Project Number 1.29

Final Report Jan 2014

Program 1

Greening the Built Environment

Project 1.29

Strategies and Solutions for Housing Sustainability

Sub-project A

Building Information Files and Performance Certificates

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Status	Draft / in Review / Approved by Board / For Signing
Date	13 January 2014
Version Number	V2

EXECUTIVE SUMMARY

PROJECT AIMS

The overall aim of this research project was to provide a broader range of value propositions (beyond upfront traditional construction costs) that could transform both the demand side and supply side of the housing industry. The purpose of this project was to explore and theoretically evaluate the potential application of the concepts of a Housing Value Matrix, Building Information File and Building Performance Certificate as a means of determining life cycle costs and value for long term housing assets.

METHODOLOGY

Phase 1, the preparation phase, focused on gathering information about how building information is created, used and communicated. This information was gathered by mapping standard building construction processes, identifying approximately one hundred and fifty different building information data points that are used to describe a residential building and assess a building's development and performance in its life cycle. Based on international literature, this list was condensed to forty five items grouped into five categories: spatial planning, occupant health, occupant comfort, operation and services, and building durability. A draft Information Flow Chart and Stakeholder Relationship Map were developed. An online survey and semi-structure focus group schedules were developed to actively seek industry feedback. Sixty four individuals, representing fourteen sectors of the housing industry, were invited to participate.

Phase 2 focused on engaging key industry stakeholders to:

a) discuss and critique outputs from phase 1 in relation to concepts of cost and value;
b) evaluate how building information could be collated and integrated at different levels; and
c) workshop if / how these factors can be used to inform housing regulation and market practices.

Phase 3 analysed and evaluated information, leading to a refinement of the Information Flow Chart and the development of Impact Relationship 'maps'.

KEY FINDINGS

BUILDING INFORMATION

A very large amount of information about a dwelling is generated during its lifecycle, but very little of this information is collated and utilised throughout its life cycle. Much information is used only once, before being discarded or filed. Some information is 'created' multiple times throughout the building's life.

A significant level of 'mandatory disclosure' already exists in the industry, with issues such as building size, setbacks, number of rooms, energy ratings, structural integrity, safety issues etc – all requiring to be reported to one authority or another. A building certificate could be seen merely as an extension of existing practices.

Whilst home owners are paying to meet the information requirements of existing disclosure (e.g. energy assessments), there doesn't seem to be any further purpose or use of the information (i.e. there is a question as to whether they are receiving full value from their investment in that information) and sometimes may not even receive the information that they pay for (e.g. valuation reports).

Some sectors of the industry (e.g. volume builders, developers of master planned estates, infrastructure providers and some industry organisations) have very large and 'rich' data sets about individual buildings, but this data is not being fully mapped, mined or utilised for their own or broader industry improvement.

Relationship impact maps

Two relationship impact maps were developed, highlighting four key relationships that appear to operate in isolation to the whole sector and may have significant impact on the sustainability outcomes (and lifecycle costs) of dwellings over their life cycle:

- The *infrastructure vortex* i.e. the relationship between developers and infrastructure providers, such as energy distribution companies.
- The *valuation vortex* i.e. the relationship between property sales, valuation and finance. The standard valuation methodology (sale comparison) is known to be very ineffective in a data poor and heterogeneous market that has arguably few sustainable properties.
- The *regulation vortex* i.e. the relationship between a wide range of regulations and the market segments to which they apply.
- The *consumer protection vortex* i.e. the relationship between the 'consumer', the product suppliers (i.e. the housing industry) and consumer protection processes.

The strongest message that emerges from the Impact Relationship Maps and examples is that, whilst theoretically the owner holds the most cards (refer to phase 1 of report), in practice, it appears that:

- Risk, responsibility and costs are being transferred, by and large, to the dwelling purchaser;
- The purchaser is likely not aware that they are bearing these risks, responsibilities and costs;
- Information that could potentially assist in their decision making is not being passed on;
- Purchasers have limited knowledge, skills and expertise to deal with these issues;
- Purchasers are poorly represented, individually or collectively or legislatively, at any point, to protect their interests; and
- The further a purchaser is from the original owner the likely worse off this scenario is.

Arguably, renters are even more disenfranchised than dwelling owners, although they do not bear the same cost risks that dwelling purchasers have. They do, however, bear risks associated with thermal comfort levels and potentially high operational costs especially in energy and water costs (e.g. energy costs are impacted by decisions about the thermal rating of the building and the sizing and efficiency of the hot water service).

Building information files / data platform

Industry participants acknowledged that a lot of information about individual dwellings does already exist, that this information was not co-ordinated or inventoried in any systematic manner, and that national building information files would present value (but would also need to address concerns). Industry stakeholders contributed suggestions of existing or emerging information systems, certification system and data sets that could be utilised in the development of a shared building information platform. All participants agreed, however, that there was a sector wide need for better knowledge about sustainability features, and more effective means of communicating the value of sustainability features to all sectors.

Value of building information files	Concerns
More effective and targeted policy (because of better knowledge of the building stock) and action (by whole industry sector)	Need to be in a useful format for each of the users
Monitoring social trends	Security and privacy issues (what information would be available to whom)
Potential for bulk purchase discounts and purchasing (for institutional owners of housing assets)	Data corruption / data currency
Improved property maintenance and management (especially for institutional owners of housing assets)	

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PROJECT OVERVIEW

PURPOSE

The purpose of this project was to explore and theoretically evaluate the potential application of the concepts of a Housing Value Matrix, Building Information File and Building Performance Certificate as a means of determining life cycle costs and value for long term housing assets.

Specifically, the key question explored in this project was:

> *Can building information files and broader concepts of value be applied to the Australian housing market to enhance the value of sustainable housing to all stakeholders?*

PROJECT MILESTONES AND DELIVERABLES

Contrary to the original project agreement, various factors lead to the project being undertaken in a condensed five month period (August – December, 2013), instead of the contracted twelve months. Table 1 summarises the project objectives and the key activities undertaken through the three key phases of the project. This table also shows how each of these phases relates to the project milestones as recorded in the project agreement.

This report is structured according to the three phases of the project. Phase 1, the preparation phase, focused on gathering information about how building information is created, used and communicated. This information was gathered by mapping standard building construction processes, reviewing some key publications and reports and seeking clarification from specific industry stakeholders. This phase resulted in the development of draft forms of an Information Flow Chart and a Stakeholder Relationship Map.

Phase 2 focused on engaging key industry stakeholders to:

a) discuss and critique outputs from phase 1 in relation to concepts of cost and value;

b) evaluate how building information could be collated and integrated at different levels; and

c) workshop if / how these factors can be used to inform housing regulation and market practices.

Phase 3 analysed and evaluated information, leading to a refinement of the Information Flow Chart and the development of Impact Relationship 'maps'. Key findings and recommendations are summarized. A draft communications plan is also presented, to disseminate the findings of this project to the broader supply chain.

This report contains the two deliverables for this project: an impact relationship map, and findings and recommendations. Table 2 shows how this report and the progress report presented in October relate to the project milestones.

TABLE 1 PROJECT OBJECTIVES, PHASES, ACTIVITIES AND MILESTONES

Project Objectives	Preparation Phase (September / October) **Milestone 1**	Industry Engagement Phase (November) **Milestones 2, 3, 4, 5**	Analysis / Evaluation Phase (December) **Milestone 6**
Dwelling data: What exists? Where? In what form?	✓ Collation of housing information ✓ Development of Building information flow chart	✓ Observe stakeholders' responses to building information flow chart and value vortex	✓ Refinement of building information flow chart
What data contributes to deeper and broader concepts of long term cost and value?	✓ Identification of housing attributes and categories of value	✓ Explore stakeholders' perceptions of what information about a house is valuable	✓ Classify building data into 'quality' or 'value' attributes
How could data be collated and integrated into a building information file / passport (BIF)?	✓ Review of Germany's building regulatory environment and Sustainable Building Quality Label ✓ Literature review - QLD Sustainability Declaration	✓ Examine stakeholders' perceptions of responsibility for building data ✓ Brainstorm options for better data collation / integration – perhaps as self-populating BIF	✓ Collation of possible options for a building information file
Evaluate applicability of a BIF at regional, state of national level?	✓ Identify how building information is currently being used at different scales	✓ Identify how industry is currently using information at different scales ✓ Investigate stakeholder perceptions of usefulness of BIF	✓ Collation of stakeholders perceptions
Evaluate Dwelling Performance Certificate as feedback loop for housing quality as constructed	✓ Literature review - QLD Sustainability Declaration; BA and Completion documentation; IEA reports on building certification schemes	✓ Explore potential forms / formats for Dwelling Performance Certificates ✓ Discuss potential implementation strategies	✓ Collation of literature findings and focus group perceptions
Develop impact relationship map	✓ Supply chain stakeholders identified (broad categories, and specific individuals within each category) ✓ First draft impact relationship map	✓ Explore interdependencies and inter-relationships that impact on housing costs and value	✓ Refinement of impact relationship map
Can a housing value matrix and BIF be integrated to inform regulatory impact assessments and mandatory disclosure strategies?	✓ Review of IEA publication on Energy Performance Certification as a policy tool to improve energy efficiency	✓ Explore stakeholders perceptions of future housing regulations wrt performance quality and mandatory disclosure ✓ Explore perceptions of role of government	✓ Synthesis of all information ✓ Recommendations

TABLE 2 PROJECT MILESTONES AND DELIVERABLES

Milestone	Details	Report / Date submitted
1	Identify key information and data gaps for individual dwellings	Project Progress Report 14 October 2013
2	Assess how data can integrated into a building information model	This report
3	Evaluate the applicability of the building information model	
4	Evaluate the potential of a Dwelling Performance Certificate	
5	Develop a impact relationship map for the housing supply chain	
6	Dissemination of Findings and Recommendations	A dissemination plan is proposed in this report and is expected to be actioned by QUT Jan – June 2014.

PHASE 1: IDENTIFICATION OF KEY INFORMATION, DATA AND STAKEHOLDERS

OBJECTIVES

This phase had four key objectives

(i) *To identify what information and data about individual dwellings already exists, where it exists and in what form;*

(ii) *To identify what information is collected and used by various sectors on which to make assessments of housing cost and value;*

(iii) *To identify mandatory disclosure strategies in relation to known research on building information and building value; and*

(iv) *To identify key housing industry stakeholders for engagement in workshops and develop materials for these workshops*

METHOD

An understanding of the process that a site and subsequent building undergoes through its development was used to identify what information is currently being generated by different housing sectors. As building data is created and collated at different stages of project development, a typical Residential Building Life Cycle was generated (Figure 1) which in turn helped to identify the key actors (Table 3).

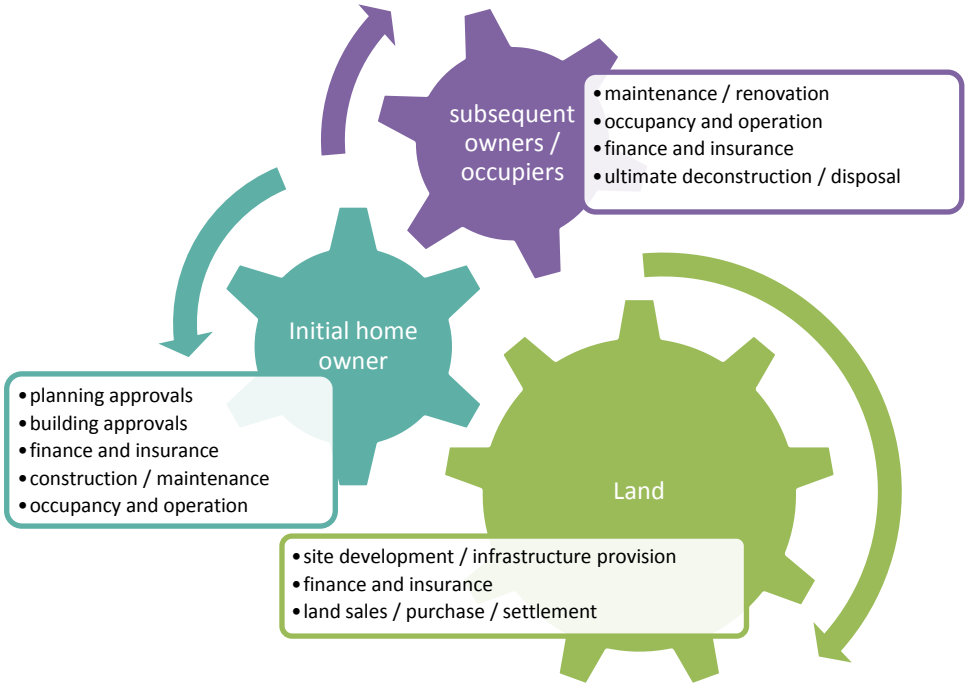


FIGURE 1 RESIDENTIAL BUILDING LIFE CYCLE

TABLE 3 KEY ACTORS IN THE HOUSING SUPPLY CHAIN

Developer	Sales / Real Estate Agent	Local Council
Infrastructure provider	Financier / mortgage broker	State Government
Architects / designers	Insurer	Federal Government
Builder / contractor	Valuer	Initial Owner / occupier
Manufacturer / supplier	Solicitor / conveyancer	Later owners / occupiers

Thorough analysis of the data required by forms and generated by reports presented by these key players was used to identify what information is collected and used by various sectors, and which information they thereby relied on to make assessments of housing costs and or values. This process also identified current regulatory assessment and mandatory disclosure strategies. These included:

- IDAS[1] Forms 1 & 2 for Development and Building Applications (DAs and BAs)
- Town Planning (Brisbane and Gold Coast City Councils) and Covenant Code Requirements (one major developer and one bespoke development)
- Building energy assessment form (e.g. BERs certificate, as per NatHERS[2] requirements)
- Master Builders Association Standard Housing Contract
- Building Services Authority Insurance Application Form
- Portable Long Service Levy Application Form
- Form 15 and 16 Requirements of the National Construction Code (NCC) (typically referred to in industry as the Building Code of Australia(BCA))
- NCC/BCA requirements for Class 1 and 2[3] dwellings
- Online borrowing calculators (CBA and ANZ)
- Property Valuation Report (for mortgage purposes) – prepared by Taylor Byrne
- Online Applications for Insurance (Budget Direct and CGU)
- Information for online real estate searches (www.reiaustralia.com.au; www.homepriceguide.com.au; www.realestate.com.au; www.rpdata.com)
- List of searches suggested by a conveyencing solicitor

This information was synthesized into a Building Information Flow Chart (Figure 2) - a visualization of the building process and the flow of information between various actors – and a Stakeholder Relationship Map (Figure 3) – a visualisation of key relationships between actors.

NOTE: these forms and processes are specific to Queensland and may vary from state to state. For example, in Western Australia, the equivalent to Queensland's Form 15 is the BA3 Certificate of Design Compliance. A comparison of the forms and processes between different states was outside of the scope of this project. For the purposes of this project it has been assumed that the different processes required in different states would result in minor differences in the type and quantity of building information generated.

[1] IDAS is the Integrated Development Assessment System used in accordance with Queensland's Sustainable Planning Act 2009 to integrate state and local government assessment and approval processes for development.

[2] NatHERS is the Nationwide House Energy Rating Scheme which governs the thermal performance of residential buildings in terms of space heating and cooling requirements (www.nathers.gov.au). BERS is software accredited for use in providing energy assessments of residential buildings. It is the most commonly used software in Queensland and Western Australia for building certification purposes.

[3] Class 1 dwellings refers to detached housing; Class 2 dwellings refers to attached dwellings such as flats, units, townhouses, apartments etc.

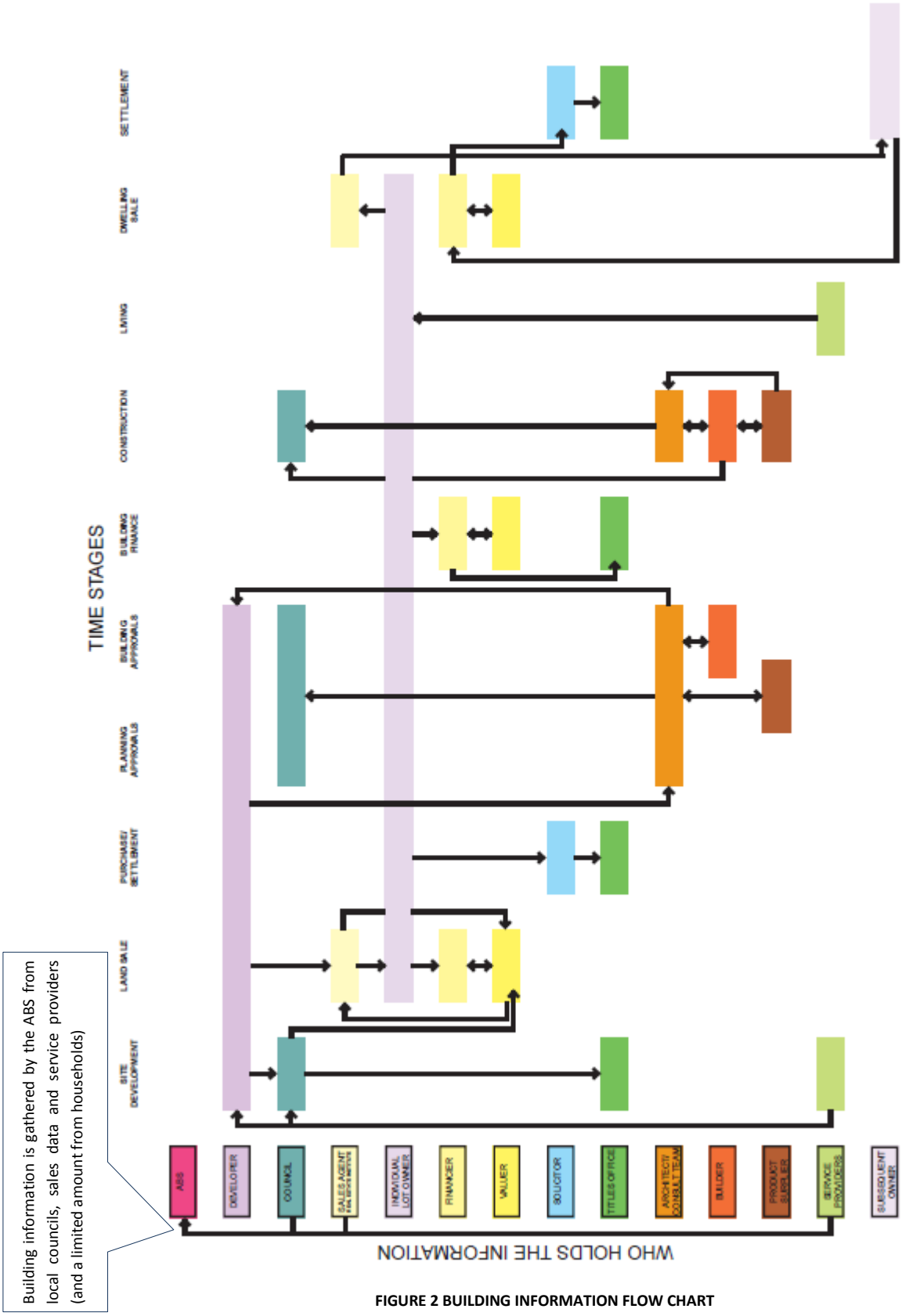


FIGURE 2 BUILDING INFORMATION FLOW CHART

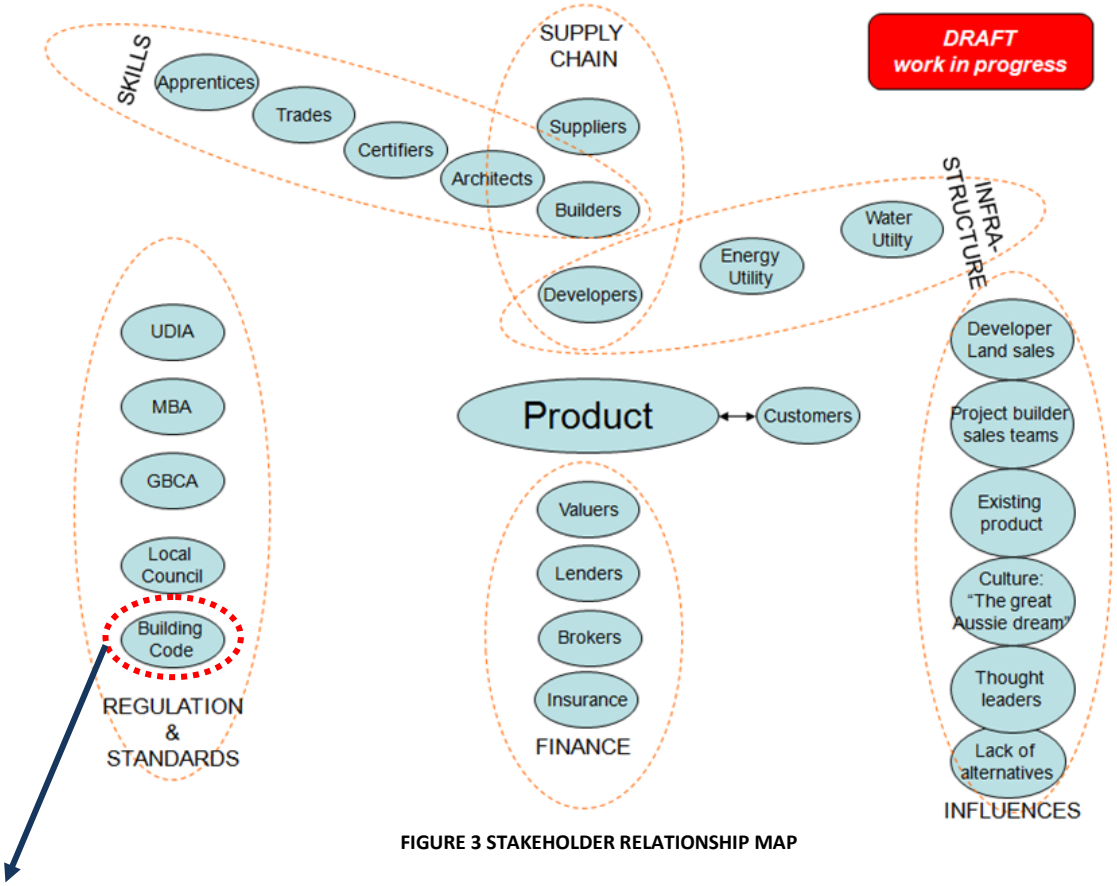


FIGURE 3 STAKEHOLDER RELATIONSHIP MAP

The term 'Building Code' in Figure 3 incorporates both the building legislation implemented by the various state and territory jurisdictions and the national technical code (National Construction Code / Building Code of Australia) to which the states and territories contribute. The other groups with the Regulation and Standards grouping reflect the input of local government and industry bodies to the formation of national and state codes and regulations.

Further clarification of information was sought via conversations with individuals from four stakeholder sectors and information from a fifth sector not directly connected with the process:

1. BUILDER: a local (south-east Queensland) builder was asked about current requirements for Forms 15 and 16. The Building Regulations advise the use of these forms as a way of providing building certifiers with help for areas that are not their area of expertise. However while builders are of the impression that these forms are mandatory for items such as structure, waterproofing, termites, insulation, glazing, compliance with energy report etc, a Queensland Government Newsflash (16th Jan 2007) states that "the decision to seek help can only be made by the building certifier". This suggests that it at the certifier's discretion as to what they ask the builder to provide in terms of these forms. This area needs further clarification, especially in terms of project homes where the majority of work (design, energy assessment, construction) is done in-house, potentially leading to perceptions of conflict of interest and non-disclosure.

2. FINANCE: an email discussion was held with a Queensland lender to attempt to decipher what, if any, building information would impact on how a finance application was reviewed. Specifically the conversation sought to understand the lender's response to a borrower if it could be shown that the dwelling being purchased had substantially lower utility costs. Typically a nominal amount is allowed for these costs in the borrowing capacity calculations and this amount is up to the discretion of the lender. However it appears this is beginning to change with the CBA, for example, now verbally requesting clients to advise of their cost of living expenses (including utility costs).

3. REAL ESTATE / SALES: Two open houses[4] were attended to investigate what information sales agents provide freely and what their responses are when you ask specific sustainability directed questions. One agent, when asked about the now defunct Queensland Sustainability Declaration, replied that the only reason it came into existence was because they needed to find a job for the husband of the then Premier of Queensland. The indication from this small sample group seemed to be that there was little perceived value in sustainable features and that sustainability was limited to PV's, water tanks, insulation and efficient lights and tap fittings. This suggests that agents' interaction with 'sustainability' is limited to areas that are regulated. This is an area that requires further investigation.

4. INSURANCE: Budget Direct insurance attracted the attention of this project because of their current marketing campaign: Zeek and Zia, an Alien couple, are seen pointing out features of their home – water tanks, solar power and vegetable gardens. The advertisement claims that 'higher intelligence' beings are making smarter choices, which includes Budget Direct Homes and Contents insurance. It then states that by making the smarter choice the average Australian has saved money. It appeared to suggest that the sustainability features were a smarter choice which provides a potential saving on insurance. When questioned about this inference, the operator on the online chat facility was quick to respond that there was no connection between having sustainable features and cheaper insurance, it was just about making a smarter choice. These "green" smart choices are not necessarily seen as of any value in terms of insurance products. This is further evidenced in a September Blog posting on the website[5] titled "*5 ways to increase your home's equity*", in which the focus of the advice was on superficial appearance rather than adding any sustainability features.

5. AUSTRALIAN BUREAU OF STATISTICS (ABS): Reports[6] related to building information were reviewed to ascertain where this information was sourced and to what extent ABS reports indicated established information flow paths between various parties.

The analysis of these forms, reports and Codes identified approximately **150 different building information data points** that are used to describe a residential building and assess a building's development and performance in its life cycle. This list was considered too overwhelming in terms of gauging industry's assistance in identifying which data was perceived as being of most value. A condensed list was considered by identifying:

- Information that was similar and could be grouped together in its application;
- Information related to those 'sustainability' areas covered by current building regulations or flagged as potential future areas of regulation (e.g. energy and water efficiency, thermal comfort, universal design, indoor air quality, life cycle considerations);
- Information related to those 'sustainability' areas reflected in voluntary programs and tools such as Green Star, or exemplified in leading edge buildings (e.g. functionality, aesthetics, building management etc); and
- Information related to international exemplars or directions (e.g. resource efficiency, resilience)

This process resulted in a reduction of key building information into 5 broad categories:

- Spatial planning (e.g. information conveying size and layout, functionality)
- Occupant Health (e.g. information conveying indoor air quality, security)
- Occupant Comfort (e.g. information conveying internal temperature, lighting, acoustics)
- Operation and Services (e.g. information about electricity, gas, water and communications connections and operations)
- Building Durability (e.g. information about expected life of house and components, ease of renovation, flexibility)

A full breakdown of the each of these categories is shown in Table 17 (Appendix A).

[4] The Observatory estate, Reedy Creek, Queensland.
[5] http://www.budgetdirect.com.au/blog/2013/09/5_ways_to_increasey.html?Linkid=09731
[6] Australian Social Trends, Data Cube – Housing (cat. No. 4102.0); Housing Occupancy and Costs (4130)

BUILDING INFORMATION OUTCOMES

The overall impression created by the Building Information Flow Chart is that there is very little information flow between players – it is obvious that whilst a lot of information is being generated for specific purposes at specific phases in the process, much of this information appears to have been discarded or archived, with little being passed on for subsequent players or for use for other purposes. Initial examination of this collated data highlighted some perceived 'weak spots' or anomalies that were proposed for further investigation. Four of these issues are discussed here

ORIGINAL OWNER OF DWELLING HOLDS THE MOST CARDS

FIGURE 4 ORIGINAL OWNER

The flow chart seems to indicate that the first owner of a dwelling, theoretically at least, has the most complete set of information about the dwelling and the site it sits on. This information could/should include land information as well as a plethora of information about the design, building approvals, construction details, performance certificates (e.g. thermal performance, structural integrity, pest management etc), construction materials, warranties and final inspection certificates. The owner adds to this their own information gathered during the occupancy of the dwelling (e.g. operational costs, functionality, comfort etc). But even this group appears to lack information that was generated prior to the sale of the individual lot e.g. infrastructure or development and planning decisions made at a larger scale. It appears as if this group (the original owner) is also not required to pass on any dwelling information to subsequent owners.

THE VALUATION VORTEX

The Building Information Flow Chart (Figure 2) clearly identified the closed cyclical effect between the Sales, Finance and Valuation sectors, resulting in a 'Valuation Vortex' (Figure 5) - where values are affected by sales, sales are based on the ability to achieve finance (in most cases), and finance is based on valuation. These three sectors did not appear to use much of the information that was created about the dwelling, and in particular seem to exclude what could be considered 'the norm'. (Note: the insurance sector is also possibly within this vortex.) Some of this phenomenon could be explained by market theories of supply and demand, and possibly industry practices of 'valuing' land more than buildings.

FIGURE 5 THE VALUATION VORTEX

According to RP Data, sales comparison is the most common valuation method used in Australia for residential properties: in essence a property is valued according to recent sales data of other properties in close proximity and with similar utility and characteristics (three to five comparables are typically used). Additionally, property assessments can be in one of four formats - full valuation, short form, restricted valuation and desktop assessment – as determined by the client and/or the valuer. Mortgage insurers require a minimum of a short form valuation (short form and full valuations require internal and external physical inspections). The industry recognizes that "in data poor and heterogeneous markets, the Valuer's experience will play a leading role in assessing the appropriate comparable properties and the associated adjustments."[1]

The pivotal role of the valuation industry has been recognized by leading researchers around the world[2, 3], and the potential for them to play a positive role in enhancing the supply and demand of sustainable housing is visualized in Figure 6.

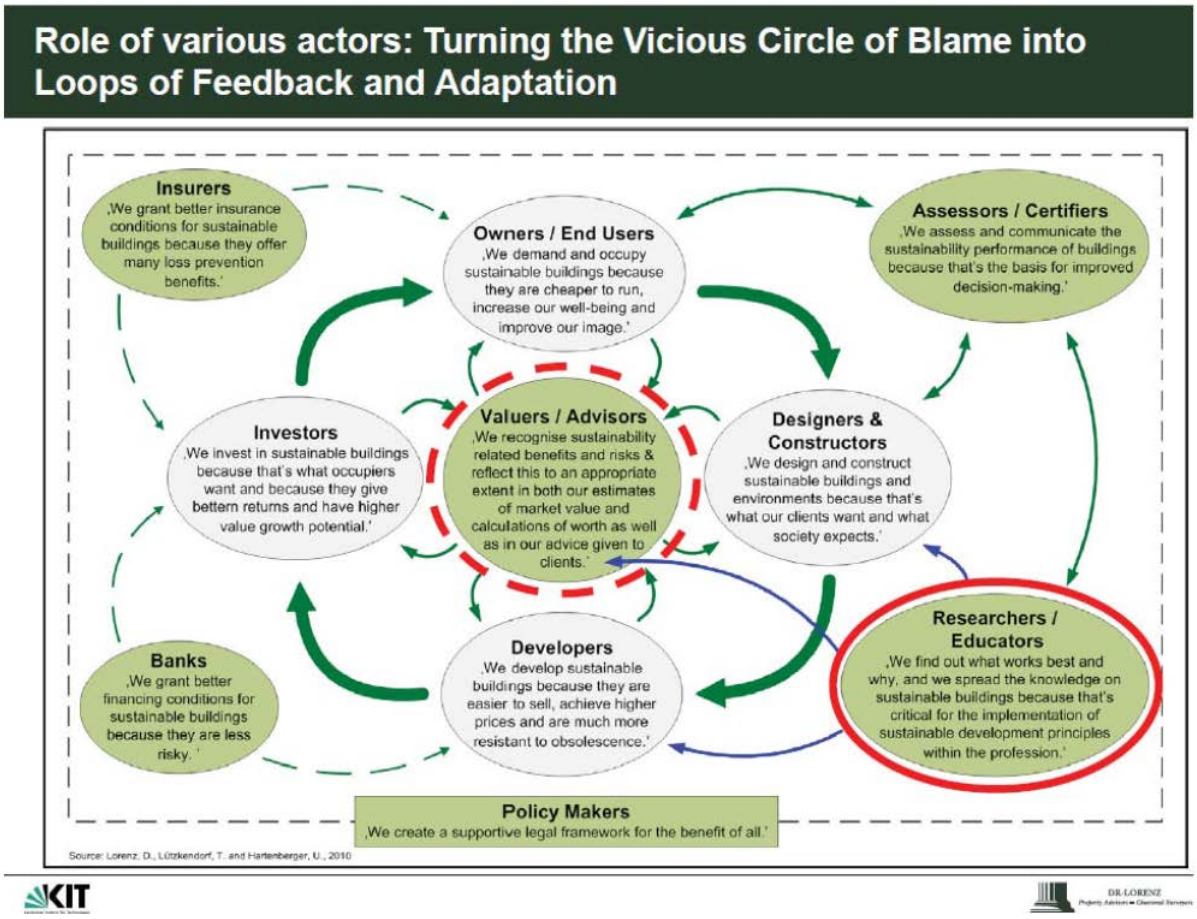


FIGURE 6 THE PIVOTAL ROLE OF VALUERS

Source: Karlsruhe Institute of Technology, Germany

LAND – MORE THAN A SPACE TO MARK A HOUSE

There was no evidence of an industry-wide understanding of the value on land, in particular its potential for greater connections with the 'building'. Arguably, because land is a limited resource, it should be used efficiently and effectively to get the most value out of it. While land itself may be in demand and seen as valuable, its 'value' in the residential sector appears to be limited to its location (in proximity to other features of perceived value) and maximising the size of the dwelling that can be constructed on it. There appeared to be little recognition (through information flows) of the potential of the land itself. In the first instance this is evidenced by real estate and sales advertisements that appear to concentrate on a limited description of the built form (number of rooms, floor area, car parking) and very limited land information (total lot size). Much information about how the dwelling has been designed to interact with the land (e.g. views, privacy, security, the functionality of external spaces for various activities, interconnectivity etc) is either non-existent or not communicated to purchasers. Anecdotal evidence supports a hypothesis that current house planning is predominantly internalised with increasing room sizes and numbers with little outdoor interaction. In Queensland, the availability of an extra 'star' by adding the outdoor room was conceivably a strategy to attempt to reduce air conditioning use by encouraging greater interaction with, and appreciation for, the external environment (shaded) – that could perhaps have resulted in reducing the need for a variety of large indoor (air conditioned) spaces. The potential benefits of this regulatory allowance do not seem to have been understood and appears to have resulted in the *addition* of an 'outdoor room' instead of the *replacement* of some indoor spaces. Further to this the outdoor room itself is becoming more internalised, and in some case arguably completely built in with fly and wind screens. The only item defining it as being "outdoors" is the outdoor table setting. It appears that new buildings need to maximise their footprint – build as close to boundaries as possible, leaving narrow strips that are of little use. This suggests the potential for alternate land uses are either not understood or are seen as being of little value.

People also appear to have a high value on privacy. For example, where visual street access is required through planning tools, the front yard of the house becomes desolate – a space left for formal plantings and grand entries. Where these tools are not in place, and 6 foot high fences are constructed, there appears to be more interaction with this yard. Does the current requirement for visual street access work, if the buildings simply then ignore the front outlook and focus inwards? These questions arise from looking at the flow of information – as noted previously, information generated prior to actual building design and construction tends not to flow on to dwelling owners and occupants (e.g. planning provisions that aim to encourage greater connectivity). Similarly attempts by proficient architects and building designers to create better building / land connectivity are not fully explained or annotated in the form of the information that owners inherit. An interesting anomaly to this phenomenon relates to the marketing of master planned communities: frequently information about the 'natural' assets of the estate are promoted to dwelling owners, but information relating to the connection between an individual dwelling and its lot is largely ignored.

Defining sustainability

In terms of sustainability information that is currently collected, it appears that the majority of stakeholders have a superficial understanding of sustainability – they appear, in general terms, to see sustainability features as 'add on' elements such as solar power or rainwater tanks, or perceive the current 6 star energy rating as achieving a sustainable house. They do not appear to understand exactly what a 6 star rating means in terms of occupant thermal comfort, or that a dwelling could contain more integrated passive design features, that provide protection from and engagement with the environment in order to achieve a high level of sustainability - without the technical 'add ons'. Further to this it appears that some sectors, or some key players in particular sectors, are starting to recognise that occupants (perhaps a significant percentage of the market?) are interested in sustainability. This seems to be prompting a desire for these sectors/actors to associate themselves with being 'green'. However, with limited knowledge of what it means to be 'green' or 'sustainable', a level of 'green wash' and/or mixed messages emerges, arguably confusing the market or diluting or limiting the potential of truly sustainable developments and dwellings.

Shared information platform – WA SLIP example

A preliminary investigation was undertaken of the Western Australian government's Shared Land Information Platform (SLIP) that streamlines government land and property information to provide customers with better access to a range of land information available [4, 5]. The key objectives of the WA government's approach were to

- simplify access to the Government's land and geographic information;
- improve the efficiency of government processes; and
- actualise the government's e-strategy.

The possible benefits of such a shared information platform, as identified in the SLIP program (Table 4), would be explored in the industry focus groups, as the same benefits could conceivably accrue to a range of beneficiaries in the residential building sector.

TABLE 4 POSSIBLE BENEFITS OF SHARED INFORMATION PLATFORM

Information integration	Reduced errors	Streamlined processes
Improved decision making	Reduced rework	Better context
Improved reaction times	Reduced administrative costs	Improved data integrity
Improved information management	Reduced transaction times	Increased govt / sector / public engagement
Easier access for citizens to participate in government decision making		

CURRENT MANDATORY AND VOLUNTARY DATA COLLECTION AND DISCLOSURE

As identified in the building construction process outlined earlier, a significant level of 'mandatory disclosure' already exists in the industry, with issues such as building size, setbacks, number of rooms, energy ratings, structural integrity, safety issues etc – all requiring to be reported to one authority or another. Preliminary investigation revealed three important perceptions:

1. Whilst home owners are paying to meet the information requirements of providing information for certification (current levels of mandatory disclosure), there doesn't seem to be any further purpose or use of the information (i.e. there is a question as to whether they are receiving full value from their investment in that information) and sometimes may not even receive the information that they pay for (e.g. valuation reports);
2. Some sectors of the industry (e.g. volume builders, developers of master planned estates, infrastructure providers and some industry organisations) have very large and 'rich' data sets about individual buildings, but this data is not being fully mapped, mined or utilized for their own or broader industry improvement; and
3. There appears to be very little recognition of the 'public good value' of information and hence no perceived action to date on the development of a national data framework for residential buildings.

Further research is required to gain a full understanding and clarification of these perceptions, however it would seem reasonable to hypothesise that without robust and valid data it would be extremely difficult, if not impossible, to develop evidence based policy in relation to the future of housing in Australia. This hypothesis was used as the basis for exploring, in this project, industry perceptions and understanding of the multiple benefits, and beneficiaries, of a potential shared data platform relating to building information.

KEY INDUSTRY STAKEHOLDERS

Fourteen industry sectors were identified and, through various existing and new relationships, a list of 64 people was compiled: collectively this group provided a broad representation of the sector and significant knowledge of housing sustainability issues. Each of these individuals was invited to participate in a short online survey and a select short list was invited to participate in focus group discussions. For privacy purposes, and in line with research ethics, the participants cannot be identified, however the broad industry sectors and the companies / organisation types invited to participate, are shown in Table 5.

The response rate to the online survey was 31% (n = 20). As the survey was anonymous, it is also possible that persons not on our invitation list completed the survey (i.e. our email invitation to complete the survey may have been passed on to other persons). Participation in focus groups was accepted by 23 individuals, with 19 actually participating on the scheduled days (see next section). Not all focus group participants completed the online survey, and not all survey participants attended focus groups.

All industry sectors, however, were represented in at least one of the engagement strategies, with the exception of finance (late apologies from several lenders), insurance (late apology) and building surveyors. Their absence was merely a matter of incompatible timing and there is scope in the next phase of the research to seek input from these sectors.

SCAN OF STATUS OF HOUSING SUSTAINABILITY

A brief desktop scan was conducted on housing sustainability topics to further assist in the formulation of the survey and focus group topics that formed the stakeholder engagement activities. This scan included online articles[6], reports on international practices [7-15], Australian industry practices [16-19], Queensland Sustainability Declaration [20, 21], and academic research on building passports and property valuation [3, 22-24]. Details of these documents are listed in the Reference section at the end of this report.

TABLE 5 INVITED STAKEHOLDERS

Industry sector	Company / business invited to participate
Architect / designer	Various leading architects
Assessors and Certifiers	Building Energy Assessors (members of ABSA) Building Surveyors / certifiers Australian Institute of Building Surveyors
Construction	Volume home builders (Masterton Homes, Henley Homes, Metricon) SME home builders Building products manufacturers
Finance	Westpac Bendigo Bank, Bank MECU
Government / regulation	Federal State (NSW, QLD, VIC, WA) Local Policy advisor
NGOs / consumer organisations	ATA Green Cross Australia Moreland Energy Foundation
Industry organisations	Green Building Council of Australia Master Builders Association
Infrastructure providers	Electricity distributors
Insurance	Insurance Council of Australia Suncorp
Land development	Stockland, Investa
Real Estate / sales / marketing	Realestate.com Sales agents Industry advocates / trainers
Social housing	Social housing advocate Social housing providers
Sustainability consultants / advisors	Private companies University researchers
Valuation	CBRE

PHASE 2 INDUSTRY ENGAGEMENT

Ethics approval was obtained to invite housing sector professionals to participate in an online survey and focus groups. Invitations were issued from QUT, on behalf of the SBEnrc, as summarized in Table 6 .

TABLE 6 STAKEHOLDER ENGAGEMENT INFORMATION (EXTRACTS)

Strategies and Solutions for Sustainable Housing – Stakeholder Information
This project is part of the Sustainable Built Environment National Research Centre's (SBEnrc) research program: Greening the Built Environment. It seeks to develop a better understanding of the drivers and barriers to sustainable housing. Housing, in this context, includes all types of residential dwellings such as detached houses, flats, units, apartments, townhouses, duplexes etc. (For this project it does not include accommodation types such as nursing homes, dormitories, etc.) Housing is more than human shelter – it is a significant national and family asset, requires considerable upfront and ongoing capital, contributes to national carbon emissions, impacts on physical health and wellbeing, and reflects social and cultural identity. The housing supply chain, from valuation and financing to design and construction to inhabitation, needs to quickly respond to the increasing stringency and scope of building regulations as well as rising energy costs, affordability, and the ability of housing to provide healthy and safe retreats in extreme weather events. This project will explore issues of building information and the value assigned to that information, by different sectors within the housing supply chain: finance, insurance, valuation, real estate and sales, development, design, construction, certification, regulation, and service providers.
Online Survey
You are invited to participate in a questionnaire associated with this project because you are a key person in the housing supply chain. The purpose of your involvement is to explore, from your perspective, the type, form and location of data about individual buildings, and the value that you place on such data – as an individual and in the context of your role in the housing supply chain. Your participation in this project is entirely voluntary. If you agree to participate you do not have to complete any question(s) you are uncomfortable answering. Your decision to participate or not participate will in no way impact upon your current or future relationship with QUT or with SBEnrc. If you do agree to participate you can withdraw from the project without comment or penalty. No personally identifiable information will be obtained from you – only the industry sector that you work for will be recorded.
Focus Groups
You are invited to participate in a focus group associated with this project because you are a key person in the housing supply chain. The purpose of your involvement is to explore, from your professional perspective, the links between building information and building value, and how these links could be strengthened and applied to benefit all sectors of the housing supply chain. Your participation will involve a video recorded focus group at a CBD location in Perth / Sydney / Melbourne / Brisbane - approximately 90 minutes of your time. The focus group will be timed for during the week – late afternoon to early evening (4pm – 5.30pm), to minimize disruption to both your professional and personal life. Questions will cover five broad topics: how building information is conveyed; concepts of value; information integration and sharing; supply chain inter-dependencies; the future of housing in Australia. All comments and responses will be treated confidentially unless required by law. The recording will be transcribed by a member of the research team and transcriptions will be stored securely as per QUT's Management of research data policy. The names of individual persons are not required in any of the project reports. Comments will be allocated to industry sectors rather than individuals

SURVEY AND FOCUS GROUPS

A 20 minute online survey was designed to gauge industry perceptions of sustainability within the housing sector and sector understandings of the relative importance of different types of building information and the values that could be assigned to that information. The survey was distributed to 64 selected individuals known for their involvement in sustainable housing. The response rate was 31% (n=20). Participant demographics are shown in Appendix B. These issues were explored in more depth via focus groups (Melbourne, Perth, Sydney, Brisbane) in late November 2013 (n=19). The 90 minute semi-guided discussions were facilitated by Dr Jan Stenton, with participation by other members of the research team. The flexible script (Table 7) allowed the discussion to follow lines of enquiry dictated by participants at the time. Several 'props' were used to spark discussion. Some of these are shown in Appendix C. The discussions were video recorded then transcribed.

TABLE 7 FOCUS GROUP DISCUSSION TOPICS

Key Topic	Sub-topics that could be explored
Building Information (how is building information communicated?)	What building information do you use to inform decisions you make as part of your role in your industry sector? Why do you need this information? (What value?) Where does this information come from? In what form is the information? Do you add further information? In what form? After you use the information, do you pass on all/ part of the information to another sector? In what form? To whom? For what purpose?
Concepts of value (how do participants perceive value?)	What do these images (housing advertisements) convey to you about the house's value and quality? What information is conveyed? What is missing? What concepts of value are conveyed? Who is the intended audience? What do you understand by value: economic, environmental, functional, social, cultural? Do you think it is possible to allocate a dollar value on each of these? Why / why not? How could this be done? Are these other concepts of value of any relevance to your industry sector? Why? Look at the images (building certificates and similar) provided. What do they convey to you about the house's value and quality? What information is conveyed? What is the intent of these certificates? Who is the intended audience? What is the potential benefit (value) of these types of certificates? For whom?
Information integration and collaboration (how do participants perceive information sharing?)	You may have completed our survey about building information, ranking information according to importance, and classifying categories of value. Were there differences between your personal perceptions compared with your business's / sector's perceptions of importance and value? Why? If key information about individual dwellings was collated in a central repository, what potential benefits do you see for your sector? What potential barriers? Can you think of ways in which this could be done (theoretically / practically)? WA SLIP program: Do you think a similar system would have benefits to the housing industry – at an individual property level? What benefits? For whom?
Supply chain sector interdependencies (impact relationship)	What sector of the market impacts most on your work in your sector? What are the implications of action / inaction by other sectors on your work? To what extent are you dependent / reliant on the actions of other sectors? Is this dependency / relationship an identified risk? How do you mitigate against it? What sector relationships would you like to create, that would add value to you?
The future of housing in Australia	What role do regulations and standards play in the value chain? Does regulation hold back or enhance housing sustainability? What sustainability performance requirements do you think are likely / possible to be regulated for new housing in the next decade? For existing housing? What sustainability features do you think the market will demand in the next decade? Why? Do you think dwellings can be sustainable and affordable? Why / why not?

Key results from the survey are discussed below, with comments from focus group discussions added to relevant sections, for further clarity. The results are presented in three main topics:

1. Defining the product
2. Ranking building information
3. Concepts of quality

DEFINING THE PRODUCT

This section presents industry feedback on a range of issues relating to information that defines a dwelling.

LIFE EXPECTANCY

The housing sector, as a whole, has widely diverging perspectives on the life expectancy of the product, as indicated in Figure 7. This diversity was also represented in the focus groups. Information about the expected life of the 'product' does not seem to be commonly passed on to the purchaser or other sectors. For example, it is conceivable that the term of a house mortgage may be longer than the expected life of the product. There do not appear to be any product disclosure requirements or consumer protection guidelines in this regard, aside from warranties expressed in statutory home construction insurance schemes in each state and territory (e.g. The Queensland Home Warranty Scheme is administered by the Queensland Building and Construction Commission and covers structural defects for a period of 6.5 years).

If properly maintained, how long would you expect a recently constructed dwelling (since 2010) to last?	Response Percent	Response Total
less than 25 years	5.26%	1
25 - 30 years	10.53%	2
31 - 40 years	15.79%	3
41 - 50 years	15.79%	3
51 - 60 years	10.53%	2
61+ years	42.11%	8
	Total # of respondents 20. Statistics based on 19 respondents; 0 filtered; 1 skipped.	

FIGURE 7 PERCEPTIONS OF DWELLING LIFE EXPECTANCY

FEATURES THAT MAKE A DWELLING SUSTAINABLE

Survey participants were asked to 'list up to 10 things that you believe make a dwelling sustainable'. The 180 responses (from 20 participants) could be grouped into 9 broad categories (shown in Table 8 in descending order of importance). It was interesting to note the different language used to communicate similar ideas: some terminology was goal oriented (e.g. the end result should be high level of thermal comfort), whilst others are process oriented (i.e. indicating a means to achieve a particular service or goal). These differing communications types are reflected in the columns of Table 8, whilst the broad categories are indicated in the rows. Furthermore, the nine broad categories could be refined to three key areas: occupant health and comfort (light grey shading), life cycle operation and impacts (dark grey shading) and 'cultural' aspects of aesthetics and community (non-shaded). These unprompted responses closely match the broad categories of building information developed in phase 1 and explored further in the survey.

TABLE 8 WHAT MAKES A DWELLING SUSTAINABLE?

Key Category	Means of achieving this services	Goal
Resource efficiency over lifecycle of building (includes Environment Quality)	low embodied energy / water; recycled and recyclable; Environmental impacts of all stages of building life (materials, construction, operation, deconstruction) Food garden	Small footprint Adaptable and flexible design Self-sufficient
Thermal Comfort	passive solar design, orientation, insulation, thermal mass, glazing size and placement, depth of eaves, 'energy efficiency'	Thermal comfort (by natural means)
Energy	Lighting, appliance choice (could also imply passive design to minimize space heating and cooling needs – i.e. thermal comfort)' solar electricity, solar water heating	Net zero energy Self-sufficient
Water	Recycled water / greywater connections; rainwater harvesting; composting toilets	Self-sufficient
Place / Location / Connectedness	Connected to place (indoor/outdoor/lot/ neighbourhood) Location in relation to other services Community	
Air	Natural ventilation; indoor air quality	
Building Quality / Maintenance / Management	Durable and low maintenance Metering, monitoring and controls Occupant behavior / operation Energy monitoring, resource consumption	
Visual and Acoustic comfort	Aesthetics, natural light, acoustics	
Overall Targets		Aesthetically pleasing Affordable

There was a strong belief – 90% - (but not unanimous) that houses could provide both year round comfort as well as reduced operational and maintenance costs (Figure 8).

It is possible for a house to provide year round comfort, without the need for heating and cooling appliances, while at the same time reducing servicing and maintenance costs.	60 % (12)	30 % (6)	5 % (1)	5 % (1)	0 % (0)

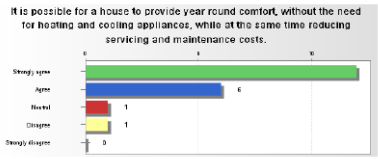


FIGURE 8 COMFORT AND REDUCED OPERATIONS

Roles and responsibilities

One of the issues that the survey questions sought to address was the often reported (anecdotally for housing) the perceived conflict between buildings 'as designed' and 'as constructed'. The responses to this question (Figure 9) show that the industry expects that primary responsibility for 'construction as approved' lies with the building contractor, with responsibility also shared with the certifier, owner and designer. Regulators are also perceived, by 25% of respondents, to have some responsibility for ensuring compliance with approved plans. Some stakeholders consider that valuers and insurers also bear some responsibility.

In your professional opinion, who has responsibility for ensuring that a house is built according to the approved building plans / documents?	Response Percent	Response Total
Designer	40%	8
Builder	90%	18
Certifier	65%	13
Regulator	25%	5
Owner	45%	9
Insurer	10%	2
Valuer	10%	2
Other	5%	1

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

FIGURE 9 PERCEPTIONS OF RESPONSIBILITY FOR END PRODUCT

Further industry perceptions of roles and responsibilities were explored through asking survey participants to indicate the extent to which they agreed or disagreed with a range of statements that had emerged from Phase 1 of the project. Key responses to the survey are presented here under the different industry sectors.

The housing sector: there was very strong agreement that, generally speaking, the housing sector does not concern itself with the actual performance of dwellings (Figure 10).

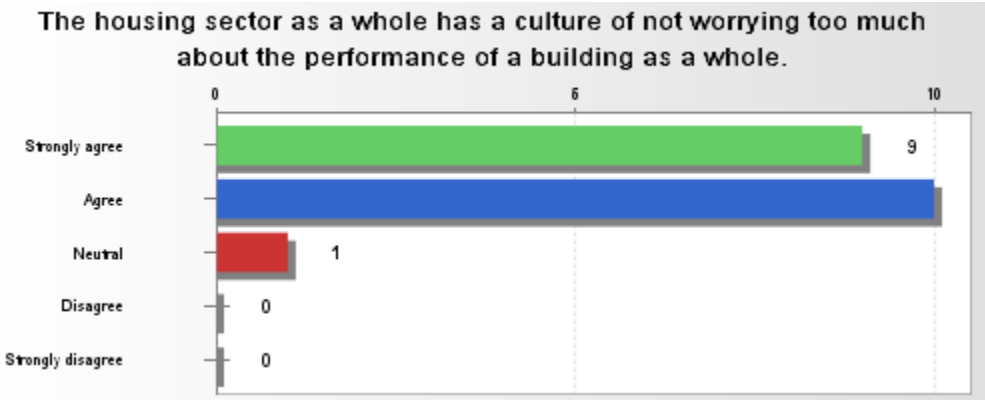


FIGURE 10 HOUSING SECTOR AND DWELLING PERFORMANCE

Builders: there was strong agreement that builders had little incentive to be concerned about the operational costs of a house (Figure 11). This was qualified, to some extent, by recognition that state legislation required specific but limited level of indemnity insurance for structural elements, and building contracts and product warranties may apply to some specific products. One project builder advised that they provided a 50 year extended structural guarantee for their homes. It appears that this extensive warranty is not typical in the industry, however it relates to limited structural features only, and not to operational costs (e.g. energy costs associated with space heating or cooling, which in turn is reliant to a large extent on design and construction variables).

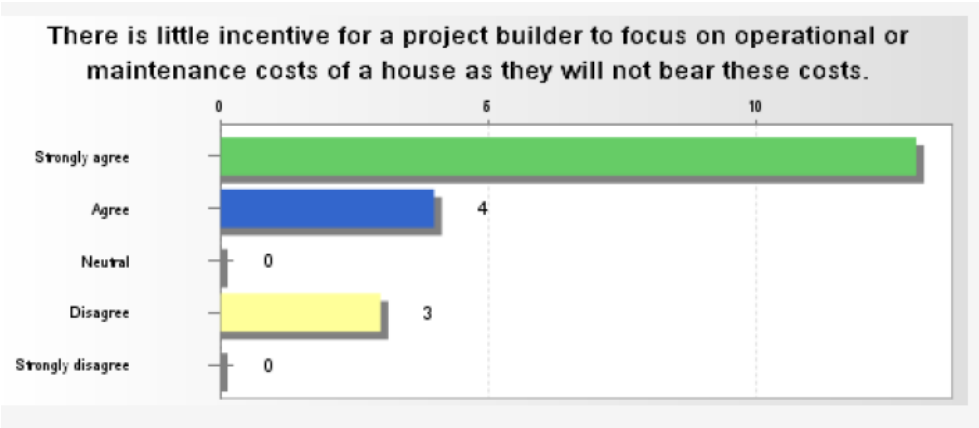


FIGURE 11 BUILDERS AND OPERATIONAL COSTS

Estate Agents: There was very strong agreement that buyers are strongly influenced by sales agents or sales information (Figure 12) and strong agreement that sales agents have a responsibility to pass on information about a particular dwelling (Figure 13). Not all participants believed that sales agents had responsibility for passing on information.

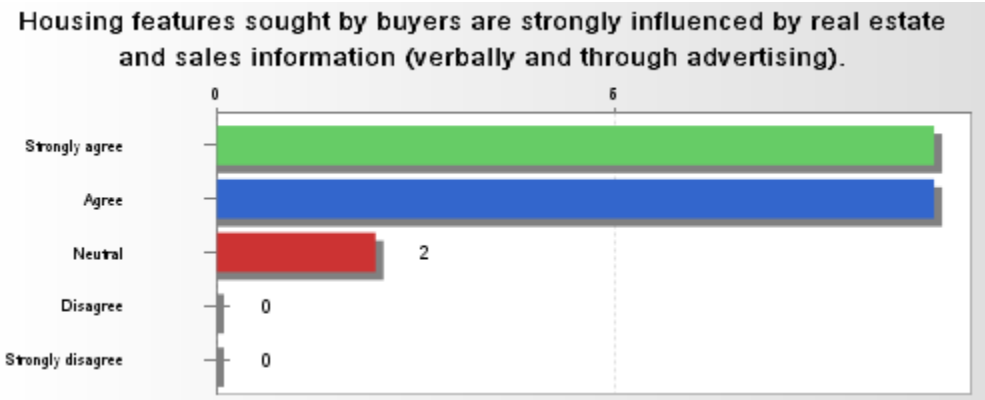


FIGURE 12 INFLUENCE OF SALES AGENTS

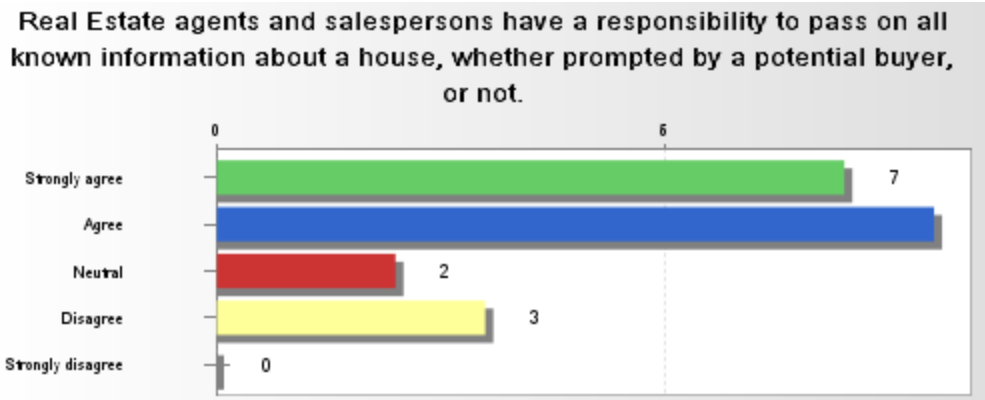


FIGURE 13 ROLE OF SALES AGENTS IN PASSING ON INFORMATION

Comments about the ability of sales agents to convey sustainability information were made in focus group discussions:

> *They struggle with the information they've got. They're not very smart people, estate agents. I say that as someone who's been in the industry 25 years. I'm not very smart. I'm good at talking but don't ask me to do too much research.*
>
> *My industry property agents have got no understanding of the language…(*to describe / market features that are offered above compliance*)*
>
> *Asking real estate agents to be specialists in sustainability was a bit of a hiding to nowhere, (*but*) giving agents the tools, the reports, the scripts, the dialogues (*to pass on to clients*)*

There was also acknowledgement of attempts being made to address this issue, such as sustainability training offered through the Real Estate Industry Western Australia (REIWA) and the recently launched Liveability program by LJ Hooker.

Builders and owners were also identified as having responsibility for passing on information.

> *We keep information and records and when we complete a house and hand over we give the clients a pack of information that's got probably all of the relevant (information) that you want in it … not what the life cycles are, but certainly building plans, and what the installation specification might be, energy rating certificate, the details of the windows might be something that could be improved but we know what they are… We actually give people a folder with all that information. That's the whole idea, it's like a book you keep in the glove box. So we do do that. We also give people a 'This is your home, this is how to use it' type of information.*
>
> *When I moved in to (a particular estate) I received a folder…It's really my responsibility to pass this on to the purchaser if I move out. But in moving out, it could end up in the bin or in my packed goods. It would be an impulsive decision as you're packing: whether you put it in the bin.*

Regulations: there was very strong agreement that regulation was essential for achieving housing sustainability (Figure 14), but mixed agreement / disagreement as to whether regulation was in fact holding back sustainability outcomes (Figure 15).

FIGURE 14 THE ROLE OF REGULATION

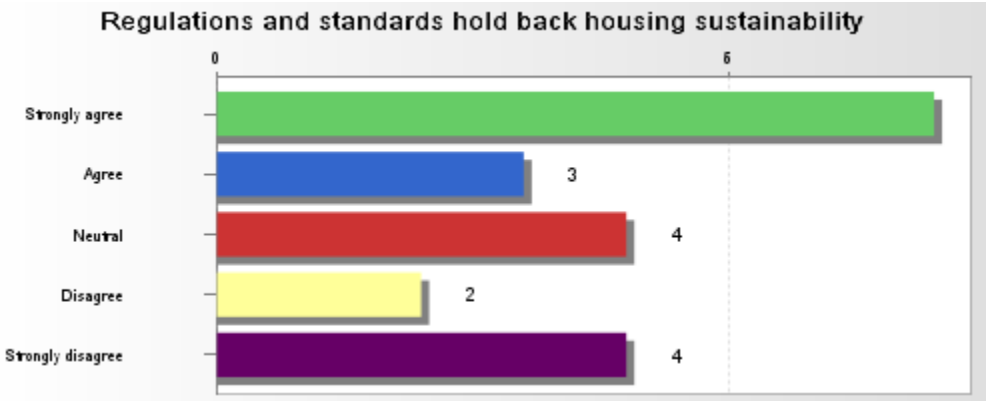


FIGURE 15 DOES REGULATION LIMIT HOUSING SUSTAINABILITY

Consistent with previous research, regulation appeared to be the standard that defined the housing products offered [25], with market competitiveness being the driver for anything above government regulations.

> *We use the National Construction Code and the Building Act to drive what we do. We make sure we comply with all of those requirements. We keep up to date with that (*and*) anything that makes us more competitive and of a lot of value to potential clients*

Valuers / Financiers: there was very strong agreement that 'mortgage vendors assume valuers do not recognise the value of sustainability features' (Figure 16). Focus group discussions hinted at the limitations of the sales comparison method when there are so few 'sustainable homes' in the market.

> *The valuers, under the Act, are only allowed to do one of three forms of valuation. One that they will always refer to is comparable sales evidence. It's very hard to do comparable when there isn't comparable evidence.*

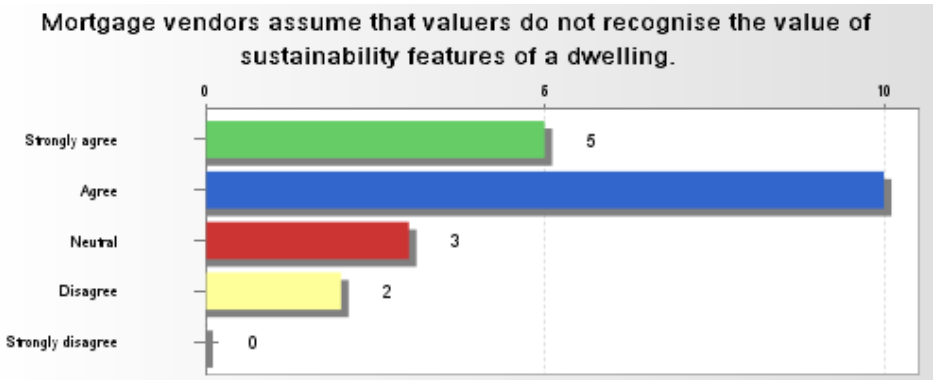


FIGURE 16 FINANCE SECTOR VALUE OF SUSTAINABILITY

Valuers, however, were rated higher than financiers (considered the least able to identify sustainability features and least likely to believe that such features add capital value to a house) and insurers (Figure 17, Figure 18). Valuers were considered slightly more likely to believe that sustainability features added value (compared to their ability to recognise such features), whilst insurers, builders and certifiers were considered less likely to believe in the capital value of sustainability features compared with their ability to recognise these features. 80% of respondents believed that home owners were equally able to identify sustainability features and believe in their ability to add capital value.

FIGURE 17 RECOGNITION OF SUSTAINABILITY FEATURES (A)

FIGURE 18 RECOGNITION OF SUSTAINABILITY FEATURES (B)

Home buyers / renters: there was some lack of certainty as to whether home buyers and renters were interested in sustainability (Figure 19), but strong agreement with the perception that home buyers are principally interested in the three features most commonly marketed (bedrooms, bathrooms, car spaces) (Figure 20).

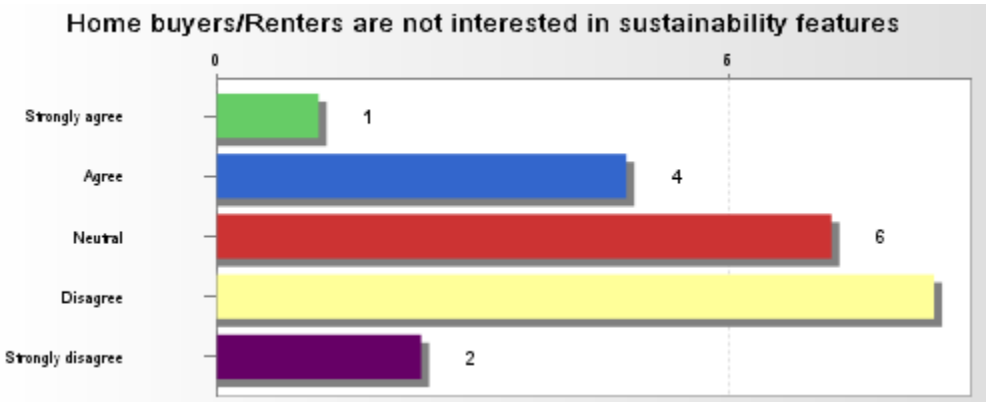


FIGURE 19 HOME BUYER INTEREST IN SUSTAINABILITY

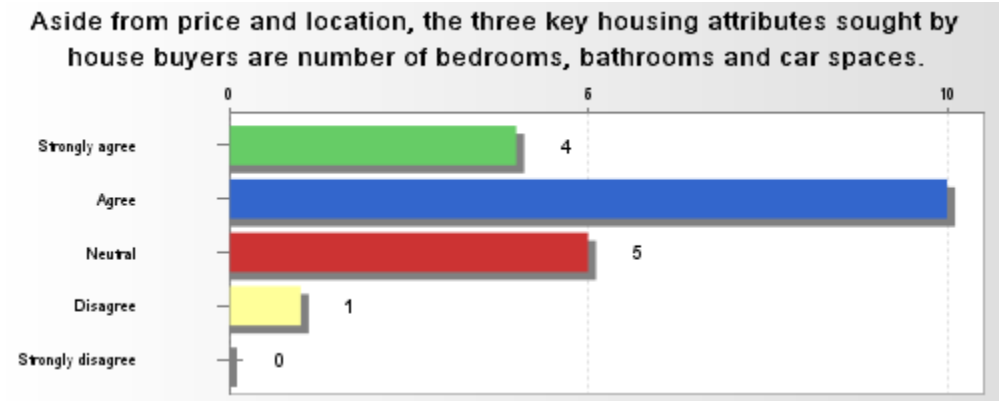


FIGURE 20 HOMEBUYER MAIN INTERESTS

RANKING CATEGORIES OF BUILDING INFORMATION

Building information identified through the flow chart process was condensed and assigned to one of five categories, using international examples of building performance and sustainability as a guide. Participants ranked these five categories from different perspectives (Figure 21). From their personal perspectives (column 2), spatial planning was the highest ranking category, followed closely by occupant comfort, health and operation and services. Building durability was the lowest ranked. This differed to their perspective of their profession (column 4), with spatial planning, occupant comfort and operations considered of primary importance, and the other categories having conflicting levels of importance. Note that, with the exception of spatial planning, other categories were considered, at a profession level, to have very limited or no importance. It is interesting to note the different rankings from the perspectives of a profession (column 4) and their customers (column 3): this could possibly indicate that professions are not aligned with, or conversant with, their customers' views.

> *Sustainability is based on a number of pillars - social, cultural, ecological and economic. Therefore, I see all of these building information categories as equally important. The consumer is more likely to only consider cost of living issues and to a lesser extent, functionality of the building and safety and health issues as important. The consumer society tends not to value durability of products including buildings.*

Consumer views of the durability of houses needs further investigation.

Further clarity could be provided by exploring these category rankings (a) at different stages of building ownership / occupation (e.g. new dwellings compared with dwellings at different stages of their life); (b) in different markets (geographic markets and location markets e.g. inner city v suburban); and (c) for different buyer categories (those purchasing to maximise resale value; those purchasing for 'status' value; those purchasing to meet personal needs; and institutional buyers). These issues of market differentiation were raised in both the survey and in focus groups.

> *If a business's perspective is long-term ownership of residential dwellings (say department of housing or a non-profit rental social housing manager), then they should be much more concerned with the long-term asset durability than the typical client resident or even homeowner might be (typical average length of ownership is something like 7 years?) I think if there was more long-term ownership of residential as an asset class by institutional investors, currently not present in Australia, then there would be more awareness of efficient building operation and services, potential for occupant health/comfort, and understanding of durability as a key component of sustainability. In the current speculative real estate nature of (residences) in Australia, these long-term concerns are lost. (This is*

largely driven by negative gearing, and not having equivalent investment incentives for institutional rather than mum-and-dad property investors).

Different people have different priorities - younger people just want to get out of the rental trap, retired people want to minimise the cost of living. A study on the drivers towards selecting sustainability alternatives is valuable to identify the barriers to adopting better ways to do things.

For each category, participants then ranked each of the 9 building features. These rankings provide an interesting insight into industry perceptions of specific building features. The majority of the 45 building features were considered of primary or secondary importance by the majority of participants. Results can be found in Appendix D.

Concepts of Quality

Similarly, participants were asked to classify concepts of building quality. These concepts were taken from the German sustainable buildings program which seeks to quantify sustainability: cultural, ecological, economical, functional, social and technical (Figure 22). Responses (in the survey and in discussion) reveal quite disparate views between personal, client and industry perspectives on issues of quality.

Building information doesn't generally convey cultural quality because it is a primary driver of consumer choice in terms of site, suburb, state or nation. For me it is very important. My clients come to me with a pre-selected property so that conversation rarely takes place. For that reason, I can't give you a ones size fits all answer on that. As for my business, since I can't influence their prior decisions, I work with my client's choices. As with all client questions the answer varies enormously from one to the next.

A bit hard to answer this as there are some seemingly competing interests in each category, eg up-front cost versus operational or life cycle cost. Most of the industry and consumers are focussed on up-front costs, have a concern over operational costs and don't really care about life cycle cost.

Again, being more informed about the potentials for achieving higher ecological or economic quality may make me prioritise and value these higher than those who may not be as informed and therefore accept the status quo. It's all about educating the market about how to future-proof living spaces, and in fact educating society about how much of our built form is actually a result of a conscious design and costing decision, rather than being a default option.

My perspective … encompasses the whole development, therefore, my concerns are at a master planning level- cultural heritage, ecological, social and technical qualities are all relevant. However, our customers are focussed on their block, their home selection, and what they can manage on their site- therefore their concerns are limited to a scale they can conceptualise easily in the face of purchasing a property.

Rank the following broad categories of building information according to the perspectives of different stakeholders indicated in the three columns below.

1 = primary importance
2 = secondary importance
3 = tertiary importance
4 = limited importance
5 = no importance

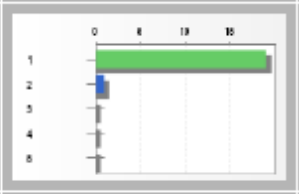
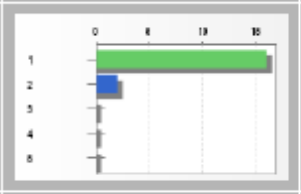
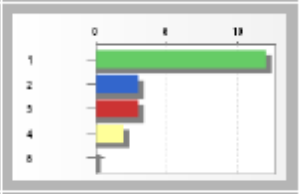
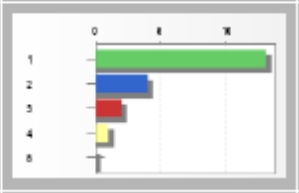
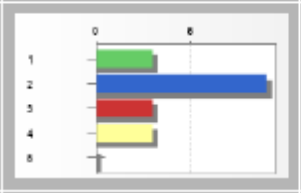
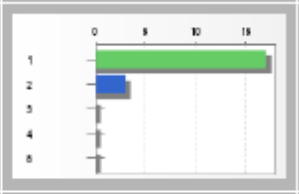
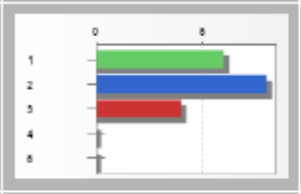
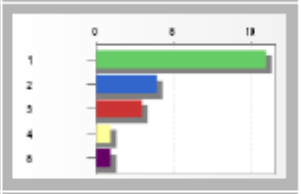
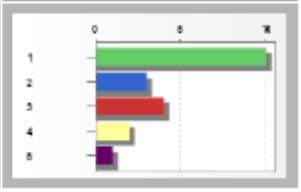
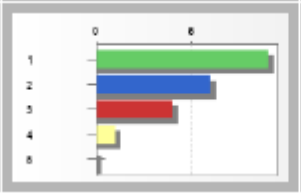
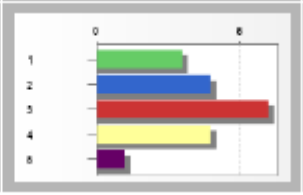
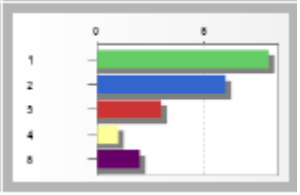
	Perspective of YOU as a dwelling occupant. 1 1 - Primary importance 2 2 = Secondary importance 3 3 = Tertiary importance 4 4 = Limited importance 5 5 = No importance	Perspective of YOUR CUSTOMERS as dwelling occupants. 1 1 - Primary importance 2 2 = Secondary importance 3 3 = Tertiary importance 4 4 = Limited importance 5 5 = No importance	Perspective of YOUR BUSINESS/PROFESSION 1 1 - Primary importance 2 2 = Secondary importance 3 3 = Tertiary importance 4 4 = Limited importance 5 5 = No importance
Spatial Planning (e.g. size and layout, functionality)			
Occupant Health (e.g. indoor air quality, security).			
Occupant Comfort (e.g. internal temperature, lighting, acoustics).			
Operation and Services (e.g. electricity, gas, water, connections & operations).			
Building Durability (e.g. expected life of house and components, ease of renovation, flexibility).			

FIGURE 21 RANKING OF BUILDING CATEGORIES

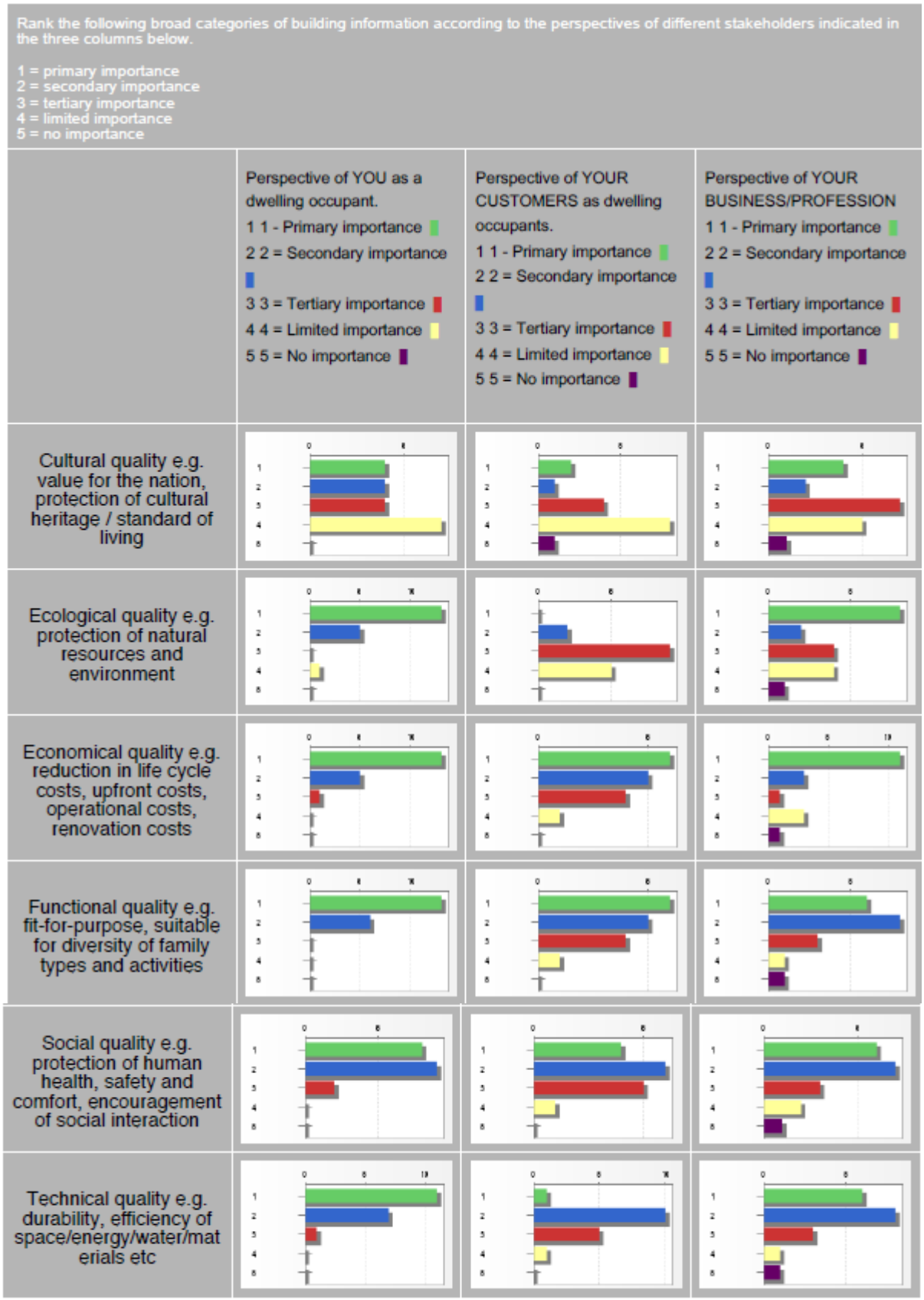


FIGURE 22 RANKING OF BUILDING QUALITY

PHASE 3 FINDINGS AND RECOMMENDATIONS

IMPACT RELATIONSHIP MAPS

Feedback from the industry engagement activities was then used to refine the information flow chart and relationship map, resulting in two Impact Relationship Maps. Figure 23, the information flow chart amended to show impact relationships, represents only the first iteration of information flows (i.e. up to the point of first resale of the dwelling), and it would seem reasonable to assume that the information flows after this point would be even more disjointed and dysfunctional than in the first stage. It shows four key relationships impacting on information flows:

- Developer / infrastructure provider (red dot-dash lines)
- Sales / valuation / finance (dark blue dotted lines)
- Regulation / industry (orange square dotted lines)
- Initial purchaser / subsequent purchasers (green dot-dash lines)

Each of these relationships impacts on the flow of information to other parties, having an impact on their decisions.

Figure 24 presents the relationships in a different way. It shows six broad industry sectors, their inter-relationships and influences, some existing data sets (sitting in isolation), and the apparent isolation of the dwelling and occupant.

Both figures are useful in highlighting four key relationships that appear to have significant impact on the sustainability outcomes of dwellings over their life cycle. Example impact relationships are provided on the following pages.

- The *infrastructure vortex* i.e. the relationship between developers and infrastructure providers, such as energy distribution companies. Very little information flows from this relationship to all other parties, yet decisions made at this point have long term impacts (Table 9).
- The *valuation vortex* i.e. the relationship between property sales, valuation and finance. The standard valuation methodology (sale comparison) is known to be not very effective in a data poor and heterogeneous market that has arguably few sustainable properties (Table 10).
- The *regulation vortex* i.e. the relationship between regulations and the market to which they apply (Table 11)
- The *consumer protection vortex* i.e. the relationship between the 'consumer' and all other parties (green dot-dash) (Table 12).

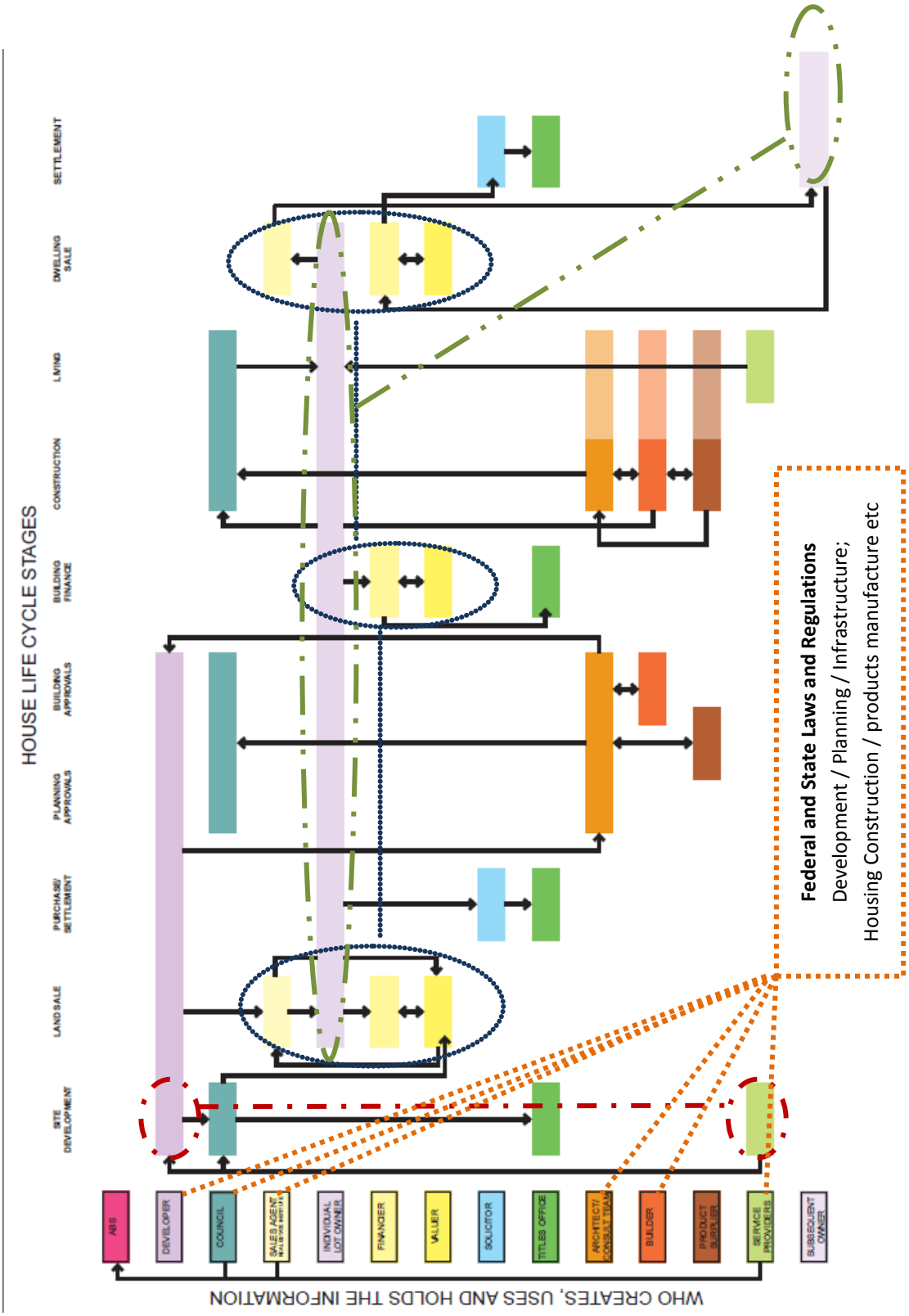


FIGURE 23 IMPACT RELATIONSHIP MAP (A)

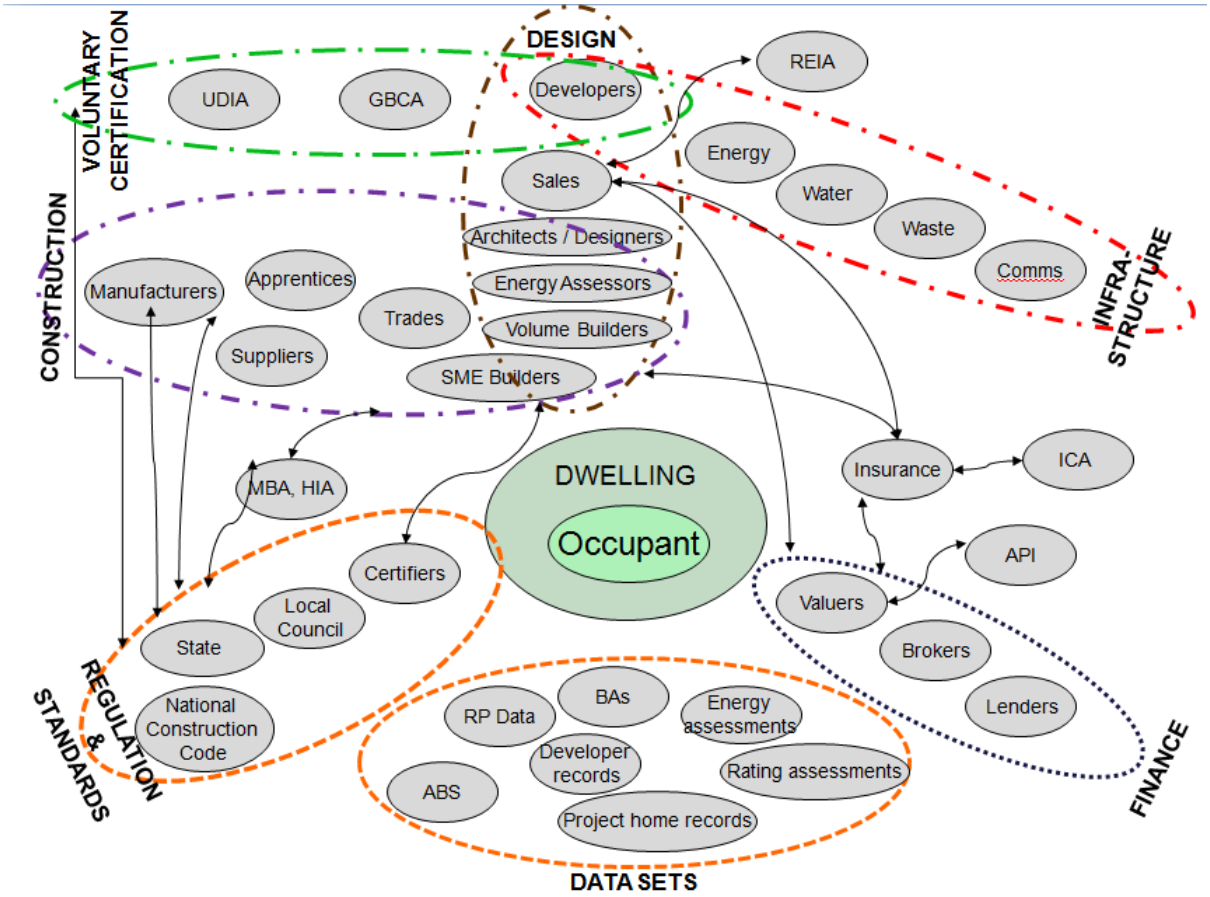


FIGURE 24 IMPACT RELATIONSHIP MAP (B)

TABLE 9 IMPACT RELATIONSHIP - INFRASTRUCTURE VORTEX EXAMPLE

Energy Infrastructure Provider	Greenfield Developer	House/Land Purchaser	Design / Construct Team
Action	**Action**	**Action**	**Action**
Develops design criteria (e.g. ADMD[7]) based on historical demand and mandates to developers infrastructure specifications	Pays for infrastructure and 'gifts' to service provider	Instructs design/construction team that they want a sustainable energy efficient house No knowledge of infrastructure constraints	Designs / constructs house to meet client's brief, based on their professional knowledge and experience
Benefit	**Benefit**	**Benefit**	**Benefit**
Reasonable assurance they can meet potential future capacity demands	Assurance that their estate will provide known levels of service performance	EE house should provide lower operational costs and environmental impacts	
Risk	**Risk**	**Risk**	**Risk**
Changes to demand can pose risks of stranded assets and reduced income (if expected demand falls) or overcapitalisation (if demand falls or is high for short periods) or further capital investment (if overall demand increases). Managed by • reluctance to change their planning model; • passing costs on to end customers; or • passing risk to developer (e.g. if infrastructure different to established criteria)	Difficulty in marketing to sustainability clients as they cannot offer an estate substantially different to business-as-usual If contract with provider to deliver lower capacity infrastructure, then this risk is passed on to purchasers through covenants	If in estate with typical infrastructure, purchaser has risk that their energy efficient house will not result in lower cost of living, or that infrastructure charges will be higher than their actual consumption charges If in estate with lower capacity infrastructure, purchaser has risk that, over time, the reasons for covenants on all individual lots within the estate, will become lost, demand might rise above design parameters, and collective lot owners become liable for capital investment in additional infrastructure	Professional knowledge and skills may not be sufficient for the task. Clients may not accept design solutions because of no perceived economic benefit. Have no opportunity to engage with service provider to reduce connection costs to offset against design/construction costs of an energy efficient house.
Cost	**Cost**	**Cost**	**Cost**
Carry cost of long term operation and maintenance of whatever infrastructure is installed. Costs passed on to end consumer	Cost passed on through individual lot sales	Pays same infrastructure charges (at land sale and in ongoing electricity bills) as purchaser with non-energy efficient house Pays costs of additional infrastructure investment	No ongoing costs

[7] ADMD – After diversity maximum demand –

TABLE 10 IMPACT RELATIONSHIP - VALUATION VORTEX EXAMPLE

Valuer	Real Estate / Sales Agents	House/Land Purchaser	Financier
Action	**Action**	**Action**	**Action**
Engaged by the finance company to assess the value of the home. A major factor in determining the valuation is recent sales in the area.	Through discussion with the seller, and based on sales in the area, sets the price of a home. (For new build, this would be the contractors quote for construction).	Places an offer for purchase or construction of a sustainable home. This offer is often dependent on their ability to achieve finance.	Orders a valuation of the home as part of the loan application to mitigate their risk.
Benefit	**Benefit**	**Benefit**	**Benefit**
		Information in valuation reports should assist in informed decision making	
Risk	**Risk**	**Risk**	**Risk**
Minimal, if valuation methodology and reporting conducted according to industry standards.	No risk, as they act on behalf of the seller, not the purchaser.	Typically does not receive valuation report or know the valuation reporting level or methodology[8]. Valuation of sustainable house (new) may be less than actual construction costs or artificially low/high due to lack of comparable properties. Valuation, in the above circumstance, is highly dependent on skill and experience of the valuer, yet this is outside of the control of the purchaser.	Mitigated by ensuring they are loaning less than 80% of the property value (without mortgage insurance). With mortgage insurance, a minimum short form valuation is required.
Cost	**Cost**	**Cost**	**Cost**
Cost (related to time) varies depending on form of report required. Cost passed on to financier (who passes it on to purchaser).	The agents takes a commission of the sale and arguably the seller factors this into their desired sale price, thereby passing the costs to the purchaser.	Pays cost of valuation report (but do not receive the report). May be pushed out of the market for sustainable homes if their borrowing capacity is less then valuations. May be pushed into the market of non-efficient homes, thereby incurring long term higher operational costs that can jeopardise mortgage repayments.	Cost of valuation passed on to purchaser (but valuation report not passed on).

[8] WA Home Buyers Survival Guide, p 13.

TABLE 11 IMPACT RELATIONSHIP - REGULATION VORTEX EXAMPLE

Government	Real Estate / Sales Agents	House Purchaser	House Seller
Action	**Action**	**Action**	**Action**
Government regulates disclosure of sustainability features at sale of property.	Poor wording of the regulation results in each agent having a different understanding about what is required, resulting in a mean standard that is less than the intended outcome	Receives different information for different homes and is unable to compare the information in deciding which home to purchase.	Does not know about or does not understand the legislation and finds little support from their sales agent.
Benefit	**Benefit**	**Benefit**	**Benefit**
Potential to change the demand for sustainable housing. Over time, sustainability declarations would contribute to a improved knowledge of the housing stock		Legislation should enable purchase to compare homes on their performance, including comfort levels and operational costs.	For houses with sustainability features, market differentiation which may lead to faster sales and/or higher prices
Risk	**Risk**	**Risk**	**Risk**
Non-compliance (due to poor wording / implementation) No change in supply or demand of sustainable housing Loss of public and industry confidence in regulation	Potential loss of sale or market value if house does not contain any of the sustainability features (and hence loss of income)	Gets no or inaccurate information & looses trust in regulation. Unable to make informed decisions about house purchase that impact on operational costs. No performance guarantees about property.	Potential loss of sale or market value if house does not contain any of the sustainability features
Cost	**Cost**	**Cost**	**Cost**
		An informed choice may enable purchasers to show their ability to manage finance repayments because of lower operating costs.	May spend time and money to prepare the mandatory report. Cost passed on to purchaser

TABLE 12 IMPACT RELATIONSHIP - CONSUMER PROTECTION VORTEX EXAMPLE

ACCC / AER[9] (Government)	Sales Agent / Builder	House Purchaser[10]	House Seller
Action	**Action**	**Action**	**Action**
Improves consumer welfare Protect competition or stop conduct that is anti-competitive or harmful to consumers Promote proper functioning of Australian markets.	The responsibility of the sales agent is to obtain the best price and terms for the seller Contracted Building: no requirement to provide information about the life of the product or performance, beyond very limited structural performance	Buyers need to look after their own interests, as no other party has an obligation to provide information to assist in the decision process	The seller is not required to supply information about the property to the buyer, but sellers and their agents cannot deliberately mislead buyers
Benefit	**Benefit**	**Benefit**	**Benefit**
			No disclosure requirements
Risk	**Risk**	**Risk**	**Risk**
	No risk, as there is no obligation to represent or protect the interests of the purchaser	Initial building contract includes plans and specifications, but there is no requirement for this information to be passed on to future purchasers. No warrant of fitness / performance guarantees are provided. May be prevented (financially, legally) from making some changes to property, but responsibility for this investigation rests with the purchaser. There is no cooling off period (WA).	No risk (other than if they deliberately provide misleading or false information) as there is no obligation to provide information about the product
Cost	**Cost**	**Cost**	**Cost**
		Bears all costs associated with obtaining professional advice to obtain the required information. Bears all costs associated with 'making good' products that don't meet expectations	

[9] The Australian Competition and Consumer Commission (ACCC) and the Australian Energy Regulator (AER).
[10] WA Department of Commerce, *Home buyers survival guide for WA*, 2012.

The strongest message that emerges from the Impact Relationship Maps and examples is that, whilst theoretically the owner holds the most cards (refer to phase 1 of report), in practice, it appears that:

- Risk and responsibility and costs are being transferred, by and large, to the dwelling purchaser (who can possibly pass these risks on to tenants or future purchasers);
- The purchaser is likely not aware that they are bearing these risks, responsibilities and costs;
- Information that could potentially assist in their decision making is not being passed on;
- Purchasers have limited knowledge, skills and expertise to deal with these issues;
- Purchasers are poorly represented, individually, collectively or legislatively, at any point; and
- The further a purchaser is from the original owner the likely worse off this scenario is.

Arguably, renters are even more disenfranchised than dwelling owners. Although their risks are different to dwelling owners, they have little control over the risks they bear associated with thermal comfort levels and operational costs (e.g. energy costs are impacted by decisions about the thermal rating of the building and the sizing and efficiency of the hot water service). This passing on of risk and responsibility could be partially explained by examining the motivations of the different sectors, as expressed by participants (Table 13).

TABLE 13 SECTOR MOTIVATIONS

Sector	Motivations (as expressed by participants)
Real estate	*Economics – driven by two things: the highest possible price in the shortest possible time.* *We're scared of government regulation…and litigation…about our lack of knowledge. We need to have the hand enforced upon us.*
Volume Builder	*(if clients ask for changes) it costs more, because as soon as they change the model, their costs increase, so they're reluctant to do it.* *A builder is about risk as well, so they don't want to be using anything that is going to cause them angst or be irresponsible.* *It's a competitive market place and these things do cost something…*
Industry Association	*If and when they (ABCB) introduce comprehensive sustainability measures that we would be more active in that space,… we would be looking for leadership from the ABCB to kind of raise the profile (*of particular sustainability feature / issue)
Regulators	*I look at current government policy directions, what are the current priorities, and what is relevant to that. I keep an eye on material for relevant potential regulatory developments, what's happening overseas, what's best practice, information relevant for making the case for regulatory reform. At the moment there aren't that many government policy directions we're responding to and we're in a bit of a state of flux.*
Manufact-urer	*We've discovered that comfort factors and liveablity can't be quantifies from a pure dollars and cents and energy payback story. So I'm doing a lot of research work into ways in which we can assist the builders so they can deliver that capability, and assist in communicating that to the consumers, (to) drive demand through the supply chain.*
Local Council	*75% of our residents live in high density rather than single housing. I've been looking at existing building and sustainability improvements through retrofits that could be made. But in devising a strategy as to what we don in moving forward and urban consolidation, there's a lot of new building that are going to come online that are going to have to be sustainable, so we don't have to go back (and retrofit them in the future)*
Infrastructu re provider	*Electricity supply is a long lived asset. Once you've built, you can't adjust. The assumptions you make on day one are locked in forever… to a large extent.* *Distribution companies don't actually have any incentive to sell less electricity*
Valuer	*If I spend this much money, how will the value of my property go up?*
Developer	*In low cost subdivisions, where the developer doesn't care, they just want to get in there and get the heck out of there again, and build at the lowest possible construction cost, but then they pass on the capital operation costs to the next person.*
Media (consumer magazine)	*(we're) really responding to what people are interested in and also some of the issues that aren't perhaps being covered. The role of media is to raise that and open that discussion – 'here are some options for you' - not pros and cons. (It's about) guiding people, aiding choice.*

BUILDING PERFORMANCE CERTIFICATES

There was much discussion about the differences between the house as a consumer product, and other products, especially vehicles.

> *If you look at your house and car as the two biggest expenses you will have in your life, I actually suggest that most people spend more time researching buying a camera or a laptop than they do the others.*

In particular it was noted that there were significant differences in terms of

- Information supplied by the seller / manufacturer / subsequent sellers (e.g. user manual, log books)
- Legislative requirements (e.g. safety, energy efficiency, roadworthiness, registration, insurance…)
- Product instrumentation that provided a wide variety of feedback to the user
- The wide range of sources of information (apart from the manufacturer / supplier), including user groups and consumer support and advocacy groups (e.g. automobile clubs)

Focus group discussions alerted participants to the New Zealand experience, where issues of health and wellbeing, as well as living costs for low income families, are driving discussions towards mandating a 'Warrant of Fitness' (WoF) for all rental properties (similar to NZ's WoF requirement for vehicles).

> *Driving the movement is concern about the impact that low quality rental housing has on the health and wellbeing of children and the elderly. Poorly insulated homes are expensive to heat; other issues include poor maintenance and rentals that do not meet basic sanitation and safety requirements. The quality of housing stock was a concern: residents want warm and adequate housing.* [11]
>
> *The warrant system gave tenants confidence about rental properties, and owners benefited from having their properties shown to be of quality. We see the benefits of both landlords and tenants as being a win-win situation. This is setting a benchmark and it will be self-regulating*.[12]
>
> *If you're in the business of selling rental accommodation, you should meet basic standards, just like any other business…Getting our houses up to standard is a simple, affordable measure that will make life better for families, save families money and save the taxpayer a fortune in health costs as well as boosting the economy while reducing our environmental impact. It's a classic example of smart, green economics that builds a better New Zealand*.[13]

A similar sentiment (i.e. consideration of societal impacts when valuing information) was also expressed by industry:

> *For the occupant it (*ranking of importance of building information*) is important - but little information is available. Buyers/renters do not demand it, as simply acquiring property is the main objective. Industry places importance on regulated information and the demands of the customer. Given this demand is not apparent in the tight housing market - only high level information is deemed important. High level: for example - security but not indoor air quality, connection to gas and/or electricity but not the efficiency of the system. If the operational cost as well as societal impact for poor housing were evident, this information would be all of primary importance to all parties.*

The potential role of the real estate industry in performance certificates, whether mandatory or voluntary, was acknowledged by industry participants in this project:

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[11] www.councilofsocialservices.org.nz 17/9/2013 and 6/11/2013
[12] www.nzherald.co.nz 16/11/2013 - voluntary implementation of WOF by Dunedin Property Management
[13] www.greens.org.nz 18/7/2013

> *If we could wave the magic wand, we would make every transaction in real estate compulsory to have an Energy Disclosure Rating (*real estate sector*)*

> *We're watching with interest LJ Hooker's launch of their new Liveability market features… It rolls sustainability into a real estate agent language and talks about the features in terms of liveability that the purchaser may understand and desire. (*regulator*)*

Another suggestion related to looking at the legal and information requirements affecting Strata Title properties, and the possibility of similar process (including Sinking Funds) could be implemented for other dwelling types (non-strata).

BUILDING INFORMATION FILES AND DATA PLATFORM

Participants acknowledged that a lot of information about individual dwellings does already exist and that this information was not co-ordinated or inventoried in any systematic manner. Some stakeholders could not see any need for the creation of an information system, as they believed their data needs were adequately catered for. Others identified the value (and concerns) such a system could provide. These are listed in Table 14.

TABLE 14 VALUE AND CONCERNS ABOUT BUILDING INFORMATION FILES

Value of building information files	Concerns
More effective and targeted policy (because of better knowledge of the building stock) and action (by whole industry sector)	Need to be in a useful format for each of the users
Monitoring social trends	Security and privacy issues (what information would be available to whom)
Potential for scale discounts and purchasing (for institutional owners of housing assets)	Data accuracy and data currency (e.g. don't know what work people have done within the home, to change the data)
Improved property maintenance and management (particularly for institutional owners of housing assets)	

A number of suggestions were raised of existing or emerging information systems, certification system and data sets that could be utilised in the development of a shared building information platform. These are listed in Table 15. All participants agreed, however, that there was a sector wide need for better knowledge about sustainability features, and more effective means of communicating the value of sustainability features to all sectors.

TABLE 15 CONSIDERATIONS FOR A BUILDING INFORMATON PLATFORM

Existing data sets that could be incorporated	Existing rating / certification systems that could be incorporated	Existing or emerging information systems / processes that could be utilized / adapted
Archi-Data (Australia: product reference library)	ARCActive	WA Shared Land Information Platform (SLIP) and other state departments (e.g. LandVIC)
Asbestos registers	UDIA EnviroDevelopment & Sustainable Urban Development Matrix	WA Housing Dept – social housing asset management strategy
Developers' data (e.g. Stockland iScope)	Green Star suite	Archidata (Canada) – Property and construction data management software (GIS, BIM)
Volume home builders' data (digital files of houses, as well as other construction data)	Energy assessments	New Zealand discussions regarding Warrant of Fitness (WoF) requirements for rental housing and Otago Property Management who have voluntarily implemented WoF certificates
Industry collated data (e.g. REIA, RP Data)	BASIX and NABERS ratings	VANZI (Virtual A&NZ Infrastructure) – 3D modelling data
Titles Office(s)		BuildingSMART Australasia (BIM)
Council Planning Departments		FSDF (Australia and New Zealand Foundation Spatial Data Framework)
		QR Code
		DPID[14]
		Property auditing processes utilised for Aboriginal housing in WA
		International Alliance for Interoperability (IAI) Standard for Exchange of Product data (STEP) OpenBIM

SUMMARY

The project has developed a flow chart indicating how information is created, used and transferred between different actors in the housing supply chain. It has identified four key relationships that appear to have very significant impacts on the long term sustainability and costs of housing. It has identified, with significant industry participation, potential strategies that could be deployed to implement building performance certificates of some type, and inform further research into building information files.

[14] Delivery Point Identifier: a unique 8 digit number allocated by Australia Post to each address in Australia; the key component of the printed barcode

DISSEMINATION PLAN

It is intended to disseminate the findings from this research project through a variety of academic, industry and general publications, both electronic and paper based (Table 16).

TABLE 16 DISSEMINATION PLAN

Publication type	Selected Medium	Indicative timeframe
Academic Research	Sustainable Buildings 2014 international conference (SB14)	Abstract 20 January 2014 Paper June 2014 Conference October 2014
	Journal: *Buildings and Energy* OR *Sustainability* OR *Smart and Sustainable Built Environment*	January / February 2014
Online Media	The Conversation and/or The Fifth Estate	January / February 2014
Industry Publications	Dissemination of this report to industry stakeholder participants	January 2014
	Short articles for publication in industry electronic news, as requested by project partners and industry participants	January – March 2014
	Building Australia's Future Conference 2014 (annual conference of the Australian Building Codes Board)	September 2014
General public publications	*Sanctuary* OR *ReNew* Magazine	January – March 2014
Input into National project	Provide report as an input into the National Energy Efficient Building Project (Pitt&Sherry)	January 2014

APPENDIX A: BUILDING INFORMATION CATEGORIES

The 150+ pieces of information about an individual dwelling identified in Phase 1 were distilled down to 45 core attributes in 5 categories (using international best practice in sustainable building certification as a guide).

TABLE 17 BUILDING INFORMATION CATEGORIES AND DETAILS

Spatial Planning	Occupant Health and Safety	Occupant Comfort	Operation and Services	Building Durability
Site area	Air Quality	Annual overall thermal comfort (star rating)	Energy connections available	Universal design (accessibility)
House size	Product Material Safety Data Sheets (human health impacts)	Thermal comfort - seasonal	Communication connections available	Flexible layout
Site cover	Product Material Safety Data Sheets (environmental impacts)	Building orientation	Water service connections available	Ability to adapt to changing needs over time
Number of bedrooms / bathrooms	Product disposal directions	Natural cross ventilation	Ability to connect internal fittings to rainwater or greywater	Building envelope construction materials (life span / durability)
Size of rooms	Visual access to neighbours and streets	Ceiling fans	Hot water service type	Kitchen / bathroom materials (life span / durability)
Ceiling height / room volume	Security measures	Heating / cooling appliances	Alternative power systems (size and output)	General interior fit out materials (life span / durability)
Internal room layouts and connections (physical and visual)	Hot water temperature regulators	Access and control of natural light	Utility costs	Ease of access to service wiring, plumbing, data cabling
Connections to external yard space (physical and visual)	Trench layout for services	Visual comfort – glare and aesthetics	Product selection (maintenance / requirements)	Ease of deconstruction
Effective and efficient use of whole site	Pest control measures	Acoustic comfort	Product selection (guarantees / warranties)	Disposal options (reuse, recycle, landfill)

APPENDIX B: INDUSTRY ENGAGEMENT DEMOGRAPHICS - SURVEY

Demographics: we wish to gather some general information about you and your role in the housing supply chain.

Please select your gender	Response Percent	Response Total
Male	70%	14
Female	30%	6

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

Please select your age group from the list below	Response Percent	Response Total
18 - 24	0%	0
25 - 34	0%	0
35 - 44	35%	7
45 - 54	25%	5
55 - 64	40%	8
65 or older	0%	0

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

In what state do you currently work?	Response Percent	Response Total
Queensland	25%	5
New South Wales	40%	8
Victoria	15%	3
South Australia	0%	0
Western Australia	10%	2
Northern Territory	0%	0
ACT	5%	1
Tasmania	5%	1

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

In which industry sector do you work?	Response Percent	Response Total
Finance	0%	0
Insurance	0%	0
Real estate	0%	0
Sales/marketing	0%	0
Development	15%	3
Construction	35%	7
Valuation	5%	1
Regulation	25%	5
Consumer Advocacy	0%	0
Other	20%	4

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

Who is your employer?	Response Percent	Response Total
Local Government	5%	1
State Government	20%	4
Federal Government	5%	1
Land/Housing Development Company	5%	1
Self Employed	25%	5
Private company	25%	5
NGO / Consumer advocate	5%	1
Other	10%	2

Total # of respondents 20.
Statistics based on 20 respondents; 0 filtered; 0 skipped.

APPENDIX C: FOCUS GROUP PROPS

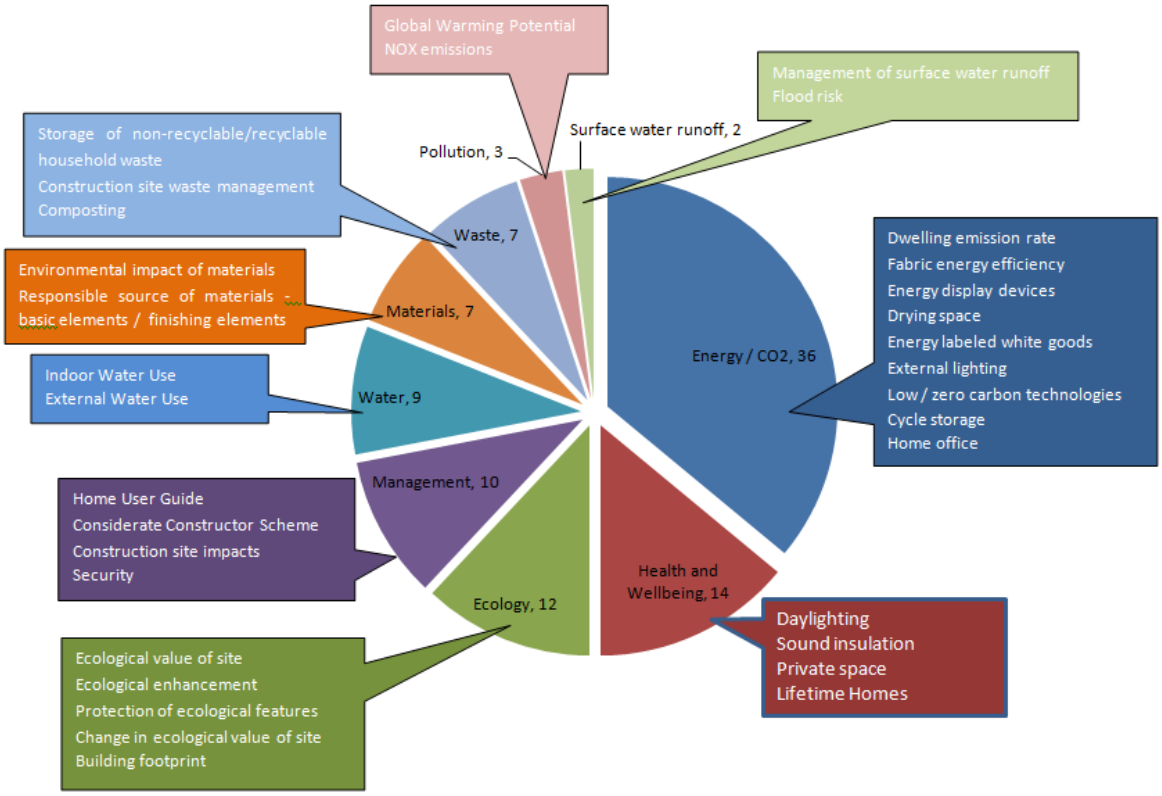


FIGURE 25 UK CODE FOR SUSTAINABLE HOMES

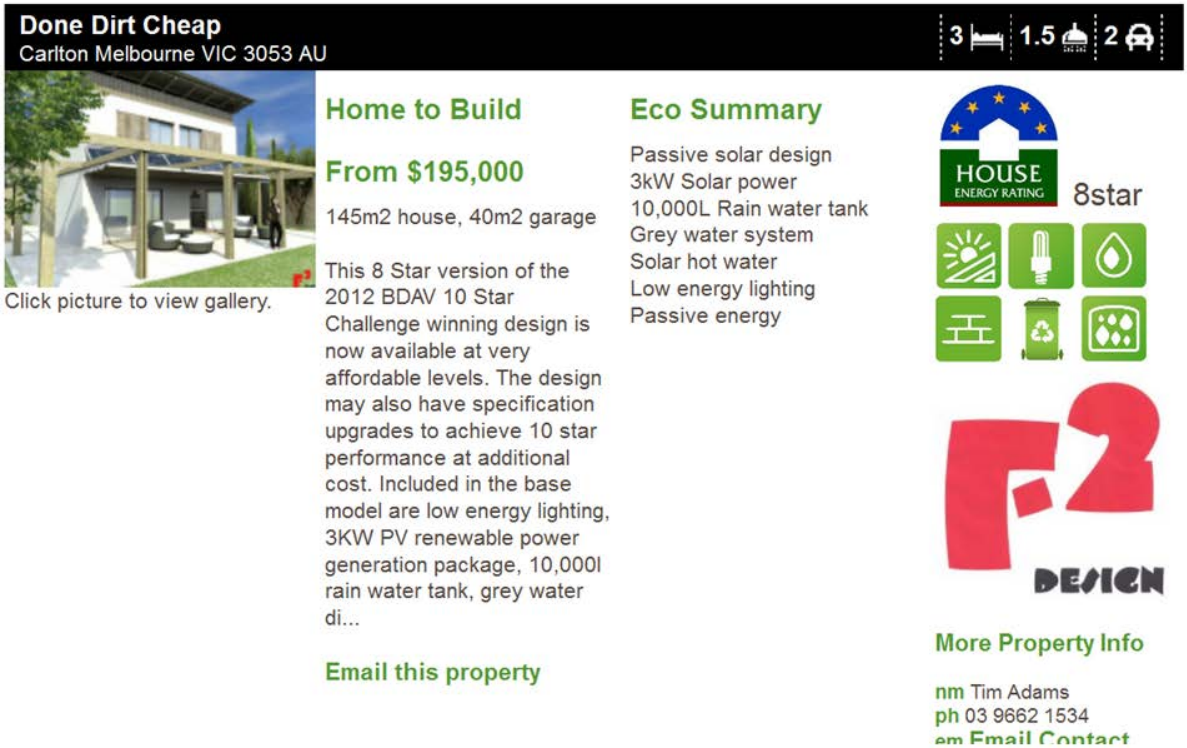
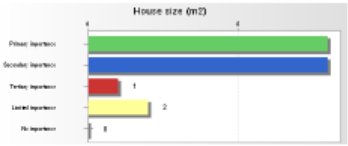
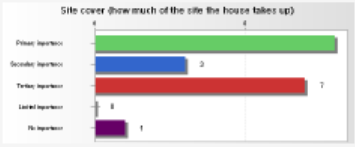
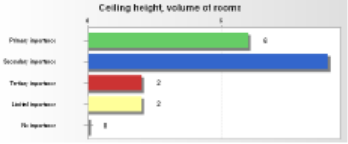
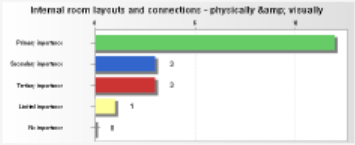
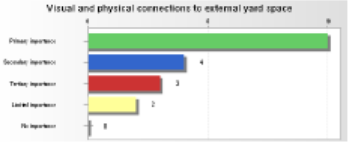
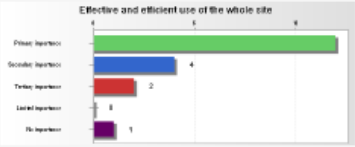


FIGURE 26 ONLINE ADVERTISEMENT MELBOURNE NOV 2013

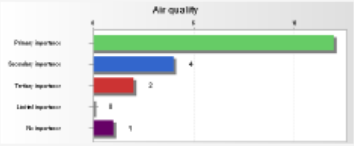
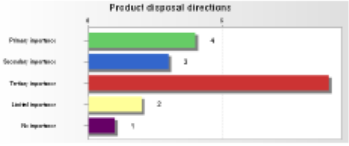
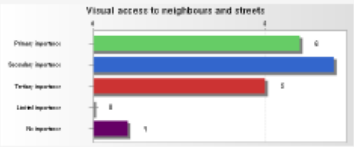
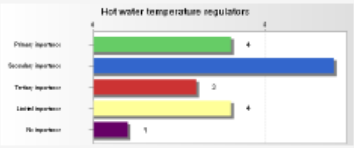
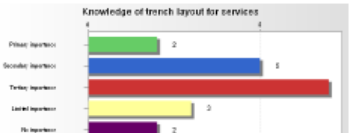
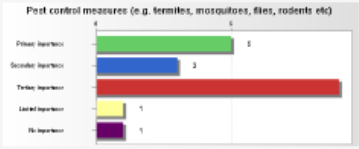
FIGURE 27 GREEN STAR PERFORMANCE CREDITS

APPENDIX D: RANKINGS OF BUILDING INFORMATION BY CATEGORY

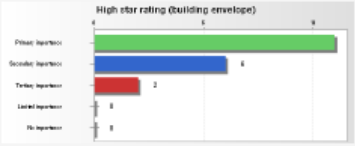
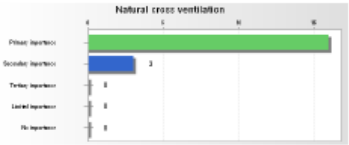
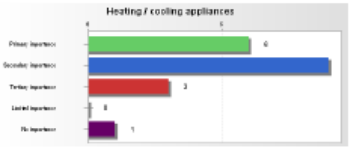
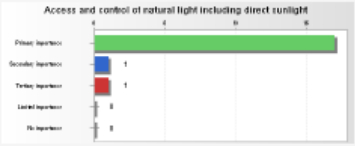
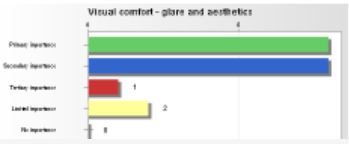
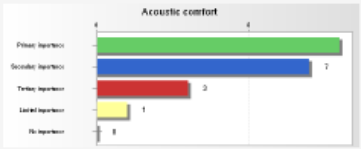
Spatial Planning

	A	B	C	D	E		Response Total
Site area	31.58 % (6)	21.05 % (4)	26.32 % (5)	15.79 % (3)	5.26 % (1)		19
House size (m2)	42.11 % (8)	42.11 % (8)	5.26 % (1)	10.53 % (2)	0 % (0)		19
Site cover (how much of the site the house takes up)	42.11 % (8)	15.79 % (3)	36.84 % (7)	0 % (0)	5.26 % (1)		19
Number of bedrooms, bathrooms	31.58 % (6)	31.58 % (6)	31.58 % (6)	5.26 % (1)	0 % (0)		19
Size of rooms	42.11 % (8)	31.58 % (6)	21.05 % (4)	5.26 % (1)	0 % (0)		19
Ceiling height, volume of rooms	31.58 % (6)	47.37 % (9)	10.53 % (2)	10.53 % (2)	0 % (0)		19
Internal room layouts and connections - physically & visually	63.16 % (12)	15.79 % (3)	15.79 % (3)	5.26 % (1)	0 % (0)		19
Visual and physical connections to external yard space	52.63 % (10)	21.05 % (4)	15.79 % (3)	10.53 % (2)	0 % (0)		19
Effective and efficient use of the whole site	63.16 % (12)	21.05 % (4)	10.53 % (2)	0 % (0)	5.26 % (1)		19

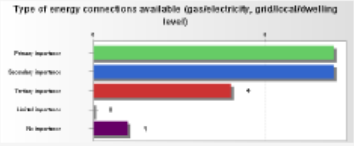
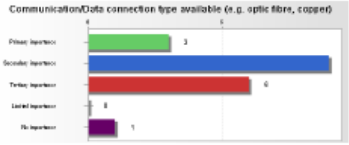
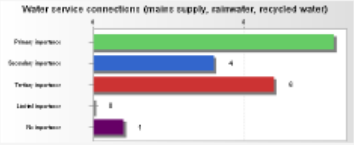
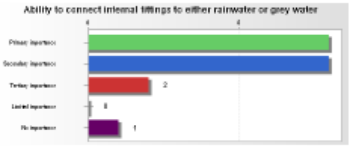
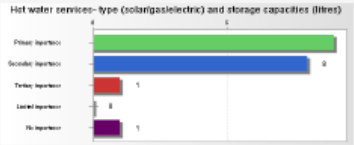
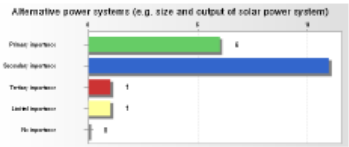
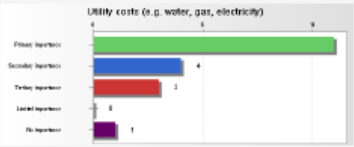
Occupant Health and Safety

	A	B	C	D	E		Response Total
Air quality	63.16 % (12)	21.05 % (4)	10.53 % (2)	0 % (0)	5.26 % (1)		19
Product Material Safety Data Sheets (MSD) - Human Health Impacts	36.84 % (7)	31.58 % (6)	26.32 % (5)	0 % (0)	5.26 % (1)		19
Product MSD Sheets - Environmental Impacts	26.32 % (5)	31.58 % (6)	31.58 % (6)	10.53 % (2)	0 % (0)		19
Product disposal directions	21.05 % (4)	15.79 % (3)	47.37 % (9)	10.53 % (2)	5.26 % (1)		19
Visual access to neighbours and streets	31.58 % (6)	36.84 % (7)	26.32 % (5)	0 % (0)	5.26 % (1)		19
Security system, general security measures	10.53 % (2)	26.32 % (5)	52.63 % (10)	5.26 % (1)	5.26 % (1)		19
Hot water temperature regulators	21.05 % (4)	36.84 % (7)	15.79 % (3)	21.05 % (4)	5.26 % (1)		19
Knowledge of trench layout for services	10.53 % (2)	26.32 % (5)	36.84 % (7)	15.79 % (3)	10.53 % (2)		19
Pest control measures (e.g. termites, mosquitoes, flies, rodents etc)	26.32 % (5)	15.79 % (3)	47.37 % (9)	5.26 % (1)	5.26 % (1)		19

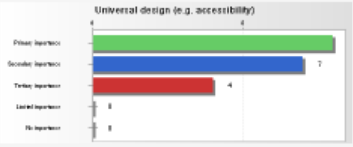
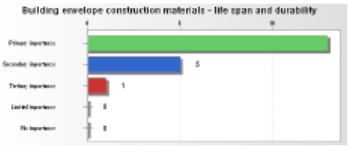
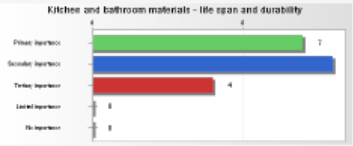
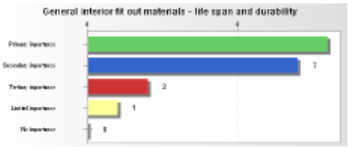
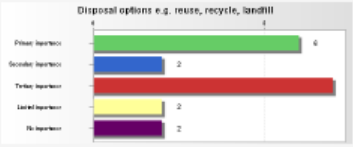
Occupant Comfort

	A	B	C	D	E		Response Total
High star rating (building envelope)	57.9 % (11)	31.58 % (6)	10.53 % (2)	0 % (0)	0 % (0)		19
Thermal comfort - seasonal (winter and summer)	78.95 % (15)	21.05 % (4)	0 % (0)	0 % (0)	0 % (0)		19
Building orientation	84.21 % (16)	10.53 % (2)	5.26 % (1)	0 % (0)	0 % (0)		19
Natural cross ventilation	84.21 % (16)	15.79 % (3)	0 % (0)	0 % (0)	0 % (0)		19
Ceiling fans	42.11 % (8)	26.32 % (5)	21.05 % (4)	10.53 % (2)	0 % (0)		19
Heating / cooling appliances	31.58 % (6)	47.37 % (9)	15.79 % (3)	0 % (0)	5.26 % (1)		19
Access and control of natural light including direct sunlight	89.47 % (17)	5.26 % (1)	5.26 % (1)	0 % (0)	0 % (0)		19
Visual comfort - glare and aesthetics	42.11 % (8)	42.11 % (8)	5.26 % (1)	10.53 % (2)	0 % (0)		19
Acoustic comfort	42.11 % (8)	36.84 % (7)	15.79 % (3)	5.26 % (1)	0 % (0)		19

Operation and Services

	A	B	C	D	E		Response Total
Type of energy connections available (gas/electricity, grid/local/dwelling level)	36.84 % (7)	36.84 % (7)	21.05 % (4)	0 % (0)	5.26 % (1)		19
Communication/Data connection type available (e.g. optic fibre, copper)	15.79 % (3)	47.37 % (9)	31.58 % (6)	0 % (0)	5.26 % (1)		19
Water service connections (mains supply, rainwater, recycled water)	42.11 % (8)	21.05 % (4)	31.58 % (6)	0 % (0)	5.26 % (1)		19
Ability to connect internal fittings to either rainwater or grey water	42.11 % (8)	42.11 % (8)	10.53 % (2)	0 % (0)	5.26 % (1)		19
Hot water services- type (solar/gas/electric) and storage capacities (litres)	47.37 % (9)	42.11 % (8)	5.26 % (1)	0 % (0)	5.26 % (1)		19
Alternative power systems (e.g. size and output of solar power system)	31.58 % (6)	57.9 % (11)	5.26 % (1)	5.26 % (1)	0 % (0)		19
Utility costs (e.g. water, gas, electricity)	57.9 % (11)	21.05 % (4)	15.79 % (3)	0 % (0)	5.26 % (1)		19
Product selection - maintenance and requirements	42.11 % (8)	42.11 % (8)	15.79 % (3)	0 % (0)	0 % (0)		19
Product selection - guarantees and warranties	26.32 % (5)	42.11 % (8)	21.05 % (4)	5.26 % (1)	5.26 % (1)		19

Building Durability

	A	B	C	D	E		Response Total
Universal design (e.g. accessibility)	42.11 % (8)	36.84 % (7)	21.05 % (4)	0 % (0)	0 % (0)		19
Flexible layout (e.g. use of rooms for different purposes)	50 % (9)	44.44 % (8)	5.56 % (1)	0 % (0)	0 % (0)		18
Ability to adapt to changing needs over time	57.9 % (11)	21.05 % (4)	15.79 % (3)	0 % (0)	5.26 % (1)		19
Building envelope construction materials - life span and durability	68.42 % (13)	26.32 % (5)	5.26 % (1)	0 % (0)	0 % (0)		19
Kitchen and bathroom materials - life span and durability	36.84 % (7)	42.11 % (8)	21.05 % (4)	0 % (0)	0 % (0)		19
General interior fit out materials - life span and durability	44.44 % (8)	38.89 % (7)	11.11 % (2)	5.56 % (1)	0 % (0)		18
Ease of access to service writing, plumbing, data cabling	36.84 % (7)	36.84 % (7)	21.05 % (4)	0 % (0)	5.26 % (1)		19
Ease of deconstruction	26.32 % (5)	10.53 % (2)	42.11 % (8)	15.79 % (3)	5.26 % (1)		19
Disposal options e.g. reuse, recycle, landfill	31.58 % (6)	10.53 % (2)	36.84 % (7)	10.53 % (2)	10.53 % (2)		19

APPENDIX E: SELECTED QUOTES FROM INDUSTRY

About designers	*I have practised (and continue learning about) sustainable design for 30 years. Most of the design profession, despite their self-perception, are blatantly ignorant. This is a big obstacle, and difficult to overcome, and leads to poor design (inappropriate orientation, no cross ventilation, deep plan buildings, limited water collection due to poor roof design, etc). Ignorance breeds insecurity which in turn leads to excuses (e.g. too expensive, won't work, can't guarantee that it will work, put in a/c as back-up).*
About the general public	*My perceived idea is that the general public are more focussed on space and the flashy fit-out items that they can show off to their friends and neighbours, rather than internal comfort and health aspects. In new construction of homes the discretionary budget is most likely to be spent on upgrade items in kitchen and bathroom fit-out. I believe it is a wasted opportunity to neglect the performance insulation and glazing options that are built into the building fabric during construction, the designer upgrade items can often be retrofitted at a later date.*
	Lack of customer knowledge, and focus on perceptions of appearance, rather than levels of functionality, is a problem. Also, lack of exposure to options, limits people's perception. Many alternatives, once 'experienced', are opened up.
	Customers are not typically as well informed - too much 'noise' for them to filter
	I believe that most people think little about these aspects (can always turn on the air conditioner!). The one that will grab their attention is the costs of energy and water.
	Most of my customers want me to provide a compliance rating. To get this the internal layout and features are the most important. Running costs come a distant third.
	I believe that many customers may accept the status quo rather than understanding how much of building comfort, operation and efficiency is really a calculated cost/benefit. The market has not been adequately educated to understand how many livability and sustainability possibilities may have been short-changed.
	Our customers are not so well informed, and have little appreciation of the impact of sustainable housing models.
	Customers tend to be caught up in a social status mindset and ignorant of the real impacts to the environment
	Customers - standard of living is important, some are keen to do their bit and help the environment but economics i.e. the upfront cost overrules this on many occasions. Running costs are starting to have an impact with rising utility prices. Social issues will not be high on a customer's priority list unless they do not meet the minimum community standards/expectations. New materials - only get a Guernsey if they save money…
About the building industry in general	*The building industry often uses short sighted metrics to value building performance, the payback often ignores important attributes such as the Internal Environment Quality (IEQ) and the liveability of a home.*
	Most people just want to comply. They want a certificate, a Form 15, so that box is ticked and they move on to something else… because it's a game, to get all the boxes ticked, at the lowest cost, and then build it.
	Businesses reflect society and often are unable to lead the choices of their clients towards more sustainable options, without risking market share in "core business".
	Some businesses are struggling to be profitable = economically sustainable. Consequently they are focused on commercial viability, rather than having sustainable choices as part of their business DNA. Every business needs to be a "Meaningful Specific, rather than a Wandering Generality".
	My profession does not place any importance on any of these factors. They are non issues
About regulators	*Regulators are engaged in the space of new buildings and alterations and additions through the implementation of minimum standards and not involved in operation of these buildings.*
	I have a fascination too with government's position, as to where their big picture is coming from … their sheer fascination at the moment is cost. Cost, cost and cost.

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