 per cent between 1987 and the turn of the century (Brown, 2004). BIS Shrapnel, an economic forecaster, found that the floor space of a ‘typical’ new dwelling in Australia increased from 228 square metres in 1998-99 to 254 square metres in 2003-04. By comparison, during the post-war era, house size was often limited to just 92 square metres (Brown, 2004). This trend is also being observed in the US, where the average new single-family house in the US increased in size from 1,400 square feet to 2,300 square feet between 1970 and 2003 (McGuigan, 2003).

Australia now holds the dubious distinction of having the largest homes in the world on average, with an average floor area of houses and apartments of 214.1 square metres being almost three times the size of those in the UK, 10 per cent bigger than in the US (where average house size has contracted significantly since the global financial crisis) and nine per cent larger than in New Zealand (Cadden, 2011). Australians typically enjoy spacious accommodation, with 87 per cent of lone person households living in a dwelling with two or more bedrooms, and 76 per cent of two-person households having three or more bedrooms, in 2009/10 (Australian Bureau of Statistics, 2012a).

Hawley (2003, para 1) notes that the rationale behind the ‘new suburbia’ is to provide “the biggest house on the smallest block for the lowest price”. Anecdotal evidence also suggests that developers have sales strategies that persuade people that they will not get a good financial return on a home with less than four bedrooms. Indeed, between 1976 and 2009/10, the proportion of households with four bedrooms increased from 17 per cent to 31 per cent (Australian Bureau of Statistics, 2012a).

In addition to multiple bedrooms, buyers are also seeking other features which have contributed to the much larger size of houses. As Hawley describes it, they are looking for:
“…four-bedroom, spiral staircase, open-plan kitchen-family-dining-lounge, multiple bathroom, study, games room, rumpus room, big-screen media room, barbecue, spa, multi-garage bigger-is-beautiful-is-better houses” (2003, para 9).

This trend occurs, however, in spite of a national trend for smaller households (that is, a reduced number of house occupants). As illustrated in Figure 4 below, the average Australian household size has been steadily decreasing, from 4.5 persons per household in 1911 to 2.6 persons per household in 2006 (Australian Bureau of Statistics, 2012c), attributed largely to reductions in completed family size and the increase in one person and two person households. In the same period, the number of occupied private dwellings increased from 894,400 to 7.6 million (Australian Bureau of Statistics, 2012c).

This trend for large houses with less occupants, coupled with predicted population growth in Australia, particularly in cities, is expected to maintain continued pressure to build new houses. It has been estimated that between 1990 and 2020, the number of occupied residential households will increase by 61 per cent, from six million to almost 10 million, and that total residential floor area will increase by 145 per cent, from 685 million square metres to almost 1,682 million square metres over the same period (Energy Efficient Strategies, 2008). The Australian Bureau of Statistics (2012c) project the number of households will grow to 11.6 million dwellings by 2031, by which time one person households are projected to comprise 28 per cent of all households, due to the ageing of the population, longer life expectancy of women over men and the delay of marriage.
To cater for the growing demand for more and larger homes, it must be anticipated that urban sprawl, and its associated raft of environmental problems such as dependence on private vehicles and associated air pollution and fossil fuel consumption, will only continue, unless there is a dramatic shift towards higher density housing and tighter planning controls to prevent this situation. Larger homes require more energy to maintain comfort, particularly given their common tendency to have central heating and cooling and their tendency to have open plan designs, making zoning difficult. Larger areas to light, longer hot water pipes, extensive outdoor lighting and other features all add to their energy use.

It is not just size which is increasing the environmental footprint of the majority of new homes being built. In today’s consumer-oriented society, the home has become a ‘luxury item’, a symbol of status, while the term ‘jewellery’ of the house has also been coined to reflect how homes are now dressed up with the latest ‘mod cons’ such as home theatres and gourmet kitchens (Brown, 2004).

‘McMansions’ (named with reference to the fast food restaurant chain McDonalds, reflecting their mass-produced, almost production-line method of production and the speed with which they are completed), is the nickname often given to these enormous, neo-traditional homes. They are renowned for being extremely large, for typically being built in the newer, outer suburbs of cities (but sometimes replacing older homes in established suburbs), and for featuring a lack of outdoor space and vegetation. Of concern is the fact that, to reduce costs while maintaining size, they have commonly dispensed with features such as eaves, meaning that little shading is provided to the houses and the use of air-conditioners becomes more necessary for the house to be comfortable in the warmer months.

Critics of McMansions are scathing in their descriptions. Tom (2007, para 8) notes that McMansions “have become a shorthand for the evil excesses of consumption”. Few, however, are as evocative as Farrelly (2003), who uses terms such as “heartbreakingly, wrist-slittingly” and “leaden the soul” when writing about these homes. Well-known Australian architect Glenn Murcutt, in describing the north-western sub-divisions of Sydney, referred to “a poverty of spirit and a barrenness of mind” (cited in Smith, 2004).

Nor is criticism confined to aesthetics or the environmental impacts of these homes. Razer (2005) quotes architecture lecturer Derham Groves’ concern over the potential social consequences of the uniformity of design and its contradiction with the
heterogeneous nature of our culture, saying “It brings to mind images from the movie Edward Scissorhands… Identically flimsy boxes from which people in cars emerge at precisely the same instant.” Such critiques are not new. More than forty years earlier, a similar sentiment (but not about ‘McMansions’, which did not yet exist) was conveyed by Mumford (1961, cited in Short, 1989, p.16), who described:

“A multitude of uniform unidentifiable houses, lined up inflexibly at uniform distances, on uniform roads, in a treeless communal waste, inhabited by people of the same class, same income, the same age group, witnessing the same television performances, eating the same tasteless prefabricated foods, from the same freezers, conforming in every outward and inward respect to a common mould, manufactured in the central metropolis…a low grade uniform environment from which escape is impossible…an asylum for the preservation of illusion.”

3.3 The Australian Housing Industry

The building and construction industry comprises three distinct types of activity (Australian Bureau of Statistics, 2010a):

- Residential construction
- Non-residential construction; and
- Engineering construction.

Residential construction encompasses both new housing and housing renovations, although it appears that there is limited overlap between these two types of work (Dalton et al., 2011a). The residential component is a significant sector of the overall building and construction industry, making a strong contribution to both the global and the Australian economy. As mentioned in Chapter 1, within Australia, it contributes more than $40 billion dollars of work, nearly $10 billion more per annum than non-residential construction (Australian Bureau of Statistics, 2010a). As mentioned in the prologue, the overall construction industry employed almost a million people in 2010, with 73,000 directly employed within residential construction (Australian Bureau of Statistics, 2010a).

In 2006/07, the Australian industry commenced construction of 149,000 new homes (Housing Industry Association, n.d.), down slightly from the peak of the housing boom of the early 2000’s, with 172,435 new homes commenced in 2003/04 (HIA, n.d.). Although it fluctuates over time and across States and Territories, the level of production of housing
and size of the industry in Australia is similar to that of other industrialised countries (Dalton et al., 2011a).

### 3.3.1 The House Building Process

The process of building a new house comprises a number of stages, which Hassell et al. (2003) define as:

1. **Land development** – undertaking the necessary steps to prepare land for residential construction. If the home is to be built in a new suburb, a large parcel of land may be acquired by a developer (which may also be a volume builder), subdivided, and individual lots then sold to builders or home buyers. At this stage also, the necessary regulatory approvals for the land’s proposed purpose are obtained, which can include rezoning of the land. In addition, rough grading (contouring) of the land may take place and infrastructure such as roads, electricity, water and sewerage is installed. In established neighbourhoods, not all of these steps will be required, although regulatory approvals may be required.

2. **Design** - includes the development of lot layout, a floor plan, and basic specifications (that is, the articulation of specific building materials, products and systems). Rough cost estimates are also developed at this time. The house may be custom-designed, typically by an architect or engineer, or it may be a minor variation of off-the shelf plans typically drawn by draftsmen, which may only require architectural or engineering review (the model typically used by volume builders). Designs will cover the floor plan, elevations, specifications that influence the appearance of the home (eg choice of finishes) and specifications that influence the home’s performance (eg for insulation levels and structural materials). They may also include building services (eg electrical or plumbing systems). Hassell et al. (2003) also note that the design stage includes “upstream” efforts that influence a home’s design, including “…product and process research, consumer and market research, design, testing, and evaluation” (p.31).

3. **Pre-construction** – the stage after a design has been developed and preparation for construction is undertaken. According to Hassell et al. (2003), the pre-construction stage typically consists of two concurrent sets of activities. First is the selection of a builder who selects sub-contractors (trades), obtains plan approvals and permits, contracts and schedules work crews, and procures building materials and products,
which are at least partially produced and delivered to the site during this stage. However, in the case of the volume building industry, many of the activities which are associated with this stage would not actually be conducted for an individual home, but are negotiated at a mass market level. Thus, a volume builder does not find a kitchen supplier and get quotes for a particular type of tap prior to building an individual house, but instead will negotiate deals with suppliers at competitive prices subject to them being used across a wide range of designs. Thus, in fact, certain pre-construction activities have effectively occurred even before the design phase for typical volume building projects. The other stage is the review of the design plans by local building departments and other agencies to ensure the plans meet State and local authority requirements.

4. Construction - The construction stage, which largely occurs on-site, includes activities such as the management of labour and materials, excavation, installation of foundations, erection and enclosing of the structure (walls and roof), installation of services (electrical, plumbing, heating, ventilation and air-conditioning etc) and appliances, and finishing of the interior and exterior. During this stage, regulatory inspectors from local government inspect the site to ensure that construction complies with regulatory requirements. The issuing of a certificate of use and occupancy after passing final inspections usually signifies the end of this stage (Hassell et al., 2003).

5. Post-construction - Post-construction activities may include marketing (if a home has not already been sold beforehand), the addition of finishing touches (such as appliances) and minor repairs of any defects. From the homebuyer perspective, activities will include obtaining finance and insurances, and later expenses associated with the ongoing maintenance and operation of the home.

Each of these stages involves a different group of stakeholders (with some overlapping members), and each offers opportunities to consider different aspects of sustainability, which, if not realised at that point in time, may be difficult, or even impossible, to later realise the potential benefits. The sustainability opportunities available at each stage, and the key stakeholders most likely to influence this, are summarised in the table in Appendix 3.

Volume builders in particular rely on a complex system of contracts, covering supply; supply and install; or labour-only subcontractors. Scheduling of deliveries to site and work activities is also complex and requires careful sequencing to maximise efficiency. In
practice, such efficiency is not always realised, with rescheduling common (Dalton et al., 2011b). Further, poor quality workmanship is not uncommon, and is often picked up during statutory building inspections. This can also delay construction times and require recall of supply and install contractors or subcontractors and remediation works (Dalton et al., 2011b). In response, volume builders have developed quality inspection and improvement systems.

It seems that in recent times the process of house building might be becoming even more complex. In attempting to explain a trend towards lengthening completion times for new homes (from between 1.6 and 1.8 quarters at the end of the 1990s up to 2.4 quarters by 2008), Dalton et al. (2011b) attributed this to a range of factors including increasing average size; increasing complexity of house designs (including greater use of two-storey houses and more complex street-facing facades), and an increased number of house models available in the volume builder catalogues. The increased complexity requires even more contracts to deliver and an increasing number of interactions with subcontractors, which can further compound the challenges associated with rescheduling.

### 3.3.2 Industry Structure

Dalton et al. (2011a) note that the housing industry is not homogeneous, with no ‘archetypal’ Australian residential building company. It is characterised by a large number of small businesses and a small number of very large businesses. According to the Australian Industry Group (AIG) (cited by Dalton et al., 2011a), of the 320,000 enterprises working in the broader construction industry, over 60 per cent were sole-trader, and around 30 per cent employed between 1 and 4 people. Further, according to ABS statistics, there is an average of 1.8 persons per business, and 52 per cent of businesses in the construction industry have an income of less than $100,000 per annum with another 28 per cent earning between $100,000 and $500,000 (Dalton et al., 2011a).

By contrast, the nation’s top 100 ranked builders, in terms of housing starts, had a combined revenue of almost $13.7 billion in 2009/10, which excludes land sales and only includes building costs. To further illustrate the contrast, Australia’s largest home builder in 2009/10, BGC (Australia) started construction of 4,392 dwellings (Housing Industry Association, 2010), down from a peak of 5,137 starts in 2003/04 (Housing industry Association, 2004). The larger companies enjoy the benefits of economies of scale, with reduced average size of operating income and operating expenses per employee (Dalton et al., 2011a).
A concentration process occurred within the industry during the 1990s and early 2000s, increasing the importance of the larger builders, but this seems to have stalled during the 2000s (Dowling, 2005 cited in Dalton et al., 2011a). An exception is that nationally, the very largest firms (ranked 1 to 5) increased their share of the market between 1999 and 2009 from 39 per cent to 46 per cent (Dalton et al., 2011a). It should be noted that there is significant variation across States, for example, in the same period in NSW the top 20 builders decreased from producing 80 per cent of dwellings to just over half; while in Victoria the top 20 increased their production significantly (Dalton et al., 2011a).

Most residential building firms are private companies, with only two companies in the top twenty (Mirvac and Multiplex) being public companies listed on the stock exchange (Dalton et al., 2011a).

A distinguishing feature of the construction industry is its project-based nature, with temporary coalitions formed for short-term projects. As Fearne & Fowler (2006) note, the fact that projects are essentially a series of sequential and predominantly separate operations means that individual players, including the supply chain, may have little stake in the long-term success of the buildings they contribute to building. This may be somewhat less the case for residential construction, where homes are typically more similar, particularly when built from catalogues of designs, than for the commercial sector.

The industry is heavily fragmented, geographically, vertically and horizontally (Hassell et al., 2003). Geographically, most Australian residential building companies base their operations in one State, although a number of larger companies broadened their boundaries in the 1990s and early 2000s, but this seems to be have contracted somewhat in recent years (Dalton et al., 2011a). Vertically, there has been a wider trend towards reducing diversification of activities in recent years, with companies tending to specialise more in particular operations, such as just building detached houses, and decreasing other activities such as land development (Dalton et al., 2011a).

The construction of a house is a complex process requiring the coordination and sequencing of many parties and activities. With regard to horizontal fragmentation, the industry typically operates under a trade contracting system, with heavy reliance on the subcontracting of self-employed tradesmen. Silberberg (1991, cited in Wadick, 2010), asserts that subcontractors comprise about 90 per cent of all workers in the domestic housing segment.
This horizontal fragmentation is, in part, a strategy to provide greater flexibility to cope with the uncertainty created by the cyclical business nature (or ‘boom and bust’ environment) of the housing industry (Ball, 1999). Periods of busy activity are followed by quiet spells over cycles of many years (Ball, 1999; Hassell et al., 2003), aligned with considerable fluctuations in employment (Dalton et al., 2011a). Factors affecting demand include demographics (number and type of households); economic conditions and household circumstances; investor demand; consumer preferences (size, quality, location); the availability and cost of rental property and dwellings for purchase; taxes and transfers; and the cost and availability of finance (Dalton et al., 2011a). Supply side factors include the costs associated with construction (particularly from labour inputs and materials); infrastructure costs; the availability of land; environmental or heritage constraints; the processes of land release and development; and taxes and transfers.

There is relative ease of entry to the housing industry (Blackley & Shepard, 1996), with builders able to borrow the money to buy land and cover building costs (or to build on land owned by someone else on their behalf), and tradesmen providing most of the equipment. This makes this industry extremely competitive (Hassell et al., 2003). Consequently, price sensitivity is very high, with ‘affordability’ a key issue, far more so than in the commercial construction industry. Relatively low levels of profit are also associated with the housing industry (Dalton et al., 2011a).

While a site manager or foreman employed by the builder coordinates the various activities required to construct the house on-site, the process requires the input and cooperation from a complex network of parties, which in addition to other employees of the builder (such as marketing staff, sales staff and managers handling contractual relations), also includes sub-contractors, manufacturers and suppliers, none of whom control the entire process (Koebel & Cavell, 2006). In conjunction with the numerous other stakeholders involved in the construction of a house, including those who simply influence rather than make decisions, the decision-making processes can become extremely complicated. Hassell et al. (2003) claim that the process of building a single house requires that thousands of decisions be made by hundreds of individuals.

Within the Australian context, Pears (1998, p.41) attempted to illustrate the complexity of stakeholder relationships within the housing industry, as illustrated in Figure 5.
It could be argued that even this diagram does not fully illustrate the full range of stakeholders with either direct or indirect control or influence over housing builders (or make clear what influence they hold at the various stages of the housebuilding process – summarised in Appendix 3).

The wider network of stakeholders includes industry associations who represent the interests of their members (including the Housing Industry Association (HIA), Master Builders Association (MBA), Property Council of Australia (PCA), Planning Institute of Australia (PIA), the Australian Institute of Architects (AIA), Building Designers Association of Australia (BDAA), Master Plumbers’ Association (MPA) and Urban Development Institute of Australia (UDIA)); manufacturers; building consultants; and advocacy groups such as non-government organisations. It also does not clearly illustrate the more indirect influence of other parties, such as the educational institutions (universities and technical colleges) which not only conduct research into construction but also educate and train participants in the housing industry. Nor does it make clear the complex interrelationship between an individual builder and others immediately within its industry network, and the rivalry that exists between companies to gain competitive advantage over each other.
The construction industry more broadly is renowned for being adversarial, with a tendency to try to push risk onto others resulting in a lack of trust between clients and contractors (Barlow, 1999; Barlow, 2000; Fearne & Fowler, 2006, Ng et al., 2005). As noted in the prologue, the industry is also associated with high levels of occupational stress (Leung et al., 2011; Love & Edwards, 2005), particularly amongst construction project managers, which can ultimately result in burnout and physiological stress. Love & Edwards (2005, p. 89) attribute this to factors including “work overload, long working hours, role ambiguity and conflict, the diverse range of personalities encountered in the project environment, poor communication, limited resources, insufficient time spent in the family/home environment and financial pressures.” Leung et al. (2011) reinforce the contribution of time pressures and dynamic social structures, but also the intrinsic uncertainties and crisis-ridden nature of construction projects. Ng et al. (2005) suggested that the most difficult stressors to manage in construction are bureaucracy, lack of opportunity to learn new skills, work-family conflicts and different views from superiors.

The industry has a significant gender imbalance, with the lowest representation of women in any industry sector (at just over 10 per cent compared to the all-industry average of 44 per cent). However, it is slightly higher in the residential sector at 16.3 per cent (Dalton et al., 2011a). Walker suggests that this may contribute to the adversarial culture, noting that men and women have different communication styles (explained particularly well by Tannen, 1995), with women more likely to adopt a collaborative and conciliatory approach to resolving issues.

3.3.3 Industry Education, Training and Registration

Education and training remains an issue of ongoing concern to this industry sector, which has one of the lowest rates of per-employee expenditure on training of any industry (Dalton et al., 2011a). There are routinely complaints about a ‘skills shortage’ in the industry, which in recent years has been exacerbated by an exodus of tradespeople into natural resources (mining) work. While there is an overly simplistic tendency to pressure schools, vocational education and training providers and universities to provide more trained workers, the industry itself has been accused of contributing to the situation. For example, the poor completion rates of construction apprenticeships (with cancellations and withdrawals outnumbering completions since 2000) have been attributed to a lack of appropriate supervision in the workplace; problems with poor and inappropriate training; bullying and abuse in the workplace and low wages (Dalton et al., 2011a). There have also been suggestions by some in the industry that apprentices need to be learning
broader skills than specifically trade-focussed, such as how to run a small business, use computers and read plans (Dalton et al., 2011a).

In the residential building sector, 58.1 per cent of employees have a TAFE qualification while eight per cent have a bachelor or post-graduate degree. While this is a higher proportion than other sectors of the construction industry, it compares to 33.6 per cent and 26.6 per cent holding equivalent level qualifications respectively averaged across all industries (Dalton et al., 2011a).

According to Australian Bureau of Statistics data (cited by Dalton et al., 2011a) there has been an increase in employer-provided training for employees in the industry as a whole, with 75.7 per cent of employers providing training in 2001/02 compared to only 47 per cent in 1997. Despite this, the industry has one of the lowest rates of employee expenditure on training, averaging $208 per employee in 2002/03. However, this masks the fact that the industry is heavily reliant on contractors and only 41.3 per cent of these ‘other workers’ were provided employer training in 2001/02.

In particular, there is a limited incidence of management training within this industry (Schaafsma, 1997), with many small construction businesses run through ‘de facto management’, whereby wives, partners or mothers (sic) manage the paperwork and run the business from home.

The system by which individuals operating in the industry are registered to perform work varies across States. Builders and some trades categories require registration by government in order to work, but other trades to do not require this. The lack of such a mechanism can make it difficult for builders to know who to engage (Dalton et al., 2011a).

3.4 The Volume Housing Sector

The volume housing sector of the housing industry, variously referred to as project housing, production housing, mass housing, ‘off-the-rack’ or ‘off-the-peg’ housing and speculative housing, has been particularly responsible for the trend towards ‘McMansions’ described earlier in this chapter. Volume builders have a long history of providing a product that they believe will be desired by the masses. Greig (2000, p.221) notes that mass housing tends to be considered as a reflection of mass society, stating:
“…most housing commentators throughout the [previous] century have argued that builders of speculative and project suburban houses carefully read the market, or the desires and aspirations of the consumer.”

According to Koebel & Cavell (2006), the business model typical of this industry sector is to emphasise customer service, particularly by quickly addressing problems in new homes, followed by emphasis on design of communities and houses.

For an industry sector which contributes so significantly not only to Australia’s housing stock but also its economy, there is surprisingly little literature about the volume housing sector, either within Australia or internationally. Exceptions include Hassell et al. (2003) and Koebel & Cavell (2006), looking at the American context, while more recently Dalton et al. (2011a; 2011b) have touched on this sector within Australia as part of an analysis of the wider housing industry structure and practices.

A lack of clear and widely agreed definitions for this sector remains a problem. Consumer Affairs Victoria (2013) defines volume builders as “Companies that build large numbers of houses based on display home models”, while Ms J Nechwatal from the Victorian Branch of the Housing Industry Association (pers. comm, 27 June 2005) defines volume builders to be those that construct more than 30 project-type homes per annum (that is, not custom one-off homes). In America, the National Association of Home Builders (NAHB) defines ‘production home builders’ as typically building more than 25 homes per year, with other typical characteristics including building on land they own, using stock plans but with choices/options, building various housing types and building for all price points (NAHB, 2013). By contrast, a study of large production home builders in the US by Koebel & Cavell (2006) defined them as companies that build 200 or more single-family residential units per year. Project houses have been defined as “….houses selected from a builder’s standard design collection” (Ambrose et al., 2005, p.335). They are typically clustered in display villages, which show what houses which can then be bought off-the-plan for construction elsewhere will look like. Such villages are an important marketing strategy for volume builders (Ambrose et al., 2005). The terms ‘volume’ and ‘project’ seem to be used relatively interchangeably in the literature.

Reliable figures for the proportion of housing stock built by volume (or project) builders are extremely difficult to obtain. Ambrose et al. (2005) claim that they make up the majority of new houses built in Australia, while Hawley (2003) is more specific, claiming that it accounts for over 80 per cent of new houses built each year in Sydney. One of the
richest sources of data relating to larger builders is the annual ‘Housing 100’ report released each year by the Housing Industry Association. This report ranks Australia’s largest 100 builders (in terms of housing starts per year). Analysis of the figures over a decade from 2000/01 to 2009/10 reveals that the top 100 companies have consistently built over a third of all homes (comprising both houses and units) commenced in Australia each year, ranging from a low of 34 per cent in 2007/08 through to as high as 46 per cent in 2009/10 (Housing Industry Association, various years). As Figure 6 shows, covering only the market share for houses started by the Housing 100, there has been considerable fluctuation over the years.

**Figure 6 – Housing 100 Market Share - Houses** (Housing Industry Association, 2010)

Even amongst the largest volume builders there is enormous variation in production, with a small number of companies heavily dominating the industry, a trend also identified in the US (Koebel and Cavell, 2006) and UK (Barlow, 1999). There is enormous spread between the largest and smallest builder in the top 100. For example, in 2009/10, the number one builder, BGC (Australia) built 4,392 homes (3,836 houses and 556 units, down from their record of 5,137 homes in 2003/04) compared to the 100th ranked builder, Pro-Struct Property Group which started 69 houses in that year. This represented 7.4 per cent and 0.12 per cent respectively of the total number of homes started by the Housing 100 in that year.

Figure 7 shows how the number of housing starts by the top 100 builders compares to the number built by the top 10 collectively, and the top 20 ranked builders (inclusive of the top 10) collectively for that year in the period from 2000/01 to 2009/10. It also illustrates that
each year, more than 50 per cent of houses built by the top 100 builders are built by the top 20 (with values ranging between 51.6 per cent to 58.7 per cent at various times during the period from 2000/01 to 2009/10), and more than a third of all of these houses are built by just the top 10 rated builders (with values ranging between 33.5 per cent to 39.0 per cent over the same period).

Figure 7 – Comparison of number of starts by Housing 100, and the top 10 and top 20 builders collectively.

The degree of domination by the largest builders does vary significantly across different States and Territories. In 2009/10, the market share of the 20 largest builders in individual States was 24 per cent in NSW and Queensland, but 70 per cent in Western Australia (WA) (with the two largest builders in the country by number of starts both based in WA) (Housing Industry Association, 2010).

Analysis of the Housing 100 statistics also reveals that the majority of the top 100 builders commenced between 101 and 250 homes. Almost all build between 101 and 1000 homes, with only a very small proportion commencing more than this, as shown in Figure 8.
The success of the volume housing sector in dominating the market rests on its ability to build quickly (a house may be constructed from a bare site within 20 weeks (Hawley, 2003)), and probably more importantly, their ability to build for extremely competitive prices, providing what an architect quoted by Razer (2005) describes as “opulence at a discount”. It is extremely difficult for smaller builders to compete with volume builders on a dollar per square metre basis. A volume home may cost $500 to $550 per square metre, compared to $2,000 a square metre for an individual architect-designed home or inner-city high-rise apartment (because of different construction costs) (Andersons, cited in Hawley, 2003).

Volume builders improve their efficiency and profitability by shortening cycle times (the length of time required to build a house) and assuring uniform quality, using a combination of standardised construction processes and established relationships with subcontractors (Koebel and Cavell, 2006). By offering a restricted range of fixed building designs and plans developed in-house, typically with only minor scope for customisation by consumers (such as different floor coverings, appliances and interior colours), they also boost planning and programming of building activities, improving the speed and cost-efficiency.
Another factor that helps drive cost reductions is the economies of scale that are possible given the enormous quantities of products and materials that the volume housing sector purchases. A consequence, however, of their extraordinary financial efficiency means that other strategies are required for economic growth. McGuigan (2003) notes that:

“...if you adjust for inflation, houses of the same size and comparable features are the same price today as they were in the 1970s. That means that if business is going to grow, the industry has to sell more product – not just more houses but more square footage. It’s like the junk-food-marketing genius who figured out that people wouldn’t go back for seconds but they’d pay more upfront to get, say, the 32-ounce Big Gulp.”

Hence, we have seen the trend described earlier towards palatial homes with multiple bedrooms, bathrooms and car spaces, alfresco dining areas and home theatres.

Reflecting land availability, the volume housing sector predominantly works on the urban fringe of cities. Volume builders are also more likely to have purchased the land prior to construction and sell a property as a house and land package, whereas smaller builders will typically contract to build on another’s land. Indeed, Barlow (1999) notes that traditionally, the British speculative housebuilding industry’s main business strategy from the 1960s to the late 1980s was to optimise land holdings and time sales of houses to benefit from land and housing inflation. This is also likely to be true for many larger Australian housing companies.

3.5 Chapter Overview

This chapter has outlined the social and economic context of housing in Australia, which has a significant bearing on the industry’s willingness and ability to respond to challenges such as sustainability, a point which will be elaborated further in the following chapter.

Housing has long been an integral part of Australian culture, and in addition to providing shelter is also a major investment vehicle for many, as well as fulfilling a range of psychological needs

Until very recently, there had been a trend of increasing house size over many years, despite a corresponding decrease in occupancy rates. This trend had adverse implications for environmental sustainability performance. Critics also suggest that the
proliferation of McMansions has a number of adverse social sustainability implications, as they contradict the heterogeneous nature of society.

It is also important, in considering potential barriers to sustainable housing, to understand the nature of the housing industry itself as well as the process by which houses are built.

The construction industry comprises residential construction (new housing and renovations); non-residential construction and engineering construction. The housing industry is a significant sector within construction and makes a significant contribution to the economy. The industry is not homogenous and is characterised by a large number of small businesses, and a small number of very large businesses. Most building companies are privately owned.

The market context also strongly influences practices by this industry. Housing construction is typified by periods of ‘booms’ and ‘busts’, and due to its relative ease of entry, is extremely competitive on price with low margins. The industry is heavily fragmented (geographically, vertically and horizontally), in part as a response to the economic cycles. The industry also operates on a project-based nature, with temporary coalitions forming and disbanding for each short-term project. The industry culture is also thought to be adversarial, highly stressful and heavily dominated by males, with the lowest female representation of any industry in Australia. Finally, the industry is characterised by low levels of training, although the majority of workers have trade qualifications.

House building is a complex process, involving numerous stakeholders and potentially hundreds of individuals involved in building a single home. The stages include land development, design, pre-construction, construction and post-construction. Each of these present a number of opportunities for sustainability opportunities to be integrated, and if not done at each stage, the opportunities can be difficult and costly, if not impossible, to realise. Also, the large number of stakeholders involved in a single housing project can act as a barrier.

Volume builders, the focus of this research, have come to dominate the housing market. Their market dominance results from of their ability to read and respond to the demands of the mass market, and to build quickly and cheaply. To do so, they have developed complex systems involving numerous contractors with suppliers, manufacturers and subcontractors. The nation’s top ranked 100 builders have a combined revenue of over
$13 billion, and consistently build somewhere between a third and nearly a half of all new houses built each year. Within this, the top ten builders build about a third of all houses built by the top hundred. Therefore, influencing even a relatively small number of organisations to become more sustainable has significant potential in terms of output, and ability to influence the wider industry.

The following chapter expands upon some of the issues noted here to more fully articulate the barriers to sustainable construction, and to sustainable volume housing more specifically, as outlined in the literature.
Chapter 4

Barriers to Innovation and Sustainability in the Volume Housing Sector

“If you’re not failing every now and again, it’s a sign you’re not doing anything very innovative”
- Woody Allen

The benefits of, and drivers for, sustainable housing were summarised previously in Chapter 2, which also suggested that sustainable housing continues to be far from the norm. Given the many purported benefits and the efforts of numerous stakeholders to promote sustainability in housing, the question to ask is why this remains the case?

Understanding the many barriers to sustainable housing that exist is critical in formulating effective strategies to encourage its further adoption. This chapter explores these barriers. Because of the limited amount of literature which was available on sustainability and housing specifically when this research commenced, particularly in an Australian context and certainly with specific reference to the experience of volume building practitioners, the literature on drivers of, and barriers to, sustainable construction in the wider industry was reviewed and both are presented within this chapter, noting that there are differences between the housing industry and wider construction industry, as discussed in Chapter 3.

Sustainability may be considered as simply one type of innovation. Hassell et al. (2003, p. 10) define an innovation as “…a product, process, or other application of technology that is perceived as new by the user and advances the state of the art”. They also note that over time, as an innovation is adopted widely, it may lose its novelty. Many examples of sustainable construction techniques, for example passive solar design or photovoltaic cells, are not ‘objectively’ new, yet by this definition they can still be considered to be an innovation if new to a specific individual or organisation.
Dewick & Miozzo (2002, p.824) more specifically define an environmental innovation as:

“...the use of production equipment, techniques and procedures, and products and product delivery mechanisms that are sustainable (because they conserve energy and natural resources, minimise the environmental impact or footprint of human activity and protect the natural environment.”

Accordingly, the barriers within the construction industry to adoption of innovation more generally were also explored and are summarised in this chapter.

4.1 Barriers to Sustainable Housing

The barriers to sustainable construction have become a topic of increasing research effort in recent times. Hoffman & Henn (2008, p.3) claim that obstacles now faced by the green building movement are no longer primarily technological and economic, but rather social and psychological. The social barriers encompass organisational and institutional barriers.

An outcome of this is what was first conceptualised by Cadman (2000, cited in Lorenz et al., 2007, p. 132) as the ‘vicious circle of blame’, which consists of:

- “occupiers who would like to have sustainable buildings but who argue that there are very few available;
- constructors who can build sustainable buildings but who argue that the developers do not ask for them;
- developers who would ask for sustainable buildings but argue that the investors will not pay for them; and
- investors who would invest in sustainable buildings but who argue that there is no demand for them.”

As a consequence, owners or end users, who may otherwise want sustainable buildings, find that very few are available (Royal Institution of Chartered Surveyors, 2008).

A range of barriers specific to sustainable construction, which contribute to this vicious cycle, were identified in the literature. These include:

- Increased capital costs (or perception thereof);
- Lack of customer/public interest or willingness-to-pay (or perception thereof);
- Increased risk (or perception thereof);
- Insufficient understanding, technical information, skills or tools;
- Other cognitive barriers;
- Inappropriate or inadequately enforced regulatory requirements;
- Incomplete integration within and between projects and supply chain issues; and
- Aesthetics.

These are each discussed further in section 4.3.

The greatest barrier may be the complexity and fragmentation of the construction industry and its network of wider stakeholders, as well as of the construction process itself (as described in the previous chapter). Many characteristics of the industry contribute to barriers to innovation generally, and thus sustainability as a type of innovation. This is explored in section 4.2.

4.2 House Building and Innovation

As Figure 5 in the previous chapter illustrated, there are numerous varied, and potentially conflicting, influences on house builders, which could potentially affect their likelihood of adopting various practices and technologies. Koebel & Cavell (2006) claim that for innovations to be readily adopted within large house building organisations they need to be compatible within social networks and must be accepted by the managers, site supervisors, subcontractors, lenders and insurers. Despite this, they claim there has been a lack of research on how these relationships work or the consequences for innovation.

The act of building a house requires a large number of tradespeople and other stakeholders to work together cooperatively through the entire duration of a process. In addition, the composition of project teams is likely to vary from one project to the next (Palmer et. al, 2006), with one of the consequences being that for an innovation to be adopted successfully by the industry throughout the country “…potentially requires that many thousands of people become aware of the innovation (i.e., add it to their knowledge base) and choose to use it and even to recommend it to others (i.e., to the decision agent or the influence agent)” (Hassell et al., 2003, p. 21). Further, as Wadick (2010, p. 112) notes, impeding this possibility is the fact that: “…[m]any subcontractors are in such a hurry to get in, finish, and get out, that they may not consider other people who depend on them.”
Coupled with the complexity of the house building process itself, it becomes apparent why driving any changes, including adoption of more sustainable practices or technologies, can be extremely difficult. Toole (1998, cited in Koebel & Cavell, 2006) noted that the variability and complexity of residential structures, site variability and the time frames required for production, can act as a barrier to innovation more broadly. This complexity has also been claimed to act as a potential barrier to quality control (Emmitt et al., 2012) and to the safety of other subcontractors (Wadick, 2010).

While there are conflicting claims, it is fair to say that the housing industry does not generally receive glowing endorsements of its track record of innovating. Criticisms that the construction industry, and particularly the house building industry, lags in innovation compared to other industries, are common (for example, Ball, 1999; Barlow, 1999; Koebel & Cavell, 2006). As W.S. Hilton (cited in Mitchell, 2000, p. 79) described it unflatteringly, an ancient Egyptian building worker:

“...might not understand the language but could work [with a contemporary worker] all day till sundown without suspecting that four thousand years lay between them”.

In a similarly negative tone, Mitchell (2000, p.79) comments that others have noted that “...a peg-board chart or a type-written schedule count in the literature as newsworthy management innovations”.

Barlow (1999) attributes this perceived lack of innovation to the fact that housing is manufactured using craft skills and a low-wage, unskilled workforce, while Koebel and Cavell (2006) suggest that it may be in part because the construction industry is made up mostly of small firms which may not have the resources for innovative strategies or investment.

However, others including Hassell et al. (2003) dispute this contention, arguing that there is limited data to support the claim that the rate of innovation is slow compared to that in other industries, with conclusions often based on small sample sizes or anecdotal evidence. Koebel and Cavell (2006) note that the construction industry, at least until recently, has tended to be under-represented in the wider literature on diffusion of innovation, in part because, as Hassell et al. (2003) argue, early studies of innovation tended to focus more on high-tech industries such as semi-conductors or radars, and adoption by organisations with well-developed research and development programs,
while Nam & Tatum (1997) have also noted that much of the literature on innovation has typically relied on other industries with very different characteristics, such as manufacturing.

Hassell et al. (2003) contend that there are numerous examples of innovation by the housing industry over the last 100 years, ranging from the installation of electricity and air-conditioning, to the use of standardised building products (such as 2x4s and roof trusses), to the inclusion of factory-made components such as kitchen cabinets. They also cite related innovations adopted within the wider industry context, such as in housing financing which has boosted home ownership rates in the United States; or in the regulatory environment, with the development and implementation of performance-based building codes, resulting in better houses. Mitchell (2000) similarly notes that Australian house builders today use a wide range of materials and processes that were not in use in the 1940s, such as steel framing, plastic cladding, fire-resistant insulation, prepainted roof iron and the use of specialist labour for building or installing particular components. In contrast, Ball (1999) points out that successful examples of innovation in housebuilding tend to be piecemeal improvements, typically of building elements, rather than radical transformation.

Drawing on this history, Koebel & Cavell (2006), in one of the most detailed analyses of innovation within the volume housing sector to date, suggest that in broad terms, the key factors which are possible determinants of adoption of innovation by builders can be classified into four main categories, namely:

- Characteristics of the innovation
- The market context
- Industry characteristics
- Building firm organisational characteristics

The relationships between these four categories, discussed further in sections 4.2.1 to 4.2.4, are shown in Figure 9 (where double-headed arrows indicate that influence between the actors is a two-way process, with each influencing the other). Understanding the complexity of these many interrelated factors is critical when proposing changes which might be made by builders, and many of the questions asked of the builders in the interviews relate to these themes. What it does not clearly show is the role of the individuals within a building firm who influence decisions or act as champions; discussed
in section 4.2.5. For innovations to be successfully promulgated on a wide scale they need to be adopted at the level of the individual, organisation and institutionally. Hoffman and Henn (2008) note that limited recognition of these critical interconnections remains a barrier to adoption of green building innovations.

This diagram emphasises the wide range of stakeholders and other influencing factors, as well their interconnections, impacting upon decisions by builders. It is beyond the scope of this research to illustrate in depth the specific nature of these interrelationships (for example, contractual or influential). Figure 9 also reinforces the fact that it is not simply a matter of builders changing their own practices if we want to influence uptake of sustainable housing. This is explored further in Chapters 8, 9 and 10.

**Figure 9 – Factors Influencing Firm’s Use of Innovative Materials, Products and Processes** (from Koebel and Cavell, 2006)
4.2.1 Characteristics Influencing Adoption of Innovation

According to Rogers (2003), characteristics of an innovation which influence its likelihood and rate of adoption include its relative advantage as perceived against the idea it supersedes; compatibility, or perceived consistency with existing values, past experiences and needs of potential adopters; complexity, the degree to which the innovation is perceived as difficult to understand and/or use; trialability, or degree to which it can be experimented with on a limited basis (allowing for learning by doing); and observability, the degree to which results are visible to others, which can stimulate peer discussion of a new idea. Clustering of visible innovations is one form of evidence of importance of observability and peer-to-peer networks. Of these factors, the first two are most influential.

Within construction, examples of relative advantage may include a product that is more desirable to consumers, productivity gains, materials and/or other cost savings, improved quality or performance. Increased complexity, which will relate to the degree of change required, is likely to be seen as increasing the risk associated with the innovation, and thus will be a less attractive option (Koebel & Cavell, 2006).

Trialability and observability are particularly important in the construction industry. Koebel & Cavell (1996) cite Toole (1998), who claims that builders rely on ample field testing and demonstration of results to reduce risk prior to adopting architectural or system innovations.

4.2.2 Market Context and Impact on Adoption of Innovation

The market context severely constrains the housing industry’s actions in terms of house design, quality, cost and innovation (Ball, 1999). Koebel & Cavell (2006) note that key determining factors related to market context include:

- **Home buyers** (or customers) - as mentioned in Chapter 2, home buyers may be a driver for sustainability, or innovation more generally; but typically seem to be perceived more as barriers. Their role is discussed further below and in section 4.3.2;
- **Economic cycles** – as mentioned in Chapter 3, the construction industry experiences boom-bust cycles. These can further increase perceptions of risk from innovation (discussed further in section 4.3.3) but can also discourage investment in employee training to support adoption of innovations (Hassell et al., 2003). Price volatility was
also identified by Slaughter (2000, cited in Koebel & Cavell 2006) as a negative influence on innovation;

- **Land availability** – land developers have a strong financial incentive to complete the land development process as quickly as possible, given all money, whether borrowed or not, has a time value. This can act as a barrier to innovation if time is required to learn about it or to find supportive designers and contractors; if a time-consuming rezoning process or changes to covenants are required; and if investors need to be convinced of the benefits of the innovation (Koebel & Cavell, 2006);

- **Access to finance** – various actors within the financial sector, including home valuers or appraisers, lenders or mortgage brokers, and insurers, all influence the house building process and the likelihood of adoption of innovation (Hassell et al., 2003). Valuers or appraisers, in estimating the market value of a home, attempt to neither overestimate or underestimate the value to ensure that banks do not make loans larger than could be recovered if the borrower defaults. This can lead them to rely on local averages and ignore the benefits of an innovation, particularly if they don’t have the necessary information about, or the time or resources to investigate, the value of the innovation. Lenders also want to ensure that a borrower can afford repayments and also wish to ensure the home is not overvalued in the event of a default on a loan. While Ball (1999) notes the conservatism of financiers has limited innovation, Hassell et al. (2003) suggest that lenders may place greater value on innovations than do valuers or appraisers, particularly if they assist to make home repayments more affordable (such as by reducing energy or maintenance bills from more efficient fittings and appliances). Insufficient data on the innovation’s performance or ability to reduce costs can act as a barrier. Mortgage brokers, who match lenders and borrowers and have an incentive to complete the process quickly and easily, may thus be conservative when valuing a home with innovations and may lean towards standard rather than innovative mortgages. Finally, insurers, who rely heavily on data for quantitatively measuring risk and setting insurance rates, also suffer from a lack of data about performance of innovations, and thus may respond to the uncertainty with higher premiums or by rejecting the application, acting as another barrier to innovation (Hassell et al., 2003).

Unlike the commercial construction sector, where clients can be significant drivers for innovation, particularly if they have strong experience with construction projects (Barlow, 2000; Kulatunga et al., 2011), most customers in the detached housing market are not equipped to influence the process significantly as they typically only use the construction industry occasionally. Consequently, they usually lack knowledge and experience of
technical standards, and tend to have direct and less formal dealings with contractors rather than designers, making it difficult for them to assess construction quality (Forsythe, 2008). Their already limited power also varies with the boom and bust cycles of the housing industry. In times of high demand, competition may force them to settle for either what they can afford or can purchase before someone else does, and they may make a number of compromises in the process. Further, there is considerable variability in the ways in which customers enter the homebuilding process, which can be prior to design commencing right up until after the home has been fully constructed. Even when involved from the design phase, customers’ level of involvement will vary depending on the degree of customisation which is allowable (which in the case of project homes, will be relatively minimal and primarily cosmetic), and also the degree of knowledge of the buyer and their willingness to defer to the expertise of the home designer (Koebel & Cavell, 2006). Koebel & McCoy (2006, cited in Koebel & Cavell, 2006) claim that client involvement in home building only occurs in the high end of the market.

While customers were generally not felt to be resistant to innovation by volume builders interviewed by Koebel & Cavell (2006), Ball (1999, p.12) claims that customers are “notoriously conservative in their tastes in house styles”. Hassell et al. (2003, p.54) suggest that innovation is typically less important to homebuyers than attributes such as “…location, aesthetics, value, the chance for appreciation, and the quality of the neighbourhood and surrounding schools”, and is likely to be of interest only if “…it is not perceived as potentially reducing other important traits such as the present or future value of the home”.

As noted in Chapter 3, given that Australians, on average, move home every seven years, the potential to encourage them to invest in sustainability initiatives that (at present) have neither short payback periods nor offer benefits to resale value is another barrier potentially requiring further financial incentives. The same dilemma was noted for America by Hoffman & Henn (2008) and for the UK by Ball (1999).

The regulatory framework can act as a barrier to adoption of innovations, particularly if it increases costs and uncertainty (Koebel & Cavell, 2006). In relation to the federal system of government in Australia, Manley (2008) notes that having this level of government can pose a challenge to innovation more widely, as it may be difficult to match products to codes or obtain approvals in an efficient way given the clashes and duplications caused by different standards in the various States. Regulatory officials enforcing existing regulations and codes may also prefer more familiar designs, materials and products.
rather than innovative approaches, and where they are making decisions on whether to allow innovative processes, the extra time taken may undermine the potential time or cost benefits of adopting a particular innovation (Hassell et al., 2003). If changes to existing zonings are required for particular projects, the extensive process typically involved, which may include public hearings, can add considerable delays to a project. This may potentially discourage innovations if they are not perceived likely to be supported by the community (Hassell et al., 2003).

However, regulations can also positively impact on technological innovations and provide competitive advantage (Gann and Salter, 2000). Koebel et al. (2003, cited in Koebel & Cavell, 2006) found that more builders disagreed than agreed that codes and regulations were a barrier to technology diffusion. Similarly, in the UK, Jowit (2012) describes two large construction companies which claimed that regulation was not a significant barrier to new home building, and that instead government should focus on facilitating financing processes for small developers and homebuyers to borrow money; reforming planning and freeing up more publicly-owned land. They also claimed that lowering standards could be counterproductive, making it harder to convince local communities to release land if they weren’t going to be building well-designed, well-built homes, with the Chief Executive Officer of one of the largest home builders in the UK noting that as a house needed to last 100 years, society should be demanding very high standards (Jowit, 2012).

Another potential barrier (or driver) to innovation identified by Hassell et al. (2003) is community interest groups, who may seek to influence planning decisions by lobbying government and promoting messages. Whether they will act as a driver or barrier to innovation depends on their specific cause and the impact of the innovation. However, as one of their interests is typically protecting the property values of their own homes, they may have a leaning towards protecting the status quo if they feel that the character of the community might be significantly altered.

4.2.3 Industry Characteristics Influencing Adoption of Innovation

Hassell et al. (2003) note that many of the challenges to increasing innovation within the housing industry are industry-wide, which often makes it difficult for individual home owners or home builders, and even significant portions of the industry, to be innovative.

The characteristics of the housing industry were discussed in Chapter 3. A number of these characteristics have been attributed to reducing innovation within this industry.
Koebel & Cavell (2006) consider the dominant factors impacting on innovation in the volume housing sector to be the:

- **Degree of fragmentation** – vertically and horizontally within firms as well as geographically, professionally and from a regulatory sense, is widely blamed for negatively impacting on innovation (Hassell et al., 2003). This is not only because of the challenges it poses for knowledge sharing, but because the intellectual property associated with any innovation is difficult to capture, protect and profit from, given that sub-contractors typically work for a range of builders (Hassell et al., 2003;

- **Concentration of the industry** – as outlined in Chapter 3, the industry is typified by a large number of very small organisations, and a small number of very large organisations. As mentioned earlier in this chapter, it has been suggested by a number of scholars that smaller firms have less resources/capacity to experiment with innovation;

- **Nature of the supply chain** – despite the importance of the supply chain (outlined in Chapter 3) to the construction process, there is limited data about its impact on adoption of innovation, and much of the information that exists is anecdotal (Koebel & Cavell, 2006). However, the influence it has on builders’ practices is significant, and can strongly positively or negatively impact on innovation, discussed further below; and

- **Industry/trade associations** – the degree to which these associations support or impede innovations will have flow-on effects for individual organisations operating within the industry.

The residential construction supply chain, which includes developers, manufacturers, suppliers, consultants, sub-contractors and real estate agents, significantly influences uptake of innovation by builders. Despite this, Koebel & Cavell (2006) note that there is little data available on the topic of the influence of the supply chain and innovation, and much of the evidence is anecdotal.

Volume builders surveyed about innovation by Koebel & Cavell (2006) rated suppliers as most important for cooperation, followed by subcontractors and manufacturers. Cooperation by internal architects or engineers, regional managers and project/construction managers was rated much less highly.
Generally speaking, the supply chain is a trusted source of information on innovation for volume builders (Koebel et al., 2003 cited in Koebel and Cavell, 2006) and “…innovators relied on established companies that stand behind their products” (Koebel & Cavell, 2006, pp 6-7). However, barriers may include concern about dealing with unfamiliar suppliers for whom there may be lower confidence about timely deliveries and reliability of contractors.

Manufacturers and suppliers, while not opposed to innovation, will not necessarily create or promote innovative products unless there appears to be customer demand. Slaughter (1993a, 1993b, cited in Koebel & Cavell, 2006, p.7) noted that although field testing to reduce uncertainties about new building products is critical, manufacturers tended to rely on builders who were “willing to absorb first-mover risks”. She also noted that manufacturers tended to ignore opportunities to commercialise homebuilder-originated innovations, and although there are limited examples of partnership between manufacturers and builders, this is starting to happen with larger building companies (Koebel & Cavell, 2006).

Koebel & Cavell (2006), noted that volume builders generally felt that subcontractors, that is trade contractors providing a narrow set of services to a construction project, were resistant to using new products. Support for this position came from Hassell et al. (2003) who note that this is particularly likely to be true if the innovation could reduce demand for their services. The skills and experiences of skilled labourers may help innovation if they can apply it to new ways of doing things, but in other cases they can simply accept traditional approaches without question.

To add to the inertia associated with change, Hassell et al. 2003 note that consultants such as architects and engineers are typically quite risk-averse, in part because of their professional obligation to understand innovations thoroughly, and be able to justify them to regulators, before specifying them in relation to building projects. They may also have limited resources to obtain information about innovations, especially if the costs are unlikely to be able to be absorbed by one client or able to be spread across a range of them. Further, consultants are less likely to have contact with housing customers given the relatively simpler nature of construction of housing as opposed to commercial or industrial construction.

Others in the construction supply chain include real estate agents, who match buyers, sellers and homes but who are unlikely to promote innovation unless they understand the innovation, its costs and benefits, and perceived value. These observations further
highlight that seriously tackling sustainability in housing will be difficult to achieve without engaging this diverse group of stakeholders in aligned activities and goals (Hassell et al., 2003).

In addition to supply chain issues, other industry characteristics claimed to adversely influencing rates of innovation include the project-based nature of the industry, with temporary organisations or ‘coalitions’ of firms formed for relatively short periods of time and then disbanding (Hassell et al., 2003; Manley, 2008); the highly competitive nature of the industry (Hassell et al., 2003); the adversarial culture (Barlow, 1999; Barlow, 2000) and the dominance of the industry by small and medium-size companies (Blackley & Shephard, 2006).

It could also be speculated that the high stress levels experienced in the industry, described in Chapter 3, could also reduce the likelihood of innovation, as when people are already struggling to control their workload they are unlikely to experiment with changes to processes or products which could cause problems or delays. Surprisingly, this potential correlation is not commonly addressed in the literature and would be worthy of future research.

4.2.4 Organisational Characteristics Influencing Adoption of Innovation

Although adoption of innovation ultimately needs to be driven by individuals, organisational characteristics also significantly influence the likelihood of early adoption of innovations. Rogers (2003, p.404) defines an organisation as:

“…a stable system of individuals who work together to achieve common goals through a hierarchy of ranks and a division of labor. Organizations are created to handle large-scale routine tasks through a pattern of regularized human relationships. Their efficiency as a means of orchestrating human endeavours is in part due to this stability, which stems from a relatively high degree of structure that is imposed on communication patterns.”

Ironically, it is the very characteristics that give an organisation its stability and continuity (that is, its inertia and routines), which can hinder its adoption of innovation. Conversely, organisations with a structure that initially discourages adoption of innovation can tend to facilitate their subsequent adoption. Barlow (1999, p.25, citing Tushman & Moore, 1982), describes ‘organisational pathologies’, which include “…previously successful behaviour
and fear of change, or the disruptive impact of innovation on existing organisational hierarchies, work processes or management structures." However, this does not necessarily have to function as a barrier to change. As Sharp (n.d., p.22) argues, “…[L]arge-scale transformation becomes possible when we are able to master the art of maintaining the stability of the organization, entity or process while engaging in the process of change.”

Barlow (2000) suggests that an organisation’s ‘absorptive capacity’ (the ways in which its knowledge is retained and distributed) is critical to successful adoption of innovations. He claims that the degree of capacity is influenced by factors including staff turnover, internal and external communication structures and the political and cultural environments. Koebel & Cavell (2006) suggest that the three key factors influencing the propensity for early adoption of innovations within organisations are its structure; its culture; and the human resources. Further details are summarised in Table 2. As can be seen, organisational structure and culture are themselves complex but are clearly important issues that have to be considered in proposing strategies for change in the construction industry. These observations inform later discussion, particularly in Chapter 9.

**Table 2 - Typical features influencing adoption of innovation within organisations**
(adapted from Koebel & Cavell (2006) and Rogers (2003))

<table>
<thead>
<tr>
<th>Variable</th>
<th>Influencing features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational structure (predetermined goals; prescribed roles; authority structure; rules and regulations and informal pattern)</td>
<td>Factors positively correlated with innovativeness include its interconnectedness, or degree of linkages via interpersonal networks; and the degree of organisational slack, that is, higher levels of uncommitted resources (typically linked with organisation size). Negatively correlated factors include the degree of centralisation (that is, the extent to which power and control are concentrated with fewer individuals), which tends to restrict the range of new ideas, and also the likelihood of decision makers being aware of operational problems or potential innovative solutions and the degree of formalisation, that is how bureaucratic it is (Rogers, 2003).</td>
</tr>
<tr>
<td>Variable</td>
<td>Influencing features</td>
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<tr>
<td>----------------------------------------------------</td>
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</tr>
<tr>
<td>Organisational culture (business strategies and</td>
<td>The organisation leader’s attitude to change is particularly important in establishing an organisation’s innovativeness (Rogers, 2003). Business strategies emphasising innovation and the presence of technology champions contribute to innovation (Koebel &amp; Cavell, 2006)</td>
</tr>
<tr>
<td>markets, growth plans, core competencies and areas</td>
<td></td>
</tr>
<tr>
<td>of business focus, approach to innovation and</td>
<td></td>
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<tr>
<td>support for innovation champions, support for</td>
<td></td>
</tr>
<tr>
<td>research and development, degree of cooperation,</td>
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<tr>
<td>openness and competition (internally and externally),</td>
<td></td>
</tr>
<tr>
<td>degree of aversion to risk, and degree of</td>
<td></td>
</tr>
<tr>
<td>centralisation of influence and decisions (Koebel</td>
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<tr>
<td>and Cavell, 2006)</td>
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<td></td>
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<tr>
<td>Human resources (number of employees, the degree</td>
<td>Koebel &amp; Cavell (2006) cite numerous authors claiming that the breadth and depth of internal talent can promote innovation through greater potential for leadership, technological competence and increased sources of ideas; as well as greater capability to assess them and reduce uncertainty. Rogers (2003) agrees, finding a positive correlation between innovation and the degree of organisational complexity; which he defines as a high level of knowledge and expertise, range of occupational specialities and degrees of professionalism. However, Koebel &amp; Cavell (2006) note that the greater capability for innovation from human resources will only be beneficial if organisations develop knowledge management tools to support it.</td>
</tr>
<tr>
<td>of technical specialisation that exists, and</td>
<td></td>
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<td>knowledge management processes in place) (Koebel</td>
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<td>and Cavell, 2006)</td>
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Management groups are also influential. Christensen & Raynor (2003) contend that middle management has a major role to play in either helping or hindering the adoption of innovations. They note that a role of mid-level managers is to ‘shepherd’ partially-formed ideas into business plans and win the support of senior management, but that they are unlikely to invest their energy heavily into new ideas if they are not assured, because of
fears that their reputation for good judgement, and ultimately career progression prospects will be threatened if they are seen to back ideas which ultimately prove unsuccessful. Clearly, an organisational culture would need to not only tolerate, but anticipate, a certain amount of failure if innovation is to be genuinely encouraged.

A further factor is the impact of organisation size on innovation, about which there is conflicting literature. The size of an organisation will significantly influence each of the three factors in Table 4. Size is typically is also a surrogate indicator of a company’s access to resources (and particularly slack resources), technical expertise and sources of information, improving its ability to be innovative. It also strongly influences organisational culture and human resources as smaller companies are less able to have a wide range of professional specialisation (Koebel & Cavell, 2006). In the case of construction organisations, a discussion of organisation size is complicated by different approaches to defining it, whether by the size of a local branch or national organisation, or by number of housing starts (Koebel and Cavell, 2006).

Larger companies, by virtue of their size, tend to structure into departments. Volume builders surveyed by Koebel & Cavell (2006) typically had Finance, Marketing, Purchasing and Information Technology departments. They were typically less likely to have internal departments focussed on technical matters, such as architecture and design (although more than half the surveyed companies had these); and less likely again to have engineering or research & development (R&D) departments (reported by a quarter to a third of the respondents).

Rogers (2003) claims a consistent positive correlation between organisation size and innovativeness, despite citing that conventional business thinking suggests that smaller organisations can be more flexible and have less bureaucracy to stifle innovation. Similarly, Koebel & Cavell (2006) concluded that larger production builders tended to be more likely to adopt innovations than smaller production builders, and to introduce more radical innovations, particularly when they had national operations. This may be due to the advantage that larger builders have from operating in multiple geographic areas to reduce their risks from market cycles and increase the likelihood of regulatory acceptance of innovations (Blackley & Shepard, 1996), or from the fact they have more employees and capital and a better market position (Hassell et al., 2003).

By contrast, Slaughter (1993a, cited in Koebel & Cavell, 2006) found that small homebuilding firms are a significant source of innovation. It is more likely in a smaller firm
that the owner would be both a technology champion and the decision-maker, thus facilitating adoption of innovation (Koebel et al., 2003, cited in Koebel & Cavell, 2006, p.3), while larger firms might tend to be more reliant on extant practices and resistant to change (Koebel & McCoy, 2006, cited in Koebel & Cavell, 2006). Further, to some extent, the trend for larger builders to be more innovative is counterbalanced by their responsibilities to shareholders and other investors not to compromise on quality, safety and profitability, as well as the fact that their much larger output makes them more vulnerable to compounding of any defects resulting (Koebel and Cavell, 2006). Consequently, innovations are most likely to be adopted by volume builders if they improve production processes, result in cost savings, or reduced call-backs or other liabilities (Hudson & Cantrell, 2004, cited in Koebel & Cavell, 2006).

4.2.5 Individual Decision Agent Characteristics Influencing Adoption of Innovation

Individual characteristics which influence adoption of innovations include a person’s past experiences, professional training, and current circumstances, all of which will influence how they think about innovation, either consciously or subconsciously (Hassell et al., 2003). Rogers (2003) suggests that the likelihood of being an ‘early adopter’ of innovation is influenced by a range of socio-economic factors, personality traits and communication behaviours. Rogers (2003) also suggests that age is not typically a significant factor. It is beyond the scope of this research to explore the ways in which the attributes of individuals contributed to adoption of sustainability and thus it is not discussed in further depth here.

4.3 Discussion of Identified Barriers to Sustainable Construction

As mentioned earlier in this chapter, a range of barriers specific to sustainable construction were identified in the literature and are summarised below.

4.3.1 Increased Capital Costs

The increased capital costs associated with green building (or perception thereof) are generally considered to be the major barrier to sustainable building (Dewick & Miozzo, 2002; Kats et al., 2003), and thus warrants exploration in some depth here. As Kats et. al (2003, p. 4) note:
“…green buildings are commonly perceived to be a lot more expensive than conventional buildings and often not worth the extra cost”.

There is still debate about how much building ‘sustainably’ actually adds to construction costs, if at all. This has not been assisted because, until recently, there have been limited studies of the actual costs and financial benefits of sustainable buildings. This is, in part, because developers tend to keep cost information proprietary, and specifications and costs for designed buildings do not include costs for other more or less sustainable options, or specifically cost out sustainability features (Kats et. al, 2003).

The publicly available information on costs that does exist more commonly relates to commercial buildings than residential. One such study suggested that “green” commercial buildings only cost an extra 2 per cent on average, and that these costs were getting cheaper over time (Kats et. al, 2003). However, he suggested that when designers and builders have experience in sustainable building, the costs could be comparable, or even slightly less, than costs of construction on conventional buildings. For example, in Pennsylvania, buildings that meet the LEED Silver standard now cost the same as conventional buildings, while a building certified to the higher LEED Gold standard was built for slightly less than comparable market rates for conventional buildings (Kats, 2003). Matthiesen and Morris (2004), after comparing the construction costs of number of US commercial buildings certified to LEED against buildings not certified to LEED, also concluded that many projects achieve sustainable design within their initial budget, or with very small supplemental funding.

Of the limited related information pertaining to housing, a UK study of the cost of constructing a house to obtain a ‘Very Good’ rating of the EcoHomes rating tool, compared to a ‘Good’ rating, generally found that there was no ‘magic’ number and that there were too many variables to allow such a figure to be determined (Wilson and Smith, 2006). Variables identified included the location, the organisation’s place in the market and access to supply chains and materials.

Ambrose et al. (2005) describe a study by the Australian Greenhouse Office which examined the costs of improving houses with an average 1.5 star rating to a 3.5 star rating through the most cost effective methods and found that for 45 per cent of houses, the cost of improvements was less than $2000, with an average cost of $1669. Only 10 per cent of houses required in excess of $5000 to improve their rating to 3.5 stars. Overall, the average cost for improvement was $3015, which represents a 2 per cent
increase in cost on a $150,000 house. An award-winning concept house that was part of the study and which incorporated a wide range of features including water-efficient fittings, water tanks, solar hot water, energy efficient appliances and lighting, obtaining the highest energy efficiency rating then possible, cost an additional $7774. It was noted that this was done through using less expensive solutions such as insulation rather than things like double glazing.

However, this reality does not necessarily match with builder perceptions. Two recent Australian surveys of designers and builders found that more than 90 per cent believed it was more expensive than a standard new house, with 39 per cent of respondents in the first survey and 33 per cent in the second survey believing the cost exceeded 10 per cent (Ambrose et al. 2005). Similarly, when a group of Californian developers were interviewed in 2001 they tended to estimate that sustainable buildings cost an extra 10-15 per cent (Kats et al., 2003).

Such perceptions have not been assisted by groups such as the Housing Industry Association, who routinely criticise regulatory attempts to increase the sustainability performance of houses on the basis of costs and imposition to industry (for example, according to Ambrose et al., 2005, citing an Australian Financial Review article of 9 August 2002, they claimed it would cost an extra $10,000 to obtain a 5 star rating).

It should be noted that a number of factors can add to the cost of a sustainable building. Particularly where an organisation is new to green building, the design and construction process often incurs significant costs from the learning curve as well as scheduling problems such as late change orders (Kats et al., 2003).

Inadequate integration of sustainable systems and technologies into the building can reduce both benefits and potential cost savings (Kats et al., 2003). As Matthiessen and Morris note, “the best and most economical sustainable designs are ones in which the features are incorporated at an early stage into the project, and where the features are integrated, effectively supporting each other” (2004, p. 15).

It is also sometimes the case that sustainable buildings are showcase projects, and therefore may include extra “finish” upgrades that sometimes significantly add to the cost but do not add any sustainability benefits (Kats et al., 2003). Even aside from ‘extras’, simply finishing a building properly is important to ensure its sustainability performance,
for example, sealing cracks to improve thermal performance. As Monbiot (2007, p. 67) points out, it is “…cheaper to build houses badly than to build them well”.

Further, risks of the unknown or untested can encourage builders and the supply chain to artificially inflate their prices, further exacerbating cost barriers. This is described further under section 4.3.3.

The volume home building process is a highly standardised process designed to maximise efficiency, assure uniform quality and minimise cost. Consequently, any proposed changes are likely to be met with resistance, particularly if they do not have a high likelihood of contributing to efficiency and profitability (Koebel and Cavell, 2006), or require changes to established industry practices. As Barlow (1999) argues, because the dominant business strategy of the speculative housebuilding industry is to optimise landholdings and time the sale of dwellings to benefit from price inflation, innovation has always tended to be of lesser importance.

There is no escaping the fact that the addition of certain sustainable technologies does cost extra upfront, even when there may be paybacks. For example, as Monbiot (2007) argues, installing extra insulation will cost more than putting in less. Solar hot water systems are more expensive than comparable electrical systems. In such instances, either regulatory requirements, the availability of subsidies and/or customer willingness-to-pay will dictate whether the costs can be justified by builders.

Other variables that can significantly influence the cost of a more sustainable building include the demographic location (for example, in an urban setting, issues related to urban redevelopment, alternative transport and waste management may be more cost-effective than for a rural setting, whereas a rural setting would tend to make larger areas of green space around the building and effective stormwater management more cost-feasible) (Matthiessen and Morris, 2004).

Not commonly noted in the literature is that there is potential for sustainable design to reduce costs through rethinking building requirements and discarding unnecessary features. For example, all other things being equal (such as comparable production processes and included fittings and fixtures), a smaller house is likely to be more sustainable than a larger one, and is also likely to cost less, given the lesser amounts of materials required to construct it and resources required to heat, cool and maintain it. This
addresses the economic dimension of a triple bottom line approach to sustainability, noting the issues of housing affordability raised in Section 2.1

The life cycle costs of the building are the costs and savings made not only throughout a building’s design and construction, but its operation, upgrading and eventual demolition and disposal. Matthiessen & Morris (2004., p. 3) note, while “...the costs and benefits of sustainable design can and should be analysed holistically, including operations and maintenance implications, user productivity and health, design and documentation fees, among other financial measurements…it is the construction cost implications that drive decisions about sustainable design.” Hoffman & Henn (2008) note that green features are often removed during “value engineering” to reduce construction costs but not considering the life cycle cost of the building. Also, decision-makers “effectively assign a zero value to many other real and often significant financial benefits” (Kats et al., 2003, p. 9) such as health costs or potential productivity gains. This is likely to be even more the case in the home, where claimed benefits such as improved productivity are even more difficult (and less meaningful) to quantify.

Certainly, Dewick & Miozzo (2002) found ignorance of future benefits to be the case for many natural insulation materials considered over a 50-year lifetime. A study of rainwater tanks for Yarra Valley Water (Hallman et al., 2003) concluded that, while there were water saving benefits from installation of either a 600 litre or 2,250 litre rainwater tank, the energy use was greater (due to the tank manufacture and use of a pump) and neither size tank would pay back within 30 years under the water prices of the time.

4.3.2 Lack of Customer/Public Interest or Willingness-to-Pay

In theory, as the customer, home buyers should have significant potential to influence the design of a home and products and features that are incorporated, either by specifying their requirements for a product or service which a supplier then attempts to meet, or by refusing to purchase an offered product or service if it does not closely satisfy their needs or wants. Thus, customers have potential to act as drivers for sustainable design, but in many instances they also act as barriers. This may be because they are unaware of the sustainability techniques and technologies that builders could employ, and consequently do not ask for them to be incorporated in their house; they may not care at all; or they may even actively oppose particular sustainability initiatives. In the UK, the World Wide Fund for Nature (n.d.), in a study of sustainability and volume housing, found that two of the six key barriers to greater adoption of sustainability in the mainstream house building
sector were no perceived consumer demand for sustainable homes; and investors being seen as uninterested in house builders’ sustainability performance.

A growing body of literature is confirming perceptions that sustainability is not one of the higher priorities for customers. In New Zealand, Eves & Kippes (2010) found that regardless of income levels, price was the most important decision-making factor, followed by location and then construction type. Typically only young or older buyers in high income brackets made sustainability or energy efficiency a major consideration in their purchase. The authors claimed that in most cases “…the number of bedrooms will be more important to the buyer than the actual energy efficiency savings or the reduction in damage to the environment” (p.205). Hurst (2012) suggested that perceived uncertainty about comfort benefits influenced perceptions about the benefits of energy efficiency, noting research by Crosbie and Baker (2010, cited in Hurst, 2012, p.365) which showed that many people who bought high energy efficient homes “…were dissatisfied with the performance and modified a number of the technologies to ‘override’ the smart systems in order to create a more comfortable internal environment”.

When this research commenced, there was very limited literature on this topic (also noted by Hurst, 2012). An exception was work by Penman (2000), who surveyed Australian housing customers (not focussed specifically on volume housing) and found that many had problems with the word ‘sustainable’, finding it cold and economic or associating it with ‘greenies’ and ‘way-out’ architecture. She noted the concept “…is too broad and nebulous, too much linked with alternative lifestyles, and too challenging to mainstream society” (2000, p. 5). She further observed that that nearly all clients surveyed considered that sustainability needed to be balanced against cost, but also comfort, function, aesthetics and lifestyle. As one of the interviewed customers stated:

“I like the concept of being environmentally friendly but not with sacrifice…like running out of hot water” (Penman, 2000, p.19).

The potential scope of customer influence on innovation more generally was described in section 4.2.2, and suggests that the comparatively limited experience and technical knowledge of home buyers, as well as potentially limited time and determination to actively participate in the design process of a home, does not support them in demanding innovation, including related to sustainability. As mentioned, Koebel & Cavell (2006) noted that significant client input typically only happens in high-end housing projects and this was confirmed to some extent by Penman (2000), who noted that there is a perception
amongst some in the building industry that people interested in sustainability tend to use the services of architects rather than project home builders.

A related, and equally important, aspect relating to customers who will also occupy their home is the sustainability impacts of their subsequent behaviour. Even if they are interested in buying a sustainable home, if they do not then know how to operate it optimally, or otherwise live a highly consumptive lifestyle, there will still be significant impacts. Authors such as Hurst (2012) have noted the significant impact of occupant behaviour on energy consumption. However, it is beyond the scope of this research to focus on occupant behaviour.

However, arguably a greater barrier is not so much a lack of interest, but rather a perceived lack of willingness to pay. This concern is not confined to the housing industry. Nidumolu et al. (2009) argue that there is a widespread fear across many industries that customers will not pay more for environmentally friendly products, particularly during a recession.

A sizeable proportion of builders appear to have a perception that clients, even if expressing a general interest in environmental issues such as energy, are not likely to be willing to pay extra for it, and are “driven almost solely by cost factors when making design/building decisions” (Penman, 2000, p.5). This is reinforced by Ambrose et al. (2005, p.340) who note that survey results “…indicate that the greatest single barrier to the adoption of energy efficient design principles by builders and designers is the perception that it is a costly exercise that will not be accepted by the client.” A national marketing manager from AVJennings, a large Australian volume builder, was quoted in *The Sydney Morning Herald* as saying:

“The simple fact is, if customers are asked if they like energy-efficient measures in homes, they say yes. But if you ask them to pay for it they would rather spend the money on a bigger home or a nicer kitchen” (Pryor, 2004, para. 13).

A number of researchers have provided examples to further support builders’ perceptions of a lack of client willingness to pay. Hoffman & Henn (2008) cited one study in Florida (by Grosskopf & Kibert, 2006) which found that consumer willingness to pay was strongly correlated to capital cost recovery, declining by 25 per cent on average for each two-year increase, and suggested this might be particularly the case for people who turnover homes quickly. This tendency to ‘over-discount the future’ (Hoffman & Henn, 2008) is...
described further under section 4.3.5. A US study by Purdie (2009, cited in Hurst, 2012) found that purchasers would not pay a premium for energy efficient homes. Studies claiming that customers are willing to pay may not necessarily follow up such claims with actual evidence to support them (for example, Mandell & Wilhelmssen, 2011 cited in Hurst, 2012).

A similar phenomenon has been observed with regard to safety features in housing (which could be argued to be a social dimension of a sustainable home). Discussions with first home buyers, people buying a second or later home, home renovators, and residential property investors (Minnery et. al., 2003) revealed that customer knowledge of safety in homes was extremely variable, ranging from poorly informed to very well informed. If people thought much about safety at all, they generally felt that it was an important issue for groups such as children, older people and those with disabilities, but “not for them and not right now” (Minnery et. al., 2003, p. 8). However, even those who were well informed “traded off safety improvements against aesthetics, convenience or cost” (p. 1). In general, safety was not a consideration in decisions to purchase a home (Minnery et. al., 2003), with issues such as price and location over-riding any safety issues. For example, polished wooden floors were preferred over carpets because of their attractiveness and relative ease of maintenance, despite the fact that they posed a greater slip hazard. There was also an expectation amongst home buyers that government regulation would identify and overcome safety problems, particularly in newer homes. Given that builders claimed that safety fixtures and features would be included if consumers asked for them, Minnery et. al (2003) concluded that there was little likelihood of rapid improvements in this area.

A problem which exacerbates the barrier of the perceived lack of willingness to pay from customers is the situation that the benefits from sustainable buildings are rarely enjoyed by the building designers or those financing construction (an issue known as ‘split incentives’). While the developer [or builder] knows the capital cost of various sustainability features, it is more difficult to be sure of the potential future savings to the occupier (Dewick & Miozzo, 2002). While in some cases, savings from lower energy and water use can more than off-set the additional up-front costs of a green home (US Green Building Council, 2007) given the current relatively low prices for energy and water, this is not necessarily the case and payback periods may be long. Further, the initial buyer may only live in a more sustainable house for a few years and therefore may not value the benefits of features with long payback periods or obtain a higher resale value in recognition of its features. (Mandatory disclosure attempts to address this by provision of
improved information for buyers). Even where an initiative could be expected to pay itself back within the expected occupancy of the house, customers may not always be prepared to pay more upfront. This is because households tend to heavily discount the value of future benefits in their decision making, ignoring the cashflow implications and the long-term financial benefits (discussed further in section 4.3.5).

There is a tendency during building investment decisions to ignore or critically undervalue many of the attributes of sustainable buildings (Kats et al., 2003). This is, in part, because “…traditional property valuation techniques are not fully capable of clearly addressing and accounting for sustainability issues when determining market value” (Lorenz et al., 2007, p. 120). Indeed, the challenges of measuring the impact of sustainable design features or other aspects of environmental and social performance on the building’s market value are so great that “…it has been called the ‘Holy Grail’ in contemporary sustainability research within the property and construction sector (Hirigoyen, 2005, cited in Lorenz et al., 2007, p. 132). The authors argue that one of the main reasons it is difficult to establish the relationship between sustainability features and market value is because many hedonic studies used within such studies have significant data limitations, relying on crude input relating to attributes such as number, age or size of building features, or other subjective/qualitative judgements based on implicit assumptions. To overcome the present limitations in terms of being able to accurately relate sustainability features with market value, (Lorenz et al, 2007, p. 142) argue that “…the description of property assets needs to be widened to include a range of technical, functional, environmental and social issues”.

In the context of volume housing, houses are built and sold quickly, and builders seek to maximise their profit. Dewick & Miozzo (2002) suggest that the corporate governance structure, profit motivation and extent of shareholder ownership are important institutional barriers to sustainable building, resulting in a perception of conflict between economic and environmental bottom lines. This discourages inclusion of techniques or products that cost more but are not similarly valued by paying customers.

4.3.3 Increased Risk

Zuker (2004) claims that the “deep-seated conservatism” and risk aversion in the building sector, discussed in section 4.2, restricts the uptake of green building. Nam & Tatum (1997) suggest this is due to the fact that the products of construction are usually costly and the consequences of failure are serious. The construction industry typically attempts
to transfer risk down to the supply chain, often to those who are least able to bear it (Barlow, 2000, citing Gann & Salter, 1998), and the locked nature of construction contracts exacerbates the nature of such risks (Barlow, 2000). Organisations also attempt to manage risk retaining information crucial to integration of systems within their sphere of control (Barlow, 2000).

Recognising this, Dewick & Miozzo (2002, pp. 823-824) argue that:

“Any attempt to promote environmentally responsible house building and renovation must consider carefully the distribution of risk and decision making power reinforced by the system of production, regulation, ownership and finance” (pp. 823-824).

The perception for increased risk is closely aligned with the perception for increased cost. Even where actual costs are not increased, the uncertainty associated with limited knowledge of new technologies or other innovations will increase perceptions of risk (Nam & Tatum, 1997) and may involve a loading of price. Matthiessen & Morris (2004, p. 14) suggest that the most significant single factor in the cost of sustainable design is where there is a perception that sustainable requirements are onerous or risky, or when bidders have plenty of alternative work, they may be less willing to bid, or else will bid higher than might be expected, on projects they consider ‘difficult’. Further, limited knowledge can cause designers, architects and clients to be more conservative and oversize sustainable building systems. This can be compounded when cost estimators then add uncertainty factors for sustainable technologies they are unfamiliar with (Matthiessen & Morris, 2004). The construction industry tends to have a reliance on conventional, ‘tried and tested’ processes, systems and materials (Koebel & Cavell, 2006), which have typically been used for decades and “have proved their reliability against the key factors affecting their field performance” (Dewick & Miozzo, 2002, p. 836). Many features of sustainable buildings have not yet been widely tested or proven, discouraging their use.

One house builder interviewed by Penman (2000, p. 26) summarised the problem of associating risk with sustainable building well, noting that sustainability is “…quite important, but what’s more important is keeping in business.”

In this sense, the legislative environment in which builders operate further discourages perceived risk-taking given that, in Australia, builders are subject to a defects liability period which requires them to fix any problems resulting from construction defects within
a given timeframe (twelve months for commercial buildings, and seven years for residential). Although not widely discussed in the literature, this could serve to discourage not only adoption of new technologies and processes, but other sustainability initiatives such as reusing components such as second-hand doors or windows (an issue I became aware of during my own renovation experience). This has potential not only to cause more problems both during their construction (and increase costs accordingly, particularly due to labour requirements) but also in their subsequent operation, both of which would become the problem of the builder.

Another associated potential risk is of experiencing greater difficulty attracting financing for a project, particularly where sustainability features are seen to be relatively untested (Hassell et al., 2003).

4.3.4 Insufficient Understanding, Technical Information, Skills or Tools

The World Wide Fund for Nature (n.d.) considered the absence of a standard definition of a ‘sustainable home’ to be one of six key barriers to greater mainstream adoption by house builders, while the Sustainable Building Task Force Blueprint (Kats et al., 2003) identified a lack of technical information as a barrier to sustainable buildings,

However, others note that there is in fact an overwhelming and growing selection of information, and the problem is instead a lack of knowledge or ability to access appropriate information as required. This applies to both builders and designers as well as clients. Penman (2000) found that commonly cited problems were information overload and poor retrievability. One designer she interviewed commented that resources were stumbled upon largely by chance.

Housing customers interviewed by Penman (2000) tended to find available materials too technical and/or bulky, or difficult to access, and tended to rely on building information and trade shows; professional designers; house and garden magazines; the internet (although some interviewees raised quality assurance as an issue with this method) and local councils. Other less commonly used resources included friends and colleagues; display homes and other people’s houses; bookstores; alternative magazines; short courses and the library.

Building designers interviewed by Penman (2000) most frequently mentioned the Environment Design Guide published by the Australian Institute of Architects. The internet
was used, but there was “overwhelming agreement that information on the web is hard to find, many web sites are hard to use, most are American…” (Penman, 2000, p. 9).

Amongst builders, more usual sources of information were technical data from material suppliers and in general manuals; professional magazines; hardware stores for builders and personal and professional contacts (Penman, 2000). Only two out of 15 interviewed used computers as an information source. (These findings might be expected to have changed more than a decade later, particularly with the release of manuals such as Your Home (Reardon et al., 2011) and with the proliferation of sustainability training such as the GreenSmart program run by the Housing Industry Association). However, limited subsequent research has updated these findings.

Although there is likewise limited literature to support this claim, it appears that universities and other technology transfer programs are not very effectively supporting the adoption of sustainability, or innovation more generally, within the construction industry. They were rated as the least influential sources of information on innovation in a study of volume builders by Koebel (2003, cited in Koebel & Cavell, 2006). Higher education institutions have also been criticised for not adequately implementing strategies to avoid a shortage of skills required to implement it. For example, (Palmer et al., 2006, p. 2) noted that:

“…there is a significant skills shortage in the [UK] construction and planning industry in terms of delivering more sustainable housing and ensuring compliance with Building Regulations”.

Numerous scholars have commented on the need to better integrate consideration of sustainability into undergraduate programs relating to the built environment (for example, Abdul-Wahab et al., 2003; Biswas, 2012; Cotgrave & Kokkarinen, 2010; Graham, 2000, Paten et al., 2005). Despite this, progress for universities incorporating sustainability into curriculum remains slow (Thomas, 2004).

Although there are concerns about the (lack of) quality or availability of information and educational opportunities, Ambrose et al. (2005) do not consider this necessarily has significantly adverse outcomes for sustainable housing, observing:

“One of the impediments to the uptake of energy efficient design principles is a lack of understanding of the concepts by the house building industry. However,
two recent surveys of house builders in South East Queensland suggest that builders do understand the concepts behind energy efficiency in their climate with respondents in both surveys indicating the top five energy saving features as: 1) cross-ventilation, 2) roof insulation, 3) window shading, 4) landscaping 5) wall insulation. These responses demonstrate a good understanding of the issue…” (pp. 338-339).

Another related barrier is that scepticism about green building appears to be widespread, a situation described by authors such as Blengini & Shields (2010), Hinnells et al. (2008) and Richardson & Lynes (2007). In part, this could link to a wider scepticism about issues such as human-induced climate change which is being stimulated by certain groups, as was briefly described in Chapter 2, or to a broader phenomenon of ‘green fatigue’ which is starting to be discussed in the mass media (Marriner, 2012) but it can also stem from more specific doubts about whether green buildings really deliver benefits, or are really required (Richardson & Lynes, 2007).

A factor potentially contributing to this situation is the fact that sustainability rating tools are not necessarily comprehensive, and thus can, to some extent, function as a form of greenwashing. Birkeland (2008) notes that many green building tools have typically aimed only to achieve a certain percentage lower for energy consumption or ‘carbon neutrality’ by counting offsets. As she wryly comments, “…if we labelled cigarettes the way we label buildings, people might start smoking ‘light’ cigarettes to get healthier” (2008, p. 15).

Scepticism is not entirely unreasonable, given that there is also a growing body of evidence suggesting that, at least in some cases, green buildings do not perform as they were designed to in practice (Arnold, 2011; Sims and Meier, 2012). For example, a study of the energy performance of 121 LEED New Construction (commercial) buildings found that while there were on average substantial energy performance improvements in LEED certified buildings compared to non-LEED building stock (with average LEED energy use 25-30 per cent better than the national average), there was wide variation across the projects (Turner and Frankel, 2008). Measured energy use intensities for more than half the studied buildings deviated by more than 25 per cent from design projections, with 30 per cent significantly better and 25 per cent significantly worse.

Arnold (2011) suggests that a key factor in the gap between predictions and performance is a lack of scientific rigour applied to the process of building simulations, particularly energy modelling, and the design process for an individual building. He suggests the
building simulation process should be thought of as a scientific experiment, requiring the formation of a hypothesis that is tested through modelling, results analysed and conclusions drawn; but that this is not how the process is typically applied in practice by the construction industry. Likewise, he considers the design process of creating a building is similarly a series of experiments, testing a variety of design hypotheses, but notes that feedback loops are not strong in the construction industry. As he puts it:

“Once a building is complete and (hopefully) commissioned the design team simply move on to the next design project. This means that there is no common mechanism for designers to test their work, or design hypotheses to see if they were correct. The finished building in itself is an experiment in design, yet few designers bother to collect the results” (p. 488).

Scott & Harris (1998) similarly bemoaned the lack of appropriate feedback processes to support improvements to the work of building designers, noting that where such systems were in place they were mostly informal and unstructured. More recently, Shnapp & Laustsen (2013) reiterated the need to provide available (and storable) and credible (verifiable and transparent) data on energy savings if the confidence of policy-makers, buildings, architects and other stakeholders is to be won.

Arnold (2011) notes, instead of enhancing designs through a feedback process, the construction industry (at least in New Zealand) typically uses building simulation only for compliance or rating processes, whereby energy simulation is viewed as a “means to an end” and “…the results are often misinterpreted or even misappropriated by some in the industry” (p. 482). He also notes that at times the various sources of error or bias inherent in simulation tools are exploited, providing the example of a particular software package which is favoured by the construction industry for Green Star simulation work as it is known to give favourable results for thermal comfort and energy credits.

Until such scepticism can be seriously tackled, including by addressing both the valid causes and the more scurrilous claims being made by a minority on wider sustainability issues, it is likely to remain a barrier to greater uptake of sustainable houses. If these issues are addressed and scepticism remains, then it becomes more of a specifically cognitive barrier, described below.
4.3.5 Other Cognitive Barriers

Hoffman and Henn (2008) noted that once the technical and economic barriers to green building have been overcome, it is essentially irrational to make environmentally harmful decisions. They note that scholars from fields as diverse as sociology, psychology, anthropology and political science have shown that humans continually make sub-optimal decisions. This is because they are bounded in their ability to achieve ‘pure’ rationality, being influenced by a number of decision-making biases, of which they may not even be aware. Humans continually make a range of simplifying strategies, known as ‘cognitive heuristics’, largely as a way of coping with the volume of information which bombards them each day and which would otherwise prove overwhelming.

With regard to adoption of sustainable building decisions, Hoffman & Henn (2008) suggest that there are six key cognitive biases, as follows:

- **Over-discounting the future** – whereby people use extremely high discount rates in their consumption behaviour, failing to accurately calculate and then make decisions based on payback periods, refusing to invest even in opportunities such as energy efficient lighting which provide returns on investment much greater than they could obtain from investing in stocks, bonds or money market funds. This contributes to the lack of willingness-to-pay discussed in section 4.3.2.

- **Egocentrism** – a tendency of people to make self-serving judgements of what they consider is fair, but which in aggregate can counteract a sustainable built environment. They provide the example of a couple living in a home with a yard believing they are doing the right thing for their children and the community, while contributing to increased urban sprawl and greenhouse gas production from car dependence.

- **Positive illusions** – like egocentrism, “the tendency of people to see themselves, their future, and the world in a better condition than it is or will be” (Hoffman & Henn, 2008, p. 11), such as the person who drives a hybrid car to reflect their environmental responsibility but then flies thousands of miles each year creating a much greater carbon footprint. The observation that energy consumption in Australia continued to rise, despite supposedly growing concern about climate change as discussed in Chapter 2, is a likely example of this bias.

- **Presumed associations** – a simplifying activity whereby people may mistakenly identify correlation between events which are not in fact correlated. Thus they may associate green building with early attempts by the hippie culture and continue to hold
that correlation in their mind; or associate a high water efficiency washing machine with poor performance.

- **Mythical fixed pie** – the tendency to assume during negotiation that interests must directly oppose each other and thus that mutually beneficial solutions cannot be found, which can tend to become a self-fulfilling prophecy. Hoffman & Henn (2008) link this to the persistent belief that green buildings cost more, the related barrier discussed in section 4.3.1.

- **Environmental literacy** – or rather, lack thereof in the general population, which continues to display a pattern of environmental ignorance, exacerbates the other biases. Hoffman & Henn (2008) provide some surprising examples to illustrate this, such as the fact that 120 million Americans think that spray cans have CFCs even though they were banned in 1978, and the same number think that disposable nappies are a leading problem in landfills when they represent about 1 per cent of the waste stream.

Harford (2011) suggests that several further cognitive factors further prevent us from learning from mistakes, which he argues is an essential part of the learning process when dealing with complex situations (and thus, should be considered an essential part of the transition towards sustainable housing, to be analysed, understood and shared). He suggests that the key factors are:

- **Denial** – the process by which we refuse to acknowledge our mistakes because of the discomfort;
- **Loss avoidance or loss-chasing** – the process by which we cause more damage while trying to hastily erase a mistake; and
- **Hedonic editing** – a subtler process of convincing ourselves that the mistakes don’t matter, such as by bundling together losses with gains, or reinterpreting failures as successes, confusing the lesson or message.

### 4.3.6 Inappropriate or Inadequately Enforced Regulatory Requirements

As discussed in Chapter 2, regulatory requirements can be a major driver of sustainable building practices. However, if poorly designed or inadequately enforced, they can also act as a barrier to good practice. The World Wide Fund for Nature (n.d.) considered that planning and building regulations that did not facilitate development of sustainable homes was one of the six key barriers impeding greater uptake of sustainability within the mainstream of the UK house building sector, although did not elaborate on how. Levine et
al. (2012) suggest that regulatory approaches need to be combined with incentives, labels and voluntary schemes encouraging beyond minimum performance standards to promote building energy policies and integrated building design. Ball (1999) argues, also without providing specific details, that the planning system (at least, in the UK) militates against innovation more generally.

A problem with legislation is that it can tend to set maximum standards. As Monbiot (2007, p.68) notes, “No builder, unless the client asks for it, will build a house that is better than the regulations demand”. He also notes that in the UK, there is little incentive for builders to comply with energy efficiency legislative requirements, as the risks of being caught are low and do not result in prosecution. This is exacerbated by the fact that new home insurance covers the risks of failure to comply with other building regulations, but not for energy efficiency.

Another issue relating to sustainability outcomes of legislative approaches is a growing trend towards the use of private assessors to verify compliance with building regulations, which is considered by some to be contributing to a decline in energy efficiency building standards both in the UK and in Sweden, given the conflicting need of private assessors to attract continued business and therefore a disincentive to be overly tough (Monbiot, 2007, p.67). A similar situation exists in Australia, although there is limited literature detailing whether this is having an impact on quality standards.

A range of ways in which regulation has impeded the sustainability initiatives of the case study organisations is discussed later, particularly in sections 7.2.1 and 8.1.

4.3.7 Incomplete Integration Within and Between Projects and Supply Chain Issues

The Sustainable Building Task Force Blueprint (Kats et al., 2003) identified incomplete integration within and between projects as a barrier to sustainable buildings. Within individual projects, commonly noted is the need to consider sustainability as early as possible in the building process and to involve a wide range of stakeholders throughout the process, even in parts they would not normally be considered to require input (for example, Hawken et al., 1999; Rocky Mountain Institute et al., 1998; US Green Building Council, 2007). As mentioned in Chapter 2, not doing so can lead to a ‘bolt-on’ approach to sustainability which misses opportunities to optimise the design and achieve cost-saving synergies.
Although still not widely discussed in the literature, the issue of supply chains as a barrier to sustainable housing is starting to gain prominence. For example, a survey of housing associations and developers building houses in compliance with the EcoHomes rating tool in the UK found that the key barrier was seen to be a lack of an established supply chain for procuring the products necessary for compliance, with 63 per cent of respondents identifying this as a barrier (compared to only 25 per cent who identified cost) (Wilson & Smith, 2006).

The specifics of integration will be discussed in more detail in Chapter 8.

4.3.8 Aesthetics

Aesthetics are rarely raised in the literature as a specific barrier to sustainable building, with an exception being Janda (1998), who concluded that many building design decisions, particularly when architects are involved, are made more on a basis of aesthetics than for any other compelling reason, such as sustainability (although it should be noted that this observation was made with a focus on the commercial construction industry). An interesting corollary to this, which is not widely discussed in the literature, is the reduced likelihood of sustainability features to be incorporated in a building if they cost more but are not obviously visible to clients and customers. For example, Dewick and Miozzo (2002) note that thermal insulation, because it is hidden behind walls, roofs and floors has no aesthetic properties and “architects, in particular, may wish to channel resources towards more visible technologies” (p. 836). Koebel & Cavell (2006) and Hoffman & Henn (2008) similarly found that customers place emphasis on benefits that are visible, discounting invisible building improvements without short-term payback periods. Hoffman & Henn note “…by investing in ‘upgrades’ that are hard to see (extra insulation, tighter windows, energy efficient water heaters), the comparative and psychological payback of tangible items like a new Jacuzzi, kitchen renovation, or new addition become more salient” (2008, p. 10), further noting that this is even more of a problem in the context of indoor air quality.

4.4 Chapter Overview

In order to understand why sustainable housing is not the norm despite its obvious benefits (as described in Chapter 2), this chapter has articulated a range of barriers to sustainable housing (or construction more generally) which have been identified in the literature. Because limited research was available when this program commenced,
barriers to innovation more generally were also explored as sustainability can be considered a form of innovation.

The complexity of sustainable housing itself, with the large network of stakeholders involved in delivering it and the tendency towards a ‘vicious cycle of blame’, are key barriers to its greater adoption. Other barriers specifically identified in the literature include perceived increased capital costs; perceived lack of customer interest or willingness to pay; perceived increased risk; insufficient understanding, technological information, skills or tools; other cognitive/psychological barriers; inappropriate or inadequately enforced regulatory requirements; incomplete integration within and between projects and supply chains; and aesthetics. An important point raised by this research is that the barrier does not need to be real; a perception of builders that it is can act as a sufficient barrier in its own right.

The construction industry is not generally renowned for its adoption of innovation more broadly, possibly due to the craft-based nature of the industry and low levels of education. However, a number of scholars have challenged this view.

The barriers to innovation broadly exist at the level of the individual, within individual organisations, and at a wider institutional level which encompasses factors such as the market context, the regulatory framework and industry characteristics. Barriers must be tackled at each of these levels to genuinely support sustainable building initiatives.

While it is beyond the scope of this research to explore the characteristics of individuals which influence adoption of innovation in any depth, the need for innovations to be compatible with organisational norms and cultures has been discussed. Importantly, it was identified that the attributes which promote stability within organisations, and which would assist the successful ongoing implementation of innovations, are very often the exact attributes which act as barriers to their initial adoption.

Other factors influencing innovation in the industry include the attributes of the innovation itself including its attractiveness and ease of adoption; the market context (and particularly the role played by customers); and the industry characteristics which were largely covered in Chapter 3. Significantly, this chapter has illustrated that driving change is about much more than expecting individual building practitioners to do so within a broader context which is unsupportive.
To better understand the implications of this within the Australian volume housing context, these identified barriers were the focus of many of the interview questions. A discussion of strategies to overcome them, at least within builder organisations, is largely the focus of Chapters 8 and 9. Strategies to address wider institutional barriers are also touched on to a lesser extent, particularly in Chapter 10.

The following chapter provides a background to the three case study organisations and summarises some of the key sustainability initiatives they were undertaking, or had recently undertaken at the time of the interviews. It also outlines future initiatives that were under consideration at that time, and then provides a brief update about developments which subsequently took place between the interviews and the current time.
Chapter 5
Real Life Experiences: Three Case Studies

“…we’re of the understanding that we’re leaving a lasting legacy on the ground…”

- Research interviewee

Having provided the context for this research resulting from a literature review, this chapter now starts to present the outcomes of this research in terms of findings from the interviews. It also provides a brief outline of each of the case study organisations and their sustainability initiatives. This primarily derives from the status at the time of the interviews (in 2005), with a brief updating to reflect the status as at early 2013.

5.1 Company A

5.1.1 Background

Founded in 1976, Company A is one of Australia’s largest volume builders (the largest house builder in Victoria and ranked third nationally by number of dwelling starts in the Housing Industry Association’s Housing 100 for 2009/10, starting 3,214 freestanding houses in this period). This follows steady growth since 2000/01, when they were ranked 27th in the Housing 100 and started just 528 homes, with the exception of a slight decline in 2008/09 (Housing Industry Association, various years).

The company is privately owned, and according to its website, currently (at 2013) has over 1,000 employees. While it started out with a focus on land development and construction of commercial buildings and house and land packages, it later got into the development of master-planned communities. This company does not undertake multi-unit construction, according to Housing 100 reports (Housing Industry Association, various years).

While its head office is in Melbourne, Company A also has offices in South Australia and Queensland (with the Queensland office covering construction in northern NSW and south-east Queensland). They had earlier operated in New South Wales but reportedly did very little work there at the time of the interviews.
Company A is a large land developer as well, predominantly in Queensland, where housing construction had played less of a role in their business at the time of the interviews. They had reportedly only recently (at the time of the interviews) started developing land in Melbourne. However, analysis of the Housing 100 reports over the last few years suggests that land development is becoming a lesser part of their business strategy, with the focus on free-standing houses.

5.1.2 Sustainability Initiatives

At the time of the interviews, Company A had geared up for the impending introduction of mandatory 5 star energy ratings and had employed in-house staff to conduct energy ratings of homes. Apart from this, their exposure to sustainable building at the time of the interviews was largely confined to the construction of the Cairnlea Ecohome, outlined in Chapter 2.

The main differences perceived by the interviewees between the Cairnlea Ecohome and Company A’s normal product offerings were the greywater and solar systems (typically interviewees referred to “solar” and did not distinguish between photovoltaic cells and solar hot water, although both were included in the Cairnlea Ecohome). One interviewee also noted the different [low-VOC] kitchen cupboards, benchtops and [water efficient] tapware that were installed.

While the Cairnlea Ecohome experience was claimed to have raised the level of awareness of sustainability amongst both technical and sales staff, it did not appear that it had yet translated into standard practice. Indeed, some frustration and disappointment about the outcomes of this project (in terms of a perceived lack of customer interest) was expressed by the various interviewees from this company.

It was suggested that the delays in constructing the Cairnlea Ecohome were partly attributable to its construction during the peak of the housing boom, which tended to divert human resources to more profitable activities, and arguably also to some degree due to issues of coordination amongst the project partners. Coordination problems were exacerbated by some key project team members ceasing their involvement with the project throughout its duration for various reasons, including due to the death of a senior manager who was a champion for the project. In part it was probably also due to the builder’s frustrations with unfamiliar products and processes.
At the time of the interviews (2005) there had been little subsequent work building upon the experiences of the Cairnlea Ecohome. However, the company was in discussions with Melbourne Water about a potential effluent reuse project being considered for several new estates in Werribee, an outer suburb in Melbourne’s south-west, where this company was to construct homes in the display villages. This project was to involve use of treated sewage for toilet flushing and garden irrigation and dual-metering of houses, with the extra cost of metering offset by being charged at the lowest rate for water. (Although one of the interviewees described it as greywater, another described it as being partially treated effluent that had been first used in farming, rather than greywater from housing. In fact, it appears that neither was correct and it was, rather, treated sewage from the Western Treatment Plant in Werribee, with an added environmental benefit being the production of energy from biogas from the treatment lagoons (Murphy, 2005)).

Company A had no staff with specific responsibilities for sustainability or environment as at 2005, and nobody appeared to have had any formal training in these areas. The Cairnlea Ecohome was originally coordinated largely by the research and development team (which encompassed a design function as well), with most of the sustainability expertise provided externally by project partners. Subsequently, the marketing team had played a significant role in promoting the home and developing marketing material, with information passed on to the sales team who then produced promotional material for customers.

No real vision was expressed during the interviews as to how Company A would continue to embed sustainability into their homes in the future, and it appeared that it was an issue for which the company was giving little attention. Indeed, there seemed to be the sense that a hurdle had been jumped by completing the Cairnlea Ecohome and as one employee noted, there were no particular plans to build another “environmentally-friendly” home in the near future.

There was generally a sentiment that certain sustainability features would be demanded increasingly in future, or the bar would otherwise be raised by customers, developers or regulators, particularly relating to energy and water efficiency. It was also felt that improvements to technology would mean it would be more widely adopted in future, in areas such as solar hot water systems, photovoltaic cells and greywater or other recycled water treatment systems. Greater awareness in customers of indoor air quality and links to health issues was also expected by one interviewee, while another noted that sustainable materials was an area they would need to address further in the future.
However, these expectations had not translated into any identified action at that point in time.

However, around 2007, Company A did once again develop a sustainability-related offering, promoting packages of additional home sustainability features on its website through a program called ‘Shades of Green’. (As of 2013, this was still listed on their website but with no details provided). During 2012, their website stated:

“At [Company A], we’ve just introduced an important option for your environmentally friendly home. It’s called Shades of Green and it provides you with a range of choices that can reduce your energy consumption, and, at the same time, increase the sustainability of our precious resources.”

A customer could purchase additional sustainability features to add to their home according to three options:

- **Light green** – includes low VOC paints, time delay switches and light dimmers for lights, window and door seals;
- **Medium green** – additionally includes double-glazed windows, energy efficient downlights, ceiling fans, higher R-value insulation batts to walls and ceilings and window frame materials that reduce heat conductance; and
- **Dark green** – includes light and medium green options as well as a solar hot water system, grey water system and rainwater harvesting.

Each option provided a brief summary of benefits, such as potential percentage energy savings, although with limited details.

As at early 2013, there otherwise appear to be fairly limited references to sustainability on Company A’s website. A webpage entitled *Community Involvement* describes a range of philanthropic activities without mention of sustainability, and the Cairnlea Ecohome rates a mention as the winner of HIA Best Energy Efficient Project Home award, buried amongst a suite of other non-sustainability related award titles, and with no supporting information provided.
In 2012, if one hovered a mouse in the appropriate location, the bottom of the Victorian homepage did provide as one of the answers to the question “Why [Company A]?” the rather vague response:

“[Company A] has been recognised for its innovative designs and commitment to sustainable homes.”

However, this link is no longer there and at the current time sustainability is not alluded to in Company A’s Vision, Mission or Values as shown on their website.

5.2 Company B

5.2.1 Background

Founded in 1989, Company B grew rapidly to become, according to its website, Victoria’s largest home builder by 1994 and Australia’s largest home builder by 1998, but according to the 2009/10 *Housing 100*, the fifth largest by number of starts. By 2009, it was estimated to have built some 40,000 homes (Dunlevy, 2009), and started 1,881 houses in the 2009/10 financial year (Housing Industry Association, 2010). One interviewee from this company described how in the company’s “heyday” they had built many more homes each year than this, but had decided to focus upon a more controlled approach to what they built.

Company B’s main market is Victoria, where it is considered to have “…pioneered affordable ‘big box’ homes now commonly known as McMansions” (Dunlevy, 2009), but it also builds homes in Queensland and South Australia. It has built homes in the past in NSW, having entered this market in the 1990s, where it:

“…ran into trouble when a skilled trades shortage created by Olympics Games construction resulted in well-publicised complaints about the quality of its homes…After its problems in Sydney, the company bounced back in 2000 to pioneer five-star energy rated homes in Victoria” (Dunlevy, 2009).

According to the same article, there had also apparently been interest in expanding into Western Australia, but this has not happened at the present time.
For many years, Company B was a private company, run by the three directors who established it. However, in 2009, a 50 per cent share was purchased by a subsidiary of a publicly listed Japanese company which builds around 10,000 homes each year in Japan (Dunlevy, 2009).

Sustainability, at least with regard to energy, was widely understood by the interviewees to be core to Company B’s business philosophy and way of designing homes.

5.2.2 Sustainability Initiatives

At the time of the interviews, Company B had no staff with dedicated responsibility specific to sustainability or environmental management, apart from a dedicated person in each State who supported the national design team by conducting house energy ratings. Environmental compliance issues relating to site management appear to have been largely overseen by two dedicated occupational health & safety specialists within the organisation with national responsibilities.

As mentioned above, Company B’s key achievement with regard to sustainable building at the time of the interviews had been to become the first volume builder within Victoria to offer 5 star energy rated homes as standard to all homes, five years before the regulations mandated it. They had achieved this in part by developing a working relationship with the (then) Sustainable Energy Authority of Victoria and with a former Victorian Planning Minister.

Initially, Company B had modified their existing house designs until they achieved the 5 star rating, but interviewees reported that they had found this typically added significant expense, as they were required to make costly adaptations such as installing more double-glazed windows. They had resolved this through considerable trial and error, redesigning their homes with greater consideration of passive solar design principles. This had involved modifications to block shapes and setbacks and increasing glass to the northern aspect (and reducing it elsewhere). As a result, the cost of achieving energy efficiency standards was much reduced.

Company B staff were the most likely of all interviewees to stress the importance of the home actually being constructed to perform in an energy efficient manner, rather than simply achieving a rating for a design.
With regard to the construction process, Company B claimed that it had largely integrated the implementation of sustainability within their existing quality program. One interviewee noted that this was necessary to avoid things going wrong, such as installing the double-glazed windows in the wrong location if there were other, non-double-glazed, windows the same size. The quality system adopted was developed in-house and was reportedly not aligned or certified to a recognised standard such as ISO 9001. It largely entailed several inspections of a home by independent inspectors at four stages, checking against the requirements of the Building Act and internal requirements (which were more onerous than legislative requirements), and checking specific factors such as the quality of drafting, building fabric, finishes and the like, as well as that the energy efficiency requirements had been met. There was reportedly also a final check of the home by Archicentre, an independent building design and inspection organisation which is an offshoot of the Australian Institute of Architects. Some of the interviewees from this company noted, however, that these quality processes were not widely publicised by their organisation.

Changes to their earlier construction processes to incorporate sustainability had included a greater emphasis on preventing air leakage, through measures such as taping joins in sisalation (reflective foil), which had reportedly required “educating” Company B’s bricklayers. They had also worked with their plasterboard installers on ensuring that insulation batts were installed before the walls were sheeted. While the emphasis was on improving the building envelope, the energy efficiency of appliances, lighting and the like was rarely mentioned. However, one interviewee reported that all display homes featured photovoltaic cells, which were offered as an option, but were rarely purchased due to their high cost.

Training of sales staff, through the provision of information that allowed them to clearly explain the benefits to customers, had reportedly also been part of Company B’s strategy.

While energy efficiency was certainly the focal point of sustainability initiatives, and the point that interviewees from this company talked most easily about, water, waste and materials selection were also mentioned reasonably frequently. Flow control valves to reduce water consumption had apparently been installed as standard in all homes for a number of years. Rainwater tanks were offered with homes and while they were not, at the time of the interviews offered as a standard feature, they had apparently been so during the water restrictions imposed during the earlier major drought in the eastern States of Australia.
Company B was using a waste disposal contractor who they had selected because they had proposed a recycling system, but it wasn’t clear if such a system was yet in operation. There was no mention of them have started to seriously tackle issues such as minimising unnecessary packaging.

At the time of the interviews, there appeared to be general uncertainty as to what the next sustainability challenge might be now that energy was largely thought to have been addressed by some interviewees (although a couple of interviewees speculated about aiming for higher energy ratings). There was interest expressed by one interviewee as to how energy use related to the subsequent use of the home could be reduced, such as by ‘zoning’ the usage of areas.

Water was not widely raised as an issue requiring additional efforts, although one interviewee noted that it remained an issue. However, some scepticism was expressed about the actual sustainability benefits of continuing to supply rainwater tanks, such as:

“I’d like to see some research on whether we’re actually significantly saving water by supplying homes...with water tanks...Our experience is, most of...they’re empty before you know it. So therefore the idea that you’re going to have a water tank out there for the long hot summer is just ludicrous.”

Taking the wider definition of sustainability to incorporate the social sphere, Company B was also involved in various philanthropic pursuits, with a dedicated separate website which outlines their commitment to philanthropic activities, noting amongst other things that they have raised over $18 million for philanthropic projects, growing at over $1.5 million annually. Specific examples include their donation of 33 homes to provide funds for hospitals. They also heavily promote their involvement in supporting a children’s orphanage in Africa (Housing Industry Association, various years) where they also acquired land to grow food. There are also various staff projects where Company B matches dollar for dollar any funds raised by its staff.

Part of the lack of a broader, clear plan for future sustainability initiatives appeared to have stemmed from not having a clear enough understanding of the issues entailed, a point that was raised by more than one interviewee.
A greater emphasis on building materials seemed to be a potential future area of focus, as it was raised by almost all interviewees from Company B, with one expressing a wish to be able to communicate the relative environmental benefits of various alternatives (such as in terms of natural resource consumption, chemicals released into the environment, longevity and the like). One interviewee also raised the health issues associated with the “chemicals” used in products such as chipboard as a social element of sustainability (the only person in this company to specifically discuss the social dimension with regard to future plans). Related to materials, a better understanding of embodied energy was also raised by one interviewee as an issue requiring future attention, with particular reference made to the embodied energy of energy efficiency features such as double-glazed windows and potential trade-offs.

Reducing wastage was also specifically raised as an area requiring future focus by one interviewee. It was thought that this would occur automatically to some extent, as the trend towards greater use of electronic estimating continued. Another interviewee suggested there was a role to play with more aggressive supply chain management to drive sustainability initiatives.

One person did not specify any particular vision for sustainability, but felt that it would be important to work with the broader industry, including educators, institutions and government to understand the wider vision and ensure they were involved early.

Not many years later, this company did go on to find itself a new and ambitious sustainability challenge, joining the Australian Zero Emission House (AusZEH) research consortium and building Australia’s first zero emission house in Laurimar, described earlier in Chapter 2.

As at 2013, sustainability is still a core marketing message on the Company B website, which positively promotes its involvement in the AusZEH research project. ‘Sustainability’ is one of the seven drop-down options to select under the ‘About [Company B]’ tab, with the dedicated webpage stating:

“[Company B] continues to lead the way in pioneering sustainable and environmental initiatives in new homes. Our focus has always been about building tomorrow’s homes, today. [Company B’s] strategic focus is to lead the way and set the benchmark for the industry. [Company B] was the first builder to introduce 5 star energy rated homes five years before the government made it mandatory, and
more recently, the first builder to deliver Australia's first zero emission home designed for the everyday family.

Our environmental commitment is steadfast and continues to evolve every day in our ongoing research and development initiatives, design and construction approach and partnerships with major land developers, government and leading industry bodies.

Into the future, [Company B] will continue to be the leaders in new home design, innovation and sustainability, whilst still providing affordable, quality homes to Australia and the rest of the world. The best in sustainable living practices are available now. All [Company B] homes are 6-star energy rated. Discover simple ways to save money whilst protecting the environment.

The sustainability webpage (as at March 2013) also provides some very limited detail about the 8-star energy rated home built and on display at Clyde North (outer south-eastern Melbourne), but surprisingly, no references to the Laurimar Zero Emission House could be found anywhere else on their website.

Company B also claimed on its website in 2012 to have produced a sustainable living brochure which was available from each of their display centres.

5.3 Company C

5.3.1 Background

Company C is the residential division of a wider Australian publicly-listed property company, with a majority share-holding by a Singapore-based corporation. It was first listed on the Australian and Singapore Stock Exchanges in 1997. It has been involved in property development for over 80 years and at the time of the interviews, had development assets of $1.7 billion, owning 49 income-producing properties with a total value around $1.3 billion (based on its 2005 Annual Report). The Annual Report also stated that, as of 2005, it employed approximately 640 people and operated in Sydney, Melbourne, south-east Queensland and Perth, with a sales office in Hong Kong.

Apart from the listed nature of the organisation, other factors significantly differentiated Company C from both Company A and Company B at the time of the interviews.
Company C is a more widely diversified property group, having Commercial & Industrial, and Investment Property divisions, as well as Residential. It could be speculated that their exposure to green building associated with the commercial sector, and particularly the fact that at the time of the interviews, their Chief Executive Officer was also the Chair of the Green Building Council of Australia, could have positively influenced the organisation’s residential arm with regard to sustainability.

Company C was a significant land developer as well as a volume builder and had sold land to both Company A and Company B.

5.3.2 Sustainability Initiatives

Of the three companies, Company C appeared to have the most developed corporate systems and processes supporting sustainable building. Generally speaking, Company C staff interviewed also demonstrated a more comprehensive understanding of what sustainability meant in the context of houses. This was, at least in part, because the sustainability function was better resourced and had dedicated sustainability staff to support the raising of awareness and the implementation of processes, as discussed below.

Company C was tackling sustainability at both the strategic corporate and operational levels. From a corporate level, it was implementing a formal organisational structure to support the initiatives and high-level strategic documents; and from an operational perspective it was implementing initiatives at both the level of the estate and also individual site level. This entailed both process changes and changes to building design and materials.

At the time of the interviews, Company C was the only one of the three case study organisations to have a publicly available Sustainability Strategy, which had been signed off by the Board. It also included a sustainability statement, taking a triple bottom line approach, within its Annual Report. Other high-level sustainability commitments included Memoranda of Understanding which had been signed with Melbourne Water and City West Water specifying that AAA-rated appliances (the water efficiency rating system in use at that time) would be used in homes, with a goal of a 40 per cent reduction in water consumption by end users. An arrangement had also been struck with Melbourne Water to significantly reduce their developer contribution fees because of their commitment to water sensitive urban design.
The major organisational change supporting sustainability was the renaming of the residential division’s design department to the Sustainable Design Department, which had occurred about three years before the interviews were conducted. This had been done to raise the profile of sustainability within the division, with a charter for the group to influence broader organisational processes relating to sustainability.

Company C was also the only one of the three case study organisations to have dedicated sustainability staff, with the new role of National Sustainability Coordinator created at the start of 2005, based in the Sustainable Design Department. Other members of this Sustainable Design Department included designers, documenters, technical staff, estimators and product researchers. Further, these formal roles were supported by a network of ‘State Sustainability Coordinators’, in each of the State units, which was a more of an honorary role in addition to the incumbent’s substantive position. These coordinators fed information about projects to the department, which then analysed and ‘repackaged’ it into various reports for different stakeholders.

One of the strategies that the Sustainable Design Department was employing was to focus on identification of supportive internal stakeholders and relationship building with those persons. As one interviewee described it, the goal was to:

“…try and bring all of these people together and create an internal network now, but not necessarily people in the right position but people with the right attitudes and desires…”

This department had primary carriage of the development of processes to embed sustainability into all facets of the organisation’s standard practice, rather than it being “…a project-by-project sort of thing”. They understood that one of the most effective ways to achieve this was by integrating it into knowledge management and quality management processes, and consequently they were developing, maintaining and managing standard operating procedures, practice notes, case studies, project reports and the like, coupled with a training program. Interestingly, as there was reportedly no ‘official’ quality management system as such within Company C, at least within the residential division, (although there was a quality assurance process for the final product) it was suggested that to some extent, the sustainability management system was serving as a default quality and knowledge management system.
One interviewee summarised the sustainability system they had created:

“…there’s a whole range of information exchange and checkpoints along the way where people are starting to see what other people are doing and why and questioning it and changing it and approving it and moving it…”

At the time of the interviews, the Sustainable Design Department was developing a program whereby consideration of sustainability was required from the start of the land acquisition process right through to completion of the house. The main area of focus at the time was the land acquisition process, as it was stressed by more than one interviewee that to be most effective, it was important to consider sustainability from day one. The department had conducted workshops to develop processes to incorporate sustainability into the workflow of the acquisitions department and to encourage communication across the organisation. By defining each of the key steps within the acquisition process, and then linking specific considerations or requirements at each point, the intention was to encourage the responsible staff to identify the sustainability opportunities and constraints at each step of the process, and to think about ways to maximise any opportunities. The results of this work had been communicated through a flowchart, which described the sustainability issues to be considered at each step of the acquisition process. This was printed in poster format for distribution throughout the company. There was also the intention that staff from the Sustainable Design Department would be more actively involved in contributing to the acquisition process by sharing knowledge.

Reporting and data collection was also a significant focus of this department, using a standard reporting proforma (spreadsheet) which was to be progressively completed over the life of a project starting with acquisitions and with input from project managers and consultants. This information was compiled into State-based performance reports which then fed into national performance reports. This process not only encouraged staff to consider sustainability considerations early in the development process, but also served the purpose of capturing the information to assist in knowledge transfer between relevant staff, particularly if staff left the organisation or project.

Because staff were told they would be assessed on sustainability performance indicators, it was reportedly having the effect of encouraging them to ask questions about sustainability up-front in a project. As a consequence, one interviewee noted:
“…it’s meaning more work up front, but it’s meaning people think about things a lot more up front.”

For example, sustainability was reported by a couple of interviewees to have become a standing agenda item in value management meetings, where a range of staff would come together to review the designs for a particular site throughout the lifetime of the project. As another interviewee noted:

“…from day one, when we purchase that site we’ll have a budget for sustainability objectives on that particular site, we’ll make a call and go OK, this site is really important to us, we’ll throw that full suite of sustainability objectives at this particular site and that’s got a cost of x. Or if it’s a smaller site, tighter budget control, we might say OK, we’re just purely going to do our legislative requirements on this particular site, and that’s got a cost of x. So from day one it’s already budgeted and costed and therefore will be implemented.”

Ongoing monitoring of the project’s sustainability performance could be conducted through the use of this reporting proforma. Although one interviewee noted that there was still room for improvement, there was a strong emphasis on continuous improvement with regard to sustainability performance, with higher performance being leveraged to introduce further improvements. However, it was acknowledged by one of the interviewees that not all projects would necessarily achieve significant outcomes with regard to sustainability:

“…all of our projects are being addressed from a sustainability point of view, some will go further than others but that will be driven by what the opportunities are on the site or other external influences generally, or, like I say, we’ve set a certain number of projects that have to be cutting edge, as soon as I determine that we’re getting down below that proforma we’ll…pull one out of the hat and say you know, this is what we’re going to go for broke on. So, we will then try and push the bar beyond where we’ve been before.”

The stated intention was to continue a similar process to what had been implemented for acquisitions through design, estimating, purchasing and construction.

Another key sustainability initiative at Company C had been greater integration of sustainability throughout its procurement and supply chain management processes. It
was apparent that the person primarily responsible for procurement within Victoria was personally committed to improving the sustainability performance of the organisation and had obviously built up a wide amount of knowledge through ongoing efforts and research. A major area of attention in recent times had been waste management, with initiatives that were mentioned including:

- Working with a kitchen manufacturer, who had historically generated quite high volumes of waste, to ensure that three big bags for the recovery of plastic, timber and cardboard were provided with the kitchens. The manufacturer was required to arrange collection of these bags to recycle the waste in their factory; reducing Company C’s waste disposal costs and simplifying the process for them;
- Putting pressure on a supplier of kitchen appliances (ovens and hotplates), which are traditionally heavily packaged to minimise damage, to explore opportunities to replace packaging materials such as polystyrene foam and plastic wrap with materials comprising recycled content, or more easily recyclable materials. (It was also claimed that this supplier had also switched from boxing products in cardboard to using polystyrene and a timber frame with clear plastic, so that people transporting the ovens could see what they were carrying. This had reportedly reduced the number of ovens that were having to be thrown out because of damage);
- A recycling program with their plasterers, whereby the supplier would collect scrap plasterboard at no charge for remanufacturing (the requirement for which had reportedly caused a change in supplier). Contamination and plaster getting wet were issues that Company C was trying to overcome through initiatives such as signage;
- A system of precutting lengths of architraves and skirtings to reduce scraps was being considered;
- Waste steel was now claimed to be minimal because overlaps from previous jobs would be used on the next site, and through consistent engineering for a site. This had also been considered for leftover bricks but was claimed to be more difficult because of batching issues;
- Similarly, polystyrene waffle pods and reo (reinforcing) used in slabs were no longer ordered in full, but instead stocks of leftovers from previous jobs would be reused;
- Working with their supplier of plants for landscaping to collect empty pots for reuse with each delivery (with a view to also exploring the recycled content of the pots); and
- Acknowledging the space limitations which made provision of different bins for recyclables challenging on medium-development sites, Company C were in the process of a national tender for a waste supplier who would collect mixed waste in
skips for sorting off-site into recyclable components. There was also a tender requirement to provide reports on recovery rates, which Company C believed would assist it to identify opportunities for further waste minimisation initiatives. They anticipated this would increase their waste costs but still considered it a worthwhile initiative. Part of their stated intention was to conduct spot audits of the waste contractor’s sorting practices.

Other sustainability-related procurement decisions had included:

- Pressuring their supplier of tapware to upgrade its builder’s range to offer AAA ratings (at that time, the most water-efficient rating) during a national tendering process; and
- Choosing a solar hot water services supplier who was able to install the units for free by claiming the RECs (Renewable Energy Certificates, a Commonwealth Government renewable energy initiative).

To communicate issues and requirements across the organisation, the Sustainable Design Department had developed an intranet site which they continued to refine, populating with case studies and the like, and produced a sustainability newsletter. These initiatives had the aim of increasing awareness about project initiatives, products and suppliers, and encouraging communication and information sharing between the State units.

With regard to training, the department had been recently conducting ‘roadshows’ across their Australian offices, at which they outlined the reasons for the sustainability push and described the impending regulatory framework. It appeared that a significant number of staff had attended these sessions, including sales staff. It was also noted that sustainability was incorporated into inductions for new sales staff, covering topics such as water treatment systems, energy ratings and hot water services, with some sales staff even being taken to meet with manufacturers, such as of solar hot water systems, to learn about the sustainability issues associated with their products.

Reflecting that of the three case study organisations, Company C (certainly in Victoria) was by far the largest land developer, Company C staff interviewed generally demonstrated a high level of awareness of the need to consider sustainability as part of the development process. This had reportedly dramatically altered the way that land was divided, with greater thought about the natural features and the final built form early on, particularly given the fact that they were now reportedly more likely to build on the land
themselves rather than sell it to another builder. This was also important in terms of supporting local government initiatives, as noted by one interviewee:

“…some of the local councils are quite proactive, in that they have their own sustainability objectives so you can drill down on what the…local government area sees as its…key elements [such as pedestrian linkages to bike paths]”.

Each development was required to develop a Sustainability Management Plan describing which measures were required throughout the construction management process. This included the need to articulate site-specific sustainability objectives based on local circumstances and requirements. Such issues included site biodiversity, for example, a site might target achieving the same percentage of tree canopy cover on the original site within five or six years of establishment. One of the interviewees talked about discussions that were underway at the time with the City of Whittlesea council about retaining existing redgum trees on a particular development site, and as much as possible, including them in the planned public spaces.

Another example provided of a potential site-specific requirement, was the need to consider rainwater tanks for uses such as toilet flushing on a site where water is a local issue. Other topics such as waste management were also included in these plans. The need to identify site-specific priorities was important to ensure that if an individual house design was changed, that critical elements (such as water tanks if water was a key site issue) were retained.

In recent years, Company C had had a particular emphasis on water sensitive urban design, including the installation of features such as swale drains and bioretention cells to maintain water within a catchment. Although this was reportedly not included in every development, particularly in higher-density estates where there simply wasn’t the available land, it was considered where feasible. Specific mention of the Monterey estate at Ferntree Gully was provided as an example of a project incorporating bioretention cells.

In terms of house-specific initiatives, a range of standardised housing designs to be used Australia-wide had been developed by the Sustainable Design Department, energy rated in a preferred orientation. This group was not involved in site design or placement of dwellings, with State design staff then selecting the design that would best meet the needs for a particular site and managing the placement themselves, taking into account
the broader sustainability objectives for the development site. The Sustainable Design Department also developed national specifications for buildings.

At the time of the interviews, all houses being sold were 5 star energy rated, with solar hot water systems as standard (they were one of the first builders in Victoria to introduce this). There was also a stated intention to include a rainwater tank as standard in the near future. Like Company B, Company C had been working with the Sustainable Energy Authority of Victoria (SEAV) to undertake energy ratings when they were barely heard of by the industry, and had introduced them in their houses sometime before 2000. They were reportedly one of only a handful of Victorian builders to have ‘preferred’ status from SEAV.

Water consumption was also a focus with the installation of an integrated tank and pump ‘Rainbank’ diversion system to divert water for toilet flushing and other uses. This product was selected, despite the fact it was a more expensive solution, because it was felt to have greater longevity but also to be far less complex than some of the alternatives which required purchase of multiple separate components. Rather than refilling a tank with potable water when it got below a certain level, it would simply divert to using potable water directly for toilet flushing, which was noted to avoid water wastage from evaporation of water in the tank.

Landscaping was also receiving attention, with use of plants requiring minimal water (which it was noted were being installed in temporary sales offices). There had also been a recent switch to the installation of inline drip systems for irrigation rather than rigid risers previously used for spray irrigation. This, coupled with the use of mulch, was understood to have reduced water wastage by about 50 per cent on garden beds by delivering water to the root zones directly, reducing water lost to evaporation. However, this decision was reportedly driven less by sustainability concerns than as a result of the regular damage to the risers that used to occur from being trodden on or driven over. Similarly, the company had started using pressure-limiting valves to solve pressure problems, with water savings outcomes as a side-benefit.

Company C was attempting to seriously tackle the environmental impacts of its sub-contractors and working with them to improve their sustainability performance. In terms of the construction process itself, housekeeping of sites had been a focus, in many instances tied in with waste management initiatives. An example was cited of tilers throwing tile scraps onto the ground after cutting, which would then be collected by
scraping the ground with a bobcat. By trying to influence their subcontractors to change this practice, Company C was hoping to maximise its ability to make use of the scraps more productively. It was also reportedly working with its painters as to how they could best wash their equipment to minimise stormwater pollution, although it was noted that this still required more work.

Company C was already promoting the sustainability features within individual houses to their customers, and at the time of the interviews was reportedly considering how they could better educate their customers by producing a booklet explaining a home’s sustainability features and the requirements for its operation and maintenance.

Other areas of focus that Company C had started to recently explore and was expecting to integrate into its processes within two or so years were indoor air quality and the life cycle of materials, both of which it was noted by one interviewee still required considerable research. The company was also looking at developing new landscaping guidelines with a greater emphasis on sustainability.

There seemed to be a high degree of optimism within the organisation about future sustainability initiatives. As one interviewee noted:

“\textit{We'll see a lot of change and like I said, we're in a fairly exciting period of global development I think at moment. So it will change and it will change fairly drastically.}”

At the time of the interviews, Company C was reportedly finalising a lengthy list of prioritised sustainability items for consideration and implementation. This list ranged from quite simple initiatives such as installation of AAA-rated taps, through to more challenging and costly initiatives such as recycling sewage into potable water. It was expressed by one of the interviewees that this list was likely to remain an ongoing work in progress, due to ever increasing demands:

“\textit{… we'll just keep working through the list for the next five years, ten years, twenty years, whatever it is, until we reach the end, but there obviously will be no end because technology will change and perceptions will change and the game will change and the list will keep on getting longer, I don't know whether we'll get closer to the end or whether the end will get further away from us as it gets built on faster and faster.”}
The same interviewee felt that their houses in future would get close to receiving ten stars for energy rating.

Another interviewee noted that Company C would also be looking further into social issues associated with its housing including areas such as disabled access (which was rarely mentioned across all three organisations in a context of sustainability) and transport links, while a different interviewee raised issues such as adaptability and affordability as requiring further consideration in future.

Unfortunately, by 2012 things had changed significantly within the organisation. Anecdotal evidence revealed that both the manager of the Sustainable Design Department and the Sustainability Coordinator had resigned some years earlier and neither role had been directly replaced.

Mentions of sustainability on the company website as of March 2013 tend to be more focussed on the Commercial and Industrial portfolio, which employs a Sustainability Manager. At the executive level, responsibility was assumed by the Manager Human Resources and Safety. References to sustainability within the context of housing on the Company C website were extremely brief, and only referred to one development in Victoria.

The People, Safety and Sustainability section of Company C’s 2011 Annual Report stated that the company’s vision was to “Deliver leading and meaningful sustainability outcomes for stakeholder benefit” which they noted including identifying, measuring and communicating progress for both environmental and social factors, using the Global Reporting Initiative framework as a basis (no additional detail was provided). Again, the emphasis of this document was on initiatives within the Commercial and Industrial portfolio and their ongoing involvement with the Green Building Council of Australia. There was a brief description of efforts to improve the performance of their offices, such as by assessing their ecological footprints, with subsequent presentations and workshops held nationally to identify opportunities to reduce this, supported by Sustainability Champions and Management Sponsors. Only one residential development (in Western Australia) received mention as it had won some awards relating to sustainability, being one of the largest urban brownfield remediation projects in Australia, but there was no discussion of how sustainability featured in its other residential projects.
5.4 Chapter Overview

This chapter has provided a brief background to the three case study organisations in terms of the organisational structures and the nature of work they undertake.

The three were selected because some aspect of their operations demonstrated leadership with regard to adoption of sustainability features in housing. Each had tackled sustainability with a different focus, and the organisational structures and processes they had put in place to do so were significantly different, providing some interesting material for comparison.

The main focus of discussions with Company A revolved around their experiences with the construction of the Caimlea Ecohome, a house designed with holistic consideration of sustainability and with input from a wide range of sustainable housing experts. This project had experienced a number of barriers, including major disruptions to the core project team, and no staff with dedicated responsibility for sustainability. Almost no training in sustainability had been provided to any of the interviewees. Mixed feelings were expressed about the Ecohome, including frustration with the process and disappointment with a perceived lack of customer interest in the outcome. At the time of the interviews, little subsequent work to build on the outcomes of this project had been done and the learnings did not appear to have been integrated into standard operating practices.

Company B had approached sustainability more narrowly, focussing mainly on energy (through pioneering five-star energy rated homes as standard well before regulation required it) and, to a lesser extent, water. However, it had been far more successful at entrenching these elements into the company’s core operations and redesigning their homes and processes to minimise their costs of offering sustainability features. Interviewees in this company were the most likely to emphasise actual sustainability performance rather than design intent. Although no one person in the company had specific responsibility for sustainability overall, the environmental compliance aspects were largely overseen by the health and safety team. There was also a dedicated person in each State that operations were conducted who undertook energy ratings.

Of the three companies, Company C had taken the most holistic interpretation to sustainability in their houses and developments, and had also best formalised the processes by which to deliver it. The company had established corporate systems and processes, driven by a dedicated national sustainability team which was further supported
by State-based coordinators. This was the only company with a formalised, publicly available Sustainability Strategy (signed off by the Board), and to include sustainability in other core documents such as the Annual Reports. Company C also had by far the greatest emphasis on the knowledge management aspects of sustainability including training, communications and documenting processes. They were also actively focussed on embedding changes into core decision making processes and key performance indicators, requiring the development of project-specific Sustainability Plans and requiring regular reporting on achievements across the company.

Reflecting the much greater interests in land development within this organisation, there was also more acknowledgement of the importance of, and opportunities for, a sustainable neighbourhood as opposed to a focus only on individual houses.

The following chapter summarises the views that seem to be held with regard to how building practitioners within these three companies understand sustainable housing, and sustainability more broadly, and the processes by which they had come to these views in terms of their formal and informal education and training relating to sustainability, and other sources of information. This helps to frame their perceptions of their specific experiences with sustainable building in the subsequent chapter.
Chapter 6
Builder Understanding of Sustainable Housing

“If you don’t know where you are going, any road will get you there”

- attributed to Lewis Carroll

The previous chapter introduced the sustainability initiatives of the three case study organisations. This chapter attempts to present how the volume building practitioners spoken with understood sustainability in broad terms and more specifically, in the context of houses. It is an important place to start from because it provides a context to all of their other responses. After all, it is difficult to build sustainable housing without understanding what that actually means.

As noted in Chapter 2, there are still widely varying interpretations of sustainability in broad terms, let alone in terms of the specifics of housing. Certainly, this diversity of interpretation was demonstrated across the spectrum of the interviewees. In terms of understanding sustainability in general terms, the answers ranged from very superficial to quite sophisticated. There was some correlation between the depth of understanding expressed and the degree of education in this area (either formal or on-the-job), but by no means was this a clear relationship, and as the purpose of this research was not to provide a quantitative analysis of such relationships, it is not described in detail. A number of interviewees seemed to only have a very crude understanding of what sustainability meant with regard to their houses, while others showed a high level of awareness of the issues that were facing their organisations in attempting to embrace it.

6.1 Understanding of Sustainability in General Terms

Before being asked specifically about sustainable housing, interviewees were first asked what they understood sustainability to mean in broad terms. While most demonstrated a fair level of awareness, a few seemed to struggle to articulate their thoughts. About a half of the interviewees were able to define sustainability quite succinctly, and touched on the concept of either living in a way which allowed future generations to meet their needs, or a similar sentiment, such as only using a “fair share”, or using resources in a way that they could be replaced. About half the interviewees also implied there was a need to
minimise impacts to the environment, or words to that effect (“environmentally neutral” was the term used by one).

Only one interviewee specifically mentioned the definition from the Brundtland Report (World Commission on Environment and Development, 1987), citing related terms such as intergenerational equity. (Given that this is one of the most commonly cited definitions of sustainable development in use, it is perhaps no surprise that this was the only interviewee who had a formal qualification in an environmental discipline).

A few, however, got very bogged down with detail and long-winded definitions and tended to have to anchor their definition of sustainability to housing, focussing on areas such as energy efficiency, water efficiency and minimised waste. Interestingly, the people who went into a granular level of detail only tended touch on a couple of points rather than a comprehensive description. Nobody articulated a comprehensive suite of characteristics encompassing energy, greenhouse, water, waste, sustainably harvested materials and the like, and yet at least one person mentioned each of these topics. Energy was the most commonly mentioned issue. Aspects of social and economic sustainability were rarely mentioned, although there was an underlying view that measures needed to make financial sense for buyers to be accepted.

One interviewee was able to describe sustainability quite generically, but then also linked it to the organisation’s ability to comply with legislation and use it as a driver to go beyond compliance. One interviewee touched on the wider sustainability of the industry and the need to be able to maintain an employee base and skills base, and the need to even out peaks and troughs in the housing cycle. One interviewee didn’t seem to understand the question at all and talked about “the most economic way of building” and cost efficiency of operating homes.

Another interviewee said that they thought the term ‘sustainability’ itself was a “shocking” word and when asked why, answered:

“Well, what does it mean?... it’s not a catchy word. It needs to be a word that is... simple to recognise, for the average person...when you start talking about...sustainability, just the word alone makes it too daunting for most people to comprehend. So there’s got to be some other way of... communicating what all this is".
When the same person was probed about whether ‘green’ was a better word, they much preferred it, saying it was “a fabulous word”.

Nobody really addressed the social aspect of sustainability when answering this question (at times social issues were referenced in relation to other questions), although one interviewee went off on a tangent about the lifestyle of home occupants which didn’t really relate to the question at all.

It could be generalised that about half of the interviewees seemed to have a broad conceptual understanding of the term to allow them to put sustainable housing into a context; with the other half or so probably understanding sustainability with regard to their knowledge of a relatively narrow range of sustainability initiatives being incorporated into homes.

6.2 Features of a ‘Sustainable’ House

When asked to define what a ‘sustainable’ house might entail, again the answers varied from the superficial to the reasonably detailed. One interviewee took ‘sustainable’ at its most literal definition, answering:

“…maybe a sustainable house isn't quite the best way to put it because you don't want the house to sit there forever and ever and ever. Or maybe you do…”.

As with the definitions of sustainability in general terms, answers about the features of a sustainable home ranged between those that were quite conceptual, and those that listed a (typically limited) set of specific features. The types of sustainability features which were raised the most commonly (by four or more interviewees) included:

- Sustainable materials;
- Energy efficiency;
- Use of “solar” (either renewable energy or solar hot water, not always specified); and
- Use of rainwater.

While energy efficiency, and 5 star ratings, were among the most commonly raised issues, it seemed that not all interviewees understood in great detail what it actually meant. For example, one interviewee provided this rather confused response when
talking about customer interest in sustainability (either not understanding that the 5 star rating is primarily about the building envelope and not appliances):

“You know, 5 star energy’s all nice, sounds lovely, but what does it actually mean? What are the benefits?…The benefit is it’s going to save you two dollars every time you cook a roast. Oh, hang on, geez I cook three roasts a week, that’s going to save me six bucks.”

Of concern was the fact that this interviewee was one of the most likely to come into contact with customers regularly.

Although sustainable materials selection was commonly mentioned, there was considerable variability with regard to which aspect of sustainable materials was mentioned – some only talked about a specific element such as not using rainforest timber, while others talked in more general terms about renewable or recycled products. Only one interviewee specifically referred to the concept of ‘life cycle’ issues associated with materials.

Issues raised by several interviewees, but less frequently than the above-mentioned features, included:

- Passive design/building orientation;
- Water (in general terms, likely meaning water efficiency);
- Use of greywater; and
- Indoor air quality.

Topics mentioned by only one or two interviewees included:

- “Impounded” (embodied) energy;
- Blackwater;
- Water-efficient landscaping;
- No detrimental wastewater emissions;
- Controlled water runoff;
- Minimised waste on-site;
- No impacts on environment/biodiversity;
- “Self-generating” (not clearly defined);
• Proximity to infrastructure such as public transportation and shopping centres (to reduce the need to drive); and
• Economically viable.

One interviewee did not articulate a list of features but instead speculated on whether it was sustainable for new houses to be as large as they typically were, noting the ongoing implications for heating and cooling, as well as maintaining them. Perhaps surprisingly, this issue was very rarely raised throughout the interviews, although it came up in the context of other questions with two other interviewees. Another specifically raised the long-term use of the house and what would happen to the materials used in the house eventually.

Only one interviewee introduced the idea of a home that was self-sufficient (although this answer was difficult to interpret and seemed to mean in so far as not requiring connection to utilities). This person noted that a few years ago, they would have considered a 5 star energy rated home to embody sustainability, but now they had a broader understanding of the issues.

It should be noted that some interviewees did raise other sustainability features in the context of other questions, suggesting that while they often had (at least a somewhat broader, if not deep) understanding of the issues, they sometimes struggled to list them in one go. For example, in response to an unrelated question, one interviewee raised the fact that medium-density developments were more sustainable in terms of better use of resources than the practice of building on “quarter-acre” blocks, but did not mention this when asked about sustainable homes.

It was noteworthy that very few people mentioned the context for sustainable houses, or namely why specific features they were outlining were relevant. For example, although energy efficiency was quite widely mentioned, only two interviewees specifically raised the reduction of greenhouse gas emissions.

The issue of potential sustainability trade-offs was specifically raised by only one interviewee, in the context of energy efficiency, with the observation:

“It should be energy efficient…but in saying that there has to be some measure on what level you go to in terms of…you put a heap of products into a house to get it to whatever energy level…that’s going to have some detrimental effects too.
because you’re going to have to manufacture all of those products…somehow it’s got to be balanced…”.

Only two interviewees clarified the point that they were talking about a house in isolation, implying that there were wider issues that might be considered in a discussion of a sustainable broader neighbourhood. However, this theme was not drawn out further in the interviews.

6.3 Aesthetics of ‘Sustainable’ Houses

As described in Chapter 4, aesthetics have been identified in the literature as a potential barrier to sustainability decisions relating to buildings. Interviewees were asked about whether or not they felt sustainability features would impact on the aesthetics of a home, and if so, in what ways. While many interviewees felt that sustainability features were likely to change the appearance of a home to some extent, the significant majority of people who spoke about this topic agreed that it did not necessarily impact in an adverse way. Several expressed the view that it simply came down to the skills of the designer. A Company A employee used the Cairnlea Ecohome as an example of how a ‘sustainable’ home could look very similar to a conventional home, noting:

“…I mean people have got a…big shock with the Ecohouse (sic) out at Cairnlea, how it just looks so…like any other model home…I think that you can design all that into a standard looking home. Which we’ve done”.

Interestingly, there appeared to be a fairly strong sense (as expressed by more than one interviewee) that it was important to maintain the status quo in terms of the appearance of volume houses. As one interviewee said:

“…from a marketing point of view, we couldn’t have them [5 star energy rated houses] look any different or anything else so we forced them [to achieve the ratings while looking similar]”.

In the words of another interviewee from another company:

“…we obviously design a certain way and have a certain look which our, you know, clients obviously find appealing…[and 5 star energy rating requirements]…obviously had a significant impact on…the way our homes appear. And we’ve
found that when we’ve told clients that they have to reduce their windows they’re not really pleased with that”.

There appears to be a certain cynicism amongst some volume builders about their perception of what “eco”-style houses look like, expressed by one interviewee as follows:

“I just know whenever anyone talks ‘eco’ you know it’s always trendy architect-looking stuff. With lots of lightweight cladding and metal roofs and you know, I don’t know how to equate that. I don’t know if it really is…a house that does what it’s supposed to do. Or whether it’s just looking the part?”

Several interviewees specifically raised windows as a particular factor which changed the aesthetics of ‘sustainable’ houses, noting that a house typically had to have fewer, and smaller, windows to achieve a 5 star energy rating. It appeared that the regulations were also having some impact on the shape of houses. One interviewee noted that flat roofs were difficult to use because it was harder to get the required energy rating because of inadequate ventilation. It was claimed by one interviewee that ceiling heights could also be potentially affected.

Several interviewees also suggested that solar panels on the roof would affect the aesthetics of a home to an extent, and several further noted that rainwater tanks would also be visible (although another noted that tanks could be screened). However, one interviewee asserted that the aesthetic impact was really in the eye of the beholder, and could even make a positive statement. About rainwater tanks, they commented:

“I come from an era where tanks should be big and shiny and silver and corrugated, that’s what my tank is. I have a problem with plastic tanks! So, my rainwater tank sits right out the front of my house for everyone to see”.

Another interviewee linked the aesthetics to wider health impacts of the home, noting:

“If you take aesthetic to mean the broader, how is this house affecting me in the bigger biological sense, then cleaner construction materials, less toxic paints, less treatment chemicals leaching out, it’s all going to be wonderful for your, the quality of your life…”.
6.4 Relative Cost of a ‘Sustainable’ House

Cost is regularly raised in the literature as a major barrier to sustainability in construction. Interviewees were asked to elaborate on their understanding of the costs of a ‘sustainable’ home to draw out the extent to which cost was an issue, and whether it actually was a barrier.

It was certainly a topic that tended to elicit quite detailed responses. Overwhelmingly, there was consensus amongst all that sustainability added to the cost of a home, although there was some disagreement as to how significant the difference was. Given the small sample size, it is difficult to draw correlations between how the answers provided correlated with their expected level of expertise of costs. Generally speaking, those who were likely to be more informed about such matters were more likely to attempt to quantify a cost difference, while others tended to answer the question more in term of generalities.

When asked to estimate what the actual added costs might be, answers varied greatly, and obviously depended on what was included in their definition. Several interviewees attempted to place a dollar figure on the cost, but it was based on specific assumptions, typically for ‘bolt-on’ features, such as the cost of adding a rainwater tanks. By contrast several interviewees estimated a percentage increase range, which varied between 0-5%, 1%, 3-8% and 5-10%. However, given they were not necessarily basing this on the same inclusions, as the question was asked in general terms, the variation in responses is not necessarily surprising. Some of the interviewees noted that the cost differences were probably not as significant as portrayed and that with some effort, something close to cost neutrality could be achieved. Company B interviewees in particular tended to see the increased cost as relatively minimal, but this was because their responses tended to be based largely on defining a “sustainable” house as simply being 5 star energy rated, relating to their own experiences.

An increase of around one per cent, or around $5,000 plus or minus a couple of thousand dollars, was raised by several interviewees who might have been expected from their roles to be more knowledgeable about this topic. However, these estimates seemed to really only cover the costs of achieving a 5 star rating (specifically providing rainwater tanks and solar hot water systems). Several estimated higher, with two suggesting an extra $5,000-$10,000 and one suggesting an extra $10,000-$20,000 for meeting compliance costs (taking into account extra building and (unspecified) infrastructure
costs). One interviewee only discussed the costs of extra insulation, and did not consider any other factors.

One interviewee claimed not to know about housing cost differences, but cited US research showing that the costs of LEED-rated commercial buildings increased by between zero and five per cent.

Reasons for any increased costs were attributed to factors including:

- Additional requirements, such as rainwater tanks, photovoltaic cells, water recycling systems, or additional insulation (typically installed to meet regulatory requirements) would by necessity cost more than not including such products;
- Double-glazed windows would always cost more to manufacture because they had more glass, more materials and more effort to manufacture them. It was also noted that if they were damaged on-site (including by vandalism, a problem that was raised by interviewees in more than one company) they were much more expensive to repair as because of the seals they had to be sent back to the factory. It should also be noted that the importance of designing a home in such a way as to avoid the need for double glazing was stressed as an important cost minimisation strategy. One interviewee suggested that double-glazed windows alone might add $4,000-$5,000 to the cost of a home.
- Additional research and design costs associated with changing practices (in the words of one “…you can’t just photocopy your old plan and stick it down…”)
- Additional labour costs associated with changed techniques. For example, it was noted that the Cairnlea Ecohome project apparently required extra coats of paint when using the water-based low-VOC paint, adding to the painter’s labour costs. Similarly, the installation of the HDPE pipes in place of PVC plumbing had taken longer for the plumbers to install, adding to labour costs in particular; and
- The costs associated with “buying a project” (that is, increasing the likelihood or speed of council approval by making it more attractive through inclusion of sustainability features), for example by installing bioretention cells in estates at significant cost.

It seemed that almost all answers provided were in the context of a product very similar to what their company already produced, rather than a more holistic definition of a sustainable house. One noted that it was easy to design for minimal cost increase when building on a concrete slab, but noted that this was not the case otherwise. There was
certainly almost no mention of factors such as whether a house could be smaller, or have simpler finishes and less features, and therefore be less expensive.

However, sustainability features were not always perceived to cost much more. A good example provided by one interviewee was:

“...water saving in the home at the grand cost of 15 cents an outlet I think it is to put in a flow control valve”.

Significantly, there was a distinction made by more than one interviewee that sustainability features seemed to add significant cost when they were treated as ‘bolt-on’ features:

“...to get your prescribed rating you can always achieve it, but what you have to do is just throw things at the house. So everything is an addition to that house. So it is double glazing for the windows, it is increasing all your insulation, to that particular dwelling...and then there's all the sealing and caulking around all the windows to seal all the cracks and gaps to the dwelling”.

Another identified that the problem was an unwillingness to think laterally within the industry, noting:

“The building industry general, and maybe not so much the development side of the building industry, but the building industry general, takes the approach of there's some change, I just need to add it on. Rather than go back to square one and rethinking the whole process”.

This person went on to elaborate:

“...when 5 star came in there were all these figures going around to what extra it was going to cost, but once again that's the bolt-on solution, you've got house model x and you want to take it from what it is down to 5 star, there's a few tools you can use but eventually you had to start getting into double glazing and double glazing adds a lot of cost. So if you design the house from the ground up or redesigned the way you do things, you can minimise or totally remove the need for double glazing, so that's an example of, you know, the two different approaches.”
Their suggested solution was:

“…you build it into the project upfront, you can wrap things around it, you can start feeding off it by doing something you might save somewhere else or you might have an impact on something else that might actually add value… If you address the issues right up front you’ve got a better chance of building them into the project and maximising other benefits from it”.

Another issue with regard to cost is that it is often more expensive to deal with the scenario of a single house than it would be if costs could be spread across a number of houses. At a larger scale again, the importance of economies of scale in driving costs down through increased production, but also increasing supplier competition, was noted by more than one interviewee. As one put it:

“I think the main [reason for cost differences], it’s probably just economies of scale. Like some of the different materials out there that might have a lower embodied energy or something like that, it’s probably as much, I mean there may be some fundamental differences but quite often it’s just economies of scale that make traditional Portland cement so much cheaper than anything else you can get that might do a similar job. Probably the same for most of the stuff out there.”

This phenomenon of falling prices for sustainability products as a result of increasing markets was already generally perceived to be occurring. Reductions in the prices of products such as rainwater tanks, double-glazed windows, solar hot water services, insulation and AAA rated (water efficient) taps were reportedly already being observed, a trend that was generally expected to continue as higher volumes were manufactured.

Only two interviewees raised the importance of taking a longer-term approach when weighing up the costs, with one specifically mentioning the life cycle costs. The other asserted:

“The costs of a sustainable house should be marginal if you financially analyse it the right way in terms of, you know, you know you can do your net present value on calculations so there isn’t a huge cost if you analyse it properly. If you take it on capital value yes, you might find there’s some discrepancies and if you factor out the moral value you won’t get anywhere but if you analyse it properly I think you’ll find that the differential is really marginal over the long run”.

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6.5 How Building Practitioners had Learnt About Sustainability

Interviewees were asked about their education and training, both formal and informal, as well as their perspectives on continuing to learn about sustainable housing, particularly with regard to the availability of relevant information.

The people spoken with had a range of educational backgrounds. There was a roughly equal split between people with a university qualification or a trade background, with two also having a higher degree (masters). This higher-than-average ratio of university graduates perhaps reflected that the interviewees were mostly quite senior managers. One of the more articulate interviewees, who provided thoughtful and considered answers to the various questions, had no qualifications at all, having dropped out of university a long time beforehand. This suggests that there is not necessarily a correlation between understanding of the issues and degree of education, although as this was not a topic deliberately explored, no firm conclusions can be drawn.

Very few of the interviewees had undertaken any formal training relating to sustainability, with the exception of one who had an environmental engineering degree, and another who had touched on it within their marketing/business studies. Unsurprisingly, given the relatively recent emergence of sustainability as a mainstream issue, those who had any exposure to sustainability at all as part of their formal studies (which was the significant minority), were typically amongst the youngest interviewed.

The degree and nature of understanding of the concept of sustainability varied considerably across those spoken to. Unsurprisingly also, it was usually more sophisticated for those with formal training in environmental issues (quoting the Brundtland Report and referring to concepts such as intergenerational equity), or who had expressed a strong personal interest in sustainability.

The majority of training people had received in sustainability was on-the-job, and oriented towards housing specifically. In terms of on-the-job training, there was significant variation across the three organisations, with all interviewees from one organisation (Company C) having undertaken at least one sustainability training program, and none of those spoken to from another (Company A). At Company C, all staff spoken with had, at a minimum, attended the internal training run by the Sustainable Design Department. It appeared that this course had been effective in positively influencing the attitudes towards sustainability.
in those interviewees who mentioned it, not only in terms of raising their awareness of the
need for sustainable building and what that meant, but also exactly how the company was
responding both from a policy and practical perspective.

The most commonly mentioned (by several interviewees) external training was in energy
rating software (either FirstRate or NathERS/HERS/BERS), typically undertaken by staff
with some input into design. Three interviewees also mentioned that they had undertaken
the more broadly focussed GreenSmart training run by the Housing Industry Association.
One had undertaken training run by the Green Building Council of Australia, which covers
commercial buildings rather than houses.

Mixed feelings were expressed about the energy rating courses. One interviewee was
quite critical of what could be covered in a one or two day course, noting:

“You really don’t learn how to do it unless you put it into practice and work at it for
a while… I probably did six months straight just sorting out energy for our Victorian
division and that was just rating houses over and over and over trying different
things and different shapes of buildings etc to find out what gave better results and
in the end it was quite funny ’cause it really came down to common sense…that
was really our training, was what we did in-house. There was no-one to do it for us
and, you know, we had Sustainable Energy Victoria going around touting that they
knew how to do it but they still didn’t know some of the things that we found out,
and, you know, it is just by putting it into practice… And I guess we’re lucky to be
able to throw some resource at it. Because a lot of smaller companies just
wouldn’t be able to”.

While one interviewee was positive about the GreenSmart course, noting that it had
covered most of the general topics, another had been critical of the trainer they had, who
apparently had been from another State and was not felt to have had a sufficiently well-
developed understanding of the significantly different responses that differing climates
required.

It appeared that the importance and benefit of learning-by-doing was felt within all three
organisations. Certainly, much of the understanding of sustainability that existed within
Company A appeared to be the direct result of their practical involvement in the Cairnlea
Ecohome project rather than specific training. An interviewee from Company C noted:
“…[Company C] driving its own policies is probably the biggest training that we’ve done, [Company C] having its own initiative to create a sustainability policy and practice and implement that practice, you learn more, a hell of a lot more out of that… when you actually implement it.”

It became apparent that in a number of instances, a personal interest in sustainability had been a stronger incentive to actively seek out sustainability training than any company directives. This was unrelated to whether roles had an environmental focus or not. For example, one interviewee mentioned extensive sustainability research that he undertook related to making procurement decisions, while another’s role had evolved to incorporate sustainability because of a strong personal interest that had seen that person voluntarily undertake sustainability-related training over a number of years, prior to gaining any formal responsibility for its management.

Currency was noted to be a potential issue with training courses given the rapidly emerging developments in sustainability, with one person noting:

“One of the interesting challenges I see in sustainability is that by the time it actually gets into an educational format it’s perhaps not as relevant as what you find in the field anyway. It’s certainly…moving very, very fast and one of the biggest challenges for a development organisation or I think anyone that's practicing in that field is keeping ahead of what's going on.”

6.6 Sources of Information about Sustainable Building

While there seemed to be a general feeling that there is plenty of information on sustainable housing, it was also generally perceived to be difficult to get guidance which was reliable and independent. The view was expressed by some that their company had largely had to work out the issues for itself. When asked whether adequate technical information was readily available, there seemed to be a sense that it generally wasn’t. To some extent, the problem people seemed to experience was not necessarily struggling to find information, but struggling to find reliable and cutting-edge information. As one person commented, while information on government policy was easy to find:

“…in terms of technological sustainability, no, that’s hard as hell to get.”
Interviewees were asked about how helpful they found a variety of information sources. The answers were far from consistent, reflecting that different roles and people of different educational levels find different methods to be preferable. Often, contradictory answers were provided. For example, while some found suppliers and manufacturers useful, another claimed that they were biased and not a reliable source of information, discussed further below. Similarly, some interviewees found research organisations very useful while others found them not useful at all. Given the small sample size and the diverse answers, it is difficult to draw any meaningful correlations between backgrounds and preferred information sources. This is an area worthy of more detailed investigation.

Generally, specific training courses, such as the HIA GreenSmart and energy rating courses described above, were one of the more preferred methods of receiving information. However, as noted there were mixed feelings about how relevant and effective they were. The only site-based interviewee expressed a preference for training courses to be short and succinct, commenting:

“…my span of sitting and listening…we’re very ‘toey’ [Australian slang for nervous or anxious] people, we have a meeting on-site…With specific training courses, you want them, they are useful, I don’t disagree with that... You would say only, like, half day courses and even then pretty strung out, you want to get straight to the point”.

Conferences and workshops were mentioned by surprisingly few as a useful source of information.

In terms of the other sources of information that the interviewees found most useful to learn more about sustainable building practice, there was enormous variation. Industry networking was raised by several as an important means of sourcing information. As one interviewee put it:

“Just talking. Basically, just networking...As in through work, as in HIA or that sort of scenario, or networking with just, general builders and stuff like that, you know, like subbies. So, just networking through the trade I suppose... As much as we have opposition builders, we network, you never stop learning from everyone else. And everyone steals ideas from everybody else”.

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However, the conflicting view was also expressed by some that the industry is not particularly good at sharing information with other competitors. As one interviewee stated:

“I guess people hold their cards quite close to their chest in terms of what they are doing.”

An exception to this, though, is for large-scale, showcase projects driven by government or major developers. An unprompted source of information raised by one interviewee as particularly helpful was other development sites incorporating sustainability features. This person reflected:

“A great example is the Commonwealth Games. Which is great, because you’ve got a very high profile site, and you’ve got the government that actually wants it, or a client that actually wants to achieve certain targets, so you can throw the full suite of sustainability tools at one particular project which you wouldn’t have the budget to do, or the market would not accept, or would not pay for on other sites, so you’ve got a bucket of money that you can actually use to achieve your result.”

Several people also mentioned that various government authorities were helpful, most commonly naming the Sustainable Energy Authority of Victoria, but also Yarra Valley Water and Melbourne Water.

Several people were effusive in their praise for the usefulness of the internet, although others noted that it was difficult to sift through the enormous amounts of information. One interviewee made the interesting observation that interactive information sources were potentially more useful because, in essence, you could be guided if you weren’t actually asking the right questions:

“The internet would be very useful but you go into it with a predetermined question of what you’re going to look for, whereas if you talk to people who are doing research they’re likely to guide you into a new conversation that you might not have thought of before.”

By contrast, one interviewee didn’t find the internet useful at all, stating “I’m illiterate on a computer”. Given how much more widely computers are now used for personal uses such as internet banking, and the prevalence of smart phones, it would be interesting for future
research to identify whether computer literacy remains a barrier for some within the construction industry.

Although a few people thought that books could be helpful, most did not. Building magazines were mentioned favourably by one. One of the sustainable building resources cited by several interviewees was the Your Home publication produced by the Commonwealth Government. Although this was usually spoken about in positive terms, it appeared to have its limitations, as expressed by one interviewee:

“...the Your Home manual is quite a...good resource but then actually being able to apply that to some of the projects we’re working on isn’t always that easy. So, I guess that’s in terms of the actual house design and things like that. [It was explained that this was partly due to a lack of detail.]...And sometimes you have certain constraints which don’t allow you to do things quite the way that you would in a perfect world.”

A couple of people mentioned the Ecospecifier database of sustainable materials as a source of information, although one was quite critical, noting that it did not allow for easy comparisons between products and was too expensive to access. This person also observed:

“...I couldn’t see the value in it. It was so hard to figure out what was actually a good product to use. It might be good for someone who sits in a [university] all day but for me, I need to be able to go and look at something fairly quickly and assess, you know, whether I’m looking at a good product or a bad product, if that makes any sense, and I found that very difficult. Very difficult.”

Another interviewee noted that they had accessed some information on sustainable materials through early association with the Aurora development in northern Melbourne, described briefly in Chapter 2, but because their involvement with that development had ceased, they were no longer privy to the research and information being developed for that development.

Another person noted that this was why sustainability staff were required, because if the information was readily available, everyone else would have it too.
There were quite polarised views on the usefulness of suppliers and manufacturers in providing information. A few people said that they found suppliers very useful, but a greater number seemed to feel that their lack of independence made it hard to trust anything they said. As one put it:

“You can’t ask the manufacturers ’cause they’ll all just flog their products! You can’t ask them!”

Another noted:

“....they just want to sell their product. At the end of the day, they’ve got a budget to hit of their sales rate and they’ve been told its sustainable by their internal training and they don’t really know their product that well but they’ve been told they have to sell so many units of that product...”

Company A seemed to have relied heavily on information from suppliers in the case of the Cairnlea Ecohome, but their challenge had been translating it into information they could then convey to their customers.

Not all staff looked externally for information. For example, at Company C, it was noted by one interviewee that the Sustainable Design Department was the first go-to source for information, while the Research & Development department at Company A was cited as a key source of information by another interviewee.

There was an insufficient sample to draw strong conclusions about the differences between the preferences of site-based staff versus professional staff.

6.7 Chapter Overview

This chapter has outlined how building practitioners understand sustainability, particularly within a context of housing. The interviews tended to reflect that although there is fairly widespread level of understanding of sustainability and sustainable housing at a basic level, it is typically quite superficial. Building practitioners’ understanding also tends to relate to a limited ‘shopping list’ of elements of sustainability (such as rainwater tanks and photovoltaic cells) rather than a more holistic consideration of underpinning principles. An observation, which would require further research to verify, is that while building practitioners may be able to describe specific sustainability elements (such as energy
efficiency), they do not necessarily link this to why the elements are actually important to sustainability (such as impacts of fossil fuel consumption on climate change). There also tends to be a much stronger emphasis on the environmental, rather than social or economic, dimensions of sustainability.

A significant finding is that building practitioner understanding of sustainable housing also tends to correlate with the focus of their own organisation’s prior or current initiatives; that is, they tend to view sustainable housing as something with minor adjustments to the status quo of their usual offerings, rather than anything radically different (such as much smaller or looking different). They also tended to consider a home in isolation and not as a component within a sustainable neighbourhood, although there were exceptions, particularly within companies with greater land development interests.

Tied to this, there seemed to be almost no consideration of the possibility of trade-offs, for example, reducing the cost of the house to cover costs of more expensive sustainability features, such as rainwater tanks or renewable energy.

Indeed, as this chapter has articulated, there is a widely held belief amongst building practitioners that sustainability adds to the costs of housing, although there was greater variation in terms of perception of amount. Reflecting the observation above about the status quo, most discussion of cost related to ‘bolt-on’ features such as rainwater tanks rather than completely reconceptualised homes, although some of the interviewees did acknowledge costs could be reduced by addressing sustainability early within a project. There was very limited consideration of the life cycle costs, perhaps reflecting that builders were rarely the ones to benefit from reductions unless upfront capital costs could be reduced.

The chapter identified that it is difficult to pinpoint the most effective forms of information and learning sources on sustainable building, with widely varying preferences expressed and a need to cater for these divergent preferences to effectively reach and influence volume building practitioners. A significant observation was the strong interest in demonstration projects as a mechanism for educating the industry about sustainable building. A lack of availability of reliable technical information seemed to be of particular concern, particularly if it was also costly to access (such as certain databases). Although potentially useful, the risk of bias in information provided by manufacturers and suppliers was also raised by some. The lack of sharing of information across the industry was acknowledged by some as another separate barrier.
This chapter also noted that sustainability has not commonly been studied formally even amongst persons with university qualifications, and is much more likely to be learnt about on-the-job. However, the degree to which such training is provided varied markedly across the three companies.

The following chapter builds upon these observations by describing the perceptions held by these building practitioners about various external and internal forces impacting on their sustainability initiatives, whether as drivers or barriers.
Chapter 7
Builder Perceptions of Forces Affecting Sustainable Housing

“At the moment we’re right at the beginning of, really, a major cultural shift, and that goes right through to the suppliers, the manufacturers, the builders, developers, and the end users.”
- Research interviewee

The previous chapter summarised how volume building practitioners appear to understand sustainable housing and sustainability in more general terms. This chapter builds upon these findings to draw out building practitioner views relating to a range of forces, both external and internal, on their sustainable building efforts to date. As described in Chapter 2 and 4, the forces (drivers and barriers) may be organisations or institutions, individuals and wider market, regulatory and industry forces.

External forces which were discussed during the interviews included:

- Customers;
- Government (local, State and Federal (Commonwealth));
- The supply chain;
- Direct competitors;
- The wider housing industry; and
- Other external forces, such as the impact of market cycles.

Internal forces discussed included influential individuals or ‘champions’ for sustainability within the organisation and organisational systems and processes which were perceived to have either helped or hindered sustainability initiatives.

In terms of being asked in general terms about external factors that were primarily driving the shift towards more sustainable housing, there was little consistency in responses, either within or across organisations. However, there was strong consensus on certain aspects, such as the impact of customers and their willingness to pay, discussed further in this chapter.
7.1 Perceptions of Customers

Almost everyone spoken with seemed to have strong feelings about the influence (or rather, the lack thereof) of customers with regards to sustainability initiatives. This is elaborated further below, and will be discussed at length in Chapter 8. However, in terms of a factual basis for the opinions that were expressed, there appeared to be surprisingly little research on which they were based, with many noting that their comments were simply based on anecdotal evidence. All three companies reportedly conducted customer surveys, but it was not clear whether these surveys actually referenced sustainability specifically, and it did not appear that the results of customer surveys were necessarily widely communicated. The point was raised by more than one interviewee that they were as likely, if not more so, to track what their competitors were doing rather than what their customers were asking for.

Company C reportedly conducts both purchaser and non-purchaser surveys, including post-occupancy surveys, but also supports its conclusions with results of research conducted by industry associations such as the HIA and MBA. A Company C interviewee supported some of their claims with the findings of internal market research, which included questions about sustainability, that had been conducted for one of the organisation’s Sydney housing estates, in Kellyville around 1999-2000. It should be noted that this data was some five years old at the time of the interviews.

7.1.1 Customer Interest In, And Understanding Of, Sustainability

Mixed, but more typically negative, feelings were expressed about the importance of sustainability to housing customers. Many felt that it was an issue of importance, but only to a relatively small percentage of their customers. There was a strong consensus that while the awareness of, and interest in, sustainability had increased slightly amongst customers overall over the previous few years (a trend that was widely anticipated to continue), it was coming off a very low base and there was still not widespread demand. Overwhelmingly, customers were not seen to be a group that were pushing improvements in sustainability, dismissively summarised by one interviewee as “total disinterest”. Another asserted:

“….my assessment would be that I don’t think many people would say they won’t buy the house of their dreams because the builder isn’t being sustainable.”
Another interviewee claimed that if customers were asking for it, it was only because the industry was already providing it:

“…in terms of a global green attitude, I don’t think that’s changed a lot in the past ten years. I think it’s changed potentially more in new home building because people are now offering it. So it might have become more of a consideration in the buying process of a new home. But only because it’s being presented. Not because the customer’s driving…not because the customer’s looking for it.”

This perceived lack of interest was partially attributed to a lack of understanding. It was also expressed by a number of interviewees that the majority of customers simply didn’t understand sustainability, particularly in terms of its practical application with regard to housing design. As one interviewee noted:

“….most people, unless you've done a PhD on sustainable housing, don't really understand all the issues around what it is you're actually buying, they just…see…oh it’s got two bathrooms and three bedrooms and that's what I want, so I'll buy it.”

Related views presented by other interviewees included:

“…we talk about…the hot water service and window placements, northerly aspects, getting the best benefit out of the northern sun, but…in terms of the average buyer out there…they’re just after a house. Location, location, location. And it’s got four bedrooms and it’s got the right block of land and I like the design and I like the colour.”

and:

“If you talk to [customers] about geographic sustainability, i.e. not building 80 kilometres out of Melbourne, no, they don’t understand that because basically with housing still being relatively affordable they see a block of land, they see a house of 30-40 squares, they add the two costs together, that gives them a number and they feel comfortable with that number. And that’s what they’re driven by in the majority of cases…”
Some firmly felt that their customers specifically wanted features that were contrary to greater sustainability outcomes, such as this comment:

“…they’re actually doubling the size of the home they’re living in [relative to houses built 10-15 years ago]. And they’re worried about their mortgage and they’re worried about their rates and they’re worried about that but they don’t really realise that they’re most likely more than doubling their energy bill and they’re also moving to a home that involves a lot more energy – you know, a lot more heaters and heating and a lot more cooling than what their existing home has none of that. Or has a limited amount of that. So it’s not really on their radar.”

While another suggested:

“The houses aren’t growing anymore and they haven’t been for the last four or five years…society’s getting wealthier, they’re getting fitted out better but they’re not growing… But consumers do desire big houses.”

Despite this, a number felt that there had been a growing level of awareness of sustainability in customers over the past few years, helped particularly by factors such as the major drought affecting Australia’s eastern States in the time leading up to the interviews and resultant water restrictions; coupled with rising energy and petrol prices. Growing awareness of the then-impending 5 star energy requirements was also flagged as a factor that was making customers think more about energy when they were making housing decisions. Other factors that were raised as contributing to increased awareness included less predictable weather patterns and talk of the greenhouse effect or climate change in the media.

The Cairnlea Ecohome project provided a tangible means of gauging customer interest in sustainability. Company A staff expressed surprise and disappointment about the lack of interest in the sustainability features that had typically been shown by visitors during its period as a display home. This had resulted in a change to the house being open only by appointment. As one interviewee put it:

“…I was just amazed that [the sales staff at the Cairnlea Ecohome] said it would be one in ten, one in twenty that would show really any interest about the green effect of this house. Which really surprised me at the time.”
There had been no sales of the Cairnlea Ecohome design to other customers at the time of the interviews.

7.1.2 Customer Characteristics

Although there is only anecdotal evidence to support any conclusions, the interviews also suggested that a customer’s interest in sustainability varied depending on their socio-economic status and motivations. It was observed by more than one interviewee that ‘white-collar’ (professional) workers (or more specifically, as put by one interviewee, “their wives”) were more likely to be interested in sustainability, whereas ‘blue-collar’ (non-professional) workers were generally not thought to be interested. It was also expressed by more than one interviewee that persons of an ethnic background were also less likely to be interested in sustainability features. For example, in the Cairnlea area where the Cairnlea Ecohome was built, there was reportedly a relatively high proportion of Asian customers, who one interviewee noted did not generally seem to be as interested in sustainability features.

As a consequence, it was speculated by more than one interviewee that the location of ‘sustainable’ display homes may have a bearing on their success, with greater potential for uptake in areas of higher socio-economic status. One interviewee suggested that the distance between the Cairnlea Ecohome and the wealthier eastern suburbs of Melbourne may have discouraged customers from these areas from visiting, and consequently considering, this home or its features.

Another interviewee suggested that a second or third home buyer was more likely to take a greater interest in sustainability than first home buyers, but did not elaborate on why. Another noted that property investors would be likely to consider broader factors which positively influenced the sustainability of a home such as proximity to infrastructure and public transport, although not so much for reasons of sustainability but rather to increase rental returns.

The Cairnlea Ecohome provided some interesting insights into different types of customers. According to one interviewee, based on discussions with sales staff in the company, they had come to the understanding that there were three types of customers who visited this display home:
• Persons with an interest in the Cairnlea Ecohome specifically for its sustainability features, but not necessarily as potential customers (“the real greenie type”), who were often reportedly quite critical of the home’s eco-credentials;
• Potential customers who were initially interested in adopting some of the elements of the Cairnlea Ecohome within another home, but who apparently, once they got into more detailed discussion, would often change their minds and decide to spend the extra money on other features, such as an extra room or an alfresco dining area, where they felt there would be a better return. It was noted that this group comprised only a small percentage of visitors; and
• Customers looking for a home in that area with no particular interest in sustainability.

7.1.3 Willingness to Pay

An important theme that came up numerous times was that the growing consumer awareness of sustainability did not necessarily translate to people spending their money accordingly. While one interviewee suggested that clients might be interested in features such as water tanks and solar systems because they “feel good about doing something positive”, this perception did not appear to be widely held. As another interviewee put it, energy efficiency was still a “nice-to-have” rather than a “must-have”, while another referred to sustainability in homes in the eyes of customers as “a plus, this is an add-on”. As another noted:

“....if people were looking at two houses the same but one was far more sustainable than the other, I think in some cases it would help sway the decision. But, it's a cost issue again and if you are saying the sustainable house was going to cost more than the non-sustainable house then people would spend their money on something else.”

The issue of how customers valued sustainability was also raised as a barrier to more widespread adoption of sustainable housing. The same interviewee noted:

“...it is adding cost, at this point of time it's not adding perceived value to our customers I don't believe, they're happy to have this stuff but I don't believe they're prepared to pay extra for it at the moment...”.

Another interviewee put it more strongly:
“…when we brought energy in, [customers] really couldn’t give a rats [colloquial expression meaning people don’t care at all]. We had some people wanting to take it out, take out double glazing and…they would rather have money in their pocket.”

This lack of willingness to pay extra was, unsurprisingly, perceived to be even more pronounced when the return on investment would be low. One of the factors contributing to this problem was the low cost of utilities, particularly water, as observed by one:

"The amount of water that you're using [from rainwater] will have an almost negligible impact on your water bill because water is so grossly underpriced anyway, but if you put in an underground tank then you're going to be paying for the electricity to pump the water anyway which will probably cost you more than the water that you're saving. So it's difficult to justify at any level apart from…an emotional level…".

The same person also noted:

“…you're not going to spend ten grand to save three hundred bucks worth of electricity.”

Thus, it was generally not felt that there was significant potential to use the payback benefits of sustainable technologies as a marketing strategy at the present time. One interviewee suggested that payback periods were not necessarily a strong driver of actions because house buyers were not necessarily likely to live in a home for long enough to accrue the benefits, such as if their house had been purchased as a "stepping stone" to a better house. Another interviewee expressed the view that there was no point in talking about a payback period if it was longer than the expected life of a particular item of technology.

Housing affordability was a theme that was raised by several interviewees, particularly in the context of the volume housing market, which was understood by most of the interviewees to be driven by low up-front prices. As one person commented:

“…we get to a point where it’s unsustainable to have house prices where they could be if we built a perfect house. That's also unsustainable. Because people aren't going to afford it. So it's the fine line.”
There appeared to be a genuine concern amongst some interviewees that any significant cost increases resulting from sustainability initiatives would reduce the customer base. As one described it:

“…the driver of volume house building is cost…it’s important to be able to achieve new sustainable heights if you want to call it that without…reducing your customer base.”

Consequently, Company B in particular had made it a focus to refine their design of 5 star energy-rated houses to get the costs down to a point where they were cost-competitive with their ‘standard’ house by avoiding expensive solutions such as double-glazed windows. A Company B interviewee noted:

“It’s all about cost. Our whole business is about affordable…affordable’s a funny word. Good value for money. Good value. So we…chucked in 5 star houses and we still went out there and sold for less than anyone else in town.”

Interestingly, however, customers spending money on ‘lifestyle’ features, such as upgrading to granite benches (for which it should be noted potentially offer no return on investment, even if it can be recouped through resale value), did not appear to be considered a problem. An issue that came up numerous times with multiple interviewees is that where a customer could afford to spend more, they would invariably favour these types of finish or appliance upgrades, or making a home larger and adding extras such as alfresco dining rooms, rather than additional sustainability features. In the words of one:

“….unfortunately at the moment it seems to be economics that are getting in the way. That they make a value judgment as to whether they prefer to go with, you know, size or finishes, and you know, they’re tossing up, are they going to put a granite bench in or are they going to put this….system in that puts electricity back onto the grid. Now it might be a similar cost and they say, well what's the return on investment with the electricity, well we, at the moment we're not getting a lot back yet it's expensive to do. Whereas the granite bench versus a laminex bench is going to change your lifestyle. And they end up making some kind of value judgment on that.”
On a similar note, one interviewee who had raised cost and willingness to pay as a barrier was asked in more detail about how much sustainability actually contributed to costs, and suggested it was in the order of $5,000 - $6,000. When asked about the fact that this was only about a 1 per cent difference to a house that typically marketed in the $500,000 - $600,000 price range, they responded:

“Yep, but average Joe Customer, if I said I’m going to drop your price by $6,000, or if I said to Joe Customer I’m going to drop your price by $5,000 and give you a spa bath, there's no question. And that's…[the] mentality that we're wrestling with at the moment.”

Another put it this way:

“…I could guarantee you, if you asked every person, we can put double glazing [sic] windows in, or we can buy you a plasma tele, and they cost the same, what would you prefer?”

The Cairnlea Ecohome project offered an interesting ‘research laboratory’ of sorts to test which types of sustainability components were most desirable to customers (at least in terms of their willingness to pay for them in their own house). Although the Cairnlea Ecohome’s design had been offered as one of Company A’s standard models, the sustainability features were typically offered as extra options which could also be added to other home designs. Reportedly the most likely features to be requested in other homes were water tanks (although it was noted that this was being forced on customers by the impending 5 star energy rating legislative requirements) and the hydronic heating systems, of which it was noted that a few had been subsequently sold. A very small number of greywater systems had also been ordered for other homes in the northern region of Melbourne, and photovoltaic cells were sold rarely (“maybe a handful”), apparently because of their high cost.

The low-VOC paints were reportedly not of much interest to customers (despite the fact that it reportedly did not affect the price significantly), nor was the natural sisal carpeting that was used. It was suggested by an interviewee that the paint was not popular because it produced an inferior finish. It was also claimed that the Corian benchtop used in the Cairnlea Ecohome had not been ordered by anyone at that time either. It was also suggested by one interviewee that customers were unlikely to be willing to pay extra for
the HDPE plumbing that had been used in the Cairnlea Ecohome, in part given its lack of visibility, but this was not explored in depth.

Consequently, there had been limited changes to standard practices within Company A, as observed by one interviewee:

"I don't think [the Cairnlea Ecohome has] had much of an impact. As I said, I think we've had a couple of clients that have come in and have wanted to run with some of the items that we used in the Ecohome, so I suppose until we get...regular requests for these things from our clients...we only deal with it on a needs basis, as a one-off sort of basis to each client's request. So...it hasn't changed significantly the way we do things."

7.1.4 Anticipated Influence of Future Trends for Customers

In terms of expectations of future trends with regard to customers, there were also mixed feelings. A number of interviewees suggested that sustainable housing would simply become the norm, and customers would not really need to understand what it meant, because it would be provided inclusive in the house cost in future. As one person put it:

"...the consumer expects a certain level of housing to be supplied to them, their expectations are getting higher and higher day-by-day and the developers are responding with better designed product and better designed developments. I think that will continue and the sustainability suite of materials will just become part of that growing level of expectation and response to that level of expectation. So I don't think that the sustainability costs will invariably always be an addition. I think that, as the market expects more...sustainability will just become the norm."

An interviewee from one of the other companies said something similar, noting:

"...people are going to expect it [a 'sustainable' home]. We've got to do the thinking for them, it's already been done, they don't need to tell us or decide which fitting or fixture that they need to select, it should already be done."

Several interviewees suggested that legislation would significantly contribute to rising consumer expectations, however, strong concern was also expressed by several that this would further strain housing affordability, which was already widely felt to be problematic.
A number suggested that rising energy or water prices would continue to be a powerful motivator for customers, and would make products such as photovoltaic cells more attractive. One further suggested that issues with public transportation and the cost of using tollways would encourage people to think about the location in which they bought housing.

### 7.2 Perceptions of Government

#### 7.2.1 Legislative Requirements

It was apparent that legislative requirements had been a significant driver of sustainability initiatives amongst each of the three case study organisations, despite the fact that when asked in open terms about key drivers of sustainability, Company C interviewees were the only ones to cite legislation as a driver, particularly in the initial stages of their journey. Legislative drivers affecting Company C also included their public reporting obligations as a public company and the associated emphasis on consideration of the triple bottom line.

Even in cases where the organisations were implementing initiatives that were not yet required by law, there was generally an assumption that such requirements were coming and a desire to be proactive, rather than suddenly having to respond to government impositions. As one interviewee said:

> “…our aim is always to be ahead of the regulations, to be more than what they want, and you know, it’s just changed so fast, so quickly, that we’ve made so many changes, especially in the last two years. Yeah, we’re still just…keeping ahead.”

As another interviewee put it:

> “…if down the track there somehow is regulation that comes in, at least we’ve got some level of awareness and understanding and capability to change.”

The hope was also expressed by some that being proactive with regard to sustainability would lead to more positive relationships with regulators, and potentially expedite the development approval process.
One of the particularly interesting observations to emerge from the interviews was that, for the most part, interviewees were not concerned about a regulatory approach and could even see the potential for competitive advantage by keeping ahead of the regulatory framework. Nor was there any major concern about the regulatory bar continuing to be lifted, provided that it was done in a way that maintained a “level playing field”. One captured it thus:

“…ideally we’d be able to change without regulation, but…sometimes if it looks like it’s going to be more expensive and your competitors aren’t going to do it then it might be hard to justify.”

Another captured this sentiment even more strongly:

“…obviously when you’re ‘busting’, you’re struggling for sales and you don’t want to inflate your prices more than you have to, but if the rules are there and everyone has to comply, then you’re no worse off than anyone else anyway. So I think the bottom line of all that is that you just have to do what’s right to do and regulate what has to be done. And if everyone’s doing it, you’ve got a level playing field and I don’t think it really is much different.”

Where frustration was expressed about legislation, it was typically about requirements which were not considered to have been fully thought through, or where it appeared to contradict other government policy. Concern was also expressed about inflexible approaches which did not necessarily suit every type of development. For example, it was suggested that the prescriptive, ‘one-rule-fits-all’ approach inherent in implementing something such as 5 star energy ratings meant that, at times, less than optimal solutions were implemented. One interviewee observed that since the introduction of energy rating tools:

“…a lot of people are ignoring the amenity…the orientation and good passive solar design, thermal mass and all that sort of stuff to suit your climatic conditions, and just purely throwing the suite of sustainability tools at a house, upping the insulation in the roof, upping the insulation in the walls…putting double glazing on windows, sarking roofs, they all help, they all get you to those prescribed criteria requirements, but you could get anything to rate if you throw money and insulation and double glazing in it and will that house become a better house to live in because it’s got that suite of materials? Or would that house be a lot better to live
in if it had purely the good design principles. So...there's two totally different avenues, and a good house has both of those things, but I think it should be based on good design.”

Several interviewees raised concerns about the impact of legislation on the amenity or aesthetics of the home. Another example raised, relating to window design being impacted by the 5 star energy ratings, was as follows:

“...window sizes is the ultimate thing and it's just wrong. Just wrong, so wrong...It just affects the amenity. I'm not that concerned about the aesthetics of a house, people love their homes regardless because it's their home, so the consumer is happy in their home, they bought it, they love it. But to affect people's amenity within that home, is more the issue than aesthetics... I would say windows are the huge, are my biggest bugbear. When I have to take them out to reach my 5 star [rating], I hate it.”

In a similar vein, this person also expressed concern about the impacts on a homeowner’s right to control their aesthetic environment from sustainability initiatives such as water sensitive urban design and landscaping controls:

“The aesthetics of our estates are changing because of engineering design, so, a great example...some of the engineering firms are great leaders in their water sensitive urban design approaches to engineering problems, they come up with some fantastic results, but are those results...do they sit well with the customer? Generally, no. Because they change the aesthetics of the estates, and then we have to put rules in place to say that, your drainage system works because you've got these plants in a particular swale, and that's in your front yard, you can't change those levels of your front yard, and you can't take those plants out and put in Japanese maples. ‘But I want Japanese maples'. We are dictating the finished urban context and design. And we take away the customer's and the consumer's right to change their own front yard. Is that intrinsically wrong, right or wrong? You get a good drainage solution, which gets you cleaner water that leaves the site, but you affect people's amenity by doing it. So it's a very, very fine line between if what they've done is good, it's great for the environment but does the customer actually see that because it does affect their little patch of their own, of the earth that they own. And that's a really, really tough question, because in trying to get that design balance between yes it works as an engineering system, but are the
An example of bureaucratic inflexibility was provided by another interviewee, whereby the Plumbing Industry Commission required installation of rainwater tanks with a minimum capacity of 2,000 litres and with a certain prescribed catchment area. The interviewee’s organisation had undertaken research on rainfall statistics for a particular development, which demonstrated that the tanks would only be a maximum of 50 per cent full for the majority of time, and had then lobbied the Commission to allow installation of 1,500 litre tanks given the space constraints of the sites and difficulties in achieving the required catchment areas in a medium-density development. However, they had been required to pay a $77 fee for each of 88 houses on the one development for a plumbing notification that each house was compliant despite the rainwater tanks having lower capacity.

This was not the only challenge associated with implementing regulatory requirements in higher density neighbourhoods. It was noted by the same person that in small townhouses it could be difficult to locate solar hot water services in small yards when there were regulatory requirements to keep them certain distances from windows and doors. As a consequence they were sometimes located next to detached garages and the like, which resulted in efficiency losses. But as this person also noted, government was also attempting to drive denser housing development to counteract the impacts of urban sprawl. This person expressed frustration, asking “…how do you get it all to work?”

Another example of a perverse sustainability outcome is that the 5 star energy rating software, or at least earlier iterations, favoured larger houses and thus provided a disincentive to reduce the size of a home, which would generally be desirable from a sustainability perspective. As one interviewee described it:

“It’s just the software’s…you know what Victoria did, small houses were terribly hard to get to the pass. And bigger houses were much easier.”

This was noted to have been largely addressed by later versions of the software.

A legislative requirement which impacted on Company C, but not the other two, related to their obligations as a publicly-listed company for public reporting. This was reported by some interviewees to have had some positive influence with respect to driving sustainability initiatives, and the opportunities to promote them.
7.2.2 Government and Education

It was noted by many interviewees that government had been particularly helpful with their company’s sustainability programs through the provision of technical support and advice. Some utility organisations such as Melbourne Water, or government agencies such as the Sustainable Energy Authority of Victoria (SEAV) were raised in positive terms when asked about which external groups had been drivers. They were generally seen to be proactive in supporting initiatives to reduce consumption of either energy or water, depending on their area of focus. Other sustainability topics were less likely to be supported. SEAV had reportedly played a significant role in supporting Company B in their process of making 5 star energy rated houses standard. The Queensland Government had reportedly also provided assistance to one of the companies related to energy rating tools.

One interviewee expressed the view that where government could particularly encourage sustainable building was by developing or stimulating the creation of demonstration sites. This person cited the Olympic Games village in Homebush, Sydney and the Commonwealth Games site in Melbourne as excellent exemplars which could inspire and inform other builders.

7.3 Perceptions of the Supply Chain

7.3.1 Consultants

It appeared from the interviews that external consultants were not widely used by any of the case study organisations; certainly nowhere near to the scale of their use by the commercial construction industry. There was a greater use of external consultants at Company C (at least with regard to the sustainability elements), with the professional categories mentioned including planners, architects for house design and civil or hydraulic engineers for civil works including water sensitive urban design. This company had also obtained advice on sustainability matters from organisations such as the internationally-renowned Rocky Mountain Institute, when developing their sustainability strategy.

When asked about external individuals or groups who had principally driven a shift towards more sustainable practice, consultants were only mentioned by a couple of individuals from Company C. It did not appear that either Company A or B used
sustainability consultants much, although there had been limited consultant input in the early design stages of the Cairnlea Ecohome.

One of the interesting insights from the interviews was the belief expressed by one that external consultants presented the ability to bring fresh ideas into an organisation because of their exposure to many others:

“Obviously they're exposed to a whole range of other people in the industry so they tend to filter information, whether unintentionally or as part of their development.”

The same person noted:

“...it’s that raising the bar thing. I mean we do it once in here so it becomes normal and we’ll do something a bit harder the next time and I think the same thing happens with your, with all of external consultants is that they’ll do…a water sensitive urban design project for someone and then maybe they won't repeat all of the learning that they've got from that in the next project but they'll pick up snippets of it and that will go into the next project for the next client and so on and so forth. So you know, just by that process they start raising the bar...”.

The influence of architects on sustainability was not widely raised by interviewees, perhaps reflecting the fact that they are not widely used by volume builders. However, one person who did mention them was rather critical of their influence, stating:

“I've found external architects to be pathetic in a word, and, they're more interested in the aesthetic than actually coming up with a result, and they carry on like little kids if we have to change their design to achieve an energy rating...but generally some of the architectural firms, the large architectural firms, don't like their designs to be played with because of the aesthetics, they miss the big picture...”.

Interestingly, this was the same interviewee who expressed indignation about having to remove windows to obtain a 5 star energy rating in their own house designs, or of customers being prevented from planting Japanese maples in their gardens due to planting guidelines.
7.3.2 Subcontractors

When asked about the influence of subcontractors on sustainability initiatives, there were mixed reactions. Most interviewees claimed not to work closely enough with subcontractors to provide detailed answers, particularly about whether changes of subcontractors had been required in the past in order to implement sustainability initiatives. However, while subcontractors did not appear to be widely seen as a driving force for change with regard to sustainability, they were generally not thought to be barriers either.

The majority of interviewees acknowledged that subcontractors would do what was asked, and therefore clearly articulating specific sustainability requirements was critical to achieving results in this area:

“…basically a trade, you provide them with an instruction and they do the job as per the specification. You know, if they had an opportunity to do something a little bit easier of course they’d do it. But it’s really got to come from our documentation and how we manage it.”

Another noted:

“Tilers will just lay the tiles you give them, carpenters will erect the walls you give them and the windows you give ’em…”.

Specific requirements were typically captured in specifications, but might also include documents such as construction management plans or waste management plans (one interviewee noted that waste management had required considerable communication). It was important to consider requirements carefully because as another interviewee commented:

“…you definitely have to do things a bit differently because at the end of the day you want them [subcontractors] to do something differently. So if you don’t do anything differently then they won’t either.”

However, one interviewee expressed a more negative perspective:
“They [subcontractors] hate it [the shift towards more sustainable building] because they would be more conscious about what they’ve got to do, they’ve got to perform more work, they’ve got to perform more complex work and for no net benefit, or not net benefit that they can see.”

Noting that not all interviewees knew much about the relationships with their subcontractors, and therefore couldn’t comment on changes, in spite of these there seemed to be the general perception that mostly subcontractors had not had to be replaced, and where changes had been required it was to bring on additional subcontractors with additional skill sets, such as for installation of new products used for the Cairnlea Ecohome (for example, the HDPE plumbing). Generally with this home, the experiences with subcontractors had been reasonably positive, as one interviewee summarised:

“… [the Cairnlea Ecohome] just showed us that our subcontractors were willing to try other things, you know, it didn’t seem to create too much of a barrier…All of them did take it on board and were happy to work with us on it.”

There was a recurrent theme raised of the need for volume builders to explain and educate subcontractors as part of the change management process. As one put it:

“…in every case, it’s got to be a result of ongoing guidance, change management, education, assistance, understanding, all of those sort of things.”

As another noted:

“Subcontractors are changing slowly. We’re educating them…but that’s a long, long process. It’s not even its infancy”.

A Company C interviewee noted that that their plumbing subcontractors had undergone the accreditation process to become Green Plumbers. Company C had also been working with other subcontractors on site housekeeping initiatives, such as trying to ensure that tilers did not drop their waste all over the site. Company B had worked with their bricklayers to ensure that they were taping sisalation correctly to prevent air leakage, and with their plasterboard companies to ensure that insulation was properly installed.
The need for additional quality inspections to check the work of trades was raised by several interviewees, with one providing an example of why this was necessary:

“…if a guy’s plastering a wall and his batts [are] missing, the client notices it, we could get that house to completion and they’ll say ‘there were no batts in that wall’ and there’s only one way to find out. Is to cut a flaming great hole in the wall. And if you can’t find them there, where else are they missing? And it turns into a really, really expensive process, so it has been an exercise to make the trades responsible for making sure things are in place before they cover them up. Supervisors have been…worked on to do the same. It’s not…easy, it’s really not easy. And we’re bound to get caught somewhere, it’s just human nature, but gee, we work pretty hard at it. The trades are a big part of it.”

A Company B interviewee noted that the tighter quality control processes that had been brought in internally concurrently with their adoption of 5 star energy ratings had meant that some of their subcontractors had no longer wanted to work for them, but expressed the opinion that this had actually improved their workforce.

Another issue raised as contributing to problems with subcontractors included a breakdown in communication between manufacturers and subcontractors.

7.3.3 Manufacturers and Suppliers

The feelings expressed about the impact that manufacturers and suppliers were having with regard to driving sustainability initiatives were generally positive. It seemed to be widely felt that manufacturers and suppliers were reasonably proactive in understanding that they needed to support their customers and provide appropriate products. As one interviewee put it:

“…what’s happening now is that the manufacturers and suppliers are in the same sort of boat as we are, I mean they’re part of the industry as well, they’re having to go through rapid change in order for them to meet industry requirements…We’re in a position now where we’re actually influencing manufacturers’ outcomes and certainly working with suppliers to work on better supply chains and things like that.”
Another commented:

“A lot of suppliers are obviously at…the forefront of a lot of this stuff …they're obviously doing work, you know, in the background because they know…where it's heading as well. So yeah, we're getting suppliers coming in and talking about sustainability and where it's going and what they can offer and what they're trying to do with it as well…”

Legislative changes had been a significant driver of change for some manufacturers, with an example given of window manufacturers. One interviewee noted that until recently, there had only been one Victorian manufacturer in the “bottom end of the market” for double-glazed windows, and builders had been forced to either use that company or purchase “upper market stuff”. The impending 5 star energy ratings had changed this situation with several companies now producing more affordable double-glazed windows. Indeed, as Company B moved to make 5 star energy ratings a standard product offering, their window supplier was cited by more than one interviewee as having played a major role in assisting them to refine their designs, as was their insulation manufacturer, who had also helped with designs and necessary product enhancements.

It was noted by some that sustainability had become a more significant marketing strategy for some manufacturers and suppliers. As one interviewee noted:

“…they're trying to get the edge. By saying we have got a much better product, a more efficient product, than our competitor.”

For the most part, it appeared that all three organisations had been able to pursue sustainability initiatives using their existing manufacturers and suppliers. While it wasn’t apparently common to change suppliers because sustainability product requirements could not be met, both Company B and C had reportedly changed their solar hot water system suppliers as part of their transition to building 5 star energy rated houses, as their original suppliers could not initially meet the increased regulatory performance standards. Company A interviewees noted that they had had to source additional (unspecified) suppliers for the Cairnlea Ecohome project, rather than change existing suppliers.
In addition, the development of national deals offered the ability to demand additional sustainable features or services from manufacturers and suppliers. One interviewee recounted:

“…we're the biggest client they have nationally 'cause there’s very few companies got national deals for domestic anything, we have that advantage. And suddenly they've gone, oh, yep, we'll service you, what do you want?”

One example, as outlined in Chapter 5, was that Company C had required their plasterboard supplier to provide bins on-site and collect scrap plasterboard for recycling to secure a national contract. A similar arrangement existed for Company B (and may have for Company A, but was not specifically mentioned). Company B had also implemented a program with a supplier to recycle bricks. The ability to influence suppliers included not only the product specifications themselves, but the wider supply chain practices.

More than one interviewee stressed the fact that their suppliers were part of their own organisation’s public face and thus it was critical that they were responsible and reliable. As one person stated:

“…it's no longer about buying a product and getting it for the least amount of money you can. It really is about getting the product at the best price you can, but making sure you're getting the product from a supplier that is being responsible about his business practices. Because you can’t be seen to be dealing with people that aren't. You know you can't go out there and profess to be caring people and then not care because it will come back and get you.”

Similarly, it was felt that any problems with supplier products would tend to be blamed by the customer on the builder, rather than the supplier. An example was provided about a solar hot water service supplier:

“…over the last four years…the amount of pain we've gone through with their couplings kept breaking down so they'd try a new one, they'd work, great, fixed that. Their wall mounted temperature gauge then kept breaking down, they got a new one. We have to go through that process and we had a lot of angry customers with it. And the customers go '[Company X’s] hot water service keeps breaking down in my [Company X] home'. Not the [name of supplier] one. [Name of supplier] don't get as bad an image as we do.”
In the context of the specific experience with the Cairnlea Ecohome, where new and unknown suppliers and products were involved, it was noted that some of the potential for problems included:

“…getting people to come to site when you needed them, you know. When with our suppliers, they’re under a contract, they know their terms, they know when they’re caught up they have to be there at a certain time…so we can control that, there’s, sort of, a call back, there’s you know, if they don’t do the right thing there’s obviously the jeopardy of losing a major contract; where you’re dealing with someone who’s just dealing on one project well it’s just a different mentality that you’re dealing [with]…”.

Thus, the risks of dealing with suppliers who have not demonstrated themselves to be reliable may serve as a barrier to adopting new products or services supplied by new organisations. One interviewee made the pertinent observation that although important in driving change and encouraging economies of scale to develop, it was essential that significant legislative reform adequately consider the ability of manufacturers and suppliers to transition in the proposed timeframe, illustrating the point with the example of the rainwater tank industry:

“…we’re talking to rainwater tank manufacturers who can’t understand what’s going on. They’ve lived in relative isolation supplying tanks to farmers out the back of Bourke and all of a sudden they’ve got city people ringing up saying I want 10,000 tanks next week. Huge change for them. And they’ve just been caught unaware. You speak to them and they’ll say, yeah, I can probably produce 10 per cent more tanks, try producing 300 per cent more tanks, and different sizes, you know they used to produce only 50,000L tanks for the farmers, the city people don’t need that, they need 5,000L tanks and things like that. So we’re having to regear, retool, quite rapidly.

The same interviewee also noted that it was not simply a case of having to create more units, it was also about changing products to suit emerging (and changing) needs. For example they noted:

“…we need different things. Water diversion systems and back-up systems and all that sort of stuff, whereas, in the rural environment you don’t have back-up water
so you don't need back-up systems. So a lot of change like that, a lot of rainwater tank manufacturers are still providing rainwater tanks and that's it, the smart ones are now packaging systems and working on domestic scales and all that sort of thing.”

7.4 Perceptions of Other Builders

Few, if any, of the interviewees spoke particularly positively about their wider industry’s willingness to change in general terms, let alone to adopt sustainability in a serious way. There seemed to be a strongly held belief that the housing and development industries were renowned for reluctance to change. As one interviewee stated:

“…because you’re working in an industry that’s largely come from a cottage style industry where each builder was their own boss… I think the industry in some ways has moved very fast and in other ways I think the cultural attitude of thinking sustainably is probably a little bit backwards.”

One interviewee used stormwater quality as an example of how the industry were unlikely to improve performance without a legislative push:

“…there's best practice targets [for stormwater quality] out there now for everyone, I think everyone is trying to achieve those, but it took the industry to set those, and those to be a target set by government to make all that actually happen. If those targets weren’t out there and weren’t set it wouldn’t be happening. So as an industry I think we’re quite lazy.”

One reason speculated for this general resistance to change was a fear that it may adversely impact on profits:

“A lot of the builders, and I won’t say this applies to [us] necessarily, but a lot of the big builders and a lot of the medium and smaller ones, would be concerned about staying in business, which locks them into…ritualistic behaviour that they would be very threatened if you came up to them and said ‘there’s some things here that you need to change’. Change for them equals a threat to their profitability or their profit stream comes from doing certain things in certain ways. You ask them to change those things and, they’re going to drop an orange here. ‘I’ve got fifteen of them up in the air and you want me to add another thing as well?’”
Another reason that emerged from some of the interviews was a perception that the industry is largely “uneducated” and that this is a barrier to sustainability more broadly. As one interviewee described it:

“The problem with the housing industry, people are not educated. This is a very, very much a field cast to the stone age, as a result of many factors… when you come out of a trade school they teach you how to hammer nails and that’s not being derogatory, but it’s just a mere matter of associations. The people you associate [with] there are interested in learning a trade, they’re not interested in sustainability. If you went to, for example, a university, you’ll probably socialise with people from all your different groups, who have different views, they’re from environmental perspective or chemists so you start to get a different feel.”

One person, who interestingly enough had not themself completed tertiary studies, noted:

“…not wishing to sound judgmental but the preponderance of people with practical skills means you’re really good with practical skills. A lot of what we’re talking about now requires some, some intellectual rigour. You have to say, this is my constant irritation really, but half a page with four bullet points on it is sometimes not enough to be able to explore the implications and some of the ideas that we need to play with.”

They went on to add:

“…sustainability and environment is, has the potential to be the next big thing. But they’re not going to be able to deal with it in a really, really positive way unless they start to get their heads in there. They’ve got to learn some of this stuff. There’s a whole new language. They know what these things are intuitively. They know what it means if you talk about their children running out of water, or their grandchildren running out of water. But having the competencies, the organisational competencies to build a business that is dynamic and responsive and innovative, they are higher order things.”

Another interviewee noted that another barrier to ongoing education of the industry was that builders and tradespersons were not subject to professional standards in the way that
other disciplines, such as engineering, are with requirements for continuing professional
development and the like:

"...the problem is that the industry is...not forced to uphold professional standards.
If you're an engineer and you want to uphold your membership you've got to do so
much training, I mean if you turn up to a breakfast these days you get your points
ticked as a builder. So no-one's forced to understand...”.

The view was expressed by some that this resistance usually ended up hurting the
laggards. As one said:

“Most of the building industry fights tooth and nail until they get told it's gotta
happen and the day they get told it's gotta happen, it's gotta happen, and they've
done no preparatory work whatsoever. And then they start doing it and it costs
them three times, four times, what it’s costing us. Because they haven't done their
homework.”

However, this reluctance to change was generally also seen as a source of potential
opportunity for the more proactive companies, by providing a source of competitive
advantage, which they were cautious about sharing.

Interviewees were asked about the effects of industry fragmentation on sustainability, and
mixed feelings were expressed about the degree to which it impacted on sustainable
building innovations. Some saw it as a key barrier, while others felt that it could be, but did
not need to be, depending very much on the people involved in implementing an initiative.
Several interviewees challenged the suggestion that the volume housing sector was
fragmented, at least in Melbourne. As one stated:

“...it might seem fragmented but in fact it’s so common, you build a house like you
build a house. And there might be some innovative builders doing some different
shape windows or they can make it look whiz bang but ultimately it’s a slab, a
frame, and bricks and tiles. And all the other things that go into it. And we're all
doing the same thing, some of us are doing it a bit better than the others.”

Another interviewee claimed:
“We all lobby government together through the UDIA and HIA, and generally you’ll have a representative of every company on committees and boards and things along those lines, so I, no, I think we can go forward as an industry, and as a development industry… I don’t see it as fragmented.”

While volume builders tried to maintain dedicated subcontractors, the interchangeable methods of construction and potential for movement by subcontractors between builders was acknowledged. As one person put it:

“Seeing every house is just a house, all we’re talking about is a modification to the skin. That’s what makes your house different from mine. We’re not talking about the essential constituents of that house, or the process of building it. They all swap staff, they all swap supervisors and managers, and they can swap them so easily because everybody knows what a house frame looks like. Everybody knows what F7 is. So there’s a common language here and if we build on those commonalities and say look, we all know what the problems are…”

It was noted by some that industry fragmentation was much more of an issue for smaller builders. Because they were less likely have the knowledge, time or resources, including access to specialist advice, to learn about new legislative requirements and tools, it was suggested that they would tend to focus on bare minimum compliance requirements (unless they had a particular market niche, such as sustainable homes). As one interviewee commented:

“…it’s not just a matter of knowing how to rate a building – the truth is after you know how to rate a building you’ve then got to know how to achieve the same end but in a more economical and efficient manner. And that’s hard when you’re a small operator…”

Further, the reduced purchasing power of smaller builders was also noted to be a barrier to greater adoption of sustainable products and processes by these builders. However, counteracting this was their ability to viably absorb lower profit margins. As one interviewee described it:

“…from a purchase point of view can we purchase some of these things at a lower price so we can bring it to the volume building market. Because we do compete to
a degree in some of these developments with a smaller builder, who, who...can compete a little bit better with thinner margins. With a volume builder."

Ensuring consistency of approach across such a large number of businesses was considered by some to be a challenge. One interviewee speculated that the number of small builders was likely to decrease because it was becoming harder for them to operate competitively.

### 7.5 Perceptions of Developers

Developers were raised by more than one interviewee as having influenced sustainability within their company, particularly when land was bought from government and semi-government agencies with guidelines and requirements related to sustainability. A couple of interviewees noted that another driver was the need to have formalised sustainability processes in place to be considered for large tenders such as the Commonwealth Games village, or major development sites such as through Landcom in NSW, and that this would then have a trickle-down effect within the organisation. As one interviewee described it:

> “...to actually win those large sites, you have to have it in place, and what you learn from those major sites drills down into your other smaller sites.”

However, some conflicting opinions were expressed about the proactivity of the wider development industry, such as this one:

> “...every change that has happened to the development industry, they don’t jump aboard, they dip their toe in the water and then wait for it to be legislated, and then, all hell breaks loose and everyone jumps in, so as an industry, they’re quite reluctant, and it’s quite a conservative industry...they’re quite cautious in their yields, and their margins.”

Reflecting that of the three case study organisations, Company C (certainly in Victoria) was by far the largest land developer at the time, its staff appeared to have a high level of awareness of the need to consider sustainability as part of the development process. Company C interviewees generally seemed aware of their greater ability to drive significant sustainability performance improvements in their capacity as both a developer and builder, particularly given they were at that time reportedly more likely to build on the land itself rather than sell it to another builder. For example, one interviewee noted their
ability to require initiatives across a development (such as suppliers picking up waste from their previous delivery when conducting the next delivery) which might not be feasible if they were on isolated sites.

7.6 Perceptions of Industry Associations

Industry associations were not widely seen to be strong allies with regard to uptake of sustainability. The prevailing sentiment was that the role of industry associations seemed to be about catering to the lowest common denominator and resisting change at all costs. In particular, there appeared to be an inherent conflict associated with representing the very different needs of large and small builders. As one person described it:

“...in fact I think the industry groups were actually quite unhappy with us when we went 5 star, because the rest of the industry was perceived to not be ready. So everybody’s so new, all the powers-that-be hear we were working on energy which didn’t, I mean it wasn’t a hugely long project, knew we were working on energy but always thought we’d come up with a three and half star as standard and we came out with five as standard and I think it was perceived by the industry that...maybe we had, I guess, not supported the industry as we should because the rest of the industry was going to struggle to get to 5 star in the short term.”

The Housing Industry Association (HIA) was the most commonly mentioned association, mentioned by several interviewees. It was noted by one that the HIA had been lobbying government to reduce the regulatory requirement in Victoria from 5 stars to 3½ stars. The same interviewee commented:

“...from our industry body [the Housing Industry Association] it wasn't maybe such an open arm reward [for achieving 5 star ratings as standard]...[because] they had to bring the rest of the industry along which they were trying to achieve at a cost price for the industry rather than maybe what our cost price was, because obviously...we have a lot of volume in the market so maybe we buy it at different rates than smaller building companies which is...a challenge for them.”

There appeared to be a certain frustration with the perceived stubbornness of industry associations and the potential consequence of being less influential in setting the agenda than they might be by taking a more collaborative approach with groups such as regulators. As another interviewee put it:
“...this is why I don’t understand the mentality of the HIA and stuff, just fight everything new that comes along. Like a lot of these things are being done for a good reason, get on board with it, figure it out and then you might be able to help steer it. But if you fight it no-one will listen to you.”

However, as discussed in Chapter 6, a number of persons had attended training courses run by industry associations, particularly the HIA GreenSmart program. There was only very limited mention of the role of the Green Building Council of Australia and its Green Star training, confined to some Company C interviewees (which was the only company with commercial building interests for which Green Star was relevant).

7.7 Perceptions of Other External Forces

7.7.1 Market Cycles

At the time of the interviews, Victoria was just coming out of a period of a real estate boom which had been ongoing for the previous few years. There were mixed feelings about the degree of impact the ‘boom and bust’ cycles typical of the housing market had on a builder’s likeliness to adopt sustainability initiatives. Some suggested it made little difference, with another noting:

“...the issues [of sustainability] are beyond boom and bust cycles, I think the industry is aware of that.”

However, another interviewee noted that these cycles potentially encouraged short-term thinking, observing:

“When you’re oscillating between huge peaks and troughs you’re either working flat out or you’re worrying about going into liquidation, doesn’t give you the opportunity to constructively consult and think about the bigger picture. It’s like elections for government and local politicians. So many of them that I’ve met only see three or four years.”

Another interviewee mentioned, in answer to a different question, that they were rarely able to attend training (during a boom period) because they were always too busy. Accordingly, reducing the extremes of these cycles could be a business strategy. One of
the Company B interviewees claimed that their organisation had started to try and avoid
the risks associated with the extremes of the boom and bust cycles, and to keep their
demand for their products relatively stable through marketing and price manipulation.

Some suggested that during downturns the industry was more likely to cut back to a focus
only on compliance. However, again the issue of a level playing field was raised, and that
as long as requirements applied to all, as one interviewee considered “…then you’re no
worse off than anyone else anyway.”

Housing affordability came up again, raised by more than one interviewee, with the view
presented by one interviewee that customers with tight budgets (linked to rapidly rising
prices from the boom) would forego ‘optional extras’. By contrast, a number of
interviewees expressed the view that once initiatives were “built into the system”, or a
precedent was set, it was difficult (and potentially more costly) to reverse, irrespective of
economic cycles:

“…what you’re talking about to change it is changing the whole system which is
not…a thing that we would do.”

Similarly, a Company C employee noted that their public Memoranda of Understanding
with various utilities did effectively require them to move beyond compliance irrespective
of economic cycles or other factors. Importantly though, such arrangements had resulted
in significant reductions of developer contribution fees and it was seen that such cost
savings might potentially become even more critical during a ‘bust’ period.

The view was further posited by one person that in a tighter market, it would be more
necessary to differentiate products with factors such as sustainability performance:

“When a market is tighter, your product has to be better, it has to be sharper, and
you have to have an edge. So, smart developers will be having that edge and that
edge should be sustainability.”

The flip side of this coin they noted was:

“When the boom time’s on, you could sell anything to anyone. And there's
investors out there that just want to buy that and turn it over and make a dollar.”
A number of people expressed the view that boom and bust cycles were much more likely to be an issue for smaller builders, in part because they did not have the resources to be confident in investing in improvements, particularly during a bust; but also because they had greater flexibility to make changes to their homes and thus may be more likely to drop out sustainability initiatives for reasons of cost. (It was also noted that this would not necessarily be a significant issue for sustainability given that the majority of small builders weren’t going beyond compliance anyway).

7.7.2 Research Organisations

Research organisations such as universities were not commonly raised during the interviews. The Centre for Design at RMIT University was mentioned unprompted by one interviewee as providing leadership and organising conferences, and implicitly referenced by some of the Company A interviewees who had involvement with the Centre’s researchers prior to the interviews through the Cairnlea Ecohome project. However, for the most part it appeared there was limited interaction between builders and research organisations.

7.7.3 Others

Although barely mentioned, one interviewee did explain that funds managers with an emphasis on sustainability had commenced discussions with the Company C Chief Executive Officer, which was anticipated to be a further driver for sustainability. Beyond this, there were limited mentions of other external forces beyond those described here.

7.8 Perceptions of Internal Forces

In all three companies, internal forces had been instrumental in driving sustainability initiatives. However, the form that these forces took varied. The key internal factors reported to have primarily driven sustainability within each organisation are described below. Certain individuals within the organisations had played a significant role in driving the transition towards greater consideration of sustainability. Other internal forces, such as management systems, appeared to be more variable in terms of their impacts and recognition.
7.8.1 Internal Forces at Company A

At Company A, there were mixed views of who internally had principally driven the shift towards more sustainable housing. The research and development team were cited because of their role in driving the design and complying with the impending 5 star legislative requirements. The directors were also cited by some interviewees, although there did not seem to be a strong perception that change was being driven heavily from the very top.

Of the three case study organisations, it appeared that Company A had undergone the most organisational disruption which had affected sustainability initiatives within the firm. One of the senior managers who had been an early key driver of the Cairnlea Ecohome project had become very ill and then passed away between the inception of the project and the time of the interviews; while the key marketing staff member who had also been actively involved in the early stages of the project had left for another organisation before the interviews were held. The staff member who had been primarily involved in designing and specifying for the home had, shortly after the construction commenced, shifted his focus to other projects within the company. Thus, there was an extremely limited pool of people within the company who had been involved with the Cairnlea Ecohome throughout the process from inception through to sale, and certainly no dedicated staff member who had been responsible for overall project management.

Despite the fact that the Cairnlea Ecohome project was significant enough in its ambition and stakeholder interest to warrant a Ministerial launch upon its completion, it appears that the project suffered in part due to a lack of resourcing, with people expected to manage aspects of this project as an extra on top of already demanding jobs. As one interviewee put it:

“I think we could have had a proper…project manager on the job and running with it during the…course that the project ran for. And I think that would have made things a lot smoother and better controlled and maybe…got a better result or reduced the timeframe more so than anything.”

It also appears that there were not strong knowledge management processes in place to capture or promulgate the lessons from the Cairnlea Ecohome project. When asked about processes which existed to capture knowledge, there was a general sentiment that these
processes were not particularly formalised, and most of the learnings to date existed only in people’s heads.

One interviewee noted that documenting the process and learnings, particularly for the benefit of new staff, was a role for the marketing department. However, this did not seem to be effective, as new marketing staff at Company A sometimes contacted the RMIT researchers involved with the Cairnlea Ecohome project (including myself) to obtain quite basic information about the project, rather than sourcing this information internally. It appeared that documentation by the marketing department had not yet been undertaken at the time of the interviews, and the primary documentation that existed internally was construction documentation such as plans and specifications or basic promotional brochures. One of the interviewees captured the issue well:

“…in hindsight, to say if we positioned [the Cairnlea Ecohome] somewhere differently, we marketed it a bit differently, we set it up and got more feedback, more of the market research, and moved as we got that research coming in, changed our marketing, really project managed it properly, that might have a better outcome for an organisation like ours. And also…we would have more subjective, or objective, feedback and some statistical data on it which you could…scrutinise.”

Nor were there well-developed training programs to disseminate information about the Cairnlea Ecohome project. There appeared to have been limited training of sales staff about sustainability, either broadly, or with regard to the features of the home. Although sales staff working at the home while it was on display reportedly received some information to read about the home, it was noted that training typically occurred on a needs-to-know basis, as follows:

“…I must admit we haven't probably followed through with continual training. Over the twelve month period…Whilst they get information…brochures and things on sustainability, it’s not really until [a sales consultant] gets an inquiry and then that’s when they start asking…Because you can provide them lots of information which they might never need.”

The same interviewee noted that they would have seen the need to spend more time training the sales staff on sustainability if there had been the volume of inquiries, or they thought that it would lead to more sales, to justify it, but this was not felt to be the case:
Yet another issue which appears to have compounded the difficulties associated with the Cairnlea Ecohome was that its construction coincided with a building boom in Melbourne. Thus, it appears that the project ceased to be a high priority for Company A, and the additional time taken to resolve issues surrounding new processes and products was in direct conflict with a desire to focus on building houses as quickly as possible for sale.

7.8.2 Internal Forces at Company B

There was strong consensus amongst interviewees from Company B that the majority of change related to sustainable practice was driven from the top. The Managing Director, having made a decision to set a direction for 5 star energy rated houses as standard, had been a major driver of change and influence throughout the organisation. Given his power within the organisation, the change:

“…was forced but without too much resistance. Surprisingly little resistance it was forced into the construction area.”

There was evidently a high level respect amongst the interviewees for the vision demonstrated by the Managing Director, and also his philanthropic tendencies. One interviewee noted that he was charismatic and “…likes being seen as a champion. And he is a champion because of the way he is.”

The influence of the wider group of directors, who are also the owners, was also acknowledged, although to a lesser extent. One interviewee also noted that the directors had good rapport with relevant Ministers and therefore were able to keep ahead of impending governmental changes. As one interviewee commented:

“….if you ever want an organisation to move somewhere then the captain of that ship has got to get his hands on the steering wheel and turn that ship two degrees to the left or the right. If they don’t do that, then the rest of us trying to do it from the engine room is not as effective…”

The role of the design department and marketing team in quickly adopting the new shift towards energy efficient housing was also acknowledged by one of the interviewees.
7.8.3 Internal Forces at Company C

While legislation may have initiated the push for more sustainable operations at Company C, personal interest from a number of individuals was obviously also a strong factor in initiating changes and maintaining momentum. As one interviewee put it:

“I think the legislative side of things got the ball rolling and then I think there was enough personal interest from people in the organisation to keep driving it further and…we go way beyond compliance now in most areas.”

Initially, this group of interested individuals had reportedly been quite fragmented, working somewhat in isolation in different States, but had subsequently coalesced to some extent with the formation of the Sustainable Design Department.

The manager of the Sustainable Design Department, who had been with Company C for many years in a different capacity and had a strong personal interest in sustainability, was mentioned by other interviewees as a specific driver for the greater uptake of sustainability within the organisation.

Another individual at Company C cited as a driver by some of the interviewees was the CEO of the organisation, and particularly his involvement with the Green Building Council of Australia. A Project Manager who had left the company but who had a strong interest in water sensitive urban design was also mentioned as a driver by more than one interviewee. It also became apparent that procurement staff had also driven significant sustainability improvements, particularly related to supply chain management and waste reduction. Individuals within State business units were also noted to have been influential in driving adoption.

Reportedly sustainability initiatives received strong support from the top level down, although it was noted that interest varied between those who were supportive to those who

“…just want to put their head in the sand…from senior management right down to our subcontractors and suppliers…”.
It was noted that this may have been reluctance to change in general terms rather than any specific aversion to sustainability.

### 7.9 Chapter Overview

This chapter has presented the external and internal forces felt by volume building practitioners interviewed to support or hinder sustainability initiatives. There was reasonably strong consensus that customers were not really interested in sustainability, and even if they were they are not necessarily willing to pay for it or make trade-offs.

The building practitioners generally are not concerned by legislative approaches to sustainability, and can even see the potential competitive advantage from staying ahead of regulations, and the benefits of a ‘level playing field’ regarding capacity to recover costs, but they are concerned that it be carefully thought through and consider impacts such as to housing affordability (as they define it). The interviews also highlighted that there remains an important non-regulatory role for government in terms of education, particularly through provision of exemplar projects such as sustainability-focussed display villages.

Views on the influence of other stakeholders such as the supply chain are more mixed, although this was not typically felt to pose major barriers. A less positive view is generally held of the influence of their industry colleagues, with other builders and industry associations more commonly seen to demonstrate inertia and unlikely to act on sustainability without more pushing. Developers, on the other hand, were generally viewed more positively and could even be a positive influence for sustainability.

Discussion of other forces, including market cycles, was less conclusive.

It became apparent from the interviews that at least one person within each company had been a strong positive influence for sustainability, but there were no obvious common themes in terms of the types of backgrounds or roles held by these people.

The following chapter will explore these issues further, discussing potential strategies which might support mainstreaming sustainable housing, in light of these observations. It will also explore how wider adoption by the industry of at least a basic level of implementation of sustainability might most effectively be achieved.
Chapter 8
Mainstreaming Sustainable Housing

“The barrier to change is not too little care, it is too much complexity”
- Bill Gates, cited in Harford (2011, p.115)

This research has described the journey of three Australian volume builders as they adopted more sustainable building practices, with the aim of exploring the drivers and barriers impacting on their decisions and experiences. Chapter 6 described the general understanding of sustainability held by the building practitioners and how they understood their organisation had applied it in the context of their products, namely houses. Chapter 7 presented their views on a range of external and internal forces impacting on their adoption of more sustainable practices. This chapter analyses these experiences and compares and contrasts them with more recent developments in sustainable housing from the literature.

The three case study organisations were, at the time the research commenced, demonstrating leadership with regard to adoption of sustainable housing. However, each of them adopted somewhat different goals and initiatives, motivated by different reasons, and implemented these initiatives with varying degrees of success.

The challenge in analysing the wide-ranging responses from the interviewees is in trying to find common themes which provide clues as to effective strategies for implementing sustainability within volume housing, to support adoption by other organisations. It is difficult enough to find a common definition of what a ‘sustainable’ house would actually entail, let alone the challenges of determining a delivery pathway which would be appropriate for adoption by widely varying organisations.

Perhaps such an attempt is not appropriate anyway. As Kay (2010) persuasively argues, complex goals are often best pursued indirectly, through what he calls an ‘oblique’ approach. As he puts it:

“...what we want from a home, or a community, has many elements. We will never succeed in specifying fully what they are, and to the extent that we do, we discover that they are often incompatible and inconsistent. The interactions
between a home and its occupants, or between the people who make up a community, are complex and uncertain. Experience of both previous and current problems guides the search for answers. Many people contribute to the outcome, and even after that outcome has been realised none of them necessarily holds a full understanding of how it came about" (p. 6).

This is an important point. No one person can necessarily fully understand how to build a ‘sustainable’ house. As Kay (2010) points out, the oblique approach was how complex building marvels such as the Notre Dame were constructed, over centuries and with large numbers of persons all contributing to an ultimate outcome. Similarly, the experiences shared by the various volume building practitioners for this research project, whether positive or negative, all contribute pieces of a metaphorical jigsaw puzzle about how to construct ‘sustainable’ homes on a large scale. Although the world’s environmental and social pressures do not allow us the luxury of huge amounts of time to learn how to revise our processes and lifestyles so that we can operate in a more sustainable manner, the complexity of the systems we are attempting to change, the ongoing evolution of our understanding of them and our increasing capacity to address them mean that an iterative, adaptive approach is the only one likely to result in long-term success or stability. It means that one or two isolated solutions will not be adequate and a number of interconnected actions will be required. So the fundamental focus must be on how organisations can better manage change towards sustainability.

A major contribution of this research to the body of knowledge on sustainable volume housing has been to document a range of sustainability goals held by several major builders and the methods by which they sought to deliver those goals; to contrast them with the goals of regulators and other stakeholders attempting to encourage more sustainable practice; and to identify any incompatibilities or inconsistencies. As importantly, this research contributes to our understanding of how we can develop a greater emphasis on sustainability for the industry; this is the focus of this and the following chapter.

Enough consistent themes were raised by the various volume building practitioners to clearly flag some of the issues requiring further attention. The interviews reinforced that there are three key areas which will require additional consideration and development of strategies as part of any serious attempt to encourage mainstream adoption of sustainability within the sector. These areas are:
1. Strategies to encourage (or force) wider adoption of sustainable building practices by the housing industry (that is, defining and delivering minimum standards in sustainable housing);
2. Strategies to ensure the effective and ongoing implementation of sustainable building practices (that is, making it stick); and
3. Strategies to encourage further innovation, updating the interpretation of sustainability, and continuous improvement (that is, raising the bar).

This chapter elaborates on the first point, while Chapter 9 elaborates on the latter two points.

Much of the literature on sustainable building tends to focus mainly on the first point, namely how builders may be encouraged to adopt sustainability in general terms, and specifically the drivers and barriers they face in doing so. Less of it tends to deal with how to ensure that these initiatives actually deliver what is intended in terms of sustainability outcomes. Nor does the literature typically clearly address effective ways of ensuring that once sustainability practices or technologies are adopted, in whatever guise, that the appropriate processes and controls are in place to ensure that these practices are sustained in the face of organisational changes or adverse external forces. There is also less emphasis in the literature on how builders may continue to redefine what sustainable building actually means and continually improve their sustainability performance, or what might motivate them to do so. Arguably, there will be little lasting progress or improvement towards sustainable housing on a mass scale if all three areas are not adequately addressed.

Legislative reform in Australia in recent years has already resulted in the industry-wide adoption of more sustainable practices and designs by builders. However, as noted previously, there is still a long way to go in terms of addressing issues beyond improving the building envelope and some building fixtures, with an emphasis primarily on energy and water efficiency. The industry still needs to move towards at least a basic level of consideration of a much wider range of issues that a sustainable house might embody, such as sustainably harvested materials, indoor environmental quality, resource efficiency, biodiversity and broader social impacts.
This research has identified that there are three key ways of achieving this:

- Expanded and more stringent regulation;
- Making it easier for builders; and
- Promoting greater customer demand.

These three points are discussed in sections 8.1 to 8.3.

8.1 Expanded and More Stringent Regulation

The interviews overwhelmingly reaffirmed that any industry-wide changes, including greater adoption of sustainability practices and technologies, is most likely to be adopted if it is legislated. This supports the arguments of others (such as Georgiadou & Hacking, 2012; Porter & van der Linde, 1995), that legislation is the strongest mechanism to drive the adoption of sustainable policies. It also reflects a history and culture of compliance-led behaviour within this industry. For example, Dewick & Miozzo (2002), using the example of thermal insulation, claim that without regulation, the building industry would not do more than was required, primarily because of cost reasons.

Having said this, there are some contradictory messages in the literature; for example, Golicic & Flint (2009, citing Brown & Stone, 2007), suggest it is more robust in the longer term to rely on market pressures rather than regulatory mandates to achieve change. However, market pressures can be difficult to create, as commercial criteria such as increased profitability, ease of selling, minimum retraining and process redesign, as well as customer ‘pull’ are needed.

Chapter 2 outlined the range of efforts in recent years, by government at all levels in Australia, to ensure adoption of more sustainable housing practices (with an emphasis on building design) through regulatory measures. Legislative tools such as the minimum energy rating requirements driven by the Building Code of Australia (now National Construction Code) have already mandated a minimum level of adoption of certain sustainability features and, in the process, also helped to raise awareness of sustainability amongst both builders and customers. However, these measures still fall far short of producing what might be considered truly sustainable homes. As described in Chapter 2, Wilkenfeld (2007) found that new houses actually use more electricity than older houses, even after a 5 star energy rating had been obtained. This is because they are not only
significantly larger, but also tend to be filled with high numbers of energy-consuming appliances.

Although to date the legislative developments have not had the desired effect of reducing overall energy consumption of homes, they have at least contained the rate at which energy consumption is increasing. More recent changes to regulations in 2011 have further tightened requirements with measures such as a 5 watt/square metre limit on installed lighting, low emission hot water services and a requirement for 6 star energy ratings. However, it is yet to be seen whether such approaches will overcome the previous shortcomings. It will be important for governments to continue to tighten energy efficiency requirements and to give consideration to energy consumption from behavioural practices, including usage of appliances, lighting and heating and cooling. As one of the interviewees noted:

“One of the biggest issues that I think we should be starting to address is heating and cooling. It seems crazy to me that our houses are getting higher and higher star ratings and more and more of them are getting air conditioning in them which is totally related to the cost of air conditioning, it’s got nothing to do with whether the houses need to be air conditioned or not.”

A major challenge for governments will be to strike an appropriate balance between continuing to raise the bar on mandated minimum standards to achieve the necessary degree of change, without being seen as overly draconian. If they cross this line it is likely to become politically unpopular and therefore potentially able to be overturned by a different government, as has been seen already with the mandatory disclosure program in Queensland (discussed in Chapter 4). Governments will also need to be careful that their actions do not deter innovation, as often happens, with companies then opposing and delaying the regulations rather than innovating in response (Porter & van der Linde, 1995). Unfortunately, the limited scope of recognition of the benefits of sustainability measures such as energy efficiency in government analysis tends to reinforce this problem. For example, the 2009 Regulatory Impact Statement for the proposed 6 star regulations ignored many benefits, such as reduced peak electricity demand and occupant health that result from improved sustainability performance (Centre for International Economics, 2009). This encouraged some industry associations to oppose the regulations and undermine future attempts to strengthen them (A. Pears, pers. comm, 15 June 2012).
One of the more interesting themes to emerge from this research is the observation that there did not appear to be any serious objection from the building practitioners towards regulation per se. However, this de facto support for regulation was subject to the proviso that it be applied evenly to provide a level playing field and a reasonable transition time. There was some concern that the wider impacts of any legislative requirements be adequately considered, and appropriate mitigation strategies put in place, to ensure that potential problems such as growing housing affordability gaps would not worsen. Concern was also expressed by some over governments unduly intervening in a home owner’s amenity by controlling aspects such as window sizes. In practice, this issue was also affected by planning rules controlling overlooking of neighbouring properties for amenity and privacy reasons. Use of computer based rating tools also allows trade-offs between window size and orientation and other energy efficiency measures.

Governments will need to be quite clear about the goals they are intending to achieve through regulation and ensure that their legislative mechanisms do not end up delivering perverse sustainability outcomes, or contradicting other government goals or planning requirements. A good example of this, raised during the interviews, and discussed in Chapter 7, was that early iterations of energy rating software were known within the industry to actually favour larger homes. Another example of how the regulatory framework can result in a potentially diminished sustainability outcome, recounted by another researcher with earlier involvement in the Cairnlea Ecohome research, related to blackwater treatment. Early in this project, discussions were held with the local council about a desire to install a blackwater treatment system at the Ecohome, but it ultimately proved too difficult to obtain approval and the plan was abandoned, with only a greywater system installed and wastewater from toilets sent to sewer.

Similarly, until relatively recently, many councils banned rainwater tanks for houses with mains water connected, in part because of concerns about the mosquito problem created. Then, following the Millennium drought in south-eastern Australia in the early 2000’s, tanks were suddenly encouraged, including through numerous rebate programs. (Interestingly, this may change again, as in recent times concerns about mosquito populations exacerbated by breeding in rainwater tanks have again arisen, particularly related to the risk of spreading diseases such as Dengue fever in tropical or sub-tropical climates (Townsend, 2010)).

Even where the legislation does not specifically thwart sustainability initiatives, this research has highlighted some real-life experiences where it has been less than helpful. A
good example was that raised by Company C in Chapter 5, whereby in a particular medium-density development they were required to submit 88 separate plumbing notifications and pay the individual fee 88 times in order to gain permission to put slightly smaller than prescribed tanks into each individual home, despite the fact that they had conducted modelling to show that there was not a significant adverse environmental outcome from doing so.

There are parallels that can be drawn with the implementation of occupational health and safety regulations. Wadick (2010), examining the adoption of such regulations by the Australian domestic housing industry, suggested a growing resistance to legislation. He argues that where legislation is felt by the target audience to be more about penalising people than delivering tangible outcomes it will be less effective, and notes that WorkCover NSW (the NSW authority responsible for workplace safety) is widely perceived as “…irrelevant, costly and ineffect ive” while its inspectors “…are perceived as authoritarian, dogmatic, petty and unfair. It is thought that they are more interested in fining people than creating a safer workplace” (p.111). As a result of these factors, he claims that the end result is that rather than delivering the intended outcomes of safer workplaces or adoption of best practice with safety, there is a tendency to only deliver a standard of minimum compliance.

Wadick’s findings offer some valuable clues which should influence approaches to expanded sustainable building regulation and compliance. This research has at least partially supported the parallel assumption that the implementation of the legislative energy efficiency framework has also encouraged a minimum compliance response, where builders learn how to ‘tweak’ their building designs to get them ‘over the line’ with regard to obtaining a building permit, but do not necessarily consider radically rethinking them to deliver anything close to ‘best practice’. While this may result in more significant changes as builders learn, there tends to remain a focus on compliance at least cost rather than higher performance.

Another risk to consider is where governments end up creating quasi-regulation, through support for market schemes not originally designed to act as regulatory frameworks. Owen (2006) notes that the enthusiastic adoption in planning schemes of the voluntary Green Star tool by some authorities such as Melbourne City Council effectively resulted in it becoming a minimum compliance tool. However, the Green Star tools were developed with the intention of promoting innovation and acknowledging excellence within the top 25 per cent of the market, not applying to all projects. She notes that a consequence of
government attempts to mainstream the Green Star tool was a tendency by industry to ‘credit shop’, whereby “…the focus shifts towards getting a rating rather than achieving optimal environmental outcomes. Thus, there can be an over-emphasis on criteria that either represent ‘best bang for buck’ or are easier to prove in practice”. She explains that the difficulty of providing sufficient documentary evidence to assessors for some credits has tended to have the effect of discouraging the adoption of these credits, for example the criteria for reducing PVC use in buildings, which requires an onerous level of documentation to be produced. By contrast, the credits for bicycle parking are much simpler to obtain and this credit tends to be favoured in preference.

Arnold (2011) provides a further example of the care needed by governments when crafting regulations, noting:

“…Green Star’s focus on CO₂ emissions rather than net energy use has inadvertently led to designers concentrating on using efficient HVAC plant rather than first optimising the building fabric. This is the reverse of good building design, and creates the risk of efficient plant being used to mask a design failing in the building envelope. This has also meant that simulation is used more to analyse HVAC options rather than to investigate passive features of the design.” (p. 485)

With regard to ensuring that legislative reforms are not unduly burdensome, consideration must be given not just to the main stakeholders affected by regulation (in this case, builders) but the ripple effects on the wider supply chain. As outlined in Chapter 7, one of the interviewees raised the rainwater tank industry as an example of an industry sector which had, to some extent, been caught off guard by the emerging legislative requirement to install rainwater tanks (if not installing solar hot water systems) in new homes in Victoria (and other States). It is highly probable that the sudden significant jump in demand for rainwater tanks had been further exacerbated by a growing interest in water conservation following the Millennium drought and by government rebates to encourage installation of rainwater tanks in existing homes. Nonetheless, such large scale impacts need to be anticipated and planned for.

Potential demand on suppliers extends to acquiring the necessary technical expertise as well. The energy rating requirements also created a significant and fairly rapid demand for trained and certified energy assessors. Likewise, Owen (2006) noted that the huge early interest in the Green Star rating tools, coupled with their adoption by some governments in planning systems, created such significant demand for accreditations that the Green
Building Council of Australia, which developed the tools, struggled to keep up with
demand. This related not only to training Green Star professionals to support projects and
provide technical advice, but also to independent accreditation organisations such as the
Australian Environmental Labelling Association (AELA), to allow them to keep up with
information requests and auditing requirements.

As revealed by the high-profile collapses of the Home Insulation Program and the Green
Loans program, discussed in Chapter 2, there are large risks to government from
attempting to drive major reforms within relatively tight timeframes. Any large scale
transformations require some period of transition, not just to allow the industry adopting
the changes to prepare, but also to allow their suppliers to plan accordingly and ensure
their ability to arrange the necessary manufacturing and distribution channels and other
required changes such as retooling or sourcing of materials. It is important that programs
be designed and implemented in a way that encourages stability of new industries that
are being created. For example, after the ‘Millennium’ drought ended and the vast
majority of rebate programs were stopped, it has been estimated that 25 per cent of
rainwater tank manufacturers have closed down (Gill, 2011). Similar criticisms have been
levelled at government with the solar industry running into severe troubles during 2012,
with more than 20 companies either collapsing or encountering severe financial hardship,
attributed to State governments slashing feed-in tariffs and other incentive programs for
solar power installation (Stafford, 2012).

Porter & van der Linde (1995, p. 124), summarise the principles of regulatory design to
promote, rather than discourage, innovation, resource productivity and competitiveness
as follows:

- **Focus on outcomes, not technologies** – prescribing particular technologies, or
  assuming that there is a ‘best available technology’, discourages further innovation.
  (However, by contrast, Dewick & Miozzo (2002) claim that prescriptive approaches are
  preferable, as while the ability to use trade-offs allow flexibility, they suggest that it
  also imposes an extra level of complexity);
- **Enact strict rather than lax regulation** – to avoid the adoption of incremental solutions
  which discourage more holistic or beneficial solutions;
- **Regulate as close to the end user as practical, while encouraging upstream solutions**
  – to allow more flexibility throughout the full production and distribution stages;
• **Employ phase-in periods** – tied to capital investment cycles, to avoid expensive, hastily adopted solutions and ‘patching over problems’;

• **Use market incentives** – to address resource inefficiencies and provide ongoing incentives for innovation beyond current standards;

• **Harmonise or converge regulations in associated fields** – to support synergies;

• **Develop regulations in sync with other countries or slightly ahead of them** – to minimise potential competitive disadvantages compared to foreign companies;

• **Make the regulatory process more stable and predictable** – with the process as important as the standards, allowing industry “to lock-in and tackle root-cause solutions instead of hedging against the next twist or turn in government philosophy” (p. 124). However, as Edwards (2009) notes, a turbulent regulatory and policy setting may also encourage organisations to move beyond concerns about sanctions and regulations to focus on advantages and cost savings from more efficient technologies, to minimise risk and transition costs;

• **Require industry participation in setting standards from the beginning** – including both the regulatory content but also the design of phase-in periods. This is far more likely to encourage cooperation and meaningful innovation than regulators simply adopting an adversarial approach. There needs to be trust to encourage industry to provide information that is genuinely useful and for regulators to take it seriously;

• **Develop strong technical capabilities among regulators** – as well as an understanding of industry drivers of competitiveness, to encourage a more collaborative process; and

• **Minimise the time and resources consumed in the regulatory process itself** – so that resources can instead be allocated to innovation. Self-regulation with periodic inspections may be a more efficient means than formalised approval and permit systems.

It is also likely that the adoption of any significant legislative reforms will also need to be supported by programs to train suppliers to provide solutions, such as was the case with the Green Loans and the Home Insulation programs.

### 8.2 Making it Easier for Builders

“**It’s hard. It gives you a headache**.”

The interviewee who made the above comment was laughing as they said it, in answer to a question about what lessons they had learnt about sustainable housing from their
experiences to date, but it seemed that the answer was given only partially in jest. It was obviously something they all found difficult in different ways, but there is certainly scope to better facilitate the transition. To assist builders to adopt more sustainable designs, practices and technologies, it is important that sustainable housing be defined clearly; that the reasons it is important and necessary are effectively communicated; and that the standard and availability of practical, relevant, unbiased and appropriately targeted information, technologies, systems and tools for builders is improved.

Builders will never be able to build ‘sustainable' houses if they don’t know what they are. As outlined in Chapter 6, the interviews confirmed that there are highly variable levels of understanding of sustainability and sustainable building across volume building practitioners, even within the same organisation. Generally, even building practitioners displaying higher levels of awareness and understanding of the issue, still tended to focus their discussion on the more ‘obvious' topics such as energy and water efficiency in the context of building envelopes and appliances. While awareness of wider sustainability-related issues such as waste and sustainably-sourced building materials exists to some extent, it was far less consistent across interviewees. More conceptual aspects of sustainability, such as the notion of the carrying capacity of the planet or intergenerational equity, barely rated a mention throughout the interviews, and consistent with the observations of scholars such as Bourdeau et al. (1998) and Essa & Fortune (2008), discussion of sustainability continues to focus on environmental issues at the expense of the social dimensions of sustainability. Such a limited and fragmentary understanding of sustainability, while not so different from elsewhere in society, can lead to piecemeal, rather than holistic, actions in response (Halme, 2001).

Also of concern is the fact that generally the building practitioners only tended to frame sustainable housing within the context of relatively minor tweaks to the status quo. Very few seemed to have seriously entertained the notion that housing of the future may need to be quite different – both in terms of considerably reduced building footprints and more flexible and adaptable designs; but also in terms of better integration with the broader community infrastructure. A strong perception was repeatedly expressed by the interviewees that their role as volume builders was to provide to their customers what their customers wanted; and that was largely perceived to be big houses with many rooms, filled with high-end finishes, fixtures and appliances.

The relatively narrow understanding of sustainability in a context of houses is probably unsurprising. The emphasis of sustainable building regulation in Victoria at the time of the
interviews had been primarily on energy and water, influenced by growing scientific consensus and public awareness of human-induced climate change raising awareness of energy and greenhouse gases. At a similar time, the Millennium drought had raised public awareness of the need for water conservation. Energy and water efficiency also tended to be the focus of much of the training in sustainable housing that was available at the time. For example, one of the better known and attended courses, the two-day GreenSmart Professional training program run by the Housing Industry Association, heavily focuses on energy and water. Their website states that this course covers “[g]lobal and local context of sustainable development; thermal performance; passive solar design and natural ventilation; design and operational issues for water and energy efficiency; selection of water and energy efficient appliances; and marketing sustainable housing to clients” (Housing Industry Association, 2012).

However, while volume building practitioners may understand that energy and water efficiency are things the homes they build should encapsulate, this research suggests that their motivations for making such changes are not primarily driven by a sense of moral responsibility. Other, potentially more significant, drivers include the perceived marketing advantages from delivering value to their customers in terms of lower energy bills in future (although this does not seem to be a strong driver); as well as the perceived opportunity to build more positive relationships with government stakeholders. It appears that genuine concern about the need for builders to play their part in contributing towards lowering greenhouse gases in the atmosphere is not a major driver for focussing on energy efficiency for most of those interviewed, although the idea of doing the right thing is consistently expressed. It was also not clear that the building practitioners fully understood the environmental or social imperatives behind the increased public interest in sustainability at that time.

Governments can intervene, particularly through regulation (discussed in section 8.1) and other measures such as higher taxes on natural resource use to send more appropriate pricing signals. Such approaches could effectively force builders to operate more sustainably without needing to understand why it is important to do so. By the same token, as resources such as fossil fuels become increasingly scarce as the finite reserves of non-renewable resources are depleted, or renewable resources are extracted at rate beyond which they can replenish themselves; the resultant lack of supply and inevitable price increases is also likely to force a greater consideration of efficient practices and sustainability more broadly. However, the first approach is inherently at risk of being a short-term solution, as governments can be voted out of office if they are seen to
implement unpalatable policies, and there is also the difficulty of driving such reforms within a global marketplace. The latter solution will come too late, as the opportunity to avoid unnecessary wastage of natural resources and associated environmental impacts will largely have been squandered once those conditions have been reached.

Thus, any stable and lasting adoption of ‘sustainability' by the housing industry will require the willing cooperation of a broad spectrum of stakeholders, and to obtain this support, it will be important that people understand the reasons for doing so, particularly if there is perceived to be difficulty or sacrifice associated with it.

In terms of supporting builders with regard to how to build more sustainably (as opposed to simply mandating outcomes), this research has also supported the view that a number of additional measures are likely to be required. It has also confirmed that there are varying preferred methods of learning about sustainable building. The larger volume building organisations typically have higher ratios of professional staff and thus may be more receptive to using more complex and detailed documentation to support learning. By contrast, site-based staff or subcontractors are potentially likely to respond better to more practically-oriented information which also takes advantages of interpersonal networks and learning through experience.

Some guidance for supporting learning about sustainable building, at least for site-based staff, may be obtained by considering how builders have learnt about a related area of occupational health and safety. Wadick (2010, p.110) asked subcontractors in the Australian domestic construction industry about how they learnt to work “safely”. The number one response with a 25 per cent response rate was ‘common sense’, with other common answers including mistakes over the years (13.3 per cent); stories from others (13 per cent); thinking ahead (12.6 per cent); from other jobs (10.7 per cent); and watching others (9.5 per cent).

Although ‘common sense’ is a relatively subjective concept, Wadick notes that it is fundamental to subcontractor’s success because of their constant need to make practical judgments in ever-changing work environments, and the fact that:

“… decisions reached through common sense very often come from critical reflection. It is developed and informed through participation in the process of performing construction work, which means common sense is learned, not fixed and is amenable to change as new circumstances challenge previously held
preconceptions. Locating the exact sites for this learning is imperative if changes are sought to the way construction workers manage safety” (2010, pp.110-111).

By contrast, more formalised methods of information delivery such as through health and safety courses or school were rated lowly by subcontractors he surveyed, with only 1.3 per cent of responses for each. He noted that while knowledge gained from practice was respected and trusted, there was “…a distrust of safety courses that attempt to privilege paper/procedural knowledge over practical, embedded and embodied safety knowledge” and “…[t]hroughout the history of the building industry, safety has been part of and integrated into subcontractors’ core business activities, but not necessarily enunciated or defined anywhere” (2010, p.111).

A combination of mechanisms is likely to be required to support learning about sustainable building. Three mechanisms that were commonly raised in the interviews were:

- Delivery of appropriate information sources and tools – tailored to the audience, whether professionals (such as architects, designers and engineers), trades-based building practitioners including subcontractors, or customers;
- Delivery of appropriately-targeted training programs; and
- Provision of tangible examples of sustainable housing to be adopted, and adapted, by the industry.

Each of these is discussed further below.

It is important to stress that the availability of relevant information and educational activities, while commonly considered to be the answer to the problem of lack of awareness or understanding, simply provides the opportunity for learning and does not guarantee any learning outcomes. The motivations of the ‘learners’ are also important (Halme, 2001).

8.2.1 Information Sources and Tools

Information for builders needs to be appropriate, relevant, timely and context specific (Wadick, 2010).
This research has confirmed common observations in the literature that generally builders had found their supply chains to be helpful sources of information (discussed in Chapter 4). In some cases, such as a main window supplier to Company B, the suppliers have been a driving force through offering appropriate products coupled with the necessary technical support. However, a barrier also raised in the literature and reinforced by this research is that suppliers are generally not seen as being independent or necessarily trustworthy sources of technical advice on sustainable building more generally as they are (understandably) perceived to have a bias; namely to promote their own products.

Better tools which allow comparison of both product categories and of individual products within categories to compare with regard to sustainability performance, have potential to significantly support the industry. These tools will need to be developed by independent and unbiased bodies to have maximum credibility. Making them cost-effective to access will also be an important strategy for their success.

Rating tools are also a potential source of information, although the main purpose for developing such mechanisms would tend to be to facilitate benchmarking, marketing and credibility of claims. These tools are discussed further in section 8.3.2. In the same way that tools such as Green Star have helped to not only more clearly articulate what a supposedly ‘sustainable’ commercial building should embody, but also provided a mechanism for independent verification, similar tools appear to be required for housing. Beyond the application of energy modelling tools such as NatHERS mandated by legislation, it does not appear that any housing sustainability tools are widely used or well-known in Australia, apart from, perhaps, the ill-fated Queensland Government program described in Chapters 2 and 4. Such tools would need to be flexible, credible, unbiased, practically-focused, and relevant in application across varied building types, site conditions and geographical conditions.

Legislative mechanisms such as the 6 star energy national regulations were developed with a goal of encouraging consideration of a wider range of sustainability issues during the construction of new homes or major renovations, but it could also be argued that the software tool supporting it is primarily used by the builder or their consultants, and may not be well understood by the client (or, for that matter, the builder). In addition, the various legislative tools tend to cover a relatively limited suite of sustainability features, with an emphasis on energy and water. Broader coverage is required.
8.2.2 Training Programs

Providing effective training on sustainable housing to builders is challenging given that it is not an industry that has historically placed a high emphasis on classroom education. For example, in one of the three case study organisations for this research, none of the staff spoken with had undertaken any formal or informal training in sustainability.

Nam & Tatum (1997) argue that it is particularly important for managers to undertake continued learning about technical matters allowing them to undertake a technological ‘gatekeeping’ process, and to provide benefits in a competitive environment. Schaafsma (1997) suggests that the low levels of participation in management-related training may be attributed to a widespread perception that available programs did not meet specific needs, and the inflexible mode of delivery of many traditional courses offered through Technical and Further Education (TAFE) colleges or universities, which did not necessarily suit the time constraints of small builders. He adds “…small builders…saw little value in theoretical and time-serving courses designed for institutional timetables…many expressed frustration about the unavailability of ‘just-in-time’ forms of training that addressed their most common concerns” (p. 20). He suggests that instead the preferred modes of delivery for formal management training of builders was off-the-job, part-time, evening courses at TAFE or university. He suggests that these could also be supplemented with distance learning resources, and also advocated the establishment of better systems of credit transfers and greater recognition of prior learning to facilitate fast-tracking formal accreditation of management competence.

Schaafsma (1997) speculated that the issues discussed above could also explain the continued popularity of expensive one-day workshops which served as ‘quick-fixes’. The limited discussions with site-based staff during these interviews confirmed that because of the need to be on-site as much as possible, information is best presented in short bursts which they can fit around their schedules.

Another potential barrier to greater uptake of training, particularly given the industry’s emphasis on practical operations, is the method of delivery. Halme (2001) notes that sustainability training can be hampered by a teacher-student model because it facilitates a one-way flow of information from the teacher, potentially reducing the receptivity of the ‘student’ but also diminishing opportunities for collaboration.
As Halme (2001, p. 111) notes:

“…when the recipients of education are small [organizations], lectures or written materials alone do not emerge as efficient sources of learning. Education and training need to relate to the daily reality of the recipient. Even if information is available, it may make little sense to a recipient organization that does not share the experience of the context in which the knowledge is created. Learning occurs in the course of action and through experience. Classroom training does not appear sufficient with the exception of actors whose attitudes are very positive to begin with and who are already to open to environmental (or a wider set of sustainability) issues. Such actors already have environmental issues in their frame of reference and thus can see the connection between the training and their own enterprise’s actions.”

Davey et al. (2004) similarly outlined the potential benefits of an ‘action learning’ approach for construction professionals, whereby groups tackle real problems, develop solutions and reflect on successes and failures, with the potential to improve performance, uptake of innovation and client relationships. However, they also noted that the competitive nature of the industry acted as a barrier to sharing.

Recognising such issues, there have been various attempts by government and industry to reform training provision. One of the most significant reforms was the development of national competency-based industry Training Packages within the vocational education and training sector. These training packages, developed by industry representatives, aligned qualifications with specific workplace tasks and roles, and comprised various units of competency which specified the outcomes of training and the criteria to be used to assess whether the outcomes had been achieved, leaving teachers and training providers to develop their own curriculum approach to delivery. However, the underlying approach was widely criticised by many educators, for example Wheelahan (2008), for divorcing learning outcomes from processes of learning and denying students access to the theoretical knowledge underpinning vocational practice. It could be posited that this may act as a barrier to greater learning about sustainable construction, given the important theoretical underpinnings of sustainability.

To address the perceived lack of adequate training relating to management skills (which will be required to support strategic planning and implementation of sustainability initiatives) Schaafsma (1997) suggested that leadership will be required from key industry
bodies. As mentioned previously, the HIA GreenSmart Professional training program is one of the more prominent attempts by the industry to raise understanding of sustainability amongst house builders, and had been completed by several of the building practitioners interviewed. HIA members may register themselves as GreenSmart Accredited Professionals after completion of this two-day training course (Housing Industry Association, 2012). However, this course does have a somewhat limited range of focus, and as one of the interviewees noted, also suffers from trying to be a national offering which needs to cater for the very different climatic and geographic conditions across Australia. In a similar vein, the MBA’s Victorian branch developed Green Living training with the similar ability for builders completing the training to identify themselves as Master Builders Green Living builders (Master Builders Association Victoria, 2013).

Wadick’s (2010) research into learning about safety identified that subcontractor learning was not generic, but trade-specific, related to the tasks they perform and the tools they use. This potentially provides some pointers as to how best to deliver sustainable building training, and suggests that perhaps the one-size-fits-all of the GreenSmart style of training may be less effective for these people than more targeted courses such as the Green Plumbers Environmental Solutions course offered by the Master Plumbers and Mechanical Services Association (MPMSAA) (2012). The counter-argument to this is that it does not encourage tradespersons to consider the wider implications of their work to the overall sustainability of the house, and the need to integrate with the works of others. This is potentially a source of conflict given the holistic nature of sustainability, although it can be overcome by considering such issues in the curriculum design.

One possible strategy that stakeholders wishing to promote further effective sustainable building training could consider is developing training strategies aligned with building ‘bust’ periods, when building practitioners may have more time available to attend such programs. For example, Schaafsma (1997) suggests that downturns in the industry provide home builders with an opportunity to upskill. However, the downside is that in these periods cost-cutting (including training budgets as well as staff retrenchments), and the value of training, will also become more of a focus.

A related point that was raised by one of the interviewees is that there is a need for industry bodies to develop higher professional standards for trades, in a similar way to those developed by professional associations such as Engineers Australia.
8.2.3 Tangible Examples of Sustainable Housing

Mimicry is a significant mechanism for learning (DiMaggio & Powell, 1991 cited in Halme, 2001), although it is not as typically raised as a learning mechanism as information provision or education/training. However, an important insight from some of the interviews is that builders appear to be strongly influenced by tangible examples of sustainable practice. The potential influence from display villages and other high profile projects featuring a strong sustainability emphasis, such as those built for the Sydney Olympic Games or the Melbourne Commonwealth Games, or developments such as Aurora in Melbourne, should not be underestimated.

This research supports the suggestion that governments and other major construction clients have a very important role to play in driving adoption of sustainability within the industry. To do so, they need to be willing to absorb some degree of risk from, for example, time or cost blowouts associated with adoption of new practices and technologies, and also to allow for the integration of some training into such projects. This provides the opportunity for builders to learn from these experiences with less risk to themselves of making mistakes or investing significantly in projects or initiatives which subsequently fail. As one of the interviewees commented:

“…you can throw the full suite of sustainability tools at one particular project which you wouldn't have the budget to do, or the market would not accept, or would not pay for on other sites.”

An important component of such a strategy is that government then also effectively leverages the educational opportunities provided by such projects, ensuring that they are widely promoted, open to visitors and accompanied by supporting technical information. Another interviewee noted that while they were privy to information when they were part of the Aurora development, once they withdrew their involvement in this development the information was no longer accessible, which does seem to represent a lost opportunity to educate the wider industry.
8.3 Promoting Greater Customer Demand

Although detailed exploration of customer demand is beyond the scope of this research, there is no question that the volume building practitioners spoken with generally perceived that customer interest in sustainability is very limited. In addition to generally believing that customers neither understand nor value sustainability, the volume builders spoken with for this research also believe that customers are typically not willing to absorb much additional cost for it.

This is serving as a significant barrier to their greater and more meaningful adoption of sustainability practices and technologies. It seems that where builders are incorporating sustainability features, they are generally either doing so because of legislative necessity; because they are relatively low-cost features; are easily promoted (eg photovoltaic cells); involve minimal risk or change in practices; or form part of a strategy to build positive relationships with government agencies.

These observations support the concept of the ‘vicious cycle of blame’ discussed in Chapter 4, whereby customers are blamed for not requesting ‘sustainable’ homes, but get little support or encouragement to do so. And yet, while it is an easy option to attempt to shift the burden onto customers, it is inappropriate to place the emphasis on individual behaviour change because it ignores “…the larger structural and ideological problems at the root of environmental destruction” (Clover, 2002). Nonetheless, addressing ways to increase customer demand is an important part of an overarching strategy to drive greater adoption of sustainable building.

Limited evidence was provided during the interviews to actually support building practitioners’ perceptions of their customers. Often their stated views during the interviews were based only on anecdotal evidence. However, volume builders have become adept at anticipating market trends, responding to what they think their customers want (Greig, 2000), and possibly even manufacturing demand by offering things customers may not even have thought of.

At times, it seems that builders make assumptions about whether or not customers value particular sustainability features when they have not necessarily clearly offered them a choice, or a complete set of information that would allow them to make an informed decision. It is possible that they may also offer the options at unrealistically high prices, something that was not explored in this research but would benefit from further research.
As Christensen & Raynor (2003) note, a barrier to adoption of innovation is that, in assessing the likelihood of success of a particular innovation being considered, decision-makers are often guided by feedback from significant customers – but these are people whose experience tends to be based on the organisation’s historical offerings which have been successful in the past.

Although some contradictory evidence exists, the literature more generally supports the idea that sustainability is not a feature of major importance to most housing customers. For example, in reviewing the impacts of the (now scrapped) mandatory sustainability disclosure requirements at time of house sale in Queensland, Bryant & Eves (2012) concluded that sustainability “…is yet to become a criterion of relevance to the majority of homebuyers in Queensland” (p. 29). Their surveys of real estate agents showed that 98 per cent of buyers did not ask for a copy of the Sustainability Declaration that sellers were at the time required by law to provide, supporting the agents’ anecdotal evidence that it was not a significant factor in house purchase decision-making. (Information about the extent to which the real estate agents themselves promoted this scheme was not provided, but this may well have had a bearing on the purchaser interest and awareness of the scheme. Certainly Hurst (2012) contends that agents will require specialised training, including on the aims and limitations of energy ratings, if they are to successfully promote sustainability features of the houses they are selling).

It is salient to reflect on public interest in sustainability more broadly. There are some recent troubling indicators. For example, a recent major study of the social, political and economic values of Australians, as part of a wider international survey, found a significant decline in the environmental concerns generally of Australians between 2007 and 2012 (Devinney et al., 2012). In 2007, environmental issues were mainstream, rated by Australians as the third highest category of issues, behind only crime and public safety and rights to basic services. More than half of the specific sustainability issues surveyed appeared in the ‘top 25’ concerns of Australians. But by 2011, only one issue (deforestation and habitat destruction) remained in the top 25 concerns, with issues rated highly in 2007 such as industrial pollution, alternative energy generation, climate change and depletion of energy resources all falling dramatically in importance. Data from Germany, the US and UK showed similarly low levels in interest in environmental issues, particularly in the US for which there were no environmental sustainability issues at all in their top 25 concerns in 2012. The authors state:
“What we see in our data is not that environmental concerns are being pushed down, but that they are simply falling. Environmental issues have been overwhelmed by other mundane concerns that remain proximate to the general population...It is possible that 2007 was nothing more than an aberration when the debate about environmental sustainability became a matter of ordinary, everyday concern. What we see now in Australia and across Western countries is likely closer to a long-term trend in the value of environmental matters to the general population” (Devinney et al., 2012, p. 38).

They also posit that the declining concern does not appear to be a direct consequence of the global financial crisis, as environmental concerns have not been replaced by economic concerns, although other authors such as Eves & Kippes (2010) do suggest that economic recessions have had an impact on eroding the success of voluntary and mandatory evaluation schemes for housing.

An even more tangible example relates to rising energy consumption, in spite of reasonably high levels of public awareness about greenhouse gases and climate change. Hurst (2012) cites data from Green Energy Markets (2011) showing that electricity generation and coal generation have grown almost exponentially (10 fold and 12 fold respectively), over the previous 48 years. More recent data from residential energy consumption modelling undertaken for the Commonwealth Government showed that energy use increased steadily between 1990 and 2005 (with minor declines in 2000 and 2003). As mentioned in the prologue, they found that overall consumption in Australia had increased by 56 per cent, from 299 PJ in 1990 to 402 PJ in 2008, and projected to reach 467 PJ by 2020, driven primarily by growth in electrical appliance consumption (Energy Efficient Strategies, 2008). Globally, it took the global financial crisis to halt growth in carbon dioxide emissions (with a small decline of 1.4 per cent during 2009), but this was more than offset by growth of 5.9 per cent from fossil-fuel combustion and cement production in 2010, owing to strong emission growth in emerging economies, a return to emissions growth in developed economies, and an increase in the fossil-fuel intensity of the world economy (Peters et al., 2012).

Given such findings, it is of concern to note that the interviews for this research, in which limited confidence in the environmental motivations of volume housing customers was expressed, were conducted in 2005; a time where the momentum of the sustainability movement was close to peaking. If this was the perception of builders at that time, one can only speculate as to how it currently rates. This is an area requiring further research.
Despite varying environmental interest, this research has suggested that there are four key ways of encouraging customers to demand more sustainable housing:

- Increase customer understanding of what sustainable housing is and its benefits, including enhancing its perceived value;
- Develop robust, credible, accessible methods of verifying sustainability claims;
- Challenge the status quo with regard to housing; and
- Provide financial incentives and other strategies to reduce any cost barriers.

Each of these is discussed further below, in sections 8.3.1 to 8.3.4.

Another pertinent observation from this research is that any attempts to influence home buyers need to take into account the demographic features of customers, which will vary depending on the area in which homes are being built. For example, more than one person interviewed suggested that targeting customers who work as professionals (and suggested to a lesser extent, female customers), was likely to be a more successful strategy with regard to sustainability features.

Researchers such as Reed & Mills (2007, p.240) have similarly argued that “…housing policies must place a higher emphasis on demographic factors, such as the distribution of the age cohorts.” Eves & Kippes (2010) found that either younger singles or couples or older persons, both from higher income brackets, were the only groups likely to make sustainability a significant factor in the housing purchase decision-making. However, Raisbeck & Wardlaw (2009) did not find any relationship of statistical significance between people’s age and whether they would like to live a house of higher environmental standards than minimum compliance, but did identify a relationship between age and motivation to consider adoption of sustainability features in new homes, with older people more motivated to invest in these features considering lifestyle and health benefits, whereas younger people were more motivated by government subsidies. (They also noted that older people were more likely to know about the star rating system for homes).

Gender differences related to housing preferences of customers are not commonly discussed in the literature, although Hurst (2012) cites research by Levy & Kwai-Choi (2004) which suggested that males tend to place greatest value on location and financial issues, while females seek other features of benefit to the family.
Another factor to consider is the different needs and preferences of owner-occupiers compared to investors. This was flagged as an issue by Hurst (2012) and was also raised in some of the interviews.

It should also be stressed that the sustainability features valued by customers may change over time. For example, the interviews were conducted not long after one of the most significant droughts on record in the eastern States of Australia, and thus there may have been a higher interest at the time in features such as rainwater tanks than may be the case now. Additional research will be required to explore this further.

8.3.1 Increase Customer Understanding of What Sustainable Housing is and its Benefits, Including Enhancing its Perceived Value

Just as building practitioners require more information about these issues to support their decision-making, so do customers. As relatively infrequent purchasers of homes, housing customers typically have limited levels of knowledge, somewhat disadvantaging them and forcing them at times to rely on professional and/or statutory information to inform their decisions (Hurst, 2012) or surrogate measures of assessment, for example service quality in lieu of the more technically complex physical construction quality (Forsythe, 2008).

In terms of implementing this strategy, there is a role for builders, industry associations and governments. As mentioned, some of the builders involved in this research were already attempting to do this, such as with promotional material prepared by Company A explaining the Cairnlea Ecohome features. Company C was particularly interested in ‘educating’ its customers about sustainability and was, at the time of the interviews, considering development of information material such as a booklet for customers, explaining the sustainability features of their homes, the benefits, but also importantly, how home buyers would need to interact with the features in the future (such as through maintenance requirements). The major criticism arising from research into the occupants’ experiences with the Research House in Rockhampton, Queensland, described in Chapter 2, was that the operating manual for the home was a source of frustration and confusion. Educating customers about how to engage with sustainability features after their initial purchasing decision is important to successful outcomes and appears to be under-represented in the literature.
Development of promotional material by construction organisations is certainly an area that is still ripe for improvement, with a need to focus on the ‘three T’s’ – targeting, tailoring and trimming material (Preece and Male, 1997).

Meanwhile, various government initiatives described in Chapter 2 have been undertaken to raise customer awareness with a view to increasing demand; most notably the Your Home series of publications by the Commonwealth Government. Industry association programs such as the HIA GreenSmart training program also exist, but seem to be promoted much more heavily to builders than to housing customers.

This research has also provided some clues as to areas that may require additional consideration when developing strategies to encourage greater customer demand. For example, anecdotal evidence from the interviews suggests that more tangible sustainability initiatives are generally more attractive to customers than initiatives that can’t be seen or touched. For example, some of the interviewees noted that features such as solar panels and rainwater tanks are typically more likely to be sought than features such as low-VOC paints or the replacement of PVC plumbing with HDPE pipes. Similarly, some of the interviewees also suggested that features such as sustainably-sourced materials, such as sustainably harvested timber, are not widely requested by customers, particularly if there is increased cost associated. As one interviewee described it, talking about features such as recycled water systems, solar hot water and photovoltaic cells:

“They're all simple, tangible things for people to understand, you know. So they're the easy ones to market probably. The hard ones to market are the ones that you can't see...whether it's a glue underneath a laminate or whatever...but I mean that's changing too because we know with asthma and things like that we obviously know that our air quality...is bloody important in our homes, so it's worth...finding what the issues are and coming up with options.”

This suggests that better explaining the importance of less ‘tangible’ features, and particularly the reasons why they are important (such as the potential health impacts from toxic substances) could be an important strategy in promoting a more holistic sustainability message for houses.

As for builders, providing tangible examples of sustainable houses, such as through incorporation into display villages, may also encourage customers to ask for particular sustainability features in their homes.
8.3.2 Develop Robust, Credible, Accessible Methods of Verifying Sustainability Claims

Tied to the theme of providing better information to customers is the need to provide them with tools that allow them to meaningfully compare options, in the absence of an ability to conduct detailed comparison of a range of complex attributes themselves. Faced with a number of choices, and limited ability to distinguish between their relative merits, customers need to rely on robust and independent rating methods to allow comparison to assist their decision-making. For example, the technical credibility and perceived independence of the Green Building Council of Australia in terms of certifying Green Star ratings can be considered to have contributed significantly to the widespread uptake of the Green Star tools.

The credible endorsement of the sustainability credentials of a product or service may also increase the likelihood that customers will be willing to pay more. For example, Harris (2007), in a review of market responses to fast moving consumer goods independently certified as sustainable in Australian and New Zealand found that “…there is consumer demand for products that are clearly identified as genuinely sustainable, even though they may be perceived to be more expensive than traditional products” (p. 50). Indeed, she notes that record sales increases of more than 50 per cent against historical figures were achieved and sustained for seven household products with sustainability labelling over 18 months. With regard to housing, the Rocky Mountain Institute et al. (1998, p.11) noted that houses in the Village Homes development in Davis, California, described briefly in Chapter 2, continue to sell for a premium ($10-25 more per square foot).

As outlined above, some of the interviews suggested that customers did not tend to place high value on features such as sustainably harvested materials. It is possible that this is, in part, because they do not understand the merits of existing certification schemes.

While not an environmental rating system, the well-known international standard for environmental management systems, ISO 14001 (Standards Australia/Standards New Zealand, 2004), provides assurance of the existence of processes in place to minimise environmental impacts of products or services. This is independently verified through a certification process against the standard requirements. However, this standard covers overarching management system elements only with a focus on processes and does not of itself provide any details about the relative merits of environmental products or
services. It also does not include any absolute performance measures beyond compliance with 'legal and other requirements' (with 'other requirements' identified by the organisation in question), merely requiring 'continual improvement' (Standards Australia/Standards New Zealand, 2004).

Eco-labelling schemes that are currently in use in Australia, such as Good Environmental Choice Australia (GECA) developed by the Australian Environmental Labelling Association, or other sustainability databases in use such as Ecospecifier for materials, are still aimed primarily at technical or procurement staff within the industry rather than the end-of-chain customers. As noted in Chapter 7, even some of the building practitioners found tools such as Ecospecifier difficult and time-consuming to use, not facilitating quick product selections, as well as expensive.

Consumer advocacy organisations such as Choice in Australia have also attempted to fill this information gap by running a number of campaigns to review the sustainability merits and claims of various products (Choice, 2012). The Australian Competition and Consumer Commission, which enforces Commonwealth competition, fair trading and consumer protection laws, has also been prominent in recent times in penalising a number of organisations for making inaccurate or unsubstantiated sustainability-related claims (Australian Competition and Consumer Commission, 2012). For example, as at October 2012, they had received 2,500 complaints about a range of issues relating to the recently introduced carbon tax and had already conducted 15 in-depth investigations (Lentini, 2012).

For tools or rating systems to be widely used by customers, and by industry as well, the costs will need to be relatively low. This was a criticism of the Ecospecifier tool by one of the interviewees. There is, however, inherent conflict in funding the significant costs of data collection, validation and analysis to facilitate robust comparisons but also offering industry and customers the ability to use the tools for minimum cost. Businesses seeking product certification typically pay a fee for this service, but the potential perception that certification is 'bought' needs to be avoided. It suggests that there is a role for government and research organisations, either by maintaining such tools or at least contributing to their funding.

Finally, the emphasis of the tools will need to shift so that they emphasise genuine sustainability outcomes rather than what Birkeland (2008) describes as simply "less bad" designs.
8.3.3 Challenge the Status Quo of Housing

The flip side of encouraging customers to ask for more sustainable features in their homes is also discouraging them from actively seeking unsustainable features. This research has tended to support the idea that the aspirational tendencies of many home buyers acts as a barrier to sustainability. As described in Chapter 3, for many years, house sizes continued to grow despite a trend towards a decreasing average number of occupants (although this trend has recently largely flattened off). There seems to be a widespread acceptance throughout the volume housing sector of the idea that customers want the biggest house with the most features they can afford, and it is the volume builder’s role to provide this in the most cost-effective manner possible. There does not appear to be any interest in challenging customers to realistically evaluate their needs or to consider how their use of space could be more efficiently configured.

Although not explored through this research, it is possible that it is actually to some extent the builders who are manufacturing demand through their marketing. Because builders typically make a margin based on a total purchase price, they arguably have a financial incentive to encourage customers to spend as much as they can afford, whether through purchasing a larger house; additional features such as al-fresco dining rooms; or more expensive fixtures and fittings. Their houses are marketed not simply as dwellings but rather as status symbols. As Razer (2005, paras 20-21) so elegantly puts it:

“Volume builders are no longer selling just bricks, mortar and Mediterranean-finished render. They’re selling a profound illustration of success and self-worth. They’re selling nostalgia for a misplaced ideal of mid-century home life, and hope for a stylish, streamlined future.

In short, they’re selling conceit and good taste.”

It is not only the builders who appear to be promoting such messages. Evidently some land developers apparently hold a somewhat cynical view of what their customers are actually seeking, if the billboard shown in Figure 10 (which, ironically, is from the same estate that the Cairnlea Ecohome was built in) is any indication.
Interestingly, this tendency to encourage customers to buy more occurs despite the contradictory message, widely expressed throughout the interviews, that builders are concerned about affordability issues associated with incorporation of sustainability features. A point raised so commonly, unprompted, during interviews that I have dubbed it the “granite bench phenomenon”, is that there seems to be limited reflection amongst the builders as to why they considered it to be perfectly rational for a customer to spend extra money on granite benches but not on features such as photovoltaic systems. Indeed, most sustainability features seemed to be considered by some interviewees to be quite optional, as typified by this response:

“…if people are sort of on a pretty tight budget they’re obviously only going to be able to afford what they need…what we’re required to build into the home. So all those extra types of things that aren’t necessarily, you know needed or required are going to miss out this time.”

Although the interviews did not explore this theme in depth, it could be speculated that they feel some need to defend a customer’s right to choose on what they spend their money rather than having it imposed (although it may also be linked to potential for higher profits to them). It could be easier to convince someone to spend money on a luxury item as a form of indulgence rather than something that feels like more a form of duty. This also comes back to the effect of visibility/status and utility on perceived value.
Volume builders seem to make the assumption often that because customers do not ask for something, they explicitly do not want it, when it is also quite possible that many people simply are not aware of all the potential things they should consider when buying a home. A house is a more complex product than almost any other product most individuals will purchase, and typically also the largest investment a person will make in their lifetime. The process of building is also complex, particularly for someone from outside the industry to understand, and, as mentioned previously, this puts the customer in a weaker negotiating position. Giving due consideration to sustainability issues only compounds this complexity. A customer wanting to make informed decisions about sustainability in a home needs to be able to grasp concepts ranging from passive solar design principles through to potential life cycle impacts of various materials and the health impacts caused by the use of toxic materials such as VOCs. This can be difficult enough for someone with tertiary qualifications in this field to adequately understand, let alone someone with no prior exposure or relevant training. Consequently, as numerous interviewees observed, customers are more likely to focus on straightforward attributes which they do understand, such as suitability of house location, its size and features such as room configurations and types of finishes.

This strongly held perception of a conflict between affordability and sustainability is likely to remain a barrier to sustainability until it is addressed more seriously. The perception may well be a bigger barrier than actual affordability challenges. This is described further in section 8.3.4.

The experience of increasingly bloated houses can be seen as a subset of a modern tendency in the developed world to overconsumption, a malaise labelled ‘affluenza’ by authors including Hamilton and Denniss (2005). We buy things that we don't need which then become a burden to us to store and maintain. A recent survey of 1,002 Australians by The Australia Institute found that 88 per cent of homes have at least one cluttered room, and that four in ten respondents reported feeling anxious, guilty or depressed about the clutter in their homes, with a third embarrassed by it. 84 per cent of respondents had subsequently bought things to deal with the excessive amount of other items they had bought, with one in five building a shed or garage to keep or store things, and one in eight moving house to accommodate their superfluous possessions (Fear, 2008).

In the same vein, by buying unnecessarily large houses that are not fully utilised, home owners are subsequently forced to clean and maintain, and expend additional resources
on, spaces that are not offering significant genuine utility. By thinking differently, there are various ways that the perceived affordability challenges could be addressed by builders, such as by designing more compact, but better planned and more flexible homes that were more sustainably constructed for a comparable price. This would not only help to decrease upfront costs, but also the ongoing operating costs, given that, in the words of one of the interviewees:

“…at the moment what we do, is we’ve got 300 square metre houses and we just blast them full of hot air…”.

However, again, such ideas did not appear to entertain much reflection amongst the interviewees. There have been various attempts to positively promote a shift towards smaller housing. For example, the Not So Big house series of books by US architect Sarah Susanka (for example, Susanka, 2008), focus on designing houses to suit the way occupants actually live and to use space more wisely, with an emphasis on quality over quantity. Similarly, there are various architectural books focussed on the ingenious strategies incorporated in housing in cities of high urban density such as Tokyo to combine multiple functions into extremely compact spaces (for example, Brown, 2005; Freeman, 2004). While it is not perhaps realistic to imagine most suburban Australians living in a similar home as a Tokyo resident in the near future, it does illustrate that there is potential to challenge the status quo more than has been done to date.

Possibly, the volume builder’s reluctance to explore serious departures from the status quo is in part because, as this research has confirmed, there seems to be a perception held by at least some building practitioners that customers don’t want anything too different from the rest of the market, at least in terms of physical appearance. As discussed in Chapters 3 and 4, because a house represents a major investment for an individual, whether or not they will actually live in it, the fear of adversely impacting on resale value as a result of creating something too ‘different’ encourages conservative tastes and creates a barrier to innovation (Ball, 1999). This is particularly true if the house is a ‘stepping stone’ to something else, as noted by some of the interviewees.

However, some have started to question the economic wisdom of acquiring such large homes. For example, Citibank (2006, p. 2) conducted research into the use of homes as a financial tool and identified that:
“...the option of downsizing to a smaller dwelling is still regarded by many as a primary source of retirement income...It’s a risky strategy. As a result of the baby boomers, Australia’s largest single demographic group, will be collectively attempting to find buyers for their properties over the coming decades, and the result could be chaos.”

Citibank further comments that because changing lifestyle preferences are discouraging Australians from living on large, high maintenance blocks, coupled with the increasing demographic trend towards single occupant households (projected to increase from the current 10 per cent or so of the population to as high as 34 per cent by 2026):

“By 2026, up to 3.7 million Australians could be looking for homes suitable for solo living, shunning the more expansive homes that retirees may concurrently be looking to sell” (Citibank, 2006, p. 4).

Competition from other groups including first home owners for smaller properties may also force down the values of larger homes.

Another point noted during the interviews conducted for this research was that there was very little discussion about the location of homes as a factor significantly influencing their sustainability, such as in terms of exacerbating urban sprawl or maintaining car dependency in areas with inadequate public transportation. Again, building practitioners seemed to frame their answers within the context of what they were already doing, or in this case, where the land was available. While this is unsurprising, it does offer another insight into how difficult attitudes may be to shift.

8.3.4 Provide Financial Incentives or Other Strategies to Reduce Cost Barriers

Cost appears to be the most commonly raised barrier to sustainable houses (or buildings more generally). It was repeatedly raised by the literature, and almost all of the building practitioners interviewed perceived it was a barrier to greater adoption of sustainability initiatives within their own organisations. Reed & Mills (2007, p. 225) state that the “...factors driving demand preferences for detached housing are constantly changing and difficult to measure, and often deemed to be a complex bundle of attributes”. Their interviews of first-home purchasers in Melbourne suggested that approximately 30 per cent of the decision was based on financial issues, with other site-specific issues affecting the timing and choice. Eves & Kippes (2010) found that price and then location were the
two most significant factors impacting on house purchase decisions, followed by the house construction type. Bond (2011) conducted a mail survey of 2,500 Australians in several Australian capital cities during 2009 and 2010 and found that, in the case of low to medium cost actions, the main reason for not adopting them was due to cost.

As discussed in Chapter 7, there is a strong perception amongst most volume building practitioners interviewed that their customers either couldn’t afford to, or otherwise wouldn’t, pay for sustainability features if they cost more. However, as outlined in section 8.3.3, their assumptions tended to be based on making relatively minor alterations to their otherwise traditional products and processes, with little interest in reducing costs by otherwise departing from the status quo of typical volume house offerings, particularly by producing smaller or simpler homes. Also, their concerns are largely confined to the up-front costs, regardless of ongoing savings and benefits.

In addition to driving cost reductions by changing the status quo of housing, as discussed in 8.3.3, this research has identified that a range of different approaches to reducing cost barriers to sustainable housing should be simultaneously explored and implemented, discussed further below:

- Better integrate sustainability into house design and estimating processes to reduce ‘extra’ costs;
- Explore ways to make sustainability features less expensive;
- Make pricing more transparent to avoid potential for unscrupulous behaviour;
- Focus on life cycle costs rather than upfront costs and explain this clearly to customers;
- Build market recognition of sustainability features so that they add to resale value; and
- Where costs cannot be reduced, explore innovative financial approaches to support sustainability initiatives; and
- Ensure that any further housing-related regulatory reforms do not have unintended impacts of exacerbating cost-related barriers.

These are each discussed on the following pages.
8.3.4.1 Better Integrate Sustainability into House Design and Estimating Processes to Reduce ‘Extra’ Costs

The importance of integrating sustainability from ‘day one’ and rethinking house design to take into account factors such as passive solar has been previously discussed in Chapters 2, 5 and 6. Many of the interviewees, but particularly those from Company B, noted that sustainability features tended to add to the total capital cost of a home when ‘bolted-on’ to their standard designs, and it wasn’t until they actually completely rethought their designs that were able to come up with cost-effective solutions. For example, better solar orientation means that expensive window solutions such as double-glazing or extra shading may not be required; or good insulation can result in downsizing of heating and cooling equipment. Integrating sustainability within cost estimating processes also reduces the chance of features being later ‘value-managed’ out (touched on in Chapter 5).

8.3.4.2 Explore Ways to Make Sustainability Features Less Expensive

As mentioned earlier, in some instances it is difficult to avoiding adding upfront costs when using certain sustainability features. More insulation will always cost more than less (unless a more efficient alternative is used); double-glazed windows will almost invariably cost more than otherwise comparable single-glazed windows.

However, economies of scale can be a powerful way of reducing costs of products and technologies. To some extent, the increased demand created by such government incentives or regulatory requirements has already driven down the costs of some sustainability features. This was noted during the interviews to be the case for products such as double-glazed windows and rainwater tanks. Governments should continue to explore strategies to further drive down the costs of sustainability products and technologies, such as by supporting research and development programs, or resource efficiency programs, by manufacturers. They should also continue to explore ways to reduce the risks associated with product innovations (discussed in Chapter 4) which may also otherwise tend to drive up costs.

8.3.4.3 Make Pricing More Transparent to Avoid Potential for Unscrupulous Behaviour

Although this research has not specifically supported this claim, there can be a potential with sustainable products and services for opportunistic exploitation of well-intentioned customers. For example, Harford (2006) describes a common practice of charging a
premium price for fair trade coffee, which although seemingly well-intentioned is often significantly higher than the actual cost premium incurred for the few grams of coffee per cup. Instead, he argues that the fair trade coffee provides an opportunity for price discrimination – to identify customers who are willing to pay a higher price and provide better margins, while not scaring off the customers who are not.

Mirvis (1994, p. 83) puts concerns about the proliferation of environmentally-friendly products (such as cosmetics from The Body Shop or Ben and Jerry’s icecream) this way:

“Cynics say it is all crafty eco-marketing aimed at well-heeled consumers who want to salve their consciences while savouring top-of-the-line cosmetics, ice-cream and other ‘yuppie porn’”.

The comparison between actual costs of delivering sustainability features and the prices charged by volume builders were not explored in this research, but would benefit from future research to see if there are discrepancies, and whether these are more significant for sustainability features than others. It is not straightforward to propose how this might be implemented, noting that there would be limited incentive for private companies that were ‘exploiting’ sustainability to participate in such research. While it will not be easy to enforce such a strategy, particularly for privately-owned companies, there is at least scope to penalise organisations under fair trade mechanisms, and to publicly shame them, if they are found to make misleading claims about environmental costs. For example, in a recent well-publicised case involving an Australian bakery franchise chain, an internal memo was sent to franchisees advising them to put up their prices and blame the carbon tax. This resulted in national media coverage, embarrassing public apologies from the parent company, the resignation of the Managing Director and an investigation by the Australian Competition and Consumer Commission (Wright, 2012).

The development of credible rating tools, discussed in 8.3.2, will also partially assist with such a strategy by at least better allowing comparison of ‘apples’ with ‘apples’.

8.3.4.4 Build Market Recognition of Sustainability Features so that they add to Resale Value, and Focus on Life Cycle Costs Rather than Upfront Costs and explain this clearly to Customers

Financial incentives are not the only driver for adoption of sustainability features. Such features may be adopted irrespective of cost (to some extent at least) if they offer other perceived benefits. The Australian Bureau of Statistics (2011) found that approximately 70
per cent of Australian households installed insulation for comfort reasons and only 11 per cent claimed to have done so to take advantage of the offered rebate. It further identified that of households that purchased or replaced selected electrical appliances in the previous 12 months, energy star ratings were considered by around half of all households for refrigerators, freezers, dishwashers, washing machines and clothes dryers, and water efficiency ratings considered by almost half of all households purchasing or replacing dishwashers and washing machines. For example, the proportion of households with front load washing machines (which are typically more water efficient than top loading styles) increased from 13 per cent in 2005 to 31 per cent in 2011. It was not clear from this analysis whether this was driven by potential future cost savings from operations, a moral decision or something else. Given the relatively low cost of water, it is unlikely that it was purely financially-motivated. However, the use of energy and water efficiency to influence decision-making was reportedly considerably higher than other factors such as dimensions or brand name.

Further, there have been numerous claims over the years that in some instances consumers are willing to spend more for more environmentally-safe products (for example, Harris, 2007; Mirvis, 1994). Bond (2011), citing earlier Australian research by Connections Research (2008), found that a large number of respondents claimed to be willing to spend between $5,000 to $10,000 or more to add certain sustainability features to their new homes, particularly favouring solar hot water heating, rainwater tanks, better insulation, higher quality building materials and solar energy. In New Zealand, Eves & Kippes (2010) found that main areas of sustainability-related focus for people looking to buy a house were for northern orientation, roof insulation and the use of heat pumps. In Singapore, Ling & Gunawansa (2011) found that 72 per cent of their survey respondents claimed to be willing to pay more to own an environmentally sustainable home, but only an extra one per cent (it should be noted, however, that this research was quite limited as it involved interviews of undergraduate students intending to buy a home at some point in the future, and thus was quite conjectural in its findings). Features these students claimed they were most likely to pay more for were natural ventilation, provision of greenery, and water conservation.

Such observations need to also factor in the well-documented tendency for people to claim willingness to perform an action or spend money, and in reality do something different. For example, Keys et al. (2010, p. 191) claim that there is a considerable body of evidence confirming the difficulties “…in predicting environmental behaviours based on attitudes, especially specific behaviours from general attitudes”.
To overcome cost barriers to sustainable housing, it will also be particularly important that a long-term approach to cost be taken, with the life cycle costs accurately analysed and communicated, rather than just the upfront costs. Builders concerns about the cost of sustainability initiatives reflect a simplistic perspective on the overall financial outcomes and a failure to recognise that the ongoing savings can more than offset the additional mortgage costs, a fact which could be promoted at time of sale to overcome this barrier. A number of interviewees agreed with the proposition that better explaining payback periods for sustainability initiatives would likely increase customer adoption rates. This echoes the call from Ling & Gunawansa (2008) to better educate potential home buyers about lifecycle costs rather than simply focussing on upfront costs. However, it was also raised by one of the interviewees that effectively communicating such messages would be difficult given they felt that customers were being “bombarded” with information.

Unfortunately, the current house sales model is such that customers are charged a particular price for a house at a point in time, even though they use loans to cover most of this cost. They may or may not be prepared to pay additional costs upfront, irrespective of the potential cost savings down the track, dependent on factors such as whether they can actually afford to pay these extra costs or extend their loan; whether they intend to own the house or if not, if they can pass on costs to tenants; and whether they intend to own the house for as long as it takes for the full payback benefits to accrue; and whether future buyers might be prepared to pay a premium for sustainability features.

This raises the dilemma of resolving ‘split incentives’ between different parties such as landlords and tenants, widely addressed by the literature as a barrier to greater adoption of sustainability (for example, National Project Consultants and Exergy, 2009). It was suggested in some of the interviews that if a builder was not able to pass on their actual costs, and would not receive any payback benefits themselves, it would decrease the likelihood of adopting more expensive features. For example, as one interviewee noted:

“Things like solar hot water services, they add arguably a thousand or fifteen hundred dollars onto the cost of your house, and that's an issue for the builder, that's what they cost. The advantage of that for the customer is that you can justify that you’ll get that money back over, oh, five years or something you can pay it off. But that doesn’t help the builder in any way, shape or form.”
As another interviewee from a different company put it:

“…they come in and they look at a volume house that's sitting in a block in a certain way, on display, and all they're worried about is fitting that house on their block for as less as possible, and they just don't place importance on which way the sun is…from our point of view we wear it, because when the house is not on its best orientation we have to spend money on it to get it up to the 5 star level.”

The building practitioners did not actually use the term 'split incentives' but the issue seemed to be a concern to a number of them.

Again, the availability of robust, credible tools to support claims of sustainability initiatives (discussed in 8.3.2), coupled with research to support claimed life cycle costs and savings, will be critical.

8.3.4.5 Where Costs cannot otherwise be Reduced, Explore Innovative Financial Approaches to Support Sustainability Initiatives

The literature commonly suggests that financial incentives are one of the most powerful motivators for customers to adopt sustainability features. Raisbeck and Wardlaw (2008), interviewing Australians intending to build a new home, found that cost and financial incentives, whether short-term as subsidies or long-term as cost savings on future bills, are a key motivator for building a more sustainable new home.

Particular solutions may be made more financially attractive through, for example, subsidies or rebates. As discussed in Chapter 2, governments have already widely started to implement such strategies to promote greater adoption of sustainability features in existing homes, such as extra insulation, installation of rainwater tanks or conversion to more energy efficient hot water systems. The challenge is for government to design such programs efficiently to deliver maximum sustainability gains for the dollars, as well as to avoid problems such as artificially triggering boom and bust cycles within industry sectors (such as the collapse of many companies within the solar and rainwater tank industries as described in section 8.1).

An issue which would benefit from further exploration is that such rebate programs have not typically been offered to new home buyers, who are usually required to absorb any additional costs as part of their building approval process, with no financial support. As
mentioned earlier in this chapter, while there is some inequity in requiring new home buyers to absorb a disproportionate share of the additional costs compared to purchasers or owners of existing homes, it can also be argued that the long-term benefits for the life of the home outweigh this, and provided that there is a payback period and it is possible to borrow the money, in effect the initial owners are being ‘forced’ to invest in a profitable measure. (This still begs the question why the owners or purchasers of existing homes are not forced to do the same except during major renovations in some States). By linking incentives such as first home buyer grants to higher sustainability performance, there would be pressure on the building industry to include sustainability features at the lowest cost.

It is not only government which can provide financial support to encourage greater uptake of sustainability in housing. There is also enormous scope for the finance industry to have greater involvement. An interesting example of an innovative financial package developed in recent times with a goal of encouraging greater uptake of sustainability in housing is the goGreen home loan program offered by the bankmecu bank (formerly a credit union) in Australia. This loan, intended to encourage people to purchase, construct or renovate more energy efficient homes, offers a more competitive variable interest rate to finance homes rating 7 stars or more using the NatHERS energy rating scheme. In addition, the bank has a biodiversity offset program where it allocates an equivalent amount of land into its ‘conservation landbank’ in western Victoria for new owner-occupied homes. Finally, the bank allows borrowers to take a three to six month pause in repayments to purchase energy and/or water saving devices such as rainwater tanks, solar water or grey water systems (bankmecu, 2012).

8.3.4.6 Ensure that any Further Housing-Related Regulatory Reforms do not have Unintended Impacts of Exacerbating Cost-Related Barriers

With regard to regulation, it is critical that broader government financial policy relating to housing does not inadvertently worsen the cost barriers. It is also critical that policies and reforms not otherwise conflict with wider sustainability goals. For example, Farrelly (2012), describing the impact of the NSW Government’s $15,000 new first home owners’ grant and stamp-duty waiver to buy off the plan, notes that it is unlikely to actually assist first home buyers as it is widely understood in the industry to be inflationary, simply increasing house prices by a similar amount to the grant. She adds that because the grant is for new homes less than $650,000, buyers are either required to buy homes which contribute to urban sprawl and car dependence, or off-the-plan apartments. As she
suggests, because “…‘new’ includes both ‘substantial renovations’ and knock-down rebuilds, the first home owners’ grant is a direct blow to existing and heritage fabric, and, by extension, to sustainability. The fact that rebuilds are reliably bigger than what they replace only worsens this carbon footprint”. She goes on to conclude that a “…bigger favour to first home buyers…would be to foster a more modest idea of ‘home’, a richer idea of ‘city’…” (para. 30).

Other government policies designed to encourage and foster home ownership have also potentially had inadvertent negative impacts on sustainability. The fact that an owner-occupied home claimed as a principal place of residence is exempt from capital gains tax (the tax otherwise paid when a building is sold at a profit) means that home owners have a financial incentive to leverage the investment potential of their home, which does potentially provide an incentive to purchase something larger than might otherwise be required simply to meet household needs.

8.4 Chapter Overview

While Chapters 6 and 7 presented many of the thoughts and observations of the interviewees, this chapter has analysed them with a view to finding common themes. Specifically, by exploring the experiences of the builders, this chapter has outlined a number of strategies by which the adoption of sustainability may be encouraged (or forced) more widely across the housing industry (or ‘mainstreamed’), through the delivery of minimum standards. There are roles here to be played by the builders themselves as well as by government, industry associations and the supply chain. However, it is beyond the scope of this research to address in any detail which stakeholder groups should best undertake each activity. The findings of additional literature was introduced in response to themes which emerged from the interviews which were not necessarily anticipated at the commencement of the research.

With regard to mainstreaming sustainability, this research has confirmed that there seem to be three key ways by which this may be achieved: through expanded and more stringent regulation; by making it easier for builders; and by promoting greater customer demand.

The interviews supported claims in the literature that regulation is the most likely method to successfully achieve change. This research has found that there does not generally appear to be resistance to increased regulation provided that it creates a level playing
field and does not indirectly impede innovation or create perverse sustainability outcomes, of which a number of examples were discussed. It should also be noted that this view comes from industry leaders, rather than necessarily representing the majority view of the industry. The importance of allowing for realistic transition periods, to allow the wider supply chain to respond adequately, also emerged from the interviews.

With regard to making it easier for builders, it will be necessary to continue to explain both the ‘how’ and the ‘why’. It does appear from the experiences of the building practitioners interviewed that a deeper and more holistic understanding of sustainability is required, as well as a better understanding of why particular features are required. At the time of the interviews, it was not entirely clear that the building practitioners fully understood the underlying context for specific sustainability initiatives. This research has also found that sustainable housing tends to be understood very much in terms of minor tweaks to the status quo, an issue which will likely require considerable efforts to alter.

This research has highlighted that a there is unlikely to be a successful one-size-fits-all approach to providing information, technologies, systems, tools or training. Targeted approaches, for example tailored to individual trade areas, may be necessary, and it will be important for any training to acknowledge the commercial imperatives of the industry and the difficulty of leaving site during working hours for many. It is also likely to be more effective if the experience of the building practitioners is acknowledged and training approached from a collaborative perspective, rather than a traditional teacher-student model.

An unexpected insight was that examples of sustainable housing (such as display villages), not commonly discussed in the literature, seem to be particularly valued by at least some in the industry as a means of learning. Bias and credibility issues, particularly where information comes from manufacturers or suppliers, were raised as areas of concern, and there appears to be an important role here for both government and industry associations to play.

Finally, a key finding of this research has been a strong confirmation that builders do not believe their customers are significant drivers of sustainability, with limited interest and even less willingness to pay for sustainability initiatives. Although their perceptions are often based on little more than anecdotal evidence, whether this perception is factual or not does not change the fact that the perception itself remains a major barrier to greater adoption. Of concern is the fact that these perceptions were being expressed in 2005, a
time when public interest in sustainability was close to peaking. It would be a topic worthy of further research to see if such views have become even more entrenched in recent times where there appears to be a more general waning in public interest.

A number of strategies by which greater customer demand could be promoted were presented in this chapter. These would require action from a range of stakeholders including builders, government and industry associations. Such actions would relate to increasing customer understanding of both the ‘what’ and ‘why’ of sustainable housing; developing more robust methods of verifying sustainability claims; challenging the status quo of existing housing preferences; and providing financial incentives. Numerous examples of how the financial barriers could be addressed were described. An interesting observation of this research was that while building practitioners commonly expressed concern about affordability in a context of sustainability, they did not seem to have similar concerns when it came to upgrade options such as granite benches.

This chapter acknowledged that equally important to ensuring initial adoption and ‘mainstreaming’, is the need to ensure that adoption if successful and lasting. These themes will be explored further in the following chapter.
Chapter 9
Embedding Sustainable Housing

“It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change.”

- Charles Darwin

The previous chapter outlined a range of strategies to promote wider adoption of sustainability practices and technologies across the wider housing industry (that is, how to better mainstream it). It also noted that an additional two areas of focus are likely to be required:

- Strategies to ensure the effective and ongoing implementation of sustainable building practices; and
- Strategies to encourage further innovation and continuous improvement.

While it is one thing to decide to adopt practices and technologies intended to deliver sustainability outcomes; it is another thing for effective outcomes to be realised in practice. More so, even though an organisation may adopt certain changes to its practices, materials, suppliers or the like, these changes may tend to be ephemeral unless a number of other conditions are met to ensure the changes become the new norm. Further, to have any hope of moving towards true sustainability, we are likely to require ongoing innovation by builders to continuously improve their sustainability performance for quite some time.

This chapter explores these two themes, presenting a range of strategies which may be adopted by volume builders to deliver sustainability outcomes. It does so with reference to the varied experiences of the volume building practitioners who were interviewed.

9.1 Strategies to Ensure the Effective and Ongoing Implementation of Sustainable Building Practices

The concerns that green buildings do not always perform as intended were described in Chapter 4, and remain a barrier to its greater adoption, particularly if there are perceived to be cost implications. These concerns are legitimised by a range of findings, also
outlined briefly in Chapter 4, suggesting that there are many examples of green buildings that have not performed as designed in practice.

If volume builders are going to go to the trouble of changing their practices to make them more sustainable, then it is critical that their efforts are not wasted by building homes which do not actually deliver improvements to sustainability performance.

Accordingly, there is a greater need to better monitor the actual sustainability performance of homes as part of a feedback loop to improve the design process and the simulation tools. Tools such as energy audits or post occupancy evaluations are ways in which such data can be collected and usefully analysed. However, these are still not standard practice in commercial construction (Arnold, 2011), and are rare in residential construction. Barriers which decrease the likelihood of meaningful data informing future building design and enhanced simulation programs, are: the lack of peer review and transparency, driven largely by the commercial sensitivity of projects; the competitive ‘us and them’ mentality between building consultants; and intellectual property issues, with “…a fear that sharing knowledge too openly simply educates ones (sic) competitors” (Arnold, 2011, p. 488).

Sims and Meier (2012) suggest that recertification of buildings would help to facilitate the transition between new building and operational certification and to verify the relationship between design and performance, particularly to account for ageing equipment and occupant behaviour changes. However, as raised in section 2.3.1, there are a range of issues, particularly relating to household privacy, which would first need to be addressed.

In addition to the issue of getting a house ‘right’ (that is, effectively delivering the intended sustainability outcomes), there is the issue of how to ensure the continuity of these processes. Even after a building company or individual makes a decision to adopt particular changes to processes, materials or technologies, and subsequently implements such changes, there are still a number of conditions required to ensure that such changes are successfully implemented, both in the short-term and in a more lasting way. Asif et al. (2009b) argue that management systems tend to follow the laws of entropy, meaning that if left to themselves they “…gradually move towards chaos and disorder. To keep them in order effort/input is required” (p. 276). They suggest that this is largely because people resist change and will try to return to their comfort zones. Accordingly, the authors argue that the desired changes need to be ‘institutionalised’, that is, embedded in an
organisation’s routine operations and culture. Barlow (2000) takes this further, suggesting that routinising ongoing and repetitive business processes can stimulate innovation.

Emerging from analysis of the various interview results, and confirming some of the observations of barriers outlined in Chapter 4, it appears that three of the most critical aspects required to effectively ‘institutionalise’ sustainable building practices and increase the likelihood of their successful ongoing implementation are:

- Fit with core organisational values, norms and strategies;
- Management system/s to support institutionalisation of the changes and adequate integration with other relevant systems;
- Availability of adequate resources to support sustainability; and
- Presence of sustainability ‘champions’.

These are discussed further below.

9.1.1 Fit with Core Organisational Values, Norms and Strategies

It seems an obvious enough statement, and yet is not commonly covered in the literature, that there needs to be congruence between the focus on the organisation’s products (that is, more sustainable housing) and a broader sustainability strategic framework. Humans are always interpreting the layers of meaning in any activity, and are attempting to separate spoken and unspoken messages. Thus, there may be problems if there appear to be inconsistencies. As Kay (2010, p. 8) notes, “…[t]he consequences of our actions depend on the responses of other people, and these responses spring not just from our actions but from their perceptions of our motives for undertaking these actions” (emphasis added).

To be successfully adopted, sustainability needs to become part of an organisation’s collective ‘mindset’. As the former Chair of the US Green Building Council reportedly said:

“Green Building is a process. It starts with Marketing, then Stuff, then Tools, then Process and eventually it becomes a Mindset” (cited in Gadiel, 2007)

Once again, the experiences implementing health and safety management within construction provide some insights for sustainability initiatives. Bradley et al. (2010) demonstrated that management ‘talking the talk and walking the walk’ (in the context of
influencing the quality of work-life balance within a construction project) was a major contributing success factor to achieving goals. Also looking at health and safety, Wadick (2010) concluded that “improved…outcomes may be compromised if the cultural values, norms and social structure of the industry are either ignored or marginalised [by regulators]” (p. 108) and that “[e]nforcement strategies that purely target behaviours will have limited long term effectiveness if they fail to address the reasons why those behaviours occur” (p. 108).

Another health and safety-related example within the Australian construction industry, which provides some potential pointers to issues which may impact on widespread adoption of sustainability within organisations, was provided by Lingard et al. (2011). They noted that coworkers arguably have a greater ability to influence workers than managers and supervisors, as they are perceived to be work task ‘experts’ and are in closer proximity and larger numbers than supervisory staff. They also provide advice when there are conflicting requirements in roles, such as between productivity and safety. They argue that this influence is likely to be even more dominant in construction where the multi-tiered subcontracting system and semi-autonomous nature of work groups weakens the connections between those with formal power and the workforce. They provide examples from earlier research which has shown that young workers in male-dominated industries do not express concerns about health and safety risks so as to appear mature to their older coworkers; and that coworkers’ tolerance for risk taking is a significant predictor of risk-taking orientation among workers. Further, they cite the work of Melia et al. (2008) which showed that construction workers’ perceptions of coworkers’ safety actions and attitudes significantly predicted their own self-reported safety responses. The significance of this ‘peer pressure’ thus requires consideration by management wishing to impose particular practices or behaviours, and this is an area meriting further research within a context of sustainability.

These are not the only insights that research into safety culture can provide to those seeking to drive sustainability improvements, and this is discussed further in section 9.1.2.

The three case study organisations appeared to have embraced sustainability within their values, norms and strategies in slightly different ways. At Company B, building 5 star energy-rated homes as standard (and having been the first major builder to do so in Victoria) was core to their brand identity and marketing. This meant that energy rating was embraced throughout the organisation, but also potentially reduced the possibility of sustainability being conceived in broader terms. Company C, while perhaps being less
explicit about sustainability as a core value, had a Managing Director who was also Chair of the Board of the Green Building Council of Australia at the time of the interviews. This organisation also enshrined sustainability in both a divisional unit name and specific job titles.

At Company A at the time of the interviews, the interest in sustainability seemed to be largely confined to a specific, isolated project, namely the Cairnlea Ecohome. Its potential for demonstrating that the company was positioned as a ‘leader’, not just externally but internally, was noted by one interviewee:

“…[the Cairnlea Ecohome has] probably been good for [Company A] from a…leadership point of view. Trying to lead the market into another area, saying we’re having a go out here in volume building at trying to bring some of the elements of sustainability and environment into this volume building sector. So I think it’s been good from an external point of view. But also as an internal point of view in that we see ourselves as a leading edge company having a go at trying new things and marketing new things. Whether it works or doesn’t work. I think it’s good, it’s important that we do that. Particularly in areas where we really believe…that it’s the way forward.”

Aligned with the comments above, it can be argued that an organisation wishing to be widely perceived as offering sustainable products or services needs to ensure that there are corresponding internal sustainability programs designed to improve overall organisational sustainability performance. Such programs may take the form of ‘green office’ initiatives encompassing, for example, recycling programs, use of recycled paper, energy efficient lighting in offices and the like. This point was barely touched on during the interviews. Only one interviewee noted:

“At the moment, pretty much all our focus is on products as opposed to our actual…office operations, I don’t think there’s ever been anyone go through here and look at energy efficiency in the building, it’s all sort of on our products and things. Which probably makes more sense ‘cos you know, we’re churning out thousands of houses every year, so that’s obviously got a much bigger impact than some extra lights on in the office or something like that…”.

The risk is that, without a comparable level of effort on the organisation’s other operations (which might also extend to measures such as encouraging staff to use public transport or
carpool, or purchasing more fuel efficient fleet vehicles), there may be mixed messages, and even a perception of hypocrisy or greenwashing, both internally and externally.

9.1.2 Management Systems to Support Institutionalisation of the Changes and Adequate Integration with Other Relevant Systems

One of the resounding themes of the research outcomes was the acknowledgement of the critical role that adequate management systems and tools play in supporting sustainability initiatives. A somewhat unexpected finding was the degree of importance of a fit with other systems, particularly quality management and occupational health and safety management, as well as processes to manage supply chains. Surprisingly, this is not widely discussed in the literature on sustainable building, although there are exceptions, most of which are quite recent (such as Christini et al. (2004); Flint & Golicic (2009); Riccaboni & Leone (2009)).

Porter (1996) notes that management tools have gradually and almost imperceptibly taken the place of strategy. However, both are required. He asserts that while strategy is required to set a clear vision of where an organisation is heading and the broad steps by which it will get there, management systems are required to ensure there are enough processes, checks and balances in place to deliver strategy. The need for various management systems and tools to support ongoing implementation of sustainability was frequently raised during the interviews as a critical requirement for ongoing successful adoption. In particular, this research has revealed that adequate knowledge management systems are essential.

Riccaboni and Leone (2009) found that integration with traditional planning and monitoring systems, including both formal and informal controls, coordination across business units and decentralised structures were all key factors for successfully implementing sustainability strategies. More specifically, scholars including Christini et al. (2004) note that without proper integration of management systems (such as quality, environmental and health and safety) there is potential for redundancy of tasks and information collection and that opportunities to save time and improve risk management by streamlining documentation, data collection and auditing are potentially lost.

There are other significant reasons that integration with other management systems is important. One is that it makes life easier and less confusing for staff and contractors. Also importantly, this integration reduces the risk of sustainability being deleted or ‘value-
managed' out where it appears to conflict with other organisational goals, particularly cost reduction. As one of the interviewees put it:

“…[sustainability] just gets integrated, it just disappears into the way your business manages itself. If it’s not, and you say to the customer, well our houses are another $10,000 dearer because we’re sending things to a special landfill, then the customer is probably going to turn away from you. And that’s one of the underpinnings of this whole problem for the industry, is that price margin is so important.”

For sustainability to have the greatest chance of effective adoption by builders, and to maximise the opportunities at minimum cost, it needs to be incorporated into processes as integrally and as early as possible, rather than ‘bolted on’. In the words of one interviewee:

“…the thing we are doing differently now is that we’re starting to address it at day one rather than trying to add it on at the end, so it’s now being built into the process rather than bolted on at the end.”

Several types of management systems were identified by this research as offering opportunities to support the implementation of with sustainability goals. These are:

- knowledge management systems;
- integrated management systems (particularly environmental management);
- quality control/quality management systems;
- occupational health & safety management systems; and
- supply chain management systems.

These are each discussed further in sections 9.1.2.1 to 9.1.2.5.

9.1.2.1 Knowledge Management Systems

The concept of the importance of well-developed knowledge management systems in supporting sustainable building practices was another strong theme to emerge from this research. Knowledge sharing is a valuable strategic asset, supporting organisational growth and sustained competitive advantage, particularly in industries with considerable uncertainties and challenges such as construction (Love et al., 2011).
The domestic construction industry incorporates both tacit and explicit knowledge. While explicit knowledge, which is ‘know-what’ or ‘know-why’ is clearly defined or ‘codified’ (Gann & Salter, 2000) and often expressed. By contrast, tacit knowledge, typically associated with ‘know-who’ and to some extent ‘know-how’ (Gann & Salter, 2000) tends to be uncodified, gained in the process of learning-by-doing and mostly captured in people’s heads (Wadick, 2010). It is most effectively transferred implicitly, that is, largely independent of conscious attempts to learn it or explicitly knowing what knowledge is required, rather than by codifying it through formalised and documented systems (Love et al., 2011) and is passed on primarily through networks. Love et al. (2011) suggest that tacit knowledge is particularly valuable within the construction industry.

The problem with implementing sustainable building practices is that tacit knowledge is primarily useful when the relevant persons are present. When people leave an organisation, unless the information has been formally documented, or otherwise preserved through routines and organisational structures (Asif et al., 2009a), there is a high degree of risk that much of the valuable knowledge may be lost. Adequate knowledge management systems are important not only to support the initial implementation of change management through appropriate information exchange, but in particular, preserving the organisational knowledge when key individuals moved on.

Love et al. (2011) further distinguish between sharing explicit and tacit information (such as relating to techniques or products) and the sharing of insights or lessons learnt, which goes beyond transmitting information to including context. Insights rely more heavily on the interpretation of the receiver to ensure that knowledge is conveyed, and the effectiveness and usefulness of this process will depend on individuals’ differing experiences and mental frameworks (Love et al., 2011). Whereas sharing knowledge may be done through a range of communication methods such as meetings, electronic tools and the like, the sharing of insights is best performed face-to-face (Love et al., 2011).

Part of a process of embedding knowledge is through developing organisational routines, which function as a “...significant repository of knowledge; networks of routines form a memory in which organisational knowledge is embedded...[they] are also a means to integrate specialist knowledge into organisational processes and are more powerful (than directions) in knowledge integration” (Asif et al., 2009a, p. 786). Importantly also, as routines tend to be organisation-specific they are more difficult to emulate externally, supporting an organisation's competitive advantage (Asif et al., 2009a, p. 786).
In effect, sustainable building practices need to be integrated into organisational routines to institutionalise them and ensure their ongoing adoption. Routines, which use organisational resources to achieve desired outcomes, may be defined as “…the way things are done or patterns of activities” (Asif et al., 2009a, p. 786). They are “…firm, stable and consistent patterns for execution of activities which ultimately become ‘default operating procedures’” and include both “…[s]tandard operating procedures and patterns of behavior not explicitly guided by written values and policies” (p. 786). In some cases, institutionalising planned changes requires the establishment of new structures and routines (Beyer et al., 1997 cited in Asif et al., 2009a, p. 786).

One of the goals of knowledge management should be to break down a tendency for organisational 'silos', whereby knowledge is not shared across different teams which work, to some extent, in isolation from each other. This was an observation from the interviews and potentially creates a barrier to greater adoption of sustainability. For example, if the work and knowledge of the design staff are not well integrated with that of site-based or operations staff, they then may be given plans and specifications to build without necessarily understanding the thought processes behind them, particularly with regard to sustainability features. This is likely to diminish the potential for successful implementation, particularly if circumstances necessitate changes.

Feedback mechanisms (which are typically from a low level to a high level, such as from project departments and sub-firms to the firm level, as opposed to information transfer from a high to low level (Zeng et al., 2007)), are also an important component of knowledge management. However, Loosemore (1998) noted that appropriate information transfer and feedback provision can be more difficult in multi-level organisational structures. Within construction, the industry characteristics tend to render feedback more difficult than information transfer (Zeng et al., 2007). As discussed in Chapter 4, the project-based nature of the industry, with numerous temporary coalitions of staff and contractors, poses challenges to organisation-wide knowledge capture and sharing.

Even within organisations, barriers to sharing embedded knowledge can include self-interest and the fact that information remains the intellectual property of the organisation (Jarvenpaa & Staples, 2000, cited in Love et al., 2011). In some cases, there may need to be a promise of either tangible returns (for example, promotions, salary increases or bonuses) or intangible returns (such as reputation or status) (Dyer & Singh, 1998, cited in Love et al., 2011).
In addition to organisational barriers to information transfer, we could assume that barriers may also be behavioural (such as from conflicting incentive structures) or technical (such as inadequate systems to support collaboration). Many attempts to create, capture, store and share knowledge have been based on the use of information community technology (ICT) applications, but this does not necessarily deliver tacit knowledge, and can confuse information with knowledge. Instead, technology such as the internet should be viewed as an enabler for accumulating and creating tacit knowledge rather than the underlying mechanism for knowledge sharing (Love et al., 2011).

The challenges in knowledge management are further increased in the context of sharing between organisations. As outlined in Chapter 4, fear of sharing intellectual property with competitors is a risk in the construction industry given its fragmentation and the tendency for sub-contractors to work with a wide range of building companies. Knowledge management systems need to go beyond capturing the knowledge of internal employees and embedding this into standard practices. The fresh knowledge and insights brought in by external persons is also highly valuable, a point acknowledged by at least some during the interviews. As one noted, in the absence of adequate knowledge management systems:

“One of the problems has been that although it’s [sustainability] influenced the project, it might not have actually influenced the company that much because when we go to the next project, if we use different consultants, all that good stuff that we did on the last project doesn't happen again…”.

Tied in with knowledge management systems is the need for regular training to introduce and reinforce concepts. For example, a study of the degree of health and safety knowledge held by construction workers by Edwards & Holt (2008) found that those who had recently undertaken training exhibited the greater retained knowledge, regardless of their age group or where they lived. This led the authors to argue for the need for ongoing training in health and safety, such as at mandatory site inductions and during what are known in the industry as “toolbox talks”. A similar approach could be explored for training relating to sustainability aspirations and requirements.

The Cairnlea Ecohome project, which had a total duration of more than two years from conception to delivery and sale, clearly illustrated the risks associated with making significant changes to organisational processes without adequately documenting and
making readily accessible this information. As outlined in Chapter 7, it was acknowledged that most of the lessons from this project were only captured in the memories of the relevant staff. As one interviewee from Company A commented, “…it’s pointless unless you put it on paper. It’s no good to have it in someone’s head.”

By contrast, Company C’s well-developed sustainability knowledge management systems and their creation of a dedicated sustainability team, housed within the design department but sharing knowledge with teams across the organisation, appeared to be delivering benefits to the sustainability performance of that company. At Company B, although the processes seemed to be slightly less formalised, there appeared to be sufficient leadership from the top and interpersonal networks to ensure sufficient communication and knowledge sharing relating to sustainability.

9.1.2.2 Integrated Management Systems

Although stand-alone management systems will be discussed in the following sections, In practice, there is a trend of companies moving away from discrete management systems for quality, environmental and OHS management towards what are known as ‘integrated management systems’. Although they each have different emphases, and some areas such as occupational health and safety are driven more by legislative requirements than is, for example, quality, there are considerable synergies which can be realised through integration. Pheng & Shiua (2000) claim that potential benefits of integrating quality and safety management systems include avoiding duplication of effort and facilitating auditing (they did not discuss environmental or sustainability management). One downside they saw from integration was reduced flexibility as consensus would be required from a wider range of stakeholders before changes could be made.

Based on my own professional experience developing, implementing and auditing quality, environmental and occupational health and safety systems, I contend that the strength of a management system lies in the presence of all components, and strong interrelationships between elements, rather than an ad hoc grouping of random elements. It appears that this lack of tightly integrated management system effectively functioning like a type of ‘safety net’ led to some of the problems, or inefficiencies, in implementing sustainability changes throughout the volume building organisations.

The three relevant standards which lend themselves to an integrated overarching system are the international standards ISO 9001 Quality management systems – Requirements
and ISO 14001 Environmental management systems – Requirements with guidance for use and the specifications which were adopted by the BSI Group as a British Standard BS OHSAS 18001 Occupational health and safety management systems – Requirements. In Australia, the Australian/New Zealand standard AS/NZS 4801 Occupational health and safety management systems – Specification with guidance for use is more commonly used, and is closely aligned with OHSAS 18001. These standards are all written quite generically so as to allow them to be adopted by a wide range of industries and organisations across many countries.

Asif et al. (2009b) note that the absence of an international standard for certification is acting as a barrier to greater adoption of integrated systems. However, in fact there is an Australian and New Zealand guidance document entitled AS/NZS 4581 Management system integration – Guidance to business, government and community organizations (Standards Australia/Standards New Zealand, 1999). Further, both ISO 9001 and ISO 14001 contain tables at the back of the standards (Table A.1 Correspondence between ISO 9001:2008 and ISO 14001:2004 and Annex B Correspondence between ISO 14001:2004 and ISO 9001:2000 respectively) which list the broad technical correspondences between these two standards, to demonstrate the capacity for integration. OHSAS 18001 and AS/NZS 4801 also include similar tables at the end comparing the three standards (quality, environmental and OHS). Thus, it is debatable whether the absence of an integrated standard has really been the limiting factor claimed by Asif et al. (2009b), although there is likely potential to enhance communication of this possibility.

It is worth briefly exploring the content of these standards, as they provide some valuable pointers as to the structure, and elements, that might be required in developing a comprehensive management system which could be used to drive the effective delivery and continual performance of sustainable building practices and processes. The three standards are based on the idea of a similar cycle, namely a Plan-Check-Do-Act cycle which loops around repeatedly driving continual improvement. ISO 14001, which is arguably the most relevant standard to sustainability management, includes five core elements of policy; planning; implementation; checking and corrective action; and management review. Within these there are a number of sub-elements, illustrated in Appendix 4. This diagram broadly picks up the key points from the afore-mentioned tables at the back of the standards comparing the system elements.
ISO 14001 is the standard most closely aligned with sustainability outcomes and management. However, it was not raised by any of the interviewees, and appears to be rarely implemented within the housing industry.

9.1.2.3 Quality Control/Quality Management Systems

A somewhat unexpected insight from this research, both from the interviews and this researcher’s involvement throughout the design and construction process of the Cairnlea Ecohome, has been the observation that one of the most significant influences with regards to sustainability outcomes during the construction stage may actually relate to quality control.

Interestingly, however, quality control is not an area that is widely promoted within the residential construction industry. It is uncommon for housing companies to have certification to the international standard for quality management systems, ISO 9001, although it is commonly held within the commercial construction sector, in part because it is commonly required from contractors by large construction clients, particularly government as part of tender or prequalification processes (for example, NSW Government Finance & Services, 2012).

It is important to stress that there are strong potential benefits from considering sustainability within the context of a broader quality management system rather than a narrower focus on quality control. ‘Quality’ is defined in ISO 9000:2005 (Standards Australia/Standards Australia 2006, p. 7) as the “degree to which a set of inherent characteristics fulfils requirements”. Requirements are typically understood, certainly in the context of the ISO 9001 standard, to relate to customer satisfaction. A management system is a network of elements by which this is consistently delivered, whereas quality control tends to be a much narrower process, focussed more on checking.

The importance of quality control was repeatedly raised by interviewees from Company B, who noted that proper site management and a process of checking was essential to ensure that the final home actually delivered what was intended, such as that double-glazed windows were installed in accordance with their design locations and not interchanged with non double-glazed windows of the same size in another location, or that caulking was done adequately.
The process of observing from a distance the construction of the Cairnlea Ecohome over many months also provided a telling example of the need for stringent quality control to ensure procurement and installation of products in accordance with specifications. Environmentally-responsible timber sourced from sustainably managed forests had been specified during design, however, a site visit from a research team member part-way through construction revealed that the standard timber architraves and skirting boards used by the company, which were less sustainably sourced, had instead been installed. Because of the need to ensure the credibility of this project, these were subsequently removed and replaced with the specified items, creating wastage in the process. This incident does highlight the need for a management system which a) ensures clear communication about changes to usual practices with staff ordering materials and with site staff and b) facilitates checking conformance with specifications throughout the project.

On a related theme, it can be argued that a focus on workmanship may sometimes become more critical when considering sustainability than for ‘standard’ products. For example, some concern was expressed during the interviews about certain products such as the low VOC paints. Company A staff who had used these paints in the Cairnlea Ecohome claimed they provided an inferior finish (specifically, it was reportedly rough around the woodwork and required additional coatings). Meanwhile, as interviews with some Company B staff revealed, as there is a greater shift towards use of passive design principles, the importance of careful sealing of gaps and cracks to prevent unnecessary heat loss or gain becomes increasingly significant to the building’s energy performance.

Of the three organisations featuring as case studies, quality control came up most specifically without prompting amongst Company B interviewees. It could be speculated that this was because the earlier adverse publicity surrounding quality control issues in their Sydney market during the 1990s had been severely detrimental to the organisation (Dunlevy, 2009). This may have also been at least part of the reason for their subsequent heavy promotion of their 5 star energy rated homes.

The research of Emmitt et al. (2012) on lean thinking in construction, cited earlier, provides some guidance as to strategies for further increasing quality control processes within the construction industry. As part of their work, they explored the ways in which inappropriate workflow processes resulted in unnecessary waste and cost, and identified strategies to improve this. Specifically, they were interested in the situation whereby individual trades were not finishing work in a way that allowed other trades to follow on
unimpeded, thus resulting in additional time and cost required for the project. They noted a tendency on construction sites:

“...for the workforce to start work wherever and whenever it could. The result of this was that it often impacted on other trades and resulted in work that was not completely finished. It appeared that the workforce was completing just enough work to enable them then to start something else. There was then a need to return to complete work that could and should have been done earlier, which causes disruption to the flow of work and is wasteful” (p. 370).

They provided the example of a cupboard for the hot water cylinder, in which it is difficult for carpenters and decorators to undertake their tasks once the cylinder is installed. Despite the obvious implication that carpentry and painting should be complete before installation, they frequently observed that only sufficient works to allow the plumbers to start their component were undertaken. They noted what appeared to be an almost random fashion in which the trades went between tasks, and also a tendency to report tasks as finished to foremen when they were not, with inadequate checking of these claims by foremen and site managers. The tradesmen interviewed by Emmitt et al. (2012) did not reportedly appreciate why completing tasks and making ready for the next trade was important for projects, and were often defensive. Indeed, they often had a financial disincentive to finish off the last, non-profitable items of work. Tellingly, the authors note:

“They were of the opinion that the way in which they were working was common on all construction sites and was the correct way of working. None of those interviewed could see anything wrong in their behavior. Indeed, they were not ready to accept there could be a better way of building” (p. 375).

In part, the problems were caused by a lack of common understanding between site managers and trades as to what constituted “finished” work. These researchers employed an innovative approach, namely the use of visual management techniques (photographs showing finished and unfinished works) and facilitated workshops and group discussions, to develop a common understanding of the problem and the reasons for changing practices. This generally resulted in a significant improvement in both workflows and work quality, with around 20 per cent savings in labour time for the work packages. Given the lack of common understanding amongst the building practitioners interviewed for this research about what a ‘sustainable’ house is, there is potential for adoption of a similar approach to that described above to promote sustainability.
9.1.2.4 Occupational Health and Safety Management Systems

Although not commonly raised in the literature, the interviews also hinted at a strong potential alignment between sustainability and occupational health and safety (OHS) systems in domestic construction, at least in so far as the environmental compliance side of sustainability. For example, it was noted by one interviewee that good site housekeeping is an important OHS measure as it reduces the risk of slips, trips and falls on-site, and the potential for serious harm if someone does fall. Equally, good site housekeeping offers sustainability-related benefits such as reducing annoyance to neighbours and the potential for litter leaving the site, and complements improved waste management and recycling programs.

Over time, builders have increasingly adopted improved OHS practices such as wider use of personal protective equipment (PPE) such as steel-capped shoes, hard hats and reflective, high-visibility vests. OHS is also embedded in formalised processes such as, for example, the preparation of Safe Work Method Statements or Job SafetyAnalyses, which outline the tasks to be undertaken to complete a particular activity and outline the risks and required controls. However, as Wadick (2010, citing ACIL, 1996) notes, there is surprisingly little literature targeting OHS in the domestic housing industry, particularly given the high-risk nature of the work.

However, there are also some fundamental differences between sustainability and OHS. Adequate OHS management offers more immediate and self-interested benefits to the builder who does not want themselves or their staff to be hurt; because of potential for lost time off work, worker’s compensation costs or the risk of prosecution or fines. However, sustainability, at least moving beyond bare-minimum environmental compliance, may not offer a builder any direct benefits, which may instead accrue either to either the home buyer (who may or may not be willing to absorb any associated costs) or the wider planet in a more altruistic sense. This means that builders who have established OHS management practices may not necessarily have as well-developed sustainability processes in place. The potential opportunities for integration require further research.
9.1.2.5 Supply Chain Management Systems

A key component of quality, environmental and OHS management systems, which is so significant in the context of this research that it requires elaboration, is supply chain management. As discussed in Chapters 3 and 4, builders are heavily reliant on an appropriately skilled and cooperative supply chain, particularly of sub-contractors. These chapters also noted the challenges in managing such a fragmented group of operators has been previously touched on as a barrier to adoption of innovation generally, and sustainability more specifically. Emmitt et al. (2012) also suggested that this may be a barrier to the quality of products, as opposed to using a directly employed workforce (Emmitt et al., 2012).

Closely tied with the need for stringent quality control, the interviews made clear that there are considerable opportunities to enhance sustainability performance through collaborative supply chains.

Encouragingly, Flint & Golicic (2009) note that sustainability is becoming increasingly important in supply chains, particularly within highly competitive industries. It is not just the construction industry that struggles to promote sustainability throughout the entire supply chain. Flint & Golicic quote a New Zealand winery executive saying that dealing with supply chain partners who don’t get the ‘sustainability story’ “…is like a death of a thousand cuts” (2009, p. 853).

There is a critical role to be played by suppliers, in terms of ensuring that their products or services will help to support builders’ attempts to become more sustainable, but also to ensure that they have the necessary data and documentation to back up any claims and improve transparency. As raised in various interviews, while there were numerous examples of suppliers providing strong support with sustainability initiatives, this is an area still felt to be lacking overall.

However, there is an equally significant role to be played by the builders themselves, in terms of getting their specifications right and placing some emphasis on sustainability as a criteria influencing selection of suppliers and materials. It was noted by some interviewees that they needed to provide incentives to encourage subcontractors to embrace sustainability, with one commenting:
“…there’s got to be some sort of financial benefit to these guys to make them do it, or incentive some place that would make you want to do it, otherwise unless you had a moral conscience you wouldn’t do it.”

It was also noted that it was important that volume builders not financially penalise their subcontractors, by providing clear specifications that allowed their subcontractors to quote accurately, with the potential for support if additional costs had to be absorbed, as described by one:

“...if this means they've got to spend three hours more on site that they didn't budget for we review that and we give them the opportunity to do that, but generally we try and share the costs, because if we don't houses become unaffordable, unsellable, then no-one has work.”

The Cairnlea Ecohome project provided a good illustration of the potential for problems from inadequate supply chain management processes. As outlined in Appendix 2, HDPE pipes had been specified as a replacement for PVC pipes for internal plumbing. Discussion with Company A staff at site visits during the project revealed that they had difficulty finding plumbers who were experienced with the different process required to join lengths of piping, which was a heat fusion process rather than the use of a solvent to join PVC pipes. The result was that different plumbers had to be used, additional equipment had to be hired which was reportedly not readily accessible at the time, and the plumbing took longer, thus costing more to the project, than would have been the usual case. This was felt, by Company A staff who were spoken with, to be a barrier to future adoption of HDPE plumbing. The problem was compounded by the fact that there did not appear to be an understanding of why HDPE was environmentally preferable to PVC, and the perception was also expressed that as home buyers would not even realise there was a different product, nor necessarily value it, it would be difficult to recoup the increased costs. As one of the interviewees put it: “…it just, you know, drains in the ground, no one sort of thinks about it…”.

Another important role to be played here, as discussed in section 8.3.2, is for independent verification of supplier claims. Such independent verification systems are already in place but were not widely in use amongst the building practitioners spoken with.
9.1.3 Availability of Adequate Resources to Support Sustainability

The idea of providing adequate resources to achieve organisational goals is effectively encompassed under the discussion of management systems, as adequate resourcing is an essential criterion of the ISO 9001, 14001 and 18001 standards discussed earlier in this chapter. However, this issue is of sufficient importance to warrant reiteration. There is little point in developing management systems without sufficient resources available to successfully implement them. Resources are taken to include the availability of adequate financial and staff resources, as well as time, also known as ‘organisational slack’ or ‘slack resources’.

Numerous studies of innovation, both broadly, and specifically focussed on the construction industry, have shown a positive correlation between levels of innovativeness and the availability of slack resources including funds and time (Nam & Tatum, 1997; Rogers, 2003). Nam & Tatum (1997) do note, however, that slack resources are rarely permitted in the construction industry because of industry conservatism acting as a barrier.

Sufficient time is an important factor for the implementation of any significant change programs. This is true both for those who are managing the implementation of such programs, but also for supporters. For example, Halme (2001) notes that public fund providers supporting sustainability-related learning networks need to take a long-term orientation and provide funding over a number of years. She notes that “[s]hort-term funding has a tendency to lead to fragmentary results, and breed frustration towards possibilities of acting upon sustainable development at a local level” (Halme, 2001, pp. 112-113).

Certainly, the lack of time allocated to key staff supporting the Cairnele Ecohome project appeared to impede the outcomes of this project, as was outlined in Chapter 7. As one of the interviewees, who was trying to maintain ongoing involvement with this project despite a heavy workload focussed on other projects noted:

“I just realised for me to do what I was, you know my job was here to do, it was just impossible to do the [Cairnele Ecohome] project justice.”

This person also noted that the project would have been far more effective, and efficient, had a dedicated project manager been allocated to the project.
However, even in organisations where sustainability was relatively well-resourced, such as at Company C, some interviewees expressed frustration about their ability to get more actively involved in individual projects due to a lack of time.

**9.1.4 Presence of Sustainability ‘Champions’**

Aligned with adequate resources, the presence of dedicated ‘champions’ to drive initiatives through to completion is well acknowledged within the literature (for example, Barlow, 2000) to be a crucial element of successful change and knowledge transfer programs, by helping to foster organisational ‘memory’ of lessons learned. These points are both discussed further below.

Strong leadership by individuals is critical for driving effective adoption of any change. Nam & Tatum (1997) describe the importance of ‘champions’, enthusiastic and committed individuals who lead innovation processes, to ensure their successful adoption. The role of specific sustainability or environmental ‘champions’ in driving sustainability improvements within organisations by “…working within their companies to integrate environmental standards, appropriate behaviours, and social values into their business operations” was described by Chen et al. (2012, p. 373). They note that champions do this using various tools and techniques including networking and building of internal, strategic coalitions.

Nam & Tatum (1997, citing Arthur D. Little Inc, 1985) suggest that within the context of the construction industry there are three types of champions: the ‘technical champion’, who carries an idea from initial concept through to development into a viable product or process; the ‘business champion’, who provides a business framework for a technical idea; and the ‘executive champion’, who sponsors, protects and drives the idea at the highest level. These may be separate individuals who work together in an integrated way, or in smaller organisations, one person may fulfil all three functions.

Although champions may either have formal authority or may rely more on personal influence, Nam & Tatum (1997) found that having both high levels of technical competence as well as the power and authority to drive changes and overcome resistance was important.
Further, in their studies of successful innovations by a range of large construction organisations (which it should be noted did not include the residential sector) Nam & Tatum (1997) found that a high level of owner involvement in the project, including risk sharing, commitment to the innovation and leadership in project planning and execution, was critical to successful innovation (p. 268). However, they concluded that within the engineering and construction industry, it was also critical that the owner also had high levels of technical competence, which allowed them to overcome resistance resulting from the uncertainty associated with the innovation.

Another important function of an innovation champion is to act as a ‘gatekeeper’ of ideas and also to actively seek out technological information. Nam & Tatum (1997, pp. 265-266) cite the example of a construction Project Manager who “…organised pieces of available technology, brainstormed the details with fellow employees and convinced the owner regarding the benefits of the innovation despite the objections of the designer.” This person also regularly read from a wide range of specialty magazines to identify potential benefits of new technology, which the authors note “…represents a good example of success through the persistent collection of fragmented, obscure and seemingly trivial scraps of information – which is not usually regarded the job of a project manager.”

A similar concept discussed by Keys et al. (2010) is the role of ‘opinion leaders’ in driving adoption of sustainability-related innovations (similar to the concept of ‘change agents’ described by Rogers, 2003 and Thomas, 2004). These people do not always have to be in senior positions, and leadership can be informal. They further note that of the group referred to in diffusion of innovation theory as ‘early adopters’, there are influential individuals who act as role models for others in the social system. These people tend to have higher than average networks of interpersonal contacts, through which they communicate innovative ideas and practices.

Emmitt et al. (2012) worked with a small design and build contractor to explore in depth, and intervene in, quality control processes and the existing culture of ‘making do’ amongst staff and subcontractors. A research associate was based on the construction site for much of this research to make observations of live construction projects. The authors noted:

“…[b]ecause of the length of time the… Associate spent with the site personnel he became an accepted and trusted member of the organisation…Reflecting on the research it appears that without the constant presence of the…Associate to
provide leadership, it would have been very difficult to bring about the planned changes” (p. 380).

They further stressed that because of deeply ingrained habits of workers and managers on-site, constant effort, effective leadership and support is required to keep personnel focussed on delivering particular goals and to avoid the tendency for behaviour to revert back to old patterns. They also suggested that a site manager plays a valuable role in reinforcing a desired culture and providing leadership. This ties in with earlier comments about the need to institutionalise practices.

The interviews made it very clear that individuals acting as sustainability ‘champions’, or opinion leaders, had a significant influence in driving sustainability outcomes internally within all three organisations. However, the characteristics of these various ‘champions’, in terms of the types of roles they occupied, their educational background and motivations, varied widely.

In the case of having the ‘top’ person critical to successfully driving innovation, as per Nam &Tatum (1997), this was particularly evident at Company B. Despite having a less formalised structure to embed sustainability throughout the organisation, the impetus from the Managing Director, who appeared to be the organisation’s key sustainability ‘champion’, was enough to deliver strong outcomes. As mentioned, at Company C, their Managing Director of the time was also the Chair of the newly formed Green Building Council of Australia, also sending a strong message of top support for sustainability throughout the organisation.

Further, Company C appeared to have best formalised a broader support system for sustainability ‘champions’ to operate within the organisation. Through a strong personal interest in sustainability, the then-manager of the national design department had been able to influence its eventual transformation into the national Sustainable Design Department, encompassing not just housing design but also developing a broader strategic framework and management structure for sustainability. This group had then effectively enshrined the creation of a number of informal ‘champions’ through the creation of numerous voluntary roles of State Sustainability Coordinators. This had not only established a learning and support network across the national operations, but also ensured that a number of staff had both the legitimacy and also accountability for driving sustainability initiatives, while not needing to employ considerable extra resources. This
further improved the coordination and consistency across what had previously been quite a fragmented approach to sustainability across different departments and States.

Company C was also the only organisation at the time to have employed a dedicated sustainability professional with an environmentally-focussed university qualification. Undoubtedly, having this full-time expertise in-house provided considerable support for the planning and strategic initiatives that were underway. A Project Manager with a personal passion for sustainability, who had left the company before the interviews were conducted, was also frequently mentioned as an individual who had championed sustainability. It also became apparent that their national Purchasing Manager was driving positive sustainability outcomes by including it as a key selection criterion throughout major procurement processes. Although this issue was not explored in detail, it appeared that this was primarily out of a personal interest and commitment that had developed as a consequence of the learning about the issues through their involvement in organisational sustainability programs, rather than specifically to comply with the corporate agenda. Through this person’s national role, they were also able to influence State Purchasing Managers.

It is less clear who the sustainability ‘champions’ were at Company A. Arguably the main champion had been a senior staff member who was heavily involved in the planning of the Cairnlea Ecohome project but who had passed away during the course of the home’s construction and before the interviews were held. A similar level of senior support for the implementation of sustainability was not particularly visible for quite some time after. Other staff members who were involved with this specific project seemed to be involved in a fairly transitory way, with one person being moved across to focus on other projects and another key person from the marketing group leaving the organisation before the interviews were conducted. It was the Site Manager who ended up having the longest running active involvement with the project.

9.2 Strategies to Encourage Further Innovation and Continuous Improvement

A minimum standard of sustainability for new homes and major renovations has already been mandated through legislation in Australia, as has been the case with minimum energy efficiency standards for building envelopes and requirements for rainwater tanks or solar hot water systems in most States and Territories. This was presented in Chapter 2. Governments have also been able to mandate higher sustainability standards in some
high profile examples as a client to the construction industry, as was the case with the Sydney Olympic and Commonwealth Games villages. Additional to such 'sticks', many different 'carrots' have also been offered with varying degrees of effectiveness in terms of sustainability outcomes. This has included the use of incentive programs; initiatives to share information both through documentation and training; demonstrating and promoting examples to the wider industry, and allowing for testing and debugging of various practices and technologies (such as through the above-mentioned Olympic and Commonwealth Games villages).

This leads to the question that given the current, still largely superficial adoption of sustainability in most attempts to date, what would encourage the adoption of further sustainability-related innovations, beyond compliance and beyond simply keeping up with competitors?

Two mechanisms with significant potential to encourage volume builders to 'lift the bar' have been identified through this research. These are:

- Position sustainability as a source of competitive advantage; and
- Promote sustainability-focused learning networks, 'communities of practice' or related strategies.

Each is discussed further below.

9.2.1 Position Sustainability as a Source of Competitive Advantage

An industry is only likely to voluntarily further innovate and to raise the bar with regard to sustainability performance if it believes that there is a benefit in doing so. Nidumolu et al. (2009) argue that sustainability is increasingly becoming a key driver of innovation. Initially, this has been driven more to obtain the benefits of efficiencies resulting from adoption of sustainability, with numerous documented examples of more productive use of resources such as energy, raw materials and labour resulting from sustainability initiatives, as well as decreased waste and improved productivity (for example, Mirvis, 1994; Nidumolu, 2009; Porter & van der Linde, 1995). In the context of green buildings, there are similarly numerous claims of a wide range of benefits, as outlined in Chapter 2.

Positive associations between environmental management and financial performance have also been claimed by numerous scholars (for example Nidumolu, 2009; Paton,
However, these authors also noted that despite such extensive examples to the contrary, a prevailing view of an inherent trade-off between ecology and the economy still persists and needs to be overcome.

Extending the idea of sustainability simply offering benefits from improved efficiency, there is evidence that it can indeed result in a broader form of competitive advantage to organisations adopting it. For example, Chen et al. (2012, citing Chen et al., 2006), note that there is typically a positive relationship between green innovations and competitiveness, in part because they can improve corporate image, and in part because it can create an entry barrier to competitors. This may well be a point which should be leveraged in attempting to encourage organisations to continually strive to improve their sustainability performance.

Although much of the research to date into sustainability as a source of competitive advantage has been largely conceptual or has focussed on the advantage from being a first mover in the market (Flint & Golicic, 2009), a number of practical case studies from various industries, such as winemaking or event management, are starting to emerge (for example, Flint & Golicic, 2009; Henderson, 2011).

In these cases, sustainability has been seen as a powerful means of product or service differentiation (Henderson, 2011). Within the wine industry, the idea of ‘telling our story’ (namely the unique circumstances relating to the product or the people creating it), was an important part of this sustainability-related differentiation (Flint & Golicic, 2009). Harris (2007, p.59) notes that “[p]roperly targeted marketing is essential to successfully promote, differentiate and sell sustainably certified product in complex and competitive markets”.

However, as Flint & Golicic (2009) point out, relying on a product alone to provide competitive advantage typically results in only temporary benefits, and instead, companies need to build competencies obtained through their supply chain to create superior value relative to competitors. More complex and sophisticated systems for implementing sustainability may provide a greater barrier to entry by being difficult for competitors to copy.

However, a sustainability competency may only provide a differential advantage if it is relatively unique in the market (Flint & Golicic, 2009). By implication, some companies must excel and others must not for there to be any competitive position. In some industries, such as the New Zealand wine industry, Flint & Golicic (2009) claim that the
first mover advantages for leveraging sustainability are now largely lost. Indeed, as the example of the New Zealand wine industry has illustrated, the greening of a whole industry within a country through the adoption of the near-mandatory standardised sustainability program ‘Sustainable Winegrowing New Zealand’, by boosting the global export market, may assist with competitive advantage globally by boosting the export market, but does not necessarily help individual operators. Wineries were thus forced to adopt additional sustainability initiatives, such as carbon neutrality, to maintain competitive advantage. This dilemma may become an issue for adoption of sustainability by the housing industry, which does not typically compete in a global market, and thus has little scope for benefit from competitive advantage if adoption of initiatives across the industry becomes the norm.

This has important implications for discussion in a context of sustainable housing, as the idea of a minority of companies excelling in sustainable practice to some extent conflicts with the overall goal of driving wide-scale adoption of sustainable housing, whereby all builders, or at least the vast majority, need to be operating in a sustainable way. To counter this, there is a need for ‘followers’ to imitate market leaders in order to simply maintain market position. Builders will need to develop a sufficient understanding of sustainability to create their own market positions, and combine this with other competitive factors in the marketplace such as unique aesthetics, financial strategies and the like.

Porter (2008) notes that much discussion of competitive advantage takes quite a narrow interpretation of the term, typically framing it simply as competition between existing competitors, and as a form of product or service differentiation, such as through the establishment of a particular niche market or improved product. However, he argues that it is a considerably more complex concept than simply rivalry between existing competitors, identifying four additional forces shaping industry competition for profits. These are the threat of new entrants; the bargaining power of suppliers; the bargaining power of buyers and the threat of substitute products or services. The degree to which these forces interact determine how the economic value created by a particular industry is divided between the competing groups – that is, “…how much is retained by companies in the industry versus bargained away by customers and suppliers, limited by substitutes, or constrained by potential new entrants” (Porter, 2008, p. 86).

Building upon Porter’s work in exploring the potential to frame sustainability as a source of competitive advantage to the volume housing sector, it is useful to identify where the
greatest opportunities may be for companies seeking to maximise their competitive advantage within this industry. The following discussion of the five competitive forces supports this.

*Rivalry among existing competitors* is high within the volume housing sector, with competition often on the basis of price, which tends to have the effect of delivering low profit margins. This rivalry is primarily with other volume builders, but also with smaller house builders. As volume houses are built to regulated standards and are reasonably similar to each other, competition on price is increased. The highly cyclical nature of industry growth further increases rivalry. The limited diversity of customer groups also provides limited opportunities for builders to develop market segmentation strategies as a way of competing against competitors.

The housing industry is generally considered to have low entry barriers, increasing the threat of new entrants, further placing pressure on volume builders to compete on cost. This is due to relatively minimal government restrictions to entry; the typical use of subcontractors minimising the need for tools or labour forces; and upfront capital requirements often being kept low by building on another’s land. Because of the ad hoc nature of purchasing (meaning that customers typically only buy houses quite infrequently), customers have low switching costs, at least until contracts have been signed (as they do not get into long-term agreements with their suppliers or have to make any significant changes to use a different builder), meaning they can use rivals or new entrants relatively easily. Retaliation by incumbents is a factor that may discourage new entrants to this sector, particularly during market ‘bust’ periods, but given that price margins are already low, this is not as easy for the incumbents to orchestrate as it might otherwise be. However, new entrants using different models, such as computerised design, manufactured housing and modules or new building materials can also potentially challenge the existing industry, while offering improved quality control, enhanced productivity, reduced construction time or other market advantages.

The power of suppliers is quite different for volume builders to the situation of most small house builders. Given the volume of purchases made by many volume builders, particularly those with national operations, it is often the builder who holds more power. For example, Company C were able to negotiate quite significant changes to their purchasing conditions and products, demanding certain water efficiency criteria for base model tapware, or that suppliers take back waste. They are more likely to hold power over smaller manufacturers, such as suppliers of double-glazed windows, rather than suppliers
which are large multinationals supplying multiple industry sectors, such as manufacturers of steel or concrete. Volume builders certainly may experience some significant switching costs should they choose to change products, for example switching from timber framing to steel framing, or to use an example from this research, from PVC pipes to HDPE pipes for plumbing. This fact gives the suppliers a slight advantage. Suppliers are also highly unlikely to integrate forward and start building houses to compete with builders, which might otherwise be an additional source of pressure.

**Power of buyers** – as discussed in Chapter 4, in the case of volume housing, customers are numerous, fragmented, with generally limited experience in buying houses and relatively low levels of technical or contractual knowledge, thus increasing the volume builder’s advantage. They typically only purchase a small number of products (one) at any time relative to the builder’s offerings. The limited amount of differentiation in project homes can make it more difficult for customers to compare rivals’ products. Further, although threat of new entrants remains, in a particular location there are a relatively limited number of suppliers that customers can ‘play off’ against each other. Although buyers can integrate backwards and build a home themselves (as owner-occupier), this is relatively rare. However, customers are also likely to be quite price-sensitive given that the purchase typically represents a significant proportion of their budget, encouraging them to shop around and this slightly increases their power.

The **threat of substitutes**, that is products or services which perform a similar function but by a different means, is possibly, and perhaps not intuitively, the strongest force that volume builders need to counter to ensure their competitive advantage. Potential volume housing customers may also choose to buy an existing, older home which they can occupy immediately, or they can choose to have a custom-designed (typically by an architect) and custom-built home. They may also consider an apartment, or other form of accommodation, over a detached house. The option of staying put in one’s original home, and not buying at all, is also a substitute, particularly while population growth is flat. While a custom-built house is probably the closest substitute, it is typically much more costly than a volume house, reducing its threat. Porter (2008) notes that industry sectors facing serious threats of substitute products or services need to distance themselves from the substitute, such as through marketing or improved performance, if they are to maintain profit and growth potential. To counter the threat of the substitute of staying in the existing home, volume builders emphasise the attractive features of the new home and add additional desirable features (al fresco dining areas, multi-media rooms and granite benches and the like) as outlined in Chapter 3. Once buyers have purchased a house
though, costs such as government stamp duty and agent commissions make switching costs reasonably high, adding another burden to builders of new homes.

The issue of sustainability offering a potential source of competitive advantage was a theme that was raised by staff from all three case study volume builders. In some cases, the goal was primarily in improving efficiencies, for example, Company C considered that the ability to deliver efficiencies through optimal use of land in larger scale developments potentially offered their organisation a source of competitive advantage.

In the case of Company B, they had seen offering 5 star energy rated homes as standard, while keeping costs low, as a market niche delivering competitive advantage. Companies A and C both appeared to see the opportunity to improve working relationships with key planning and regulatory stakeholders as a source of competitive advantage. For example, the Cairnlea Ecohome was, at least to some extent, an attempt to further develop competitive advantage by providing a niche product and, as one interviewee described it, “…open[ing] the eyes of management in the sense that…we need to look at the whole scenario, so that we can be ahead of our competitors in design.”

9.2.2 Promote Sustainability-Focussed Learning Networks, ‘Communities of Practice’ or Related Strategies

As discussed in Chapters 3 and 4, construction projects are typically complex, both with regard to the numerous project stakeholders and the objectives. As Kay (2010, pp. 8-9) notes “…problems …are rarely completely specified and the environment in which we tackle them contains irresolvable uncertainties” and:

> “…complex objectives tend to be imprecisely defined and contain many elements that are not necessarily or obviously compatible with each other…we learn about the nature of the objective and means of achieving them during a process of experiment and discovery” (Kay, 2010, pp. 3-4).

An interesting opportunity which has already been used to promote greater uptake of sustainability in various sectors has been the establishment of focussed learning networks (for example, described by Halme, 2001, in the context of tourism) or communities of practice (CoPs) (which Love et al. (2011) describe within the context of the construction industry, providing a specific example relating to climate change amongst others).
Despite this, it is not a straightforward task to encourage people to share knowledge, particularly those who do not see each other regularly as is common in construction, and it can be particularly challenging to build stable partnerships and learning networks (Schaafsma, 1997). Informal small groups such as CoPs are most effective at promoting the frequent interaction which supports the transfer of implicit (tacit) knowledge. Further, the establishment of social networks can motivate sharing, and encourage people to work harder or persevere against adversity, due to a sense of moral obligation or social ascription (Love et al., 2011).

Love et al. (2011) suggest that integrated project information systems can be developed requiring members to document their decision-making and activities, which may well require the redesign of work processes, organisational structures and existing information systems. Clear rules of engagement are required, as are the commitment of senior management and the provision of adequate resources (Love et al., 2011). Finding the right blend of members is important, as it is important that people have equal levels (but not necessarily the same types of) knowledge. A risk to be managed with CoPs, however, is that members can become repeatedly inundated with requests for information resulting in workload saturation (Love et al., 2011).

There is also a role for governments and industry clients to play in encouraging construction organisations to form alliances or CoPs. Halme (2001, pp. 112-113) notes that it is best that the establishment of any learning networks takes a long-term view, as she claims it does take time for these networks “…to become adept at explicating tacit and embedded knowledge to one another, and develop the network so it is fit for creating ‘large wins’”.

Love et al. (2011) even go as far as to recommend pulling together various CoPs to create what they call ‘champions of practice’ which could provide advice relating to accumulated ‘best practice’ strategies.

Another potential strategy is the development of sustainability-focussed mentoring programs. Mentoring is a “developmental and supportive relationship between a senior, more experienced employee and a junior, less experienced employee” intended to transmit both formal and informal knowledge (Hoffmeister et al., 2011). Although the concept underpins the model of trade training for apprentices, which is effectively a mentorship model, there has been limited research exploring mentoring in the context of the construction industry, which has a number of differences to more conventional...
arrangements, given the constantly changing work environment and teams that are formed (Hoffmeister et al., 2011). It is beyond the scope of this research to explore this possibility in any depth, other than to identify it as an area of potential which could benefit from further research.

9.3 Chapter Overview

While Chapter 8 dealt with how to mainstream sustainable housing, this chapter has described the next level of activity required for lasting change – specifically, strategies to ‘make it stick’ and then continuously improve performance through further innovation.

With regard to how to ensure that adopted changes are maintained for the long term, it is important to first ensure that houses actually deliver on their intended sustainability outcomes in practice – for which monitoring and feedback are critical. It is also important that sustainability initiatives and processes be institutionalised within organisations, by making them routine. To do so will require the following:

- That such changes fit with core organisational values, norms and strategies – that is, that contradictory messages are not delivered and that management ensure they ‘walk the talk’. An insight from this research is that while focussing on the housing product is important, it seems likely that it is also important that sustainability be adopted within the organisation more broadly, such as through adopting green office programs simultaneously to reinforce messages on sustainability;
- That processes are integrated into existing management systems. A key finding of this research has been the importance of fit with other management systems covering areas such as knowledge management, quality control, health and safety and supply chain management;
- That adequate resources are provided to support sustainability initiatives. This appeared to be one of the most significant differences between the three case study organisations featured in this research, and certainly appeared to be a major factor behind some of the problems experienced with the Ecohome project; and
- That there be sustainability ‘champions’ to drive initiatives across the organisation. As a range of the interviewees of diverse backgrounds appeared to adopt this role to some extent, and this factor not explored in great depth, no specific correlations can be drawn from this research about the types of roles best suited to being champions (for example, whether being very senior is important).
Once changes are institutionalised, it is then important that a process of continuous improvement be implemented and further innovation encouraged. This research has confirmed that all three organisations seemed to believe that sustainability offered their company a source of competitive advantage, and the literature on how sustainability might be framed as a source of competitive advantage to the industry more widely was discussed. Also, the literature suggests that further innovation may be supported through mechanisms such as Communities of Practice to share and build knowledge. However, this was not a point commonly touched on in the interviews, and thus was not explored in depth.

The following and final chapter revisits the research questions and provides some concluding thoughts. It also builds upon some of the themes discussed in this chapter to touch on ways in which sustainable housing may be pushed outside of its current paradigm and how it may need to evolve in the future. Finally it discusses some ways by which organisations might best respond to these challenges.
Chapter 10
Concluding Remarks and Future Opportunities

"The significant problems we face cannot be solved at the same level of thinking we were at when we created them"
- Commonly attributed to Albert Einstein

The focus of this research has been on ways of adapting volume housing to make it more sustainable, and the associated role of builders. Although the uptake of such practices by this industry sector is only one part of the larger problem of transforming Australian housing stock, it is one with potential for considerable influence. By finding ways to effectively influence and motivate volume builders, as the producers of the greatest proportion of new housing stock, there is potential to not only enhance the sustainability performance of many new homes, but also to influence the wider housing industry through provision of examples and economies of scale reducing costs. The experiences of the three case study organisations featuring in this research have provided a wealth of material to guide such approaches.

It was noted throughout this thesis that a key barrier seems to be that the building practitioners spoken with still largely seem to perceive sustainable housing as simply involving some minor tweaking of the status quo. After summarising the key findings of this research, this chapter then identifies some more radical opportunities for future sustainable housing requiring further exploration and research. Although rarely raised during the interviews, these have emerged from the literature review and the analysis of, and reflection upon, the interview outcomes.

10.1 Directions provided by the Research Questions

The contribution that this research has made to the body of knowledge on sustainable housing is to explore and distil some of the key perspectives held by Australian volume builders. This research was largely exploratory in its approach given the limited literature which existed on this topic at its commencement.
This research had the goal of answering the following research questions:

- How have Australian volume builders responded to the challenge to build more sustainable housing?
- What can we learn from their experiences to better promote and support ongoing effective uptake of more sustainable housing within the industry?

The first research question has been answered by documenting examples of a range of sustainability initiatives being undertaken by three large volume building organisations operating in Melbourne, Australia, particularly in Chapter 5. This research also captured, in Chapter 6 and 7, the perspectives of the building practitioners within these companies about their experiences and learnings to date. These learnings cover things that have been working well for them with regard to sustainability, the factors that are not helping (or even hindering) their efforts, what is needed to help further and what has been flagged for future effort but was not yet underway. This is a significant contribution to the literature as such views are rarely documented in the public domain and help to fill a gap.

One of the key findings of this research has been that while there is evidence of numerous, diverse initiatives being adopted, these tend to reflect a quite narrow interpretation of sustainability with an emphasis on the environmental aspects, particularly energy and water. The majority of leading initiatives, at least at the time of the interviews, had been aimed mostly at keeping just ahead of regulatory requirements rather than attempting to genuinely rethink how we consider housing. In fact, a perceived criterion of success seemed to be specifically not dramatically altering their standard offerings. This is unlikely to result in the magnitude of sustainability performance improvements which our heavily stressed ecosystems and social systems require. This point will be discussed further later in this chapter.

With regard to the second research question, a wide range of lessons can be drawn from these builders’ experiences to better promote and support ongoing effective uptake of more sustainable housing within the industry. These were explored in some depth in Chapters 8 and 9, considering not only how to increase initial uptake, but also to ensure that it is effective, lasting, and continues to improve.

This research has confirmed that there are a number of issues currently impeding efforts to boost sustainability within the industry. Beyond specific challenges associated with the
industry structure itself, such as its fragmented, competitive, price-sensitive and sometimes adversarial nature, there are also wider challenges that relate to implementation of sustainable development more generally. Identifying the issues is the first step to resolving them, although it is beyond the scope of this research to do much more than flag them for future research to explore in greater depth. Other challenges experienced by volume builders include ongoing confusion about, and inconsistent interpretations of, the meaning of sustainability, both in general terms and certainly within a practical, housing-related context. There is also the very significant issue of existing paradigms which mean people frame solutions within their past experience and the existing context. This is discussed further in section 10.2.

More effective uptake of sustainable housing will require not only measures to promote its uptake in the first place, but also strategies to ensure that its adoption is effective and lasting. The first of these points was described in detail in Chapter 8, while the latter was covered in Chapter 9.

It is acknowledged that there are many stakeholders apart from the builders, who influence such outcomes. This research supports prior claims that the supply chain is critical to driving sustainability initiatives, and that there is an important role for government, in its capacities as a regulator, an educator/enabling agent and as a client. Industry associations also have a more proactive role to play in driving change. Finally, customers will also need to demand sustainability more than they have done to date. Without such stakeholder buy-in, successful widespread adoption of genuinely sustainable housing is unlikely. It is unreasonable to pin all of the expectations onto individual builders to drive the degree of changes required to address the sustainability imperative, and yet there is still a tendency for this to happen.

With the goal of stimulating greater initial uptake of sustainable practices across this industry, a number of strategies should be applied by the various stakeholders with potential to influence the processes. These include to:

- **Expand regulation**, which is recognised by builders as being vital to forcing change and, significantly, creating a level playing field for them. This is a key role for government;
- Support and assist the builders through mechanisms such as *more effective and accessible information sources and tools, training programs and tangible examples* — a role which can be played by government, suppliers and industry associations; and
• **Promote greater customer demand.** Customer demand may be stimulated through a range of mechanisms including increasing customer awareness; developing robust, credible and accessible methods of verifying sustainability claims; and significantly, by challenging the status quo with regard to consumer aspirations and expectations for housing features. Provision of financial incentives, or the implementation of other strategies designed to reduce the strongly perceived cost barriers associated with sustainable housing, will also be critical. Promoting this demand is primarily a role for government, but with support from industry associations (with programs such as the HIA GreenSmart program being an example) and, to some extent, suppliers. These were discussed in depth in Chapter 8.

While it is one thing to encourage immediate uptake of ‘sustainability’, it is another matter for it to be effective and ongoing. Like going on a crash diet to lose weight, short term outcomes can quickly be eroded without sustained effort. To extend this analogy, sustainable housing cannot be a fad or quick-fix; it is the metaphorical equivalent to adopting a long-term healthy diet and exercise regime.

To ensure that outcomes are effectively delivered, it is important that systems incorporate feedback mechanisms to monitor actual performance, compare with the design intention, and use the outcomes both to inform future design changes and also the rating tools.

To ensure that outcomes are realised in an ongoing manner, it is important that any changes or strategies:

• Fit within organisational values, norms and strategies, without which it will be a relentless struggle;
• Adequately integrate within existing management systems (which may cover quality, environmental and health and safety), as well as knowledge management systems and adequate supply chain management mechanisms to increase the degree of ‘institutionalisation’ of the changes;
• Ensure the provision of adequate resources to support changes; and
• Ensure the presence of sustainability ‘champions’.

Without adequate consideration of all of the above points, any changes are unlikely to be successful in a lasting way.
Finally, there is an important role to play in encouraging and supporting ongoing innovation and continuous improvement with regard to sustainability. This can be done in at least two ways (as elaborated in Chapter 9):

- By ‘rebadging’ sustainability more positively as a *source of competitive advantage*, as opposed to either something driven by guilt or fear of legislative penalties. However, noting that a niche is the point of competitive advantage which is counter to industry-wide adoption, there is somewhat of a dilemma in also trying to mainstream sustainability practices and techniques. As the niche expands, pressure flows onto others to conform, or experience a negative impact. Increasing support and awareness also underpins incorporation into codes of practice, regulation and the like; and
- By promoting sharing across the industry through *learning networks or communities of practice*. While challenging to implement, this is critically important. Training by suppliers about innovative solutions, complemented by incentives and/or regulation and provision of effective training infrastructure can facilitate learning.

The strengths of the research method adopted were that it allowed for wide-ranging discussion of a range of issues with a small pool of volume building practitioners, allowing a broad range of issues, barriers and strategies to be drawn out in detail. The use of case studies was helpful in documenting activities and experiences which would otherwise not be easily accessible in the public domain.

A key limitation, however, was that the small sample size, and the research design, did not allow for any meaningful quantitative conclusions to be drawn. It was also difficult to draw out reliable correlations, for example how particular roles held, or educational backgrounds, influence perspectives on sustainable housing. The field will benefit from future research focussing on both of these areas to extend the findings presented here.

In earlier sections I have commented on the complicated nature of the development and implementation of this research project, and it is apparent that with a clearer and more contained project a more rigorous approach to content analysis could have been adopted. This could provide even more certainty that key themes had been identified for the research. Replication of the research, or in similar projects would provide scope for future researchers to design the work around a structured content analysis.
Another limitation of this research was its extended duration, which meant that the field continued to evolve after the interview data had been collected and analysed. Although this is always a challenge with any research, its effects were more pronounced by the time that elapsed.

While insufficient data has been gathered in this research to allow any formal conclusions to be drawn, a high-level observation and anecdotal evidence suggest that in reality, the field of sustainable housing has not evolved as significantly since the interviews were conducted in 2005 as might have been hoped. Indeed, the backlash against sustainability described in Section 2.2 is still considered to exist to some extent.

A major outcome of the research has been to provide a beginning to understanding the issues associated with implementing sustainability in the mass housing industry in Australia. Through this we have ‘scratched the surface’, and clearly there is much more to understand. This could begin by replicating or adapting the semi-structured interviews that were held for this research, with the same organisations or others, to create a longitudinal study.

Despite the fact that there may be some backwards steps in the adoption of sustainability more broadly, an assertion which is beyond the scope of this thesis to explore in any further depth, there have also been a number of interesting conceptual developments of relevance to sustainable housing in recent times. These were not presented in the early chapters of the thesis because many of the themes were not widely discussed at the time the literature review was being conducted and research design being developed and implemented. Nonetheless, they are presented briefly in Section 10.2 as they are also issues which future researchers of sustainable housing in Australia may wish to consider and explore more fully.
10.2 The future of sustainable housing?

This research has focussed mainly on incremental changes to existing construction practices, materials and technologies. However, a number of scholars argue that in fact an entire paradigm shift in construction is called for (Birkeland, 2008; Rees, 1997; Woolley, n.d.). While not emerging directly from the interviews with the builders conducted for this research, some interesting emerging ideas have been briefly captured here to provide additional ideas for future research to build upon the work presented here.

Birkeland (2008) notes:

“Achieving sustainability (by any definition) will be a complex, multidimensional challenge. It will involve public engagement, debate, education and a new ethic; new forms of governance and conflict resolution; family planning and support; new economic institutions and management frameworks; basic changes in public planning, policies and priorities; and empathy and compassion...they all need to progress together in virtuous cycles” (p. 4).

The UK-based Royal Institution of Chartered Surveyors (RICS) (2008) also supports the need to replace the ‘vicious circle of blame’ within the construction industry (outlined in Chapter 4) with ‘virtuous loops of feedback and adaptation’, as illustrated in Figure 11.

Figure 11 – Virtuous loops of feedback and adaptation (Royal Institution of Chartered Surveyors, 2008)
This alternative model would see every stakeholder placing importance on sustainability and taking responsibility for encouraging it within their sphere of influence, rather than seeking to blame others for perceived gaps.

Such an alternative is consistent with Birkeland’s (2008) suggestion that the construction industry needs to transition towards something she calls ‘positive development’, which essentially means leaving the ecological situation better than before the development. Such development would expand both the ecological base (ecosystem goods and services, natural capital, biodiversity and habitats, ecological health and resilience and bio-security), and the ‘public estate’ (the substantive democracy that ultimately depends on equitable access to the ecological base). It would also increase human health and viability, enhance urban space both for people and natural processes, involve a transformation from fossil-fuel driven to solar-powered infrastructure and help to correct imbalances in power and wealth. Significantly, it would also increase life quality and choices available to future generations.

Taking an even broader view, Hawken et al. (1999) propose that a fundamental rethinking of the structure and reward system of commerce is called for. They suggest that to do this, we need to not only consider radical improvements in resource efficiency or productivity (the typical focus of much discussion of sustainability), but to adopt an additional three principles in an integrated and mutually reinforcing way. These principles are biomimicry; a service and flow economy; and investment in natural capital. The four principles are discussed briefly below. Apart from resource efficiency, the others appear to be rarely considered by volume builders and would benefit from future research.

10.2.1 Radical Resource Productivity

This principle is based on using natural resources such as energy, water or other materials, much more efficiently while producing the same utility or work. The associated benefits are slowing resource depletion, lowering pollution and providing a basis for increased worldwide employment. While this is arguably the most commonly focussed upon of the four principles in most discussion of environmental sustainability, Hawken et al. (1999) note a caution if efficiency is pursued as a goal in isolation of the other principles. This is because there is still a risk of “…overwhelming resource savings with even larger growth in the production of the wrong products, produced by the wrong processes, from the wrong materials, in the wrong place, at the wrong scale, and delivered using the wrong business models. With so many
wrongs outweighing one right, more efficient production by itself could become not just the servant but the enemy of a durable economy” (Hawken et al, 1999, Preface). This phenomenon has been labelled the ‘Jevon’s paradox’, and was described by Polimeni & Polimeni (2006), who argue that complex systems tend to adapt quickly to changes and as a resource becomes more efficiently produced, and therefore more affordable, current technology will be used more or new technology will be introduced with more options and features. Examples include more roads encouraging greater use of cars, further worsening traffic congestion (Newman, 1991, cited in Polimeni and Polimeni, 2006) and the associated socio-environmental costs such as air pollution, health impacts and the like. In the context of housing, as the home building process has become more efficient (particularly financially), houses tended to get larger until very recently.

Considering volume builders, an example of radical resource productivity might be using a combination of approaches including strong passive solar design and promotion of daylighting; good insulation and sealing of air leaks; coupled with reducing the size of a building; to significantly decrease the amount of energy required to keep the house comfortable.

10.2.2 Biomimicry

Biomimicry is the idea of redesigning industrial systems using the ways in which biological systems work, with continuous closed cycles and significantly reduced toxicity, as a source of inspiration. It imitates biological and ecosystem processes to manufacture chemicals, materials and compounds, with processes which use minimal inputs, lower temperatures and enzymatic reactions rather than traditional mechanical and petrochemically-driven industrial processes. The concept came to prominence when Benyus (1997) published a book by the same name.

The idea is based on observation of a long history of evolution. As Hawken et al (1999, pp. 15-16) note, “...spiders make silk, strong as Kevlar but much tougher, from digested crickets and flies, without needing boiling sulphuric acid and high-temperature extruders. The abalone generates an inner shell twice as tough as our best ceramics and diatoms make glass, both processes employing seawater with no furnaces. Trees turn sunlight, water and air into cellulose, a sugar stiffer and stronger than nylon and bind it into wood, a natural composite with a higher bending strength and stiffness than concrete or steel”.

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In a similar way of thinking, the Living Building Challenge, briefly outlined in Chapter 2, is based on the idea of a building functioning “...as elegantly and efficiently as a flower:...informed by its bioregion’s characteristics, and that generates all of its own energy with renewable resources, captures and treats all of its water, and operates efficiently and for maximum beauty” (International Living Future Institute, 2012, p. 2).

There are currently limited practical examples of products based on biomimicry which could be immediately adopted by the volume housing sector. However, it remains a concept worthy of further exploration.

### 10.2.3 Service and Flow Economy

This principle involves a societal shift whereby instead of goods being made and sold, services are leased or rented. The goal shifts to selling results rather than equipment, and encourages the creation of long-lasting, upgradeable durables, or products which if they cannot be reused are designed to facilitate their deconstruction and reincorporation into the ‘technical nutrient’ cycles of industry.

For example, instead of buying a washing machine, consumers pay for the service of having their clothes cleaned; instead of buying carpet, they pay to hire the service of having their floor soft and warm - a strategy that Interface Carpets has adopted with huge success through a leasing arrangement and switching from providing broadloom carpet to more easily replaceable carpet tiles (Hawken et al, 1999).

In addition to changing the way by which assets are valued, such an approach would also likely have strong social benefits, as it would be more likely to increase employment by increasing labour needs (something which should be encouraged) while reducing waste (which should be discouraged). It could also have economic benefits by better stabilising business cycles, given that services are required continuously, whereas goods are more likely to be purchased in good years.

In terms of volume housing, the application of this principle might relate either to the house itself, with a societal shift away from the strong desire for home ownership and instead leasing homes which are most appropriate for current needs (something which is already common amongst younger people; and which, as Farrelly (2012, para 29) notes, is
considered quite normal in some other countries. She notes that in Germany, “property bubbles are unheard of because renting is respected and protected, so investors at all levels bankroll other, more creative enterprises than super-size homes”. Alternatively, it may be that houses include certain fittings, fixtures and appliances which are leased rather than owned, promoting to a greater degree the idea of ‘product stewardship’, an approach in which the production, selling, using and disposing of products has a shared responsibility to ensure their lifecycle impacts on the environment and human health and safety are better managed (Department of Sustainability, Environment, Water, Population and Communities, 2013).

10.2.4 Investing in Natural Capital

The fourth principle relates to reversing planetary destruction and restoring and expanding the earth’s 3.8 billion year old store of natural capital, which “…includes all the familiar resources by humankind: water, minerals, oil, trees, fish, soil, air…[but also] living systems, which include grasslands, savannas, wetlands, estuaries, oceans, coral reefs, riparian corridors, tundras and rainforests” (Hawken et al, 1999, p. 2) as well as the species within these ecological communities and the ecosystem services they provide. A very similar concept is espoused by Birkeland (2008) in her discussion of ‘positive development’.

Perhaps of the four concepts this is the most radical for the volume housing sector to absorb. However, in the same way that the development of the Homebush area in Sydney for the 2000 Olympic Games was used as an opportunity to support the major remediation of the heavily contaminated area; the capital generated from the land sale and housing construction process can also be used in part, to a greater degree, to support enhancements to the local environment and ecosystems. Another example would be the creation of wetlands to support flood control and improve stormwater quality, as part of the implementation of water sensitive urban design.

10.3 Getting to ‘Positive Development’

Examples of the ways in which the four principles discussed above might relate to volume builders were provided. The issue becomes the extent to which, in reality, these concepts are currently considered by volume builders. While resource efficiency as a concept was generally well-grasped by the interviewees, a vision of sustainable homes aligned with the idea of ‘positive’ development, or consideration of concepts such as biomimicry or service
and flow economies, was not raised by any. Rather, sustainability more often seemed to be thought of as an ‘optional extra’ or nice-to-have, something that was more of market niche rather than an urgent societal priority.

This view of sustainability may be because of a pervasive societal paradigm that accepts the current way of living as inevitable, and reflects “…systemic faults embedded in our society” (Martens, 2006, p.37). Similarly, Birkeland argues that one of the key barriers to achieving positive development is our “…institutional and intellectual frameworks that reflect negative, defensive attitudes towards the environment. Negative impacts are seen as inevitable, so we only aim to slow the pace of environmental destruction” (2008, p. xi). Complex sustainability issues are unlikely to be responsive to simple market interventions but will instead require fundamental changes in our society including alterations to lifestyles, resource use and approaches to development (Keys et al, 2010). Arguably, population growth is yet another issue that will require tackling in the future (for example, Ehrlich and Ehrlich, 1990) as it is considered to contribute to congestion, biodiversity loss and housing affordability issues (Sustainable Population Australia, 2013). Surprisingly, discussion of this topic features less commonly than might be expected in much discourse of sustainability. It is beyond the scope of this research to do anything other than acknowledge the physical constraints of housing a population that continues to grow.

The largely narrow vision of sustainable housing which has been articulated by the research participants may, in part, be a result of the sheer complexity of the issue. As this research has indicated, the concept of a ‘sustainable home’ is incredibly complex, encompassing understanding of: what sustainability means in practice; the environmental merits of various materials in their harvesting and processing; design principles such as passive solar design; and weighing up trade-offs such as between individual homes and wider communities. It also entails taking into account multiple, often competing, house building stakeholder perspectives. Hence, it is not surprising that sustainable housing remains a daunting topic, and has mostly been tackled to date in a limited and rather piecemeal way.

However, as Ball (1999, p. 10) argues, trying to drive innovation and improve productivity within the housing industry will require structural reforms and “a holistic rather than piecemeal approach”. As an alternative, achieving a state approaching ‘positive’ development, will require change to occur at the level of individuals, of organisations, of industries and of broader societal institutions. It is beyond the scope of this research to consider the role of individuals in any depth. However, considering what individual
organisations, or the construction industry more broadly, should be doing, one approach is to focus more on increasing collaborative learning and information sharing. Chapter 9 discussed the potential for increasing builder understanding through learning and information-sharing tools such as communities of practice. Halme (2001) claims that most efforts in sustainability learning to date have been ‘translational’ (lower-level) in nature rather than ‘transformational’ (that is, changing the ways in which people think and/or act). This has a range of undesirable outcomes. Edwards (2009) suggests that by attempting to solve problems requiring authentic transformation with changes that are mainly translational, organisations are “…locking themselves and their communities into ways of thinking and acting that exacerbate the problem” (p. 199).

Worse, he also claims that the effort which goes into driving translational changes (or ‘weak’ sustainability based on incremental adaption and efficiency) serves as a distraction from the transformative changes that are required and may even have counter-productive effects and suggests that the:

“...lack of consciousness around valid transformational goals and the ubiquitous pursuit of translational efficiencies and productivity mean that the sustainability crisis is being exacerbated by the efficiency and technology innovations that are being touted as the solution” (Edwards, 2009, p. 200).

This is similar to the argument of a ‘Jevon’s paradox’ and the discussion of the need to consider all four principles outlined by Hawken et al. (1999), discussed earlier in this chapter.

Halme argues that for a transformational shift to occur, more active forms of learning are required, beyond education and classroom training but rather through “shared practical experience or events in the network...[which]...takes a format of hands-on practical activities...[and]...has a greater potential even for those less sensitive and aware participants who do not possess previous...knowledge or high motivation” (p. 112). She expands on this critical issue to provide a clear justification for understanding the importance of transformational change:

“Higher-level learning refers to discovery, exploration, revolutionary learning or frame breaking whereas lower-level learning organizations simply adapt to changes in their environment by adjusting their action strategies through repetition and routine within their own set of rules...The latter kind of learning is supposed to exploit existing
trajectories, and produce innovations of an incremental character. In terms of outcomes, lower-level learning is also expected to produce transactional outcomes, for instance gains in performance or enhanced resource acquisition...Higher-level learning is more likely to contribute to transformational outcomes...” (2001, p. 108).

One of the main reasons that true transformation tends to be the exception rather than the rule is that, as Edwards (2009, p. 194) notes, it “…always involves considerable organisational disruption and ‘pain’”. Hence it is important to understand how any perceived disruption or pain can be reduced.

As a guide, Nidumolu et al (2009) assert that companies on the journey towards true sustainability typically go through five distinct stages of change, namely:

1) **Viewing compliance as opportunity** - compliance with norms (legislative or voluntary codes) is seen as an opportunity for innovation. Compliance before requirements are enforced offers the potential for ‘first-mover’ advantages, which is particularly beneficial for companies operating across a range of legislative environments (eg international operations) which focus on the most stringent rules as they can benefit from economies of scale and optimise the supply chain. Focussing on emerging norms gives more time to experiment with materials, technologies and processes. Another potential benefit of responding proactively is that it can earn ‘brownie points’ from regulators and turn them into allies;

2) **Making value chains sustainable** - increasing efficiencies and reducing the consumption of both non-renewable and renewable resources by analysing each link in the value chain and making changes in obvious areas, such as supply chains, eg by identifying sources of waste. Less obvious opportunities, such as returned products (recapturing some of the lost value by reusing them rather than scrapping them), should then be progressively tackled;

3) **Designing sustainable products and services** – developing new offerings or redesigning existing ones to become eco-friendly. In markets beyond traditional areas of expertise, companies may team up with non-governmental organisations to provide input and endorsement;

4) **Developing new business models** - finding novel ways of delivering and capturing value and revenue, which will change the basis of competition. This may involve delivering services in tandem with other companies or employing new technologies which provide start-ups with the ability to challenge conventional wisdom; and
5) *Creating next practice platforms* – whereby the dominant logic and implicit assumptions behind today’s business practices are questioned through the sustainability lens, resulting in changes to existing paradigms and challenging the status quo. Questions should be quite radical in their nature, as were similar ones that contributed to today’s industrial and services economy, such as could a carriage be created that would move without horses pulling it? Or can we fly like birds?

This is not dissimilar to frameworks proposed by other sustainability commentators, such as Benn & Dunphy (n.d.) and Edwards (2009), although they have different starting points. Benn & Dunphy begin with the stages of rejection followed by non-responsiveness; while Edwards includes ‘subsistence’ and ‘avoidant’ organisations in the first stages. While such stages would undoubtedly represent the position of some volume builders on the journey to sustainability, it is taken here that compliance is the minimum starting point for discussions of how to mainstream sustainable housing.

Revisiting the experiences of the case study organisations that featured in this research, it is apparent that all had, to a large degree, tackled Stage 1 as articulated by Nidumolu et al (2009) and were grappling with Stages 2 and 3 with varying degrees of success (correlating examples are noted in Table 6). However, almost nobody spoken with in these three organisations seemed to have much awareness of the ideas behind Stages 4 or 5, much less be starting to tackle them. This observation is likely to be true of much of the volume housing sector.

As mentioned in Chapter 8, one of the critical activities to be tackled to enhance sustainability performance of homes is to drive a change in the status quo about what we (as a society) value in housing. With regard to the types of questions that might be asked by organisations attempting to operate at a Stage 5 level (or encouraging other organisations to do so), relevant questions might relate to areas such as:

- Why do houses need to be configured the way they currently are (for example, in terms of size, room functions, aesthetics and the like?)
- Why do we use the construction techniques and processes that we do? (For example, are alternative approaches such as modular designs that can be reconfigured as needs change something that should be considered more widely?)
Why do we use the materials we do? (For example, use of waste materials such as fly ash in cement is now relatively common but required a significant change in thinking initially).

Many of the issues these questions relate to tend to be taken for granted. We generally have a sense that houses should be designed a certain way (such as separate lounge room, dining room and kitchen, family area, two to four bedrooms and the like) because that is what we are accustomed to. And yet what we tend to take for granted as a ‘typical’ house design in western countries is a relatively recent phenomenon. Bryson (2010) provides an insightful account of how houses have evolved. For example, in Europe until only a few hundred years ago, houses were simply a single room in which all activities were conducted by all members of an extended household, gathered around a hearth. It is only as materials such as glass and steel became available and relatively affordable that features we take for granted such as extensive use of windows evolved. Considering that, as described in Chapter 3, following World War II, houses were often only allowed to be a maximum of 92 square metres and they now average over 200 square metres (despite decreasing average occupancy rates), our expectations of what we ‘need’ in a home do not necessarily reflect reality.

Using the framework of Nidumolu et al. (2009) and the experiences of volume builders discussed previously we can consider some options for the future. Such consideration leads to the possibilities outlined in Table 3.
### Table 3 – Stages of sustainability progress and opportunities for key volume building stakeholders

(building on the work of Nidumolu et al., 2009)

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<th>Opportunities for industry associations</th>
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| 1. Viewing compliance as opportunity | • Meet anticipated compliance requirements (e.g., 6 star energy rated houses) as standard before mandated (as done by Company B, and to some extent Company C)  
• Keep abreast of potential regulatory changes and collaborate proactively with regulators to influence the final shape of legislation and assist with formation of supporting tools (described by Company B)  
• Enter into Memoranda of Understanding or similar with government agencies to formalise sustainability commitments (as done by Company C)  
• Volunteer to participate in pilot projects or demonstrations supported by regulators (as done by Company A with the Cairnlea Ecohome and Company B with the Zero Emission House)  
• Seek opportunities to work with other companies, including rivals | • Keep abreast of potential regulatory changes and collaborate proactively with regulators to influence the final shape of legislation and assist with formation of supporting tools  
• Support building companies by providing guidance on keeping ahead of regulation and most efficient means of compliance | • Consult widely with industry and give plenty of notice of proposed legislative changes to allow proactive adoption  
• Partner with industry associations or with selected builders to pilot and debug proposed regulatory changes and to provide demonstrations to the rest of the industry |
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| 2. Making value chains sustainable | • Encourage suppliers to bring the cost down/offer as standard more sustainable options eg 3 star WELS-rated tapware or reduced packaging, and/or offer other services such as taking back waste for recycling (as done by Company C)  
• Require suppliers to take back waste products for recycling (as done by Company C)  
• Gain a greater understanding of environmental management processes eg certified ISO 14001 systems or techniques such as life cycle assessment, and give preference to suppliers who employ these processes and techniques  
• Place higher emphasis on using demonstrably sustainably harvested or extracted materials (such as Forestry Stewardship Council certified timber products, etc)  
• Seek out innovative products/technologies, including from alternative suppliers on an ongoing basis for experimentation with a view to widespread adoption | • Work with suppliers to bring the cost down/offer as standard more sustainable options (eg 3 star WELS-rated tapware)  
• Educate members about how to select more sustainable suppliers and products  
• Promote more sustainable suppliers to members | • Promote or develop programs to compare the relative merits of different suppliers and products  
• Educate the industry about how to select more sustainable suppliers and products (including through support for rating tools and databases)  
• Support supplier R&D programs to develop more sustainable products and processes |
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| 3. Designing sustainable products and services | • Offer house designs with greater emphasis on sustainability considerations to customers (eg smaller, more adaptable, meeting passivhaus requirements etc)  
• Explore designs which promote higher density living while still meeting customer requirements  
• Explore the use of unconventional building materials which can regenerate rapidly (such as hemp (Bevan & Woolley, 2010))  
• Stop offering unsustainable technologies or practices as options eg mechanical central air-conditioning  
• Offer a comprehensive range of sustainability features (beyond compliance requirements, such as low-VOC points) as standard  
• Use recognised rating tools to accurately communicate sustainability performance  
• Build relationships and seek endorsement from organisations with perceived sustainability credibility (eg environmental groups)  
• Consider future-proofing opportunities such as designing roofs to facilitate later installation of photovoltaic cells where not currently considered economically feasible; or providing | • Provide guidance to the industry about how to design more sustainable houses including opportunities for future-proofing  
• Promote research findings on innovative products and processes in ways that will be accessible to the housing industry  
• Raise awareness in customers about the benefits of sustainability features to promote demand  
• Develop or support the development of more comprehensive, rigorous sustainability rating tools and champion their use (to avoid ‘greenwash’) | • Provide guidance to the industry about how to design more sustainable houses including opportunities for future-proofing  
• Raise awareness in customers about the benefits of sustainability features to promote demand  
• Develop or support the development of more comprehensive, rigorous sustainability rating tools and champion their use (to avoid ‘greenwash’)  
• Support ongoing research into best practice sustainable housing |
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<td>dual pipe systems for later connection (see 10.4.1 for further details)</td>
<td>rigorous sustainability rating tools and champion their use (to avoid ‘greenwash’)</td>
<td>• Promote uptake in the industry through incentive or recognition programs eg awards/grants</td>
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<td>• Educate the customers about the benefits of sustainability features to promote demand</td>
<td>• Conduct continual market research to ensure knowledge is cutting-edge</td>
<td>• Support research into how both products and processes can be made more sustainable, including by applying innovative concepts such as biomimicry</td>
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<td>• Provide feedback mechanisms to support improved occupant behaviour (eg real-time and aggregated data display relating to energy and water consumption)</td>
<td>• Promote uptake in the industry through incentive or recognition programs eg awards/grants</td>
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<td>• Employ principles such as permaculture in landscaping, incorporating not only low-water plants but also productive plants (fruits, vegetables and herbs), and natives to improve the community ecosystems, provide lifestyle benefits and reduce packing and transportation of food</td>
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<td></td>
<td>• Conduct continual market research of sustainable housing and products opportunities to ensure knowledge is cutting-edge</td>
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| 4. Developing new business models | • Attempt to better understand actual customer needs (and support customers in critically examining them) and respond innovatively rather than pre-empting them with standard product offerings  
• Explore better integration of alternative construction approaches (eg further pre-fabricated; modular components) to facilitate more flexible housing designs and subsequent modifications  
• Explore opportunities for partnerships with suppliers of more sustainable products with opportunities for risk and financial benefit sharing  
• Explore the use of offsets (for carbon, biodiversity etc) to compensate for environmental impacts of house construction | • Attempt to better understand actual customer needs and satisfaction with existing offerings and promote findings to the industry  
• Conduct research into the pros and cons of current contracting models and explore and promote alternative models  
• Work with financial providers to explore innovative financing mechanisms for homes relating to services rather than products (eg leasing carpet rather than | • Attempt to better understand actual customer housing needs and satisfaction with existing offerings and promote findings to the industry  
• Support other stakeholders (eg the financial sector) to develop financial products which support monetisation of services rather than products and for addressing split incentives  
• Ensure that regulation and taxation rulings do not pose unintended barriers to collaborative partnering arrangements |
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<td>owning) and for addressing split incentives</td>
<td>• Support industry R&amp;D into new business models and promote findings</td>
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<td></td>
<td></td>
<td>• Research and advise industry on offsets</td>
<td>• Support research into the nature of risk associated with partnerships, transfer of risk and strategies to address including governance processes</td>
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<td></td>
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<td>• Support industry R&amp;D into new business models and promote findings</td>
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<tr>
<td>5. Creating next practice platforms</td>
<td>• Use construction as an opportunity to remediate and rehabilitate surrounding land and ecosystems as needed</td>
<td>• Support research into radical changes to housing design and construction and promote positive outcomes</td>
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<td></td>
<td>• Implement radically different housing designs, eg a house that rotates on the site to catch the sun (an example in Canberra was described by Anderson, 2012); green roofs and walls, etc</td>
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<td>• Support research into radical changes to housing design and construction and promote positive outcomes</td>
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<td>• Explore opportunities to promote more efficient use of space while meeting functional needs (eg bedrooms with pull-down beds to facilitate alternative uses during the day, or moveable walls to allow spaces to be reconfigured). For ingenious examples in apartments see Vinnitskaya (2013)</td>
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<td>• Use materials in novel ways – eg use photovoltaic cell film for wall cladding rather than conventional materials; or make greater use of paper/cardboard as explored by Japanese architect Shigeru Ban (see for example a range of articles on the Inhabitat (2013) website)</td>
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<td>• Proactively pilot the use of novel technologies, for example self-cleaning glass for windows (eg Viridian, 2013)</td>
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<td>• Design homes to allow for both centralised (eg electricity grid) and decentralised (eg local trigeneration plant) amenities and utilities, and design to support the integration</td>
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<td>• Review and update planning mechanisms to ensure they support innovative programs and do not create unintended barriers</td>
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<td>of innovative programs such as smart grids (for example see CSIRO, 2011)</td>
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<td></td>
<td>• Explore ways to integrate homes more tightly into their communities, employing principles such as water sensitive urban design in yards and greater communal spaces/facilities and sharing of resources (eg easily accessible share vehicles or bicycles, garden equipment etc)</td>
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<td></td>
<td>• Implement radically different housing construction methods to reduce environmental impacts during construction and continue to refine/test/improve processes</td>
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<td>• Explore the creation of networks of suppliers who can operate using the principles of 'industrial ecology', namely that one’s waste becomes another one’s food.</td>
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Table 3 illustrates the important roles to be played, not just by builders but by industry associations and government in progressing through the stages of the sustainability journey with respect to housing. In reality, the wider network of housing stakeholders, such as developers and financiers all have a role to play, as shown in the virtuous cycle illustrated in Figure 11. It cannot be stressed strongly enough that while changes to designs, processes and materials/technologies employed by individual builder organisations are essential, ‘pinning our hopes’ on builders to fix all the problems is a fatally flawed approach. A balanced approach, where responsibility rests with those best positioned to make relevant decisions, is required.

Although it is not easy to imagine radically different models of housing, it is possible that a form of ‘disruptive’, rather than ‘incremental’ innovation (Christensen, 2003) could transform completely what customers are looking for; in much the same way that the invention of iPods and iPhones significantly diminished demand for compact discs, or the way the internet has completely transformed how businesses operate. The experiences of companies that have been more forward-thinking in this regard, such as outdoor clothing and equipment maker Patagonia, provide some cause for hope. In the words of their company president, cited by Mirvis (1994, p.82):

“*My own company was responsible for encouraging our customers to overconsume and buy things they wanted rather than what they really needed*”.

The company responded by creating fewer products and simpler styles, and found that their business remained strong, despite the fact that their products are not inexpensive relative to their market segment. Volume builders could set themselves a similar challenge.

In the same way that organisations need to tackle their preconceived ideas and ask probing questions about the nature of their products and services, similarly at a macro-level society should be asking questions such as:

- Is the current government structure which encourages people (through, for example, taxation incentives) to buy their own homes and the ways in which sustainability is incentivised (or is not), most appropriate?
- Is the way in which the industry operates, heavily reliant on a fragmented group of subcontractors and suppliers, the most appropriate?
• What governance structures will be required to support a new positive development paradigm? (Birkeland (2008) touches on this issue in some depth).

There is currently limited literature to provide any guidance on these types of issues, and there are many opportunities for future research to support the development of future housing paradigms. However, Georgiadou & Hacking (2012, p. 162) provide an example relating to urban (rather than housing) design which provides some pointers as to areas ripe for further scrutiny in the context of individual homes. Summarising the key success factors in the roll-out of European schemes designed to contribute to the long-term viability of the community through urban design, they note that the factors include “...pioneer thinking; whole systems approach; strong political leadership deeply committed to a long-term sustainable development agenda; green skills and applying new green technologies; multi-stakeholder collaboration and community engagement”.

Aligned with this, another issue briefly touched on by some of the interviewees but not widely elaborated on is the need to consider sustainable communities rather than sustainable houses as individual entities. Arguably, there is much greater potential to benefit from outcomes such as potential synergies and economies of scale at a community level. This was observed by Martin & Pears (2005), as summarised briefly in Chapter 2. Georgiadou & Hacking (2012, p. 161) concur, referring to conclusions of other organisations such as CABE and the UN which have supported the view that a community-scale focus, rather than emphasis on individual buildings, offers:

“...greater opportunities for a step change in sustainability through the integration of community-scale energy, water and waste networks, communications, infrastructure and better economies-of-scale for novel technologies...This is due to the ‘long-tail’ feature of the built environment, which shows that there are many small opportunities to enhance sustainability spread across millions of buildings and it is increasingly difficult to achieve large emissions savings as the size of the development gets smaller.”

10.4 Further Opportunities

As we move towards reframing our entire housing paradigm to better consider sustainability, other opportunities for consideration present themselves. Based on my own experiences promoting sustainability within the commercial construction industry, one of the issues I have encountered is the need to ‘future-proof’ buildings, increasing
their resilience against later changes. I was therefore surprised to find that this issue is rarely addressed in the literature, particularly given growing awareness of the need to plan our built environment to respond to a changing climate (such as described by Hertin et al., 2003). Georgiadou & Hacking (2012) are a notable (recent) exception, claiming that it is a key component in the pursuit of sustainable development in the built environment, particularly given the long lifecycles of buildings and the difficulty of revising design choices. For example, they cite a UN (2010) estimate that 70 per cent of current building stock will be standing in 2050, typically with an associated high energy and carbon footprint. And yet the concept of future-proofing barely rated a mention amongst the interviewees.

A related, and equally important opportunity, to treat houses as ‘living laboratories’ for sustainability, has similarly received little attention. Both areas are ripe for future research attention, and are briefly summarised below.

10.4.1 ‘Future-Proofing’ Homes

Georgiadou & Hacking (2012) use the definition of future proofing provided by Jewell et al. (2010):

“…designing something that can be resilient to future developments including both mitigation of negative impacts and taking advantage of future opportunities” (p. 162).

Future-proofing aims to limit the risk inherent in long-term decisions regarding the building’s design and energy performance by ‘stress-testing’ against various possible future scenarios and promoting flexibility within design strategies. An example of a future-proofing strategy is that a home may not include photovoltaic cells when first built for cost reasons, but be designed to facilitate their later installation as their prices continue to decrease in future. Another aspect of future-proofing homes is designing them for a wide range of occupants, for example, allowing for use by the disabled, flexible occupancy and the like.

Unsurprisingly, Georgiadou & Hacking (2012) note that “…[b]uildings that are designed to be adaptable may prove more resilient and durable over the long-term than those tailored to meet a particular short-term need” (2012, p.161). In addition to considering the functionality and viability of materials, components and technologies over the long-term,
a building should give consideration to alternative future energy solutions and be ‘systematically integrated’ into the pre-design or design stages of construction.

There are other future-proofing scenarios barely addressed in the literature but illustrative of the types of challenges we may need to better respond to in the future. One issue of growing awareness and concern relates to the looming scarcities of essential agricultural nutrients such as phosphorus, which is consumed by humans in their food and discharged in urine to sewers, from where it enters aquatic ecosystems and can cause environmental issues such as eutrophication and algal blooms (Abeyesuriya et al, 2012). Accordingly, trials of urine-diverting toilets, developed with the goal of capturing urine to extract its phosphorus content, have started to occur, such as one at the University of Technology, Sydney. This trial concluded that while present toilet models are not quite ready for installation in public spaces, for new buildings under construction “...the urine pipework can be added at a miniscule additional cost (relative to the cost of the building) in anticipation of the time in the future when urine diversion is feasible, and necessary as resource scarcity really bites” (Abeyesuriya et al, 2012, para 13). Accordingly, a new building under construction at the university is incorporating this pipework, and it is also anticipated it will be incorporated at the major Barangaroo development in Sydney’s CBD.

10.4.2 The House as a Living Laboratory

Intentionally and unintentionally, the built environment influences human behaviour, culturally and socially. As Bonnett & Olgyay (2009, p.1) put it, “[t]he lessons locked in mortar and floor plans both limit and encourage certain human behaviours”. The outcomes may be either positive from a sustainability perspective or may inhibit sustainable behaviours. Sometimes this is in more tangible ways, such as demonstrable changes in workplace productivity or retail shopping behaviours resulting from increased access to daylight (documented by numerous authors, such as Hawken et al, 1999), and sometimes it is more subtle. For example, Bonnett & Olgyay (2009) note that civic buildings in democratic societies commonly adopt Greek or Roman architectural features to invoke ideas of power, authority and timelessness; while Nazi architecture typically employed strong symmetries, stark open spaces and heavy tectonics to emphasise centralised authority and discourage individual diversity.

Consequently, buildings also offer an “instructional” role (Bonnett & Olgyay, 2009) and can even represent a form of ‘pedagogy’ of sustainability. Various authors including
Barnes (2012) have discussed the important roles that green buildings can play as sustainability education tools, not only by describing their ‘green features’ but by explaining how the technologies and practices can be applied to other homes, workplaces and communities.

Despite such examples, the potential of the house as a means of engaging its occupants in a more sustainable way of living has received surprisingly little attention to date. An exception is the above-mentioned research by Bonnett & Olgyay (2009). They note that our environments can influence us and support learning via three modes: by functioning like a museum, with signs and exhibitions; by experience which includes kinaesthetic and emotional processes, such as by feeling breezes; and by experiences which require involvement, such as by opening a window to cool a room. They note that when ideas are learnt only through demonstration, they often do not translate into action or behavioural changes, and for most effective learning, all three modes will be integrated. At this point the building begins to function more like an ecosystem which includes the occupant, and encourages the occupants to learn about themselves and their relationships to the social and biological world.

Examples of buildings which tend to function in this way, resulting in potential adverse consequences (such as discomfort or running out of electricity) if occupants do not engage with the operation (such as by opening a window of a naturally-ventilated building or monitoring battery charge levels), are passive, net-zero and off-grid buildings (Bonnett & Olgyay, 2009). Two elements are important here: the ability for the individual both to control the environment and to obtain feedback.

This is also the thinking behind various attempts to create ‘living laboratories’ for sustainability, assisting their occupants to engage with and learn about sustainability. For example, such an approach has been fundamental to driving a broader sustainability transformation program at Harvard University (Harvard University, 2013). In Australia, the Green Building Council of Australia has also recognised the importance of raising awareness of sustainability amongst occupants, awarding one point in its Green Star Education (v1) tool for the ‘Learning Resources’ (MAN-10) credit. To obtain this point, a building must display at least three of its environmental attributes in a manner that can be readily understood by building users. These attributes must align with awarded Green Star credits; one must relate to energy use and one to water use; and measurable environmental and economic benefits must be communicated to the casual observer (Green Building Council of Australia, 2012).
In terms of housing, a goal of the Queensland Government’s Research House project in Rockhampton (outlined in Chapter 2) was that it function as a living laboratory, with two adults living in the home during 2002-2004 and their day-to-day experiences being the subject of monitoring (outlined by Buys et al., n.d.). More recently, Liedtke et al. (2012) describe a LIVING LAB design study currently being conducted by the European Union, which is a combined lab/household “…analysing existing product-service-systems as well as technical and socioeconomic influences focussed on the social needs of people, aiming at the development of integrated technical and social innovations and simultaneously promoting the conditions of sustainable development...while putting the user (i.e. home occupant) on the centre stage” (p. 106).

These initiatives suggest that the concepts associated with the learning laboratory could be readily incorporated into housing developments in the near future.

10.5 Concluding Directions

This thesis has argued that the housing industry in Australia still has a long way to go towards sustainability, in terms of current practices followed, and products offered. The magnitude of social and environmental impacts resulting from this industry sector’s activities necessitate urgent, and significant, changes and indeed, a paradigm shift is likely to be required. This is particularly true for the volume building sector which produces the vast majority of Australia’s new homes.

Despite the fact, as the literature review has suggested, that ‘sustainable’ housing is still being far from the norm, there are a number of positive examples which provide some clues to the strategies which may be adopted to support increased future delivery of more sustainable housing. Through exploring in some depth the experiences of three large volume builders operating in the Australian State of Victoria (and elsewhere), this research has identified key themes and learnings. Specifically, it has described some of the ways in which Australian volume builders have responded to the challenge to build more sustainable housing; and what their experiences teach us in terms of better promoting and supporting ongoing effective uptake of more sustainable housing within the industry. A discussion of these findings was covered in Chapters 8 and 9.

I acknowledge that this work is but one small part in a much wider quest to better understand not only sustainable housing, but sustainability in broader terms. There is still
much work to be done, and I have flagged some exciting future opportunities for the industry as well as areas requiring further research.

The extended duration of this thesis afforded the opportunity to reflect on the material over a period and to update it with reference to emerging research developments. While I hope that my research contribution will support the critical transformation to a more sustainable construction industry, what a decade of research has reinforced to me is just how complex the issues are, and consequently how sophisticated solutions will need to be.

While I have answered my research questions, I have not provided definitive answers to this wider problem. It is unlikely that we will ever reach a final destination of fully understanding sustainability or knowing how to live in a truly sustainable way. Instead our understanding, and subsequent responses, are likely to continue to evolve. Recognising this, the complicated nature of sustainable housing is not dissimilar to the observation by General H.R. McMaster (who was not talking about sustainable housing but rather the 2003 Iraqi war) when he said:

“It’s so damn complex. If you ever think you have the solution to this, you’re wrong and you’re dangerous” (cited in Harford, 2011, p.37).
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Bibliography

In addition to the documents listed in the references, numerous other documents were referred to and informed the thinking behind this thesis, even if they are not specifically cited in the text. The multi-disciplinary nature of this research meant that a comprehensive literature review covering all aspects discussed in depth was simply not possible. Its contribution to the body of knowledge instead rests on synthesising such wide-ranging literature. Other documents of relevance are listed here as a resource to the reader.


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Appendix 1

Outline of Interview Themes and Rationale for Questions

<table>
<thead>
<tr>
<th>Theory questions</th>
<th>Interview questions</th>
<th>Rationale</th>
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</thead>
<tbody>
<tr>
<td>a) What backgrounds do people have with regard to their professional/trade training and experiences in industry?</td>
<td>1. What is or are your profession/s or trade/s? 2. When did you complete your studies? 3. Do you belong to any professional or trade organisations, and if, which? 4. What’s your role? 5. How long have you had this role?</td>
<td>Provided a context against which to frame their answers and areas they would be likely to know more about. The objective here was not to adopt a quantitative approach to linking particular answers to a particular type of background or training. These questions also acted as an icebreaker.</td>
</tr>
<tr>
<td>b) How well do volume building practitioners understand sustainability in broad terms, and how have they learnt about it?</td>
<td>6. Now I’d like to talk to you about sustainability with regard to houses, and I’d like to get your opinion about a number of issues. There are a number of different interpretations of the word sustainability. What do you understand it to mean? 7. Was anything related to sustainability part of your formal training and if so, what was covered and how much time was spent on these topics? 8. How much training have you done in the last five years and approximately what proportion of this related to sustainability issues?</td>
<td>Put subsequent answers about sustainable housing into a context as to how much educational background they had in this regard. Asking about sustainability in general terms first gauged how well they understood the theoretical underpinnings and avoided ‘priming’ them by starting with a more familiar topic, namely houses.</td>
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For a full interview, noting that not all questions were asked of all interviewees due to time constraints in some instances, and additional exploratory questions were often added during the interview process.
<table>
<thead>
<tr>
<th>Theory questions</th>
<th>Interview questions</th>
<th>Rationale</th>
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</table>
| c) How deep an understanding do volume building practitioners have of sustainable housing, and how have they learnt about it? | 9. Please rate the various sources of information about sustainable building (handout provided) in terms of how useful you find them.  
10. Is adequate, relevant technical information available?  
11. In your opinion, what features should a sustainable home include? | The depth of their understanding of sustainable houses framed all discussion of barriers and strategies to increase adoption. If a narrow understanding was held, the answers would likely be less useful to support future adoption. |
| d) How important do they think sustainability is to their company, and is this changing? | 12. At the present time, how important is sustainability in your company's usual business?  
13. Is this level of importance similar to what it was a few years ago?  
14. How do you see its importance will change in the next few years? | Starting a process of reflection on the implications of sustainability to their business. |
| e) How important do they think sustainability is to their customers, and is this changing? | 15. At the present time, how important do you think sustainability is to your customers?  
16. Is the level of importance to customers similar to what it was a few years ago?  
17. How do you see the importance of sustainability is going to change for customers in the next few years?  
18. Do you base your opinion of customer perceptions on tools such as tracking of market trends or customer surveys? | Customers are commonly cited in the literature as a barrier to sustainable housing. This aimed to explore whether this was true in these real life examples. |
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<tr>
<th>Theory questions</th>
<th>Interview questions</th>
<th>Rationale</th>
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| f) What are the current key drivers? | 19. What were the key factors that motivated [company] to get involved with sustainable houses?  
20. Have any particular individuals or groups within your organisation principally driven the shift towards sustainable housing in [company]?  
21. Have any particular individuals or groups external to your organisation principally driven the shift towards sustainable housing in Australia?  
22. Can you describe the influence of that sustainable building consultants have had, especially within the company? Were these internal or external? | An open question to see which drivers sprung to mind without prompting.  
Followed up by exploring potential drivers (people) to prompt additional detail if relevant. |
| g) How straightforward is it for them to adopt as a standard practice? | 23. What do you do differently when working on sustainable housing projects compared to conventional ones?  
24. Has all of this had an impact on your standard operating practices, and if so, in what ways? | Attempting to gauge whether the changes were significant enough for this degree of difference to act as a barrier, and whether/how they counteracted this through their operating practices. |
| h) What are the key barriers? | 25. In what ways does the boom and bust nature of the housing industry influence your sustainable building practices?  
26. What do you consider to be the three most significant barriers to sustainable house? | Question 26 was to ascertain what they thought to be the barriers without prompting them, before drilling into detail about a range of barriers identified in the literature. Subsequent questions were to test how well the case study organisations |
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<tr>
<th>Theory questions</th>
<th>Interview questions*</th>
<th>Rationale</th>
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<tr>
<td>27. Is the fragmented and project-based nature of the housing industry a barrier to sustainable housing?</td>
<td>27. Is the fragmented and project-based nature of the housing industry a barrier to sustainable housing?</td>
<td>experiences correlated with a range of specific barriers (or potentially drivers) identified in the literature (without necessarily suggesting they were barriers in the phrasing of the question). Question 48 was an open question attempting to synthesise answers about the various barriers and draw together a wide range of issues discussed above.</td>
</tr>
<tr>
<td>28. How have your relationships with subcontractors changed when working on sustainable projects?</td>
<td>28. How have your relationships with subcontractors changed when working on sustainable projects?</td>
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<tr>
<td>29. Have you found you’ve needed to tighten up specifications or do more regular monitoring and inspections?</td>
<td>29. Have you found you’ve needed to tighten up specifications or do more regular monitoring and inspections?</td>
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<tr>
<td>30. Have you had to change any subcontractors?</td>
<td>30. Have you had to change any subcontractors?</td>
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<tr>
<td>31. How have your relationships with manufacturers or suppliers changed when working on sustainable projects?</td>
<td>31. How have your relationships with manufacturers or suppliers changed when working on sustainable projects?</td>
<td></td>
</tr>
<tr>
<td>32. Have you had to change any manufacturers or suppliers?</td>
<td>32. Have you had to change any manufacturers or suppliers?</td>
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<tr>
<td>33. What has been the effect of your internal management structures or processes with regard to sustainable building? (Prompt: Have they been a help or a hindrance?)</td>
<td>33. What has been the effect of your internal management structures or processes with regard to sustainable building? (Prompt: Have they been a help or a hindrance?)</td>
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<tr>
<td>34. Who internally has been least motivated?</td>
<td>34. Who internally has been least motivated?</td>
<td></td>
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<tr>
<td>35. Who externally has been least motivated?</td>
<td>35. Who externally has been least motivated?</td>
<td></td>
</tr>
<tr>
<td>36. What’s your understanding of the cost of sustainable houses compared to conventional houses and what do you think contributes to any differences?</td>
<td>36. What’s your understanding of the cost of sustainable houses compared to conventional houses and what do you think contributes to any differences?</td>
<td></td>
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<tr>
<td>37. To what extent do you believe you can pass on any extra upfront costs related to sustainable features, and is this a significant barrier?</td>
<td>37. To what extent do you believe you can pass on any extra upfront costs related to sustainable features, and is this a significant barrier?</td>
<td></td>
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<tr>
<td>38. Are customers factoring in the long term savings such as</td>
<td>38. Are customers factoring in the long term savings such as</td>
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<td>Theory questions</td>
<td>Interview questions</td>
<td>Rationale</td>
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| reduced energy consumption in purchasing decisions?  
39. What would assist this in future?  
40. Going back to the issue of cost, has that changed in the past few years?  
41. In what ways are current building regulations and planning requirements impacting on your sustainable building practices?  
42. Apart from regulations and planning codes, what impacts are governments having, for example through initiatives or support for sustainable practice?  
43. Do you believe sustainable features affect the aesthetics of a house and how?  
48. (asked later) Finally, there are many proponents for the need for more sustainable housing. Why do you think it is not already a mainstream practice? |  | Question 44 explores how and to what extent they are integrating sustainability. Question 45 was deliberately open and exploratory to see what themes arose without leading. |
| i) How are volume builders building upon their experiences to make sustainable building common practice? | 44. What processes do you have in place to capture learning about sustainable practice so it's not lost as a result of factors such as staff turnover?  
45. What are the key lessons, either positive or negative, that you’ve learnt from your sustainable building efforts to date?  
46. What do you think the future holds for [company] with regard to sustainable housing, for example which elements of |  |  |
<table>
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<th>Theory questions</th>
<th>Interview questions</th>
<th>Rationale</th>
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<tbody>
<tr>
<td>sustainable housing are you like to continue with or adopt and why, and which features do you expect to discontinue or not adopt and why?</td>
<td>47. How is your company positioning itself to respond proactively to future demands related to sustainable housing?</td>
<td>Provided an opportunity for any issues I had not otherwise raised to be discussed. The final questions were a courtesy but also had potential to prompt thoughts of additional drivers (people).</td>
</tr>
<tr>
<td>j) N/A</td>
<td>Forty nine Are there any other comments you’d like to make about sustainable housing? Fifty Are there any other people that you think that I should speak to? Fifty one . Is it alright if I call back if I have any follow up questions?</td>
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### Appendix 2

**Cairnlea Ecohome Sustainability Goals and Initiatives** (based on Martin, 2004)

<table>
<thead>
<tr>
<th>Goal/s (from the original workshop)</th>
<th>Initiatives to deliver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimising energy use for heating, cooling and other purposes</td>
<td>- The home was designed to obtain at least a 5 star energy rating, well before this was a regulatory requirement.</td>
</tr>
<tr>
<td>Reducing greenhouse gas emissions</td>
<td>- Substantial effort went into ensuring that the house’s orientation enhanced its passive solar benefits, with living areas predominantly to the north (and to a lesser extent the east), and the northern side of the house featuring the greatest use of windows and a pergola for shading in summer. The ground floor flooring features mostly tiles on a concrete slab on the ground floor to increase the thermal mass.</td>
</tr>
<tr>
<td></td>
<td>- To avoid unnecessary heat loss (or gain during warmer months), the home was well insulated, with R3.5 recycled polyester batts in the ceiling and R2.0 recycled polyester batts in the external walls. It had a weather wrap with R1.3 foil, including taping of joints and around window and external door frames and weather seals to doors. A heat recovery ventilation system was installed to ensure fresh air but avoiding the loss of heat during air exchange. The house used ‘aluminium improved’ high performance windows with timber reveals for all openings. These windows feature a co-planar reveal system which avoids cold bridging and reduces temperature transfer through the aluminium, improving energy efficiency.</td>
</tr>
<tr>
<td></td>
<td>- The home was also designed to encourage cross-ventilation with operable windows, and unusually for this type of house, did not have air-conditioning as it was felt unnecessary with all the other features.</td>
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<td></td>
<td>- The house featured a photovoltaic system (three 150 watt solar panels and a 700 watt inverter) connected to the electricity grid and the use of energy-efficient fixtures and appliances. A preference was given for gas rather than electricity because of its lower greenhouse gas emissions, including the hydronic heating system and the gas-boosted solar hot water system.</td>
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<tr>
<td>Goal/s (from the original workshop)</td>
<td>Initiatives to deliver</td>
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<tr>
<td>Less commonly mentioned initiatives to improve energy efficiency included locating the wet areas close to the hot water system to avoid heat losses from piping. Use of water efficient fixtures had the energy-related benefit of reducing the amount of water requiring heating. The refrigerator was located away from heat sources such as stoves and direct sunlight from windows. Additionally, a clothesline was provided to minimise the need for a clothes dryer.</td>
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<tr>
<td>Embodied energy was considered during the design process, with brickwork with natural raked mortar joints selected as it had lower embodied energy than some other types of bricks.</td>
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<tr>
<td>Reducing water consumption</td>
<td>A rainwater tank, with rainwater to be used for toilet flushing, irrigation and other domestic purposes (the house was also connected to the mains supply for drinking water). While two of the three toilets used rainwater for toilet flushing, the decision was made not to use rainwater for one toilet because the system was pump-operated, so one was connected to mains water only to cater for incidents such as power failures.</td>
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<tr>
<td></td>
<td>A greywater system, collecting water from the laundry, shower and bath was also installed. Regulations prevented storage of greywater on-site, so it was immediately diverted to an underground irrigation system. There had been an intention to use recycled greywater for toilet flushing, but, according to a project participant involved earlier in the project, regulatory issues meant that this could not be done.</td>
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<td></td>
<td>Water efficient fixtures, particularly AAA-rated (the older rating system and, at the time, the best rating possible) shower heads and mixer taps for all bathrooms and the kitchen, and dual-flush toilets, were installed.</td>
</tr>
<tr>
<td>Minimising water pollution from the site</td>
<td>Grassed swales were used to move stormwater while facilitating retention on-site.</td>
</tr>
<tr>
<td>Minimising use</td>
<td>The home is two-storey to reduce the building footprint.</td>
</tr>
<tr>
<td>Goal/s (from the original workshop)</td>
<td>Initiatives to deliver</td>
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<tr>
<td>of other resources</td>
<td>• During construction a contractor was selected who could sort recyclables from mixed waste off-site.</td>
</tr>
<tr>
<td>• Reducing waste</td>
<td>• Waste chutes were incorporated into the kitchen connected to various outdoor recycling receptacles to facilitate recycling</td>
</tr>
<tr>
<td></td>
<td>• A composting facility was provided</td>
</tr>
<tr>
<td></td>
<td>• Durability was considered with treated steel selected for the metal roofing, fascia, downpipes and quad gutter and treated steel weatherboard cladding selected for the first floor side and rear elevations.</td>
</tr>
<tr>
<td></td>
<td>• Recycled materials were used including recycled concrete with a polystyrene (CO₂ blown) insulating waffle pod for the slab floor (to reduce the amount of concrete required). Recycled polyester batts were also used for insulation.</td>
</tr>
<tr>
<td></td>
<td>• Using healthy and sustainable materials</td>
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<td></td>
<td>• Plantation timber was specified for use throughout the house including the prefabricated wall and trussed roof framing, and the kitchen joinery. Local plantation timber was used for truss frames.</td>
</tr>
<tr>
<td></td>
<td>• Polyvinyl chloride (PVC) was avoided as much as possible because of concerns about toxicity from its production, although it was used for electrical cabling and some plumbing traps, primarily for reasons of cost. However, the majority of PVC plumbing including sewer, waste pipes and stormwater drains was replaced with high density polyethylene (HDPE) plumbing, which requires a mechanical rather than chemically-based method of installation (this was quite innovative at the time of installation).</td>
</tr>
<tr>
<td></td>
<td>• Low-VOC (volatile organic compound) water-based paints and finishes were specified</td>
</tr>
<tr>
<td></td>
<td>• The kitchen joinery was constructed from low emission plantation timber veneer and whiteboard, and Corian benchtops were installed, to minimise the presence of harmful chemicals such as formaldehyde.</td>
</tr>
<tr>
<td></td>
<td>• Natural (sisal) carpet was used and mechanically fixed to reduce the use of glues for installation.</td>
</tr>
<tr>
<td></td>
<td>• The use of tiles on concrete downstairs reduce air emissions and allow for easy cleaning and removal of dust-</td>
</tr>
</tbody>
</table>
### Goal/s (from the original workshop) | Initiatives to deliver
--- | ---
mites. |  - A gas-powered hydronic heating system avoided subsequent generation of harmful byproducts of gas combustion or stirring up dust with ducted systems.  
- The previously-mentioned heat recovery ventilation system increases fresh air and reduces humidity.
• Conducting environmentally-sensitive landscaping |  - The garden used indigenous plants and had beds for vegetable gardens and fruit trees.  
- Low-water tolerant plants were also selected.  
- Use of lawns was avoided as much as possible.
• Minimising adverse impacts to biodiversity |  
• Promoting adaptability |  - A home office was installed on the ground floor to facilitate working from home
• Facilitating accessibility for those with disabilities and older residents. |  - A bedroom with ensuite was located on the ground floor to assist accessibility.
### Appendix 3

**House Building Stages, Stakeholders and Sustainability Opportunities** (expanding upon on the work of Hassell et al, 2003)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Key stakeholders</th>
<th>Key sustainability opportunities</th>
</tr>
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</table>
| **Land development** | • *Developers* – dependent on the existing land uses, activities may include purchase, sub-division, rezoning, obtaining approvals, grading and installation of infrastructure.  
• *Municipal authorities* - who develop, modify and enforce land-use and zoning policies and regulations for their jurisdictions. Elected officials tend to have more of a decision-making and ruling role in the process, while the departments play more of an advisory and enforcement role.  
• *Community and advocacy groups* – which in this context are generally locally based and may represent various causes such as environmental protection, architectural appearances, historical preservation, and the like, with the aim of influencing land-use decisions. More commonly this group will impact on wider land use policy rather than issues specific to individual homes. | • *Selection of optimal locations* – for example, avoiding areas which further contribute to urban sprawl or with limited access to adequate infrastructure such as public transport, shops and employment hubs, requiring private vehicle travel.  
• *Optimising features such as block size, shape and orientation* – this will involve a number of trade-offs with regards to sustainability performance. Making blocks smaller helps to reduce sprawl, but reduces the opportunities for sound passive solar design and for features such as rainwater tanks and catchment areas. |
<p>| <strong>Design</strong>        | • <em>Architects/engineers/draftsmen/building designers</em> – architects and building designers focus more on the appearance and design of a house, while engineers typically design components such as structural, mechanical or | • The design phase is arguably the one that offers the greatest opportunity to maximise sustainability benefits, at |</p>
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<td>electrical systems. The input of architects and engineers is uncommon for volume houses, which are commonly drawn up by in-house designers or draftsmen, with architects or engineers potentially only reviewing and approving designs.</td>
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<td><strong>Building consultants</strong> – may be used to provide specialist advice that may assist architects or designers in the early stages of a house’s life. However, they are not commonly used by volume builders (or are in-house staff), although sometimes consultants may be used to perform thermal modelling as required by the State legislative requirements (such as for energy ratings and the like).</td>
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<td><strong>Homebuyers</strong> – are only involved at the design stage in some cases, specifically where they purchase an empty lot and initiate construction of a house. The degree to which they are involved will also depend on their level of interest and expertise, and whether the home is to be custom-designed or built from off-the-shelf plans.</td>
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<td><strong>Researchers (including scientists, engineers, others from industry, government and academia)</strong> – conduct research into building materials and products, as well as the overall homebuilding process, and recommend design and construction techniques to lower costs and improve quality (Hassell et al, 2003).</td>
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<td><strong>Testing and certification organisations</strong> – independently test and certify products and material against criteria developed by standards-setting bodies, least in terms of an individual house, in the most cost-effective manner. As Frank Lloyd Wright was suggested to have said, “You can use an eraser on the drafting table or a sledge hammer on the construction site.”</td>
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<td>It is also the first real opportunity for a builder to influence sustainability considerations, unless their organisation also undertakes land development.</td>
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|       | Volume builders typically control the design of their homes, but because they tend to have a limited range of standard designs allowing only minimal customisation, compromises may be required between the client needs and the site parameters and constraints. In many cases this may not subsequently optimise the potential sustainability benefits, particularly for passive solar design. Other opportunities at the
Stage | Key stakeholders | Key sustainability opportunities
---|------------------|--------------------------------------------------
| | to verify whether minimum performance and safety standards are achieved.  
- **Evaluation groups/building certifiers** – may work for the building authority or be a private (independent) body which checks compliance of designs against building criteria such as local codes.  

In Australia, other stakeholders not addressed by Hassell et al (2003) include:  
- **The Australian Building Codes Board**, who maintain the National Construction Code (formerly the Building Code of Australia) which prescribes design and performance criteria.  
- **Standards Australia**, who develop national standards covering building elements and products, amongst other things.  
- The various **State governments**, who develop building legislation that dictates any mandatory design criteria or performance standards (such as energy efficiency standards).

| | | design stage pertain to designing to integrate with the community (eg the living areas fronting the house to encourage neighbourhood surveillance); optimally locating infrastructure and pipework (eg minimising the distance for transporting hot water), integrating sustainable products, materials and technologies into the specifications.  
- One of the simplest, but most effective, sustainability opportunities at the design stage is simply to reduce the size and complexity of the home, thus reducing the actual footprint on the land and increasing the proportion of land able to promote biodiversity and rainwater recharge. A smaller and simpler home design also reduces the amount of resources (both materials and labour) required to build it, as well as the resources required in future for
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| Pre-construction | • **Builder** – whose role is essentially one of process management, with responsibility for planning, scheduling and organising tasks and resources (both materials and sub-contractors) required to construct the home.  
• **Sub-contractors (trades)** – separate organisations or individuals who typically specialise in a specific trade, such as plumbers, electricians and carpenters. Generally they provide their own tools and equipment and manage their own work crews.  
• **Material producers, product manufacturers and pre-fabricators** – encompassing the producers who extract or produce raw materials used in housing such as wood, gypsum, clay or steel; the manufacturers who convert them into housing products such as doors, plasterboard, tiles or taps; and the pre-fabricators who process materials into larger subcomponents such as roof trusses.  
• **Suppliers (retail and wholesale)** – the primary distribution channel through which building materials and products are supplied to builders and trade | its operation and maintenance (such as energy to heat and light it, or materials required for refurbishments). That said, the inclusion of features such as home offices may enhance overall sustainability benefits by reducing requirements for commuting. |
<p>|               |                                                                                   | One of the key opportunities at this stage pertains to procurement. Although the actual products and materials are typically specified in the design stage, there is potential to encourage more sustainable behaviour from suppliers, such as by requiring them to take back packaging waste or recycle off-cuts. |</p>
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| Construction | - **Builders** – who are responsible for managing all aspects of the physical construction, either using their own staff or trade contractors.  
- **Sub-contractors (trades)** – separate organisations or individuals who typically specialise in a specific trade, such as plumbers, electricians and carpenters. Generally they provide their own tools and equipment and manage their own work crews.  
- **Municipal field inspectors** – typically employed by local government or working privately to ensure compliance with regulations and codes through scheduled and unscheduled construction site visits. | The focus of much of the literature when discussing sustainability within the context of the construction phase is to focus on the site operations and issues such as stormwater management and soil erosion, or the need for sound waste management on-site. |

Another potential stakeholder at this stage not raised by Hassell et al (2003) is the local community. While building plans are lodged with council and awaiting approval, there is often potential for the neighbouring community to influence the design through the consultation process that occurs (unless a plan is classed as ‘complying developments’, as occurs in some States). Their scope to influence change is typically restricted to issues that directly impact upon them, such as perceived overshadowing or loss of views.
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| Post-construction | • **Customers** – who in many cases will not be involved with any of the prior phases of home construction  
• **Real estate agents and salespersons** – who market houses to potential buyers and may be either independent agencies or employees of a building company for larger companies. In many cases they are main point of contact with house buyers and therefore have potential to be useful sources of information about the house, although they typically understand little of its technical aspects.  
• **Mortgage brokers** - evaluate whether an intending homebuyer can afford a loan and arrange appropriate financing through a lender. In Australia, it is common for buyers to deal directly with the primary lender and not use these services.  
• **Appraisers/valuers** – who assess the home’s value, considering factors such as location, size, construction type and the values of comparable homes, to ensure the home is worth at least as much as the requested loan amount.  
• **Lenders** - who mortgage the home by providing the funds for the purchase of the home to the buyer but retain the deeds to the house. This is most commonly banks or credit unions, although there also non-bank lenders.  
• **Insurers** – who protect homeowners against the risk of loss or damage to the home by covering the value of the home (this is often a mortgage requirement). | In the context of discussion of sustainability opportunities, of all the phases of the home building process, it is post-construction which arguably receives the least attention, either within the literature or during discussion with volume building staff. This is the stage which offers the only opportunity to engage with home buyers in many cases, and yet the available evidence shows that such exchanges typically do not tend to place much emphasis on any sustainability benefits of the home. |
Schematic Diagram of the Housing Construction Process (adapted from Hassell et al, 2003)

LAND DEVELOPMENT
- Acquisition
- Use planning & subdivision
- Rough grading & infrastructure construction
  - Builder hired
  - Sold to owner
  - Sold to builder
  - Zoning review & approval
  - Plot & subdivision approval
  - Permits & inspections for infrastructure construction

DESIGN
- Floor plan, lot layout
- Basic specifications
- Basic cost analysis
- Specify options
  (Custom plans by architect/engineer or standard off-the-shelf)
- Design improvements
- Evaluation
- Product & material improvements
- Testing & certification
- Suppliers or wholesalers
- Application for permits, plan review & approval, permit issuance
- Code development and adoption

PRE-CONSTRUCTION
- Selection of homebuilder
- Selection of trade contractors
- Sequencing & scheduling
- Select & order materials
- Code development and adoption

CONSTRUCTION
- Excavation
- Foundation
- Structure
- HVAC, plumbing, electrical etc
- Finishing: interior, exterior
- Certificate of use & occupancy

POST-CONSTRUCTION
- Purchase by owner
- Financing & insurance
- Purchase durables & consumables
- Use by owner (residence or rental)
- Warranty, claims & services
- Operation & maintenance
- Renovation & rehabilitation
Appendix 4

Management System Framework Incorporating Requirements of ISO 9001, ISO 14001 and AS/NZS 4801