

Facilitating 'green' building: turning observation into practice

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I declare that except where due acknowledgment has been made, the work is that of the candidate, Dominique Hes, alone.

Also the work has not been submitted previously, in whole or in part, to qualify for any other academic award.

Furthermore, the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program. Editorial work was carried out by Anitra Nelson and Frans Willem Timmerman and the thesis typeset by Joy Lankshear.

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ABSTRACT

This thesis is the story of my five year journey developing a practice in integrating 'green' innovation within the built environment—mainly in new buildings. It is an exploratory thesis based on qualitative observation and documentation of my experience and detailed reflection on the successes and failures of this practice as I moved from naïve novice to expert. Initially I identified a great deal of desk-based and survey research on 'green' buildings, but little research actually looking at the field from within the practice of a building project. I thought that exploring this would create some understanding of why some 'green' initiatives were not taken up at the rate many people expected.

Through the telling of the over fifty stories which make up this thesis, I hope that I can create vicarious experiences in readers thus enabling them to use my journey to reflect on their own paths and to therefore learn with me. A number of useful tools and methods I developed to support my practice are presented, along with the key insights I extracted from my experience: that different types of 'green' information are relevant at particular stages of the building life cycle; that reflective practice is an essential tool in a facilitative practice working in a discursive, dynamic and complex field; that the power, culture and nature of the agents play a role in the ability to successfully integrate 'green' innovation; and, most importantly, that there is a need for all agents to have a voice in the integration of 'green' innovation into a project.

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Preface

This preface aims to help the reader make sense of the thesis.

The use of 'I'

This thesis is a complex story of a journey I have travelled over the past five years, and to a certain extent my whole life. The research has not only added to the body of knowledge in the area of sustainable built environment, but has also become my profession. Through the past five years I have been welcomed for what others recognise as my expertise in the field of 'green buildings'; it has become my practice. So, it is not without forethought that 'I' is used; it reflects the method used and the intimate relationship between the research and the researcher. The approach used is outlined in chapter 2, but at the heart of it is that 'I' am the participant researcher and the thesis is an exploration of the result of my journey.

The use of the first person narrative is outlined in Boshier (2002), and supported by many authors for example Schön (1979, 1983, 1987), Wolcott (1990) and Whitehead (1998, 1999). Wolcott highlights why using the first person in a reflective practice thesis is crucial:

Because the researcher's role is ordinarily such an integral part of qualitative study, I write descriptive accounts in the first person...The more critical the observer's role and subjective assessment, the more important to have that role and presence acknowledged in the reporting. (Wolcott, 1990:19)

I also use 'I' to emphasise that this is about *my* journey and *my* reflections on the journey. What you will read are my reflections, my collection of observations, and materials linked to the relevant literature in the area. It is not THE TRUTH, rather it is my ponderings, which I hope will further the discussion in the field. Hitchcock and Hughes:

Many qualitative researchers argue strongly for the use of the first person. The extent to which the prospective researcher is able to achieve this is a moot point since the prevailing norm is to adhere to a neutral stance which will inevitably require the use of the third person. However, apart from being singularly unexciting this method of reporting research may in fact be distorting the

very realities it is claiming to represent. Since qualitative researchers take the re-presentation and re-construction of social reality very seriously the use of the first person narrative style may not only be justifiable, but essential (1995:338, my emphasis).

With the use of the first person narrative what also becomes apparent is the transition that has occurred; I have changed from who I was in 1998, to who I am today sitting behind this computer in 2004. So, in using 'I', a coherent story emerges, a story that is supported by the methods chosen to do the research and leads to the results while sweeping the reader along the journey (Ricoeur, 1985:280):

A transition only makes sense within the frame of a coherent story; but that story is not yet told, and in turn gets its coherence from the ways in which individual episodes, and the transitions between them, are put together.

Lastly I have used the personal narrative approach to communicate my experience and to allow my own personal idiosyncrasies to emerge and make the whole thesis more personal, more experiential.

Other theses that form the basis of this research

There are two main theses that laid down the path for this research. The first was Boshier (2002), due to the use of the first person and his conversational and reflective style of writing. The second was Karen Stewart, who inspired the format of this thesis through hers: 'Choice, challenge, change' published in 2000. Her work resonated with me and is quoted where relevant.

Structure of the thesis

This thesis is a story of a journey. The first two chapters introduce me the author, the context of the research, the gaps I am investigating and the approach I have used. Chapters 3 to 6 are the story itself, told by me reflecting back on all the material collected over the five years of this PhD. Chapter 7 is the discussion, which I have written as a series of insights gained. The chapter closes with a conclusion and a review of whether I have actually addressed my gap. The final chapter will not make any sense without reading the story, so I strongly suggest reading chapters 3 to 7 in order.

A short autobiography

...this researcher, as a human instrument, was subject to limitations such as personal biases, missed opportunities, and potential mistakes... (Stewart, 2000:58)

The further I go into this journey the greater my own limitations seem to become. So to start this thesis I would like to paint a picture of who I am, my background and influences.

I am white, female, blond (the mousey kind), blue-eyed, with Dutch ancestry.

My childhood was displaced; I lived in South Africa, Brazil and Holland before moving to Australia in fourth grade. Having moved over twenty times and gone to over ten different schools before the age of 12, I was a shy 'bookish' adolescent.

My high school education was adequate and I performed well, being in the top ten of my class, nothing notable though. Interestingly, and maybe relevantly, I became involved in a Christian group and tried to evangelise the school—my firm belief in their doctrine and fear of my fellow students going to hell, overruling my shyness. At the age of 16, I began to realise that the group was manipulative, repressive and hypocritical. I managed to emotionally and intellectually escape their hold.

Virtually the day after my final exam at high school I packed my bags and started travelling, first around Australia and then around Europe. I returned eighteen months later to study science at the University of Melbourne. I chose Melbourne because I liked the city, but mostly because it was far enough from home, a small town near Newcastle (1200 km away), that I did not have to feel guilty about not going home more often. I had true independence.

In my first years at university, though no longer as shy, I was reserved and prone to depression. Then at the tender age of 21, I was diagnosed with MS and told I would be a vegetable in five years. This was frightening as it was something I had vaguely experienced as a child as my grandfather wasted away. After going through a myriad of tests and an MS expert it was determined that the first specialist had been wrong. But, for a month I was in shock. Do I give up now? Do I fight? I decided neither. I decided that I was an ok person and I would continue to live my life as if I did not have MS. This was THE main turning point in my life. I became a realistic optimist and no longer

bound by insecurity, I was going to have a go and, if I failed, well I'd learn from it and keep moving on.

I finished my degree by spending a year in Holland studying environmental science and economics at Amsterdam University. As part of this course I first experienced collaborative projects with multi-disciplinary input. It is where the 'green' bug bit.

On returning to Melbourne, I began a masters degree in cleaner production (engineering) and worked for the Environment Protection Authority of Victoria for six months. Then I secured a challenging job back in Holland. Having felt so displaced in Australia I was trying to determine whether Holland was more of a 'home'. The job was the international account and development manager of a life cycle assessment consulting company PRé Consultants and their software SimaPro. Simply put we determined the environmental impacts of products for companies so they could redesign them. The main lesson from this time was that I enjoyed holding seminars and teaching.

On my return to Melbourne almost three years later I began the research behind this thesis.

Reflection

There are three main areas that I would like to reflect on. The first is that having written the autobiography I feel that there is a definite 'evangelical' thread that runs through the story. Have I swapped one religion for another? If so will this impact on my ability to see things objectively? Particularly, as I mentioned above, as I believe that we can live a sustainable existence. It is just about learning how.

The second reflection is the ability for me to learn from mistakes and overcome adversity. I have picked myself up dusted myself off, reflected and moved on many times. There are two issues here: tenacity and being unafraid to be critical of my own actions, to learn from my mistakes and change accordingly.

The third is that I am doing a PhD thesis on sustainability (currently an epistemology based in the rationalist/positivist realm, i.e. science and engineering) in the built environment, in the School of Architecture and Design, using qualitative methodology, particularly action research, to inform my reflective practice (epistemology based in the interpretivist/constructivist realm). How is this possible? How can I have a scientific/engineering pragmatist background and be doing a PhD thesis in a design-based discipline using what some positivists think of as an 'airy fairy' method?

① Context

This thesis investigates what happens in the built environment, from the decision to create a new building, through the process of design, development, documentation, construction, commissioning and occupation. It presents a reflective practice journey from naive novice to expert in the facilitation of ‘green’ building innovation. The purpose is to explore the development of a practice facilitating innovation in the industry—innovation that supports a more sustainable or ‘green’ outcome. The aim is to be able to give a meaningful description of the process, the journey and the lessons in developing the practice. Using reflection I seek a deeper understanding of the journey and aim to facilitate vicarious learning in others on a similar path. The rationale behind this aim is explained in greater detail in this chapter.

My motivation to carry out this research is to support the built environment to become more sustainable—environmentally and socially responsible (what I term ‘green’). It is to provide some meaningful exploratory research and support further discussions into how to facilitate this. It is not to be prescriptive, but to look at what actually occurs in practice.

My interest in sustainability in the built environment arises because buildings and their surroundings have a large impact on both environmental and social sustainability. Most papers and books that discuss ‘green’ buildings begin by describing the impacts buildings have (Eisenberg *et al.*, 2002; Rao and Brownhill, 2001; Ashkin, 1995; Graham, 2003; Maver and Petric, 2003; Owen, 2003; Rwelamila *et al.*, 2000; Williamson *et al.*, 2003). Environmentally speaking the most frequent quoted figures are that the built environment and the construction industry are responsible for approximately 40 per cent of resource consumption, 30 per cent of the world’s energy consumption (Roodman and Lenssen, 1995) and between 10 and 40 per cent of the world’s waste generation (Kibert, 2000).

Therefore changing this industry has the potential to create a large decrease in environmental impact, particularly because of the longevity of the built environment. A building designed and built today may still stand in 100 years. In its operation, refurbishment and demolition it will continue to have an impact long after the generation who built it. A similar argument can be made for its social and cultural impact.

1.1 *My theoretical framework*

From the outset my position is that we as humans have the capacity to facilitate a significant change towards a more sustainable world, environmentally, socially and culturally. My position five years ago was that *if only we could make it easy to choose the sustainable option then people would choose it. If people only understood how to do it better, they would.* How naïve was I? I know now that it is a lot more complex, and this research was my first step in understanding this complexity:

A journey of a thousand miles must begin with a single step. (Lao-tzu)

At the end of the day I think that I am an interpretive researcher. The philosophical base of interpretive research is hermeneutics and phenomenology (Boland, 1985). The latter is relevant to this research. Throughout the five years I have attempted to understand the building process and its integration of new knowledge, in this case sustainable or ‘green’ design, and my role in facilitating the transfer. I hoped, quoting an information systems researcher, to produce ‘*an understanding of the context of the ... system, and the process whereby the ... system influences and is influenced by the context*’ (Walsham, 1993:4-5). In simple terms, how does it all actually work?

1.1.1 Research questions

This research, then, is motivated by a dream for a more sustainable future and the pragmatic description of what actually occurs in building projects through the eyes of a fledgling practitioner in the field. Being experiential, the research attempted not to be blinkered by using the research questions as an endpoint as one would use a hypothesis. Instead the research questions were seen as guiding the process.

While reflecting on the practice of a ‘green’ innovation facilitator some key questions were asked both to distil the experience of the real world integration of ‘green’ innovation and to highlight how this journey lead to my practice. These questions are:

- How was ‘green’ innovation facilitated, what information was required, what were barriers experienced?
- What were the main lessons learned, and the main methods for overcoming the barriers?
- How did the journey progress?

The research questions in this thesis actually evolved over time, and in collecting and evaluating their evolution an interesting format emerged for illustrating the development of the practice (Table 1). This is further discussed throughout the research and as part of Chapter 2 on the methodological framework.

Table 1 – Guiding questions evolution

Guiding questions	
1998-99	<ul style="list-style-type: none">– What is design?– What is sustainability in design?
2000	<ul style="list-style-type: none">– What 'green' information is relevant in design?– What 'green' information is relevant to other agents engaged in built environment projects?– How do I present this information usefully?
2001	<ul style="list-style-type: none">– What 'green' information is relevant at which stages of a built environment project?– What if I don't have the information?– Where do I find the information?– How do I present this information usefully?
2002	<ul style="list-style-type: none">– What 'green' information is missing?– Why isn't the available 'green' information being implemented?
2003	<ul style="list-style-type: none">– What can I do to facilitate better implementation of 'green' initiatives in the built environment?– Is my practice needed in the long term?

Though this thesis was mainly written to document the research, the **aim is to be able to give a meaningful description of the process, the journey and the lessons in developing the practice of integrating 'green' innovation within the built environment with the ultimate goal to facilitate vicarious learning – to take others along the journey with me.**

My objectives therefore are:

- to produce the thesis – an academic document for the purpose of furthering the knowledge in the 'green' building field;
- to describe of a sustainable innovation practice in development; and
- to further my own understanding of sustainable innovation facilitation in the built environment and give me the tools to continue the journey.

In going down this path I have attempted **not** to define ‘variables’, ‘hypothesis’, etc. but to experience without preconceptions the full complexity of the situation and attempt to record the human sense-making as it emerged (Kaplan and Maxwell, 1994).

Thus this research has been a journey of experience, of observation and of learning and sits within the phenomenological paradigm. It embraces a multicultural perspective and accepts the multiple realities that people act within individually, following their agendas and subjective reality (Fetterman, 1998). The work is inductive and makes few assumptions at the beginning, instead being open to the phenomenon, the process and the experience. However, this does not mean that assumptions are not present, for I live within my own subjective reality; it is just that they are not explicitly brought into the research. Due to its emergent character this approach lends itself to grounded theory (Glaser and Strauss, 1967). To me this has become a method for describing how the experiences have resulted in practice and distilling them into the 11 concluding insights. Grounded theory is discussed later in Chapter 2.

Finally, in presenting my theoretical framework for this research, I do not suggest that it is the only means by which the problem could have been framed. I outline my representation of the research ‘problem’ and present and reflect upon the benefits and limitations of the selected approach.

1.2 The audience

Apart from myself, there are three groups of readers I considered while writing this thesis. Firstly, those struggling with the incorporation of sustainability innovation in the built environment, particularly those who like myself have come from a science or engineering background. I imagine that chapters 4 to 8 might form part of a text read by fledgling students in building and engineering courses. Secondly, those who are interested in reflective practice and the use of action research to facilitate research, education (of self and others) and practice. Thirdly, the academic establishment and the assessors who will be looking at this thesis. Interestingly I have not written this with architects in mind; I am not an architect and do not have their theoretical mind set. My theoretical framework is one of a pragmatist, constructivist who wants to facilitate change and learn—be in the thick of it. I prefer not to get caught up in the intricacies of the theories.

As I see it there are two areas in which this thesis is innovative: 'green' building facilitation and reflective practice. This creates a dilemma: in what area does expertise need to be demonstrated to achieve the benchmarks required for a doctoral thesis? Is this a reflective practice thesis or a 'green' building thesis? I would argue it is both, but that at the heart of the research is a sincere desire to increase the sustainability of our building practice and therefore I have to conclude that this will be a 'green' building thesis that utilises the tools provided by reflective practice.

One of the common laments of those who focus on experience in all its messy complexity is that they lose track of the forest for the trees and find it hard to draw closure to a study. There are no easy ways to sort this out beyond constantly attending to the researcher's purpose from beginning to end of the study. (Clandinin and Connelly, 1998:56)

Excuse the pun, my focus is adding to the knowledge on integrating 'green' innovation into the built environment, and though I at times have got lost in the trees of reflective practice, my context (or forest) remains facilitating 'green' buildings. For this reason sustainability and the built environment are outlined in the introduction as part of my motivation and reflective practice under my approach to the research (Chapter 2).

1.3 My research field explained

The sections below outline the field in which this research is placed. Firstly, therefore, it explains in detail what I understand as sustainability, my definitions for it and my rationale for using the term 'green'. Following on, I briefly discuss the built environment, its role in sustainability and introduce the agents who act in this field.

1.3.1 Understanding sustainability

My starting point is the Brundtland definition of sustainability as '*[m]eeting the needs of the present generation without compromising the ability of future generations to meet their needs*' (Brundtland, 1987:43). This is where the problems begin. The definition is human-centric. It is about the sustainment of the human race (Fry, 2003), our children and our children's children—sustaining the planet in a state in which humans can survive or maybe even live well. The environment, animals, plants form

part of what is considered our needs, but have no intrinsic value per se. Many authors argue against placing humans at the centre; after all

'humans are more likely to miss having a habitable world than the world is likely to miss humans, and in a few million years civilisation might start all over again. The very idea that human action can destroy the Earth repeats in negative form the hubristic ambitions of those who seek complete human control of the world'. (Harvey, 1998:328)

I agree with this to a certain extent. My instinct is that everything has value, energy and a right to be respected. I specifically use the word instinct because my view, though it resonates with Buddhism and many of the practices of our ancestors, is something I arrived at independently through my experiences and reflections on life.

Thus, when looking at the triple bottom line¹ (Elkington, 1998) my view is that instead of three equal intersecting circles of environment, economy and social sustainability, environmental sustainability should be the overarching space that holds society and in turn holds economy. For without the environment we would not exist, without society the economy would not exist.

1 Triple bottom line (TBL) focuses corporations not just on the economic value they add, but also on the environmental and social value they add – and destroy. At its narrowest, the term 'triple bottom line' is used as a framework for measuring and reporting corporate performance against economic, social and environmental parameters. At its broadest, the term is used to capture the whole set of values, issues and processes that companies must address in order to minimize any harm resulting from their activities and to create economic, social and environmental value. This involves being clear about the company's purpose and taking into consideration the needs of all the company's stakeholders – shareholders, customers, employees, business partners, governments, local communities and the public. (Anonymous (2004) 'Triple bottom line.' SustainAbility, <<http://www.sustainability.com/philosophy/triple-bottom/tbl-intro.asp>> last accessed 31 August 2004.)

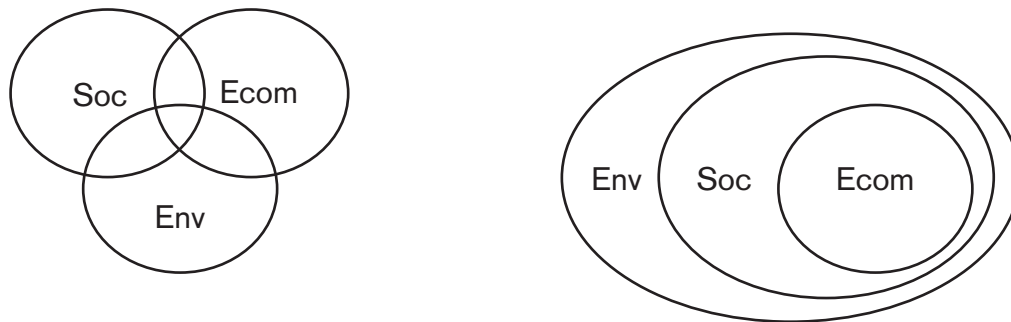


Figure 1 – Two illustrations of sustainability, triple bottom line (Elkington, 1998) and concentric dependence²

In developing my concept of sustainability, economic sustainability does not feature strongly. This is a conscious decision because the economic and cost component of building practice is already well researched and well defined. It is taken into account in the research only in that it has a major role to play in the current building industry as it's the main decision making tool.

Further into this chapter I discuss the connection between the building industry, my concept of 'green' and sustainability. I also briefly outline the contested nature of sustainability definitions. For now I would like to clearly state that there are enough definitions of sustainability being spouted all around the world. Whole theses have been written on the various definitions, what they mean, and their social, political and philosophical origins. In fact Professor William Scott (2002:1) at his inaugural lecture at the University of Bath in 2002 pointed to Andrew Dobson's research, which found over 300 definitions. To me this highlights what my colleague Ceridwen Owen argues: *'that a single universal definition of sustainability is not practical'* (Owen, 2003 referring to Jacobs, 1999); I do not want to enter into the discussion, or the resulting constraint, of a single definition.

Each project has its own unique context and therefore each should develop for its own purposes a unique definition. Most importantly this tactic supports the need to sit down at the beginning of each project and actually resolve the ambiguity and define the unique sustainability criteria for the individual project; starting the process of ownership.

² The concentric dependence model is not a concept which I developed, I once saw it in a presentation; the concept remained with me, but unfortunately I cannot find a reference to the original author.

This acknowledges the uniqueness of each project and allows for the acknowledgement of the different points of view of the participants. Meppem (2000) terms this the ‘discursive community of practice’ when discussing the integration of sustainability into his field—the planning practice. The same could be argued for all practices. Meppem, highlights how defining sustainability can become a useful concept rather than a contested stumbling block: ‘...*sustainability then becomes the pursuit of communicative praxis for collectively defining our development concerns. This position accepts that particular formulations of environmental problems are discursive constructs...*’ (Meppem, 2000:48). That is, let us accept that different people have different points of view and move forward.

Sustainability is contested on many levels. The main question posed time and time again is sustaining ‘what’ for ‘whom’. As touched on above I believe that its contestability is actually its strength. Similarly to social justice or democracy, the contests are a necessary condition of the political struggles between those holding different interests. Resolving the contested nature of sustainability is not the purpose of this thesis. My aim is to explore the practice of sustainability in the building industry; to spend chapters arguing for my definition would take me away from my main objective. Closing this discussion I would just like to share one of my favourite quotes describing my preference for action, rather than arguing about semantics: ‘*[f]rom the perspective of the ‘green’ movement ... poststructuralism must appear dangerously relativistic and abstract, absorbed in arguments about representation, while forests fall*’ (Levy, 1999:203).

What are the ‘green’ issues?

This research is titled facilitating ‘green’ building. Why is it important? What are the ‘green’ issues? How have we come to understand them? What is their history? What about the social issues? I will briefly answer these questions below.

History of the sustainability or ‘green’ movement

A brief history is outlined below on the key incidents that have informed my awareness of unsustainability and a move to a more sustainable lifestyle—thinking of our impact and the future generation. They created the awareness and the impetus to look forward

and to try to minimise our impact so as to sustain the human race—our children. Though as argued above this is anthropocentric (Fry, 2000), it is inevitable as I, a human, am at the centre of this research and cannot separate myself, even if I should wish to.

Table 2 – Key incidents that have informed my awareness of unsustainability and a move to a more sustainable lifestyle

Date	Significant book or event	Impact	Source
1700s	Benjamin Franklin – diplomat, scientist, early advocate for “public rights” and against industrial pollution.	Increasing awareness of industrial pollution and human rights.	EHT ³
1854	Henry David Thoreau published <i>Walden</i> .	A book describing a simple lifestyle in a natural setting, highlighting the concept of living with nature.	EHT ⁴
1770 – 1850	William Wordsworth comments on the industrial revolution “outrage done to nature” and was appalled that the common people were no longer “breathing fresh air” or “treading the ‘green’ earth”.	Beginnings of social consciousness.	EHT ⁵
1866	The term ‘ecology’ was first coined by the scientist Ernst Haeckel.	Gives a term and concept to describe the science of the interconnections between organisms and their environment.	Fox 1990:31
1850s – 60s	Ralph Waldo Emerson began writing about nature.	Awareness of nature as integral to life.	EHT ⁶
1812	Birth of Charles Dickens, English writer whose work condemned the worst of conditions and inspired the best in people.	Beginnings of social consciousness continuing the work of William Wordsworth.	EHT ⁷
Late 1890s	Johnson and Muir officially joined forces to create the Sierra Club.	First environmentalist group.	EHT ⁸
1945	Bombing of Hiroshima and Nagasaki	Awesome power – first real understanding that we could destroy all life as we know it	EHT ⁹

3 Environmental History Timeline <http://www.radford.edu/~wkovarik/hist1/timeline.text.html> accessed 16/02/2004

4 ibid

5 ibid

6 ibid

7 ibid

8 ibid

9 ibid

1963	Rachel Carson – <i>The Silent Spring</i> .	Alerted the world to toxic consequences of DDT, resulted in the ban of DDT in 1972.	Carson, 1962
1968	<i>The Challenge for Survival – Earth, Air and Water for the Man of the Megalopolis</i> – edited by Pierre Dansereau, Columbia University Press.	Connection of survival and the city.	Kunst, 2003
1968	First view of the earth from space.	Graphic realisation of the earth being finite—birth of the concept spaceship earth.	
1969	Man walks on the moon.	Realisation of man's ingenuity.	
1970	The first Earth Day took place in the US.	Community and government acknowledgement of environmental issues.	
1970's	Oil crisis	Awareness of limits to energy use – rise of passive solar design	
1972	Club of Rome's <i>Limits to Growth</i> report.	First report on resource scarcity.	Meadows <i>et al.</i> , 1972
1973	E.F. Schumacher <i>Small is Beautiful: Economics As If People Mattered</i> .	Conceptualising and verbalising that resources are scarce, support use of renewable energy.	Schumacher, 1973
1987	Brundtland Commission (UN's World Commission on Environment and Development) report on sustainable development.	Thinking about the future generations.	Brundtland, 1987
1987	Ozone hole treaty.	Banning of Ozone layer damaging chemicals such as CFCs.	Treaty home page ¹⁰
1990	Chellis Glendenning publishes <i>When Technology Wounds: The Human Consequences of Progress</i> .	Book about toxic waste and its impacts on people.	EHT ¹¹
1992	1992 Earth Summit in Rio and later for the President's Council on Sustainable Development.	Agenda 21 – Rio Declaration — Intended as an "Earth Charter," an attempt to reconcile conflicts over many issues. – Statement of Principles on Forests. – Framework Convention on Climate Change. – Convention on Biological Diversity.	Protocol home page ¹² and EHT ¹³

10 <http://www.theozonehole.com/montreal.htm> accessed 16/02/04

11 Environmental History Timeline <http://www.radford.edu/~wkovarik/hist1/timeline.text.html> accessed 7/06/2004

12 <http://unfccc.int/resource/docs/convkp/conveng.pdf> accessed 16/02/04

13 Environmental History Timeline <http://www.radford.edu/~wkovarik/hist1/timeline.text.html> accessed 7/06/2004

1997	Kyoto Protocol adopted by US and 121 other nations.	Protocol for the limiting of climate change caused by fossil fuel use.	EHT ¹⁴
1999	Paul Hawken publishes <i>Natural Capitalism: Creating the Next Industrial Revolution</i> .		EHT ¹⁵
2001	September 11 terrorist attacks on the US.	Shock of the hate which is felt towards the US, which then attacks Afghanistan.	
2002	World Summit on Sustainable Development (Rio + 10).	Very little resolved though the role of the individual and grass roots movement highlighted.	
2003	Invasion of Iraq by US and British forces.	Leads to widespread oilfield burning and other war-related environmental problems.	
2003	Electric power failure affects 50 million people from New York to Ontario.	Highlighted the impact of centralised power and dependency.	

Summary of the main environmental issues and impacts

This thesis will not dwell on the environmental and social impacts that are mainly through of when discussing sustainability but I will introduce them and their main consequences (McMichael, 2001 is a good resource for further reading on this).

The greenhouse effect is caused by the increase of carbon dioxide (CO₂) in the atmosphere, like a greenhouse in your backyard keeping the seedlings warm, it traps heat on the earth. The thicker the layer of carbon dioxide the more heat is retained—in effect double and triple glazing your greenhouse. This has led to theories on climate change and sea level changes. The increase in carbon dioxide is due to its release from the burning of fossil fuels, such as oil (petrol), gas, coal, timber, plastic in waste incinerators, etc. Though carbon dioxide is the primary greenhouse gas, other chemicals such as methane (CH₄) created by decomposition, and many of the ozone depleting CFCs, also have a significant impact. It is expected that climate change and sea level changes are the main consequences of the greenhouse effect. Depending on the severity of these, life on earth may change considerably.

14 ibid

15 ibid

Ozone layer depletion. Unlike the greenhouse effect ozone layer depletion will kill directly. It is the reduction of a protective shield 15-35 km above the Earth. This ozone layer prevents dangerous ultraviolet radiation (UV) from reaching the earth's surface. UV is dangerous because it reacts with living cells in humans causing skin cancer and cataracts. Apart from the human consequences the impact on other living organisms such as plants and animals is also significant. This depletion is caused primarily by chlorofluorocarbons (CFCs), substances that were used extensively in refrigerants and as blowing agents in many applications such as styrofoam production and aerosol sprays. There has been a phasing out of these CFCs since 1987, this is ongoing.

Water. There are two main environmental issues with water: reduction in availability of potable water, and its pollution. Without water life on earth would not exist in its present form. Due to our impact on the earth the amount of available potable water is decreasing and what is available is often polluted and needs treatment.

Air. Is what we breathe to function and contains the oxygen we need for survival. Oxygen exists because of the metabolism of plants, which take in carbon dioxide and nutrients and with the use of sunlight produce food, releasing the oxygen. Being a fundamental part of life, the main issue with air is its pollution, that is, elements other than oxygen can enter the body when we breathe in.

Toxicity. Is caused by the release into air, water and soil substances that are dangerous to humans, plants and other animals. Many toxins are manufactured by humans; most are not known to be toxins when first used, such as lead. The impact varies depending on the substance; they can cause minor temporary illnesses such as headaches and nausea, or have more significant impacts leading to death.

Biodiversity. The impact on biodiversity and significantly the genetic diversity of life on earth is a major issue in environmental sustainability. Put simply biodiversity is the inter-related ecosystems around the earth made up of living organisms—both plants and animals. The reduction of these ecosystems impacts on their number and variety, i.e. their diversity, for example through animal and plant extinction. This is significant, apart from the esoteric loss of beautiful and valuable species, in that it reduces the genetic diversity of the ecosystem, leaving it susceptible to collapse.

There are other environmental issues that I will not go into such as smog, pollution, acidification (acid rain, etc.), nutrification and eutrification (nutrient loading of terrestrial and aquatic ecosystems) for this is only a brief introduction with the aim of highlighting the main impacts I am referring to when I discuss reducing our environmental load through 'green' innovation.

Resources. Water and air are resources, but are mentioned separately because of their importance for human survival. Other resources such as materials can be divided into non-renewable such as coal, oil, sand, and gravel and renewables such as trees, sunlight, wind, etc. '*Renewable resources are those that can be used and reused without depleting their primary source*' (Graham, 2003:63). It can be argued that running out of non-renewable resources is not an environmental impact. The consequences of exhausting iron ore and therefore the steel, is that we would need to find an alternative. But running out of renewable resources such as air, water, sunlight will be catastrophic.

It is true that humans, through cultural developments such as agriculture, trade, and fossil-fuel combustion, at least in the short to medium term. We may yet raise those limits further, or we may now be seeing early evidence of having recently exceeded the global carrying capacity, new technology notwithstanding. We do not yet know which. (McMichael *et al.*, 2003:1919)

This clearly brings in the issues of human population and growth, though crucial to the sustainability debate this thesis does not have the scope to go into any more depth. The related social aspects of sustainability are discussed below.

Main social issues

The main social issues 'green' innovation can impact on are summarised below (for further information see Singh *et al.*, 1994 and UN, 1995). The social dimension of sustainability encompasses the political, the cultural and all people-centred social issues, and to some extent the economic. It entails ensuring that the basic conditions for human life to flourish exist within society. These include:

- Food, shelter and clothing
- Health care

- Education
- Social interaction, sense of belonging and spiritual enrichment
- Fulfilling daily activity such as work

These are relevant to our human society, our interactions, support and culture. Various terms used when discussing social sustainability are:

Equity. *Equality of rights; natural justice or right; the giving, or desiring to give, to each man [or woman] his [her] due, according to reason, and the law of God to man; fairness in determination of conflicting claims; impartiality.*¹⁶

Poverty. *The quality or state of being poor or indigent; want or scarcity of means of subsistence.*¹⁷ Poverty is relative though what is poor in Australia is considered well off in many other countries. Social sustainability aims for a world where there is no poverty.

Access. Ability for all people to access all facilities.

Culture. Protection and support of all cultures, languages, beliefs and so forth.

Main barriers to sustainability

The Dutch government has started to do its environmental management planning over a -30+30 year planning frame, looking 30 years into the past and 30 years into the future. This plan is called the National Environmental Plan 4 (NMP4). In this plan they outline the seven barriers to sustainability (Kemp and Loorbach, 2003:4):

1. Unequal distribution: poverty causing irresponsible environmental management
2. Short-term thinking (in politics and business)
3. Fragmented policies and institutional deficits
4. Prices do not reflect external costs of environmental degradation
5. Actors causing problems do not own the problem (they are not responsible for the solution of those problems)
6. Solutions involving system changes are surrounded with great uncertainty
7. Insufficient precaution

¹⁶ Webster's Revised Unabridged Dictionary, © 1996, 1998 MICRA, Inc.

¹⁷ *ibid*

To deal with these problems they state that long term efforts at all levels of society are needed:

To solve the big environmental problems we need system innovation which may take various forms. The [system] innovation may take the form of a societal transformation process that may take one generation or more. For the transformation to happen, economic, social-cultural and institutional changes are needed that reinforce each other. ... New parties and innovative technologies play an important role. It is not a matter for the government alone but for the whole of society ... management of transitions requires a form of process management in which uncertainty, complexity and interdependencies are addressed. (Kemp and Loorbach, 2003:6)

This research looks at 'green' innovation in the built environment and therefore these barriers are part of the understanding I have kept in the foreground when looking for opportunities for innovation.

Understanding the built environment

The built environment was defined in a recent opening ceremony for the year of the built environment in Melbourne, Australia as '*the buildings, places and structures in which we live, work and play*'. Below is a brief introduction to the terminology used in this thesis to describe the built environment and the people who populate it.

Defining 'green' buildings

In discussing this research, I use the term 'green' building based on the discussion above, to mean what Peter Yost (2002:14) defined as a mix of resource efficiency, integration of process and social concepts:

The heart of 'green' building is resource efficiency in the design, construction and operation ... The soul of 'green' building is systems integration in design and construction. 'green' building addresses four major areas: energy, materials, indoor environmental quality and site development...'green' building can—and, arguably, should—enfold the broader contexts of neighbourhood, community and even regional development.

As with sustainability, 'green' building is complicated (if not as highly contested) by context, by degree of commitment and ideology (Yost, 2002:12). This has led to a

...proliferation of literature, [yet] there is still no consensus on how to comprehensively and uniformly define the concept of sustainability as it pertains to the built environment, nor is there consensus on what aspects of the built environment should be considered in evaluating the sustainability of a built facility. (Pearce and Vanegas, 2002:54)

Sustainability in the built environment is difficult to define, in any but the most general terms, but easy, with hindsight, to recognise. We can observe it in those buildings which have been with us for many decades, centuries, even millenea. (Maver and Petric, 2003:641)

This is the first conundrum of my research: if I cannot define my research by a term agreed upon, am I wasting my time? Some might say yes; I say no. What I have learned is that due to the nature of the built environment the context for each project is different—site, country, community, surrounding milieu, etc.—thus the definition of what is meant by 'green' is also different. This may only be by small degrees but there is still difference. This should not stop action.

A fellow sustainable or 'green' building academic in Australia, Terry Williamson, agrees with the social and environmental bent of this definition as he says in his recent book 'Defining Sustainable Architecture': *'in particular, the notion of "sustainable architecture" includes questions of a building's suitability for its sociocultural as well as environmental context'* (Williamson *et al.*, 2003:4, my emphasis).

I have chosen 'green' for simplicity and in reference to William Bobenhausen who introduced the term 'Lean' to 'Clean' to 'Green' evolution¹⁸ to describe the changes in sustainable building initiatives since the 1970s. We have moved through the lean years of the 70s and the clean years of the 90s and are now, I argue, entering the 'green' phase of looking at things holistically. But terms vary and it could also be called 'sustainable building' or 'environmentally sound/friendly/sensitive' building. Some also

18 William Bobenhausen, Director of Sustainable Design, Steven Winter Associates, Inc., Norwalk, CT. Presentation at an Urban Land Institute workshop on Sustainable Design in Commercial Development, at AEW Capital Management, Boston, MA, 10 November, 1998.

see it as 'timeless'. Others refer to the high-tech aspects of 'green' buildings as 'high performance' or 'smart' building. Architect William Bobenhausen thinks that it should just be called 'good' building design (Landman, 1999:6).

The built environment has a large environmental and social impact

The main phases of a built-environment project are: conception, design, documentation, construction, commissioning, use, refurbishment and demolition. Differing industry agents are active in each of these phases; each can have a different impact on the outcome and many have already made industry-based commitments for a more sustainable or 'greener' future.

'Agent' as a term is used extensively in this thesis to describe any person or group involved in the various building projects, including those using the end products once they are finished. The term is used as defined in the work of Habraken in the book 'The Structure Of The Ordinary': *'the built environment comprises not only physical forms—buildings, streets, and infrastructure—but also the people acting on them...We are all players: agents who inhabit the environment, transforming it to our liking and making sure things stay as we choose within the territory we claim'* (Habraken, 1998:7).

The agents who are mainly referred to in this thesis are:

- Architects and designers—who create the building
- Engineers and consultants—who advise on design in specific areas—hydraulics, costs, mechanical systems, etc.
- Builders and subcontractors such as plumbers, electricians, etc.—who construct the building
- Project managers—who manage the project either from the design or construction stage
- Clients—who have commissioned the building
- Users—who use the building
- Building managers—who manage completed buildings

- Planners—who plan how areas will be developed and require certain conditions to be met before awarding permits for construction
- Regulators—who develop the requirements implemented by the planners
- Community—interacting with the built environment without necessarily using specific buildings

1.3.3 Agents in the built environment and their ‘green’ commitments

Below is an introduction to the agents who populate this thesis and who where part of my practice. It is a brief explanation of my perception of their roles and their frames (Schön, 1994) to highlight the different perspectives at play in the integration of ‘green’ innovation. I have divided it into the architects and the designers and the other building professionals. Initially this was done because the design fields were the main focus of this research; it is only later that it became the whole industry. Furthermore, as I argue below, design has a major role to play in introducing ‘green’ innovation. This in no way means a superiority of one group over another.

Architects and designers

Terry Williamson *et al.* (2003:1) argue that architectural commitment to the ‘green’ agenda is a natural progression from their response to major themes within the community:

‘Sustainable architecture, then, is a revised conceptualization of architecture in response to a myriad of contemporary concerns about the effects of human activity. The label ‘sustainable’ is used to differentiate this conceptualization from others that do not respond so clearly to these concerns’. (Williamson *et al.*, 2003:1)

Further Williamson *et al.* (2003:1) discuss how not so long ago ‘good architecture’ was that which responded to its environmental context, especially climate. That is a building that *‘would adequately protect the inhabitants from the climate’*. But then in the last century or so, with the advent of mechanical systems and abundant energy, buildings no longer needed to respond to climate, resulting in similar skyscrapers in most major cities, the Californian bungalow in a snow field, and so forth. This has only

recently started to change with the oil crisis in the 1970s, concerns about the 'green'-house effect in the late 1980s and 1990s and other environmental impacts of the built environment coming to the forefront. *'We started worrying less about what nature can do to us, and more about what we have done to nature'* (Williamson *et al.*, 2003:1). Buildings and their designers no longer need to respond to the risk from the environment and climate but from their own *manufactured risk* (Giddens, 1999 cited in Williamson *et al.*, 2003:1) and therefore responsibility: *'[b]uildings contribute directly and substantially to manufactured risk because of the amount of raw materials, energy and capital they devour and the pollutants that they emit, and architects therefore have a specific and significant professional role in reducing this risk'* (Williamson *et al.*, 2003:3).

Other authors also approve of integrating sustainability within the practice of architecture (Landman, 1999; Coleman and Robson, 2000; Guy and Farmer, 2000; Guy and Farmer, 2001).

"green design and all its facets will be an ordinary part of a designer's job," says Bonda, director of interior design for the Hillier office in Washington, DC, and past president of the American Society of Interior Designers (ASID). "I'm not sure how long it will take us to get to that point, because like any other discipline 'green' design comes with a learning curve, but we will get there. I'd imagine designers will begin by throwing little environmental things in with all the other things they do, and then it becomes a habit rather than a choice." (Quoted in Calmenson, 1997: paragraph 3)

"Great design and responsible environmental practices are essential to one another." (Mac Bridger, CEO of Collins & Aikman Floorcoverings, quoted in Coleman and Robson, 2000:11)

This has also been recognised by the various professional architectural bodies around the world, for example the UIA (Union Internationale d'Architecture) commitment to sustainability in architecture:

We commit ourselves, as members of the world's architectural and building-design professions, individually and through our professional organizations, to:

- Place environmental and social sustainability at the core of our practice and professional responsibilities;*

- *Develop and continually improve practice, procedures, products, curricula, services and standards that will enable the implementation of sustainable design;*
- *Educate our fellow professionals, the building industry, clients, students and the general public about the critical importance and substantial opportunities of sustainable design;*
- *Establish policies, regulations, and practices in government and business that ensure sustainable design becomes normal practice;*
- *Bring all existing and future elements of the built environment—in their design, production, use and eventual re-use—up to sustainable design standards. (UIA, 1993: paragraph 4)*

However, recent research summarised by Owen (2003:3) suggests that, though there is lip service, there is little action. For example:

The disinterest in sustainability is identifiable by its conspicuous absence in most architectural discourse, with debate on sustainability in architecture generally reserved for 'special issues' of architectural journals, as well as the dedicated environmental architecture awards. In fact, these awards can be presented as exemplars of architectural indifference to sustainability, since in the ten years since their inception they have been consistently under-subscribed. Furthermore, while many leading architects such as Rogers, Foster, and Piano appear as champions of the cause of sustainability, for other architectural stars... sustainability remains irrelevant to the core pursuit of architecture...

and further in a footnote referring to the work of Wittmann:

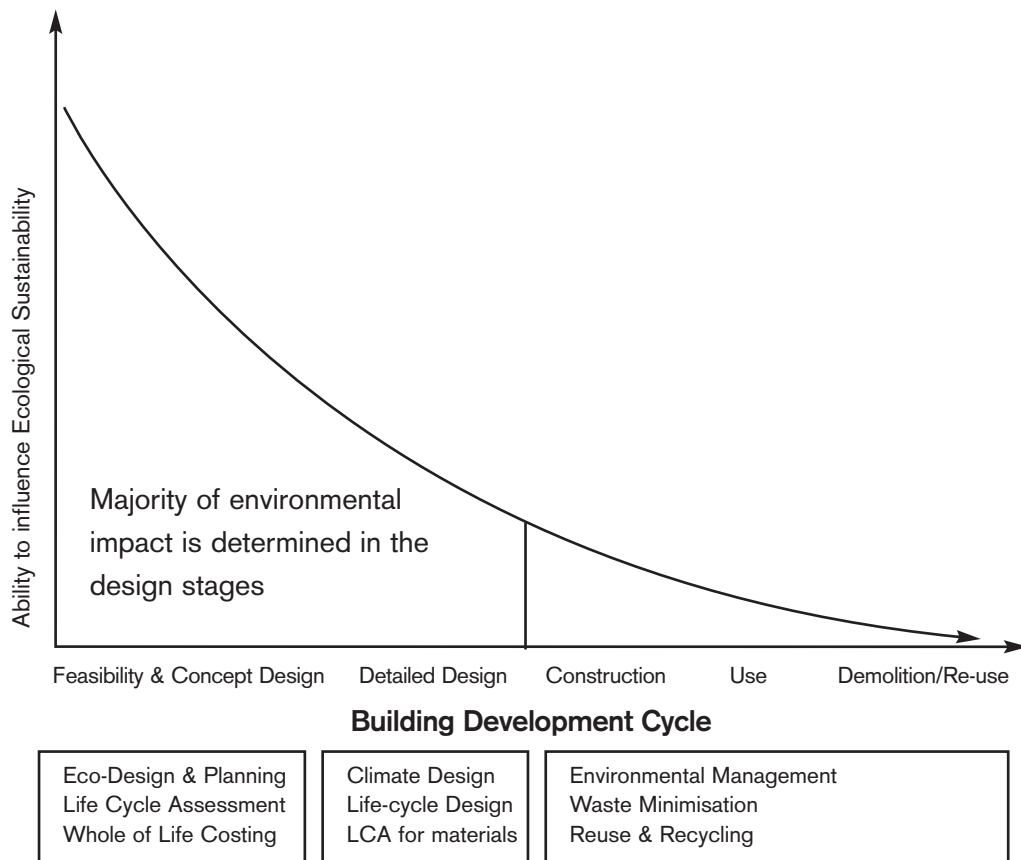
[a] survey of Australian architects by Wittmann regarding their perception of sustainability within architecture practice also revealed inconsistencies between the architects' stated belief in the benefits of sustainability and the integration of sustainability initiatives in practice, leading the author to question the commitment of architects towards sustainable architecture (Wittman, 1998, referred to in Owen, 2003:3).

Architecture and design is central to this research because design has the point of greatest potential to affect the 'green' innovation of the project (the basis for the

profession of architecture). I hoped to get an insight into why this lip service exists from within actual projects.

Why is design crucial to ‘green’ innovation of the built environment?

It is at the design stage when there is the greatest potential to have an impact on the outcome (Bakker, 1995; Bashford and Robson, 1995; Burgess and White, 1979; Chapman, 1998; Dewberry and Fletcher, 2001; Graedel *et al.*, 1995; Graham, 2003; Lewis *et al.*, 2001). Before construction the costs, and similarly the environmental and social impact, of the building are minimal: ‘*decisions in the first 10% of a project control 80 to 90% of total system cost*’ (Welsh *et al.*, 1999:1) and similarly the future impact (Graedel *et al.*, 1995).



Examples of strategies available at each stage (there are many)

Figure 2 – Ability to influence ‘green’ innovation in design, (Lewis *et al.*, 2001 quoted in Graham, 2003:219).

Though the design and the designers have the greatest potential to impact on the sustainability through ‘green’ innovation, the research discussed above shows that implementation is slow.

How I interpret design

Given this key role that design plays, below is an outline of how I, a non designer, interpret design. The following reflection on what architectural design is resonates with my view:

Architectural design is a multifaceted activity which requires, for its successful performance, a mixture of intuition, craft skills and detailed knowledge of a wide range of practical and theoretical matters. It is a cyclical process in which groups of people work towards a somewhat ill-defined goal in a series of successive approximations. There is no 'correct' method of designing ... [i]t is a fluid, holistic process wherein, at any stage, all the major parts have to be manipulated at once. In this sense, it is less like solving a logical puzzle and more like riding a bicycle, blindfold, while juggling (Maver and Petric, 2003:642).

Primarily design is a creative process of solving problems (Lawson, 1990) and of meeting the needs of stakeholders, bringing disparate elements together through the use of experience, inspiration and tacit knowledge. Many researchers have attempted to model and define the process of design but, as Chapman (1998:236) concluded, these have not succeeded in capturing how it works. Design is a dynamic and highly iterative process (Chapman, 1998), with a continual process toward identifying solutions and then testing them against the needs of the project (for example Chapman, 1998; Schön, 1983; Schön, 1987; Williamson *et al.*, 2003). This could be criticised as being a very non-designer way of describing design. From a designer's point of view design is about producing 'designed' objects with cultural and aesthetic meaning. Two critical publications that elaborate on this are *The Ethical Function of Architecture* (Harries, 1997) and *Behind the Postmodern Façade* (Larson, 1993). Being a non-designer I initially accepted Lawson's definition without question because it made sense to me. Now I realise the importance of the artefact and its embodied and aesthetic meaning.

The following extract from the Williamson *et al.* (2003:67) book (quoting Beach, 1990; McHarg, 1969; Schön, 1987:66-67) sums up how I would like to treat design in this thesis:

New situations rarely exactly match past situations, or the predefined problems and answers set out in prescriptive design ... Rather, the design enterprise itself

involves research, triggered by questions to be answered in the design situation and with the research results immediately pressed into action in design decisions (Schön 1987:308-9). The research may be as apparently straightforward as the 'simple sequential examination of the place in order to understand it... as an interacting system' that McHarg advocates (McHarg 1969:151) as a part of designing with nature. It may also investigate materials, patterns of use, or any other facet of design. Results are not always as expected, and decision-making proceeds by fits and starts. Beach comments:

Opportunities (plans) beget goals. Goals are modified as plans are refined. Principles that at first seem irrelevant turn out to be relevant, often painfully so. Plans that at first seem straightforward turn out to be impossible to implement or to fall short of achieving their goal. Goals that look desirable become less so when the requirements for their achievement become clear. (Beach 1990:15)

My fascination with architecture

Apart from the great opportunity in influencing the eventual 'greenness' of a building by integrating initiatives into the design, I have a deeper fascination with architecture and building design, due to its influence and lasting legacy:

Winston Churchill was reported to have made the statement that we shape our buildings and then they shape us. (Banning, 1994: paragraph 2)

Thus, by working with and understanding architects, I might have a greater influence. There could be flow-on effects on the behaviour of those using the building, seeing and learning about the building.

I am though, as this thesis shows, fairly naïve of the architectural discipline and approach. Nevertheless, with awareness of this innocence, I have pragmatically tried to understand the field in order to work effectively within the built environment.

Other agents in the built environment

Engineers

Engineers have the potential and the duty to be a major influence in the achievement of the primary goals of the future: a sustainable habitat for all life,

and one that continues to allow mankind to achieve his potential and to enjoy the process of living. (Submission by World Federation of Engineering Organisations to UNCED Conference, UNCED, 1992:1)

The engineering agents involved in the built environment are mainly civil, electrical, mechanical, hydraulic and structural. Each of these has its own professional bodies developing their own perspectives on sustainability. In general there seems to be less activity on sustainability in the built environment in the engineering field than the design field, though their role at the design stage is just as crucial. Designing appropriate systems, ensuring the integrity of the building and avoiding waste in use through efficient operational design are the main areas of influence from the engineering profession. Considering in most cases that a building's operation is its main impact over the life of the building, the engineering professions' potential to ensure a building is 'green' is considerable.

Engineers are also perceived to be the level-headed, meticulous decision makers, and are often turned to for advice in implementing innovation. Based in their pragmatic positivist paradigm, they are trusted to achieve improved performance and looked towards for guidance for 'green' solutions.

Engineers are increasingly looked to for sustainable solutions yet find themselves less than adequately prepared to provide answers...Sustainable development, however, poses an array of problems that go far beyond what is generally found in the textbooks or experiences provided as part of engineers' formal training. The problems to be addressed are more complex, clients are more differentiated and extend beyond the immediate user/client of engineering services, and there is an increasing demand for engineering solutions which respond to a variety of social and political challenges. (Crofton, 2000:397)

In Australia an environmental engineering society was set up in 1994 within the Institute of Engineers Australia, now Engineers Australia. They introduce their principles by stating:

Engineers, because of their professional role in society, have a particular obligation towards the integration of development and the environment, leading

towards sustainable development. The Environmental Principles for Engineers are Principles for the Engineering Profession for the Planning, Implementation and Management of Engineering Works that are Socially, Ecologically and Economically Sustainable.

The Environmental Principles were prepared in 1992 by the National Committee on Environmental Engineering (predecessor to the Environmental Engineering Society).(EES, 2004: paragraphs 1-2)

Principles:

- *Engineers need to develop and promote a sustainability ethic*
- *Engineers need to recognise the interdisciplinary nature of engineering*
- *Engineers should practice engineering in accord with a sustainability ethic that leads to sustainable development*
- *Engineers should act with integrity, objectively and ethically, remembering their responsibility to the community*
- *Engineers should pursue and encourage professional development (IEA, 1992:1-3)*

Builders and subcontractors

In the research on barriers to 'green' building innovation uptake contractors and builders figure strongly (barriers are discussed below). Comments tend to reflect that the building industry is a slow-changing, traditional industry with many idiosyncrasies remnant from their craft industry past. Many builders learn the trade through the family business, apprenticeships and through attending technical education institutions. Learning from the older generation is a valuable socially sustainable activity but does mean that there is slow opportunity for change and innovation.

Although a growing number of states and municipalities have adopted energy efficiency and 'green' building initiatives, the private sector has been very slow to accept this responsibility. Obviously there are several reasons for this. One factor may be the generally conservative, risk-averse nature of the building industry. As service providers we must strive to achieve the goals of our clients, many of them developers and building owners primarily concerned about

controlling first costs, and less concerned about a building's future operating cost and performance. For this section of the building industry to adopt a progressive approach to sustainable design, we will need to make a persuasive business case for sustainable design. (Lehrer, 2001: paragraph 2)

To address this in Australia, there is a program of education for all home builders that is being undertaken by the Housing Industry Association. The Master Builders Association is developing a similar course. Also there are programs being developed to educate tradespeople such as electricians and plumbers in 'green' technologies. One very successful example of this is the 'green' plumbers program¹⁹.

Apart from the education of builders and subcontractors the Seattle sustainable building review (Thung, 1998:10) points out that one of the main barriers for the trades is a lack of incentives:

Most current incentive programs are aimed at the developer, not at the people designing and constructing the building. A single building project can employ dozens of consultants and contractors (architects, general contractors, sub-contractors, landscape architects, etc.). Each group, particularly those on the design team, can influence the way the building and landscape is designed and constructed. However, most financial incentive programs are targeted at the developer, thereby providing little incentive to those carrying out the work to build more sustainably.

Planners and regulators

Regulators are also seen as barriers to the implementation of 'green' innovation in the built environment (Eisenberg *et al.*, 2002). Regulators and planners put in place the requirements for the development and construction of the built environment. They have various roles, from developing a country-wide regulation such as the Building Code of Australia to processing a planning application for a small home.

The regulators worry about the impact of regulations on the economy, on those who are disadvantaged and the consequences of being re-elected. They have a fantastic

19 For more information see <http://www.greenplumbers.com.au/> last accessed 31 July 2004

opportunity to create a great deal of change by requiring that 'green' innovation be implemented but, given the above factors, generally are slow to implement change and quite conservative. This is particularly because of the consensus process by which most regulatory changes are implemented—seeking consensus between community, industry and non-government organisations is a slow process.

There are two types of planners. Strategic planners develop the requirements for a local area and can have a significant impact on 'green' innovation by allowing for it in the framework. The other planners implement these requirements by reviewing applications for approval to build. Of concern here is their potential ability to affect 'green' innovation by blocking projects if the innovation falls outside their regulatory framework.

In relation to my practice planners have a significant role in the built environment and the social aspect of sustainability, particularly in their integration of the input from the community and their consideration of the whole system. Forester outlines the roles of planners as:

Working to promote jobs and housing, a healthy environment and better schools, city planners...have complex and fascinating jobs to do. They must study complex social, physical, and economic problems to propose effective strategies of public response. They must listen carefully to work through controversial political arguments. They must learn not only about "the facts" at hand but inquire about value too, asking what ought to be honored, protected, sustained, or developed—what, practically, should be done. Not least of all, they must inform, advise, and even coach a range of public officials and appointed, elected, and grass-roots decision makers too. These ordinary challenges of planning are actually quite extraordinary. (Forester, 1999:1)

Construction and site managers

As buildings have become more complex the use of construction managers has become more common. These are professionals who plan and execute the organisation of the building process. They manage the contracts, the time lines and the contractors. They have a significant influence on the correct implementation of 'green' innovation in the design. Through their policing role and final responsibility for the construction they have significant power over the outcome.

1.3.4 Barriers to a 'green' built environment

From the literature several studies (Anderson *et al.*, 2000; Davis, 2001; Eisenberg *et al.*, 2002; Landman, 1999; Mendler, 2001; Owen, 2003; Rao and Brownhill, 2001; Thung, 1998) were reviewed to provide a summary of the main barriers to integrating sustainability or 'green' innovation into the building industry. The main barriers are:

1. the real or perceived financial cost and risk (Anderson *et al.*, 2000; Davis, 2001; Landman, 1999; Owen, 2003; Rao and Brownhill, 2001; Thung, 1998) which includes the problem of the upfront cost and the ongoing costs usually coming from separate budgets, if not separate organisations;
2. the lack of information and training (Davis, 2001; Landman, 1999; Owen, 2003; Rao and Brownhill, 2001; Thung, 1998) of the designers, contractors and clients;
3. naturally following the second is the lack of demand from the clients (Anderson *et al.*, 2000; Davis, 2001; Landman, 1999; Owen, 2003). The European report written by Rao and Brownhill (2001:5) introduces the idea of the circle of blame: '*designers and contractors say clients don't ask for it, clients say designers don't provide it*';
4. closely followed and again logically by the lack of support from subcontractors (Landman, 1999; Owen, 2003); and,
5. finally regulators (Eisenberg *et al.*, 2002).

All these studies were compiled through desk based literature surveys, interviews and questionnaires. There is no literature on observed barriers on site in the field from a participatory approach.

Designers classify obstacles such as "lack of information, low priority and product reservation." (Coleman and Robson, 2000:5)

"94% of designers agree that they would increase their use of sustainable design solutions if sustainability was part of a client's corporate mission."

"87% of designers surveyed would increase their use of sustainable design practice if they could supply clients with these value added benefits (increased workplace performance) which would be amortized over the life of the building or space." (Coleman and Robson, 2000:7)

It is important for me to consider these barriers as I enter this research and this practice. With this information it is possible to look for, avoid and have strategies in my practitioner's tool box that address some of these barriers.

1.4 Outline of the thesis

This thesis is composed of seven chapters. This introduction outlined the terms and context of the research, it is followed by the method section and then sections describing the growth of the practice. The chapters describing the development of the practice follow the chronological journey of the research. Therefore I am more naïve in the early chapters than in the later ones—I have consciously tried to conserve that 'naiveness'. The final chapters discuss the results of the research and reflect on what has been learnt by this research in the form of 11 insights. The journey is described with references to specific experiences over the five years; these are highlighted in grey boxes and are taken directly from a journal, vignette or document from my practice. In discussing the journey chronologically, the work of the Dreyfus brothers (Dreyfus and Dreyfus, 1985 and 1990) describing the change from novice to expert, is used as a tool that enables reflection on that period—both the development and the learning. The work of Patricia Benner (1984, 1996 and 1999) is briefly mentioned here as hers was one of the first to bring together the concepts of the journey from novice to expert and Schön's notion of reflection as a tool in facilitating this. Her work was mainly in nursing and thus apart from this acknowledgement is not referred to in any further detail. The figure on the page following is a diagram of the structure. Of course no journey is as linear and clear-cut as this supposes, in fact at stages where I had reached expert level, I was still making mistakes like a novice.

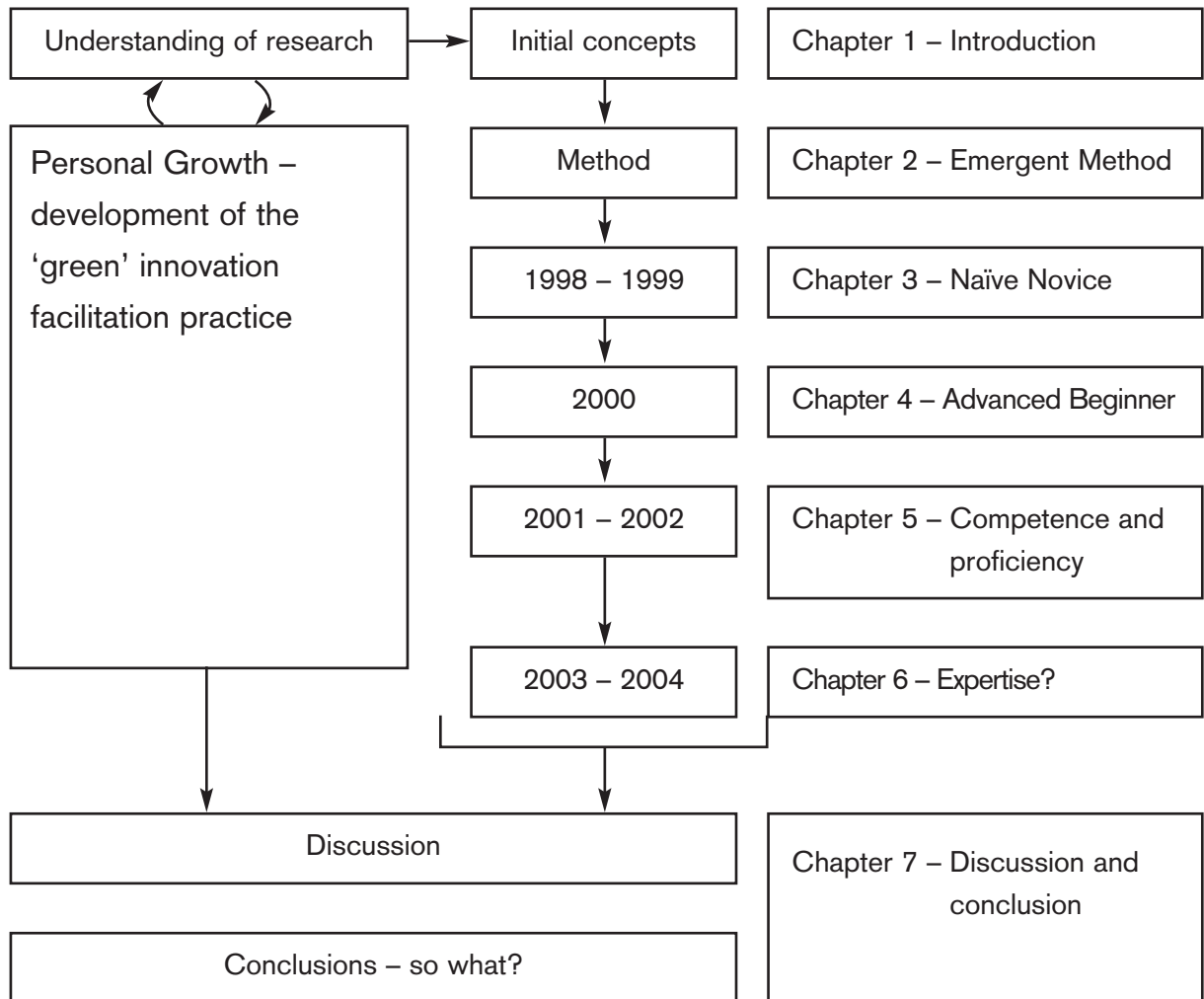


Figure 3 – Thesis structure

1.5 Reflection

This research started in earnest in 1999. At this time a few ‘green’ building projects had been built in Australia, for example the Moreland Civic Centre and the ongoing construction of the 2000 Olympics facilities and athletes’ village. There were more examples overseas. Yet most of these projects were not seen as ‘mainstream’ and tended to be demonstration projects with little ongoing research and monitoring. Most projects looked at various aspects of ‘green’ innovation—they looked at energy or water or the use of resources—and none integrated the social aspect and environmental aspects in an ongoing holistic study encompassing all the agents. Further, most did not carry out any post-occupancy analysis or work with the building users.

Now five years later *‘[t]he ‘green’ building movement is growing exponentially around the world...’* (AGBC, 2003: paragraph 1). As this thesis was written sustainable design of buildings was moving from being an option to being expected. Showing his foresight Wilson *et al.* (1998) quoted Douglas Durst of the Durst Organization, developer of the 4 Times Square skyscraper predicting that *‘environmental responsibility is the future of real estate—the choice is not whether, but when. As the public begins to understand that healthier and more productive buildings are possible, they will demand them!’* (Wilson *et al.*, 1998: testimonials page). Yet little research has been done on the practice of integrating ‘green’ building innovation, from within the practice—that of practice moving from rhetoric to implementation. Books, guidelines, theories and case studies are wonderful aids, but why does this not currently translate to mainstream implementation? There is not enough practice.

It was difficult writing this chapter because much of the discussion and framing of the ideas, literature gaps, research method etc. can be found in later chapters. Also it is difficult to know how candid to be about oneself and the role of one’s history. It feels a little like bearing my soul without really knowing whether it is needed. In fact, initially I got carried away with the autobiography and had to distance myself from it and think what parts of it were actually informative to the purpose of the thesis.

The main lesson from this section for me was the need to continually think about the purpose of the research and the thesis, to not lose sight of the forest for the trees.

1.6 Summary

This chapter introduces the field of research, the motivation and path of the researcher. Motivation is the key element because it informs the others. My motivation for looking at the built environment is based on the fact that it contributes so significantly to sustainability, thus this research looks to provide some meaningful exploratory research into the integration of 'green' innovation by looking at what actually occurs in practice. As such the guiding questions are:

- How was 'green' innovation facilitated, what information was required, what were barriers experienced?
- What were the main lessons learned, and the main methods for overcoming the barriers?
- How did the journey progress?

② Approach

2.1 Introduction

In doing this research I am trying to understand the system of the built environment, 'green' innovation and facilitating its integration into building practice. In attempting to develop this understanding, a flexible, intuitive, learning model was looked for, something that would support an experiential journey. This was involved because the research was attempting to do many things that did not fit neatly into any single framework, i.e.:

- to understand why or why not 'green' options were integrated into a building project;
- to participate in the whole process—with the client, the architect, the construction team and the building users;
- to add one's own expertise to the process;
- to document what was said and done while being part of it;
- to collect plans, drawings, sketches, minutes, contracts, specifications;
- to go through a reflection process individually and to a very limited extent with the other agents;
- to observe the change resulting from the intention of the project—not necessarily consciously chosen—and the input from all to achieve that intent.

Initially a method was used which amounted to participating and observing, then participating and acting and finally facilitating. A qualitative method seemed most appropriate and due to my desire to facilitate change from within the industry, participatory action research seemed to fit most closely. The development of this method, the data collection and analysis are discussed below.

This chapter is broken up into several sections that together form a description of the research method. As mentioned, finding a 'method' challenged me to define my work into boxes, which all seemed the wrong shape. Not only did nothing 'fit' but I also found

that due to the emergent quality of the research and its response to the field, the research method did not stay constant, but evolved. The chapter outlines reflective practice as the main ‘way’ of my practice, the resulting emergent experimental method of data collection and analysis that fed into the reflective process. This emergence is described as the journey of the research—a short summary of the research over the five years and how it responded to conflict, failure and opportunity. Following this is a practical description of how the data was collected and analysed and my insights developed. Grounded theory, on the other hand, was the framework used for describing the way the data was distilled into this thesis and the resulting insights that fed into the practice. There is also a brief outline of the approach to ethical and validity issues.

2.2 Research method

The strategy for inquiry based on the experiential, emergent framework led to a dynamic research design with reflective cycles and flexible data collection. This resulted in a few dead ends, a few changes in direction and unexpected opportunities leading to adaptation of the method over time. Though Myers (1997:241) outlines that *‘specific research methods also imply different skills, assumptions and research practices’* it is argued that the research methods applied in this project, though requiring slightly different practices (participant observation, action research, case study development and interviews), still added to the underlying data collection and could be carried out on a common set of assumptions. The method used to inform the reflective practice was an adaptation of participatory action research and the concluding insight developed through grounded theory. To start, it is important to understand what is meant by reflective practice and outline the lexicon of terms used in the description of this field.

2.2.1 Understanding practice

Schön was not the first to discuss practice, it has a long history, I have chosen Schön as the basis for this outline because his work and writing resonates with my understanding of my research and my journey. Donald Schön’s books (1983, 1987) significantly influenced my thinking on practice and how to verbalise the journey. His work will be discussed throughout the thesis. Rather than spending many pages describing

reflective practice in general terms, I have summarised those aspects of the field I use in this thesis. This text here is aimed at briefly describing the main relevant ideas he, and others, bring to the table and mentions associated critics of his works:

I begin with the assumption that competent practitioners usually know more than they can say. They exhibit a kind of knowing in practice, most of which is tacit...Indeed practitioners themselves often reveal a capacity for reflection on their intuitive knowing in the midst of action and sometimes use this capacity to cope with the unique, uncertain, and conflicted situations of practice. (Schön, 1983:8-9)

In a later book, *Frame Reflection*, Schön and colleague Rein (1994) discuss the importance of understanding the way one comprehends a situation, or 'frames' it. This thesis represents an explanation of how I frame the building industry and how I absorbed and processed the information in the field trying to firstly understand it and secondly to integrate 'green' innovation.

2.2.2 A lexicon of reflective practice terms

Reflective practice—able to think against oneself

Despite all that has been written and lived in relation to reflective practice, my experience has been that it is frequently reduced to the dimensions of conceptual 'logical' analysis and 'learning from the past'—and especially past mistakes. (Cherry, 2003)

Reflective practice is a concept that has been picked up in particular by educational (see McKernan, 1991; Short, 1993 and many others), nursing (for example Benner, 1984, 1996, 1999; Mackintosh, 1998) and, to a lesser extent, management researchers (Golding and Currie, 2000; Cross and West, 2002; Betts, 2004). It is heavily linked with learning and growing individually and in practice. According to Cross and West (2002) an *'effective reflective practitioner will be able to:*

- *Increase awareness of 'hidden knowledge' which may become plain through working with others.*
- *Apply not only technical and theoretical knowledge but also knowledge from practice and experience.*

- *Update and check all knowledge for its appropriateness to the current context— no ‘off the shelf’ solutions.*
- *Remain alert to the application of informal theories and discrepancies between ‘espoused’ and ‘actual’ theory.*
- *Engage with a process of enquiry and reflexive self-enquiry.*
- *Detect error effectively.*
- *Increase emphasis upon problem definition rather than problem solution in client situations.*
- *Demonstrate greater interactivity in client situations and less reliance on old models.*
- *Enjoy a more dynamic approach to uniqueness and uncertainty in client situations.*
- *Learn using both an internally consistent model of professional training and also by critiquing such processes themselves and the value systems which challenge or perpetuate them.’ (Cross and West, 2002:9)*

In a nutshell, it is about going through a process where you build on your theoretical and practical knowledge (what Schön calls ‘knowing-in-action’) through a process of continually looking at yourself, your achievements and actions and looking for lessons, a deeper understanding of why, then investigating potential improvement.

Back-talk – is when a practitioner engages in a reflective conversation with the materials (for example an artist with the canvas and the paints, an architect with drawings and material samples), a process that may aid in developing a deeper understanding of the problem (Adams *et al.*, 2001). This is a major technique used in this thesis.

Critical reflection – ‘*Critical reflection refers to an activity or process in which experience is recalled, considered, and evaluated, usually in relation to a broader purpose. It is a response to a past experience and involves conscious recall and examination of the experience as a basis for evaluation and decision-making and as a source for planning and action*’ (Richards, 1990:5). Critical reflection to me is looking at an experience and thinking about it deeply. I think about these experiences in terms of: what went well, what did not, why, how

this informs my practice facilitating 'green' innovation in the built environment and how can I approach it next time.

Explicit knowledge – is often explained as 'know-what' as opposed to 'know-how', that is it *'can be generally described as knowledge that can be written down (e.g., in books, manuals, procedures, software, and documents)'* (Christensen and Birou, 2002: paragraph 8).

Frame and framing – the way a situation is understood by the person doing the perceiving, the lenses through which they see the world, as Schön and Rein put it: *'[t]here is no way of perceiving and making sense of social reality except through a frame, for the very task of making sense of complex, information-rich situations requires an operation of selectivity and organisation, which is what 'framing' means.'* (1994:30)

Generative Metaphor – is a term used by Schön (1979). It is a story that helps define a solution and generate an answer.

Knowing-in-action – 'I shall use knowing-in-action to refer to the sorts of know-how we reveal in our intelligent action—publicly observable, physical performances like riding a bicycle and private operations like instant analysis of a balance sheet. In both cases, the knowing is in the action. We reveal it by our spontaneous, skillful execution of the performance; and we are characteristically unable to make it verbally explicit' (Schön, 1987:25). This is a simple way of generalising what Meppem (2000) calls the 'different-ways-of-knowing', which is vital for this research, as the knowing-in-action of an architect is very different to the block layer or solar panel expert.

Metaphor – a story, image or even a word, that allows you to understand one thing in terms of another. I often use a stubby holder (sock to keep beer cold) in my courses with builders as a metaphor for the importance of insulation.

Phronesis – a concept introduced by Aristotle known as practical wisdom, commonly referred to as the third dimension of knowledge (the other two dimensions are Episteme—academic knowledge and Techne—technical knowledge). Phronesis is also explained as 'political knowledge', *'that is the ability to understand and interpret the situation at hand and decide about appropriate actions.'*

Lennartsson and Sundin go on to argue that any reflective practice needs to foster this knowledge because *'[w]hat is new in our time is that the general situation is very different from what the teacher has experienced, and from what previous generations have met'* (Lennartsson and Sundin, 2001:14).

Praxis – (Cherry, 2003) is *'practice that is formed through the integration of what I do—that is, what I have learned or has become habit with the surfacing and acknowledgment of what I believe, think, imagine and feel, informed by critical and creative consciousness of the physical, aesthetic, ecological, social, moral, spiritual and cultural milieu which shapes me and upon which I, in turn, impact'*. Again showing the history of practice based research Gaby in her summary of reflective practice in education explains that *'Praxis (or practice), on the other hand, is directed both to the achievement of something morally worthwhile, and is a morally committed form of action that is in constant revision as practice is progressively pursued. Praxis is guided by phronesis or 'practical wisdom', and is indispensable to practice as Aristotle's supreme intellectual virtue.'*(Gaby, 2003:6)

Reflecting-in-action – Reflecting-in-action is the in-the-moment ability to look at a situation, reflect on why it is occurring and plan your action in response.

Reflection-for-action – Reflection-for-action is anticipative: here the learner *'defines their aspirations [and] establishes priorities for subsequent learning'* (Cowan, 1997 cited in Jolly, 1999). Cowan's work led to a diagrammatic explanation of reflective practice that includes the past, present and future (reflection-in, on and for-action).

Reflection-on-action – Reflection-on-action is reflection on a past experience: *'[r]eflection-on-action deals with thinking back on what we have done to discover how our knowing-in-action may have contributed to an unexpected action This includes reflecting on our reflecting-in-action, or thinking about the way we think, but it is different from reflecting-in-action.'* (Farrell, 1998: paragraph 10)

Stuckness – Again Nita Cherry (2003) defines this as: *'the times of deep frustration, blockage and pain when it seems that 'nothing is happening' but potentially*

everything is going on...'. To me 'frustration' is the key in the above description; the 'stuckness' in this thesis refers to those mental blocks, the 'not knowing' while in practice. Another definition of 'stuckness' is someone doing things the same way they have always done it, and cannot see beyond this, being in a rut (Goff, 2001).

Surprise – it's an unexpected occurrence, insight, the sudden 'a-ha' moment. Schön (1987:28) defines this with more depth, also describing the impact of surprise in a reflective practice: *'Surprise leads to reflection within an action-present. Reflection is at least in some measure conscious, although it need not occur in the medium of words. We consider both the unexpected event and the knowing-in-action that led up to it, asking ourselves, as it were, "What is this?" and, at the same time, "How have I been thinking about it?" Our thought turns back on the surprising phenomenon and, at the same time, back on itself.'*

Swamp – is a metaphor that explains the messy complex area of investigation or experience or the *'...site of those messy, novel, emerging issues which challenge existing practice...'* (Cherry, 2003)

Tacit knowledge – (the know-how) *'is knowledge in the form of skills, abilities and experience. As a general rule, tacit knowledge cannot be easily transmitted through writing'* (Christensen and Birou, 2002: paragraph 8). It describes knowing-in-action.

Transdisciplinary – not strictly a reflective practice term, I use the term to describe a method of identifying disciplinary boundaries and through this developing an acceptance of their difference to promote the discursive collaboration needed for 'green' projects (Meppem and Bourke, 1999). As Meppem (2000:48) points out, *'[t]ransdisciplinary orientations recognise that how problems are conceptualised will largely define the solutions sought'*²⁰. This is more than multidisciplinary as it again goes that step deeper, not only at working together but at the culture and 'how-we-do' (tacit knowledge, knowing-in-action) areas of each discipline and their underlying power and tensions.

20 The idea that how problems are conceptualised will largely define the solutions sought is a concept that has a long history in design methods in the 1960s and 1970s, often under the label of search space.

White spaces – according to Cherry (2003:24): *'are those issues that don't line up neatly with our discipline boundaries or that fall right off the existing page'*. Usually ignored because they are in the 'too hard basket' yet they are the interesting and messy bits that are so vital to progress and innovation—working in the field, collaboratively, transdisciplinarily to solve 'green' problems, in my view is one of these spaces.

Wicked problems – brought into the forefront by Rittel and Webber (1974:34-36) in discussing planning, they developed a set of ten properties of wicked problems:

1. *There is no definitive formulation of a wicked problem.*
2. *Wicked problems have no stopping rule.*
3. *Solutions to wicked problems are not true-or-false, but good-or-bad.*
4. *There is no immediate and ultimate test of a solution to a wicked problem.*
5. *Every solution to a wicked problem is a 'one-shot operation': because there is no opportunity to learn by trial-and-error, every attempt counts significantly.*
6. *Wicked problems do not have an enumerable (or exhaustively described) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.*
7. *Every wicked problem is essentially unique.*
8. *Every wicked problem can be considered to be a symptom of another problem.*
9. *The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.*
10. *The planner had not right to be wrong.*

I believe that many of the problems I am researching, looking at sustainability, the building profession and the integration of 'green' innovation into the built environment, qualify as wicked problems. As explained further into the thesis

this resulted in an emergent approach to the research moving a way from a qualitative research method to simply exploring what actually occurs. It also resulted in the format of the thesis as wicked problems and an approach to solving them is best described as stories.

2.2.3 Criticisms of reflective practice

Schön's work has not gone without criticism (for example Bleakley, 1999; Cross and West, 2002; Eraut, 1994; Kinsella, 2003; Mackintosh, 1998; Zeichner, 1994). Some of these several authors have noted that though he describes the importance of reflection he does not practice it in his own work. Others such as Eraut (1994) point out that often there is not the time to reflect in professional practice when you are out in the field. Cross and West (2002) list the literature that identifies areas where ambiguity and confusion can be found in Schön's work. These centre on the varied meanings associated with reflection and reflective practice and its varied application as mentioned above (Cross and West, 2002:7).

Kinsella (2003: paragraph 6) provides the most concise and practical summary of the main criticisms of reflective practice. She does this while preparing the way for some insightful recommendations on how to address these issues and move reflective practice forward.

I wonder what would happen, if Schön's 'reflective practitioner' moved into a dialogic community that recognized power differentials, considered the problematic nature of a realist view of language, and considered the lived experience of users of service? In the interest of conceptual clarity, I suggest a hermeneutic examination of philosophical perspectives embedded in the theory (Dunne, 1997). Furthermore, given the above critiques, I suggest that work that illuminates notions of dialogue, discourse, and intersubjectivity provide fruitful locations for extending Schön's theory of reflective practice.

I interpret this as meaning that to further the field of reflective practice it is important not only to hear the voice of the practitioner but also those active or receiving of the practice. Where possible I have kept this in mind in writing this thesis and reflecting on my own practice.

2.2.4 Introducing a practitioner's journey – from novice to expert

I have always seen life, and thus this research, as a journey. Conceptualising the research as a journey ensured that everything that occurred, the good and the bad, could be seen as a step forward, backwards or sideways, on this journey. A journey is a good metaphor for this type of research which tries to understand a phenomenon. As Kotarba and Fontana said '*one must immerse oneself in everyday reality—feel it, touch it, hear it, and see it—in order to understand it*' (Kotarba & Fontana, 1984:6 quoted in Adler and Adler, 1998:97).

In outlining the approach of this research project, it is crucial to outline the work of authors who have written on the progression of a practice from novice to expert or mastery. In experiencing the building industry and 'how-they-do-things' and developing a practice aimed and influencing this, there was a time of complete naivety and a slow gradual growth through experience to greater understanding. The Dreyfus and Dreyfus (1985) brothers call this the journey from novice to expert. The steps are summarised as:

1. Novice – Learns objective facts and features and rules for determining actions based upon these facts and features. It is often explained as being context free—though this is ideal as it reduces responsibility allowing learning: it is not practical; all learning is within a context. (My interpretation of this description is that it means that it is in a classroom, or other place which is not the 'field'.)
2. Advanced beginner – Starts to recognise and handle situations not covered by given facts, features and rules (context sensitive) without quite understanding what he/she is doing.
3. Competence – After considering the whole situation, consciously chooses an organised plan for achieving the goal.
4. Proficiency – No longer has to consciously reason through all the steps to determine a plan.
5. Expert – Generally knows what to do based upon mature and practiced understanding.

These stages will be explored in more detail in the following chapters.

Action research

The method chosen initially for the research was action research, and then because of the strong desire to explore from within the industry, ‘participatory’ action research.

‘To use a modern expression, in action research, the journey is the goal, because the journey of discovery, reflection and enhancement is intended never to arrive at a destination that legitimises stopping the process of being on such a journey.’ (Personal communication Prof C. Bunning, International Management Centre, Pacific region, Brisbane)

To finally come to the conclusion to use ‘participatory’ action research was actually quite a painful and frustrating process in itself. The method never seemed ‘quite right’ and no other method quite fulfilled *my* concept of what the research was going to achieve as outlined above in the introduction. ‘Participatory’ action research was finally settled on because it provided the framework for the project, if not an exact model. Specifically the work of Hult and Lennung (1978 in Hult and Lennung, 1980:442-443) and their resulting definition convinced me to take up this approach. The definition that Hult and Lennung (1978) propose describes action research as (in brackets my thoughts on its applicability to the specific research directions described above):

- *assisting in practical problem-solving* (meeting the clients’ expectations of the environmental performance of the building);
- *expanding of scientific knowledge* (what are the barriers and impediments to integrating ‘green’ features into a building project; how do you facilitate ‘green’ innovation in the building industry);
- *enhancing of actor competencies* (supporting the agents in the integration of the ‘green’ features and my reflective practice);
- *it can be performed collaboratively in an immediate situation* (this was an actual project);
- *uses data feedback in a cyclical process* (reflection on the results of the project in the practice);
- *aims at an increased understanding of a given social situation* (information on the actual building process and environmental information integration);

- *is applicable for the understanding of change processes in social systems* (what were the results of the insertion of environmental information; how has the practice evolved); and,
- *is undertaken within a mutually acceptable ethical framework* (initially through an ethics approval and then through sensitive treatment of the material in the research).

The aspect of participatory action research that did not align with this project was the joint setting of objectives and reflection on the action as a group—though in general all the participants did have the aim to finish the projects. For this reason I have ‘participant’, ‘participatory’ and ‘participation’ in brackets. There was a strong element of participation but not in its traditional form.

2.2.6 Evolution of method – hybrid method developed through emergence

On reflection the research method was a mixture of action research, participant observation, case study, interviews, and a myriad of other data collecting techniques centred on the experience of what happened in the field. It all informed the reflective practice through providing the data for review and reflection.

The evolution of the research is impossible to explain without some reflection on the journey thus pre-empting the thesis. The literature supports the emergence of the method, as well as the better known emergence of theory, as a valid undertaking, *‘[t]he theory is emergent—discovered in the data.... The methods can be emergent too’* (Dick, 2002). The text in the box below describes the journey of this research and my practice from 1999 up until today. This was necessary because to understand the research and the methods used it is important to understand the journey, the opportunities, conflicts and resultant changes of direction. The research method—the way I approached data collection and planning for action—adapted in response to the field in which I was immersed. The figure below illustrates the changes in direction over the five years – the diagram is explained step-by-step in the grey story box below.

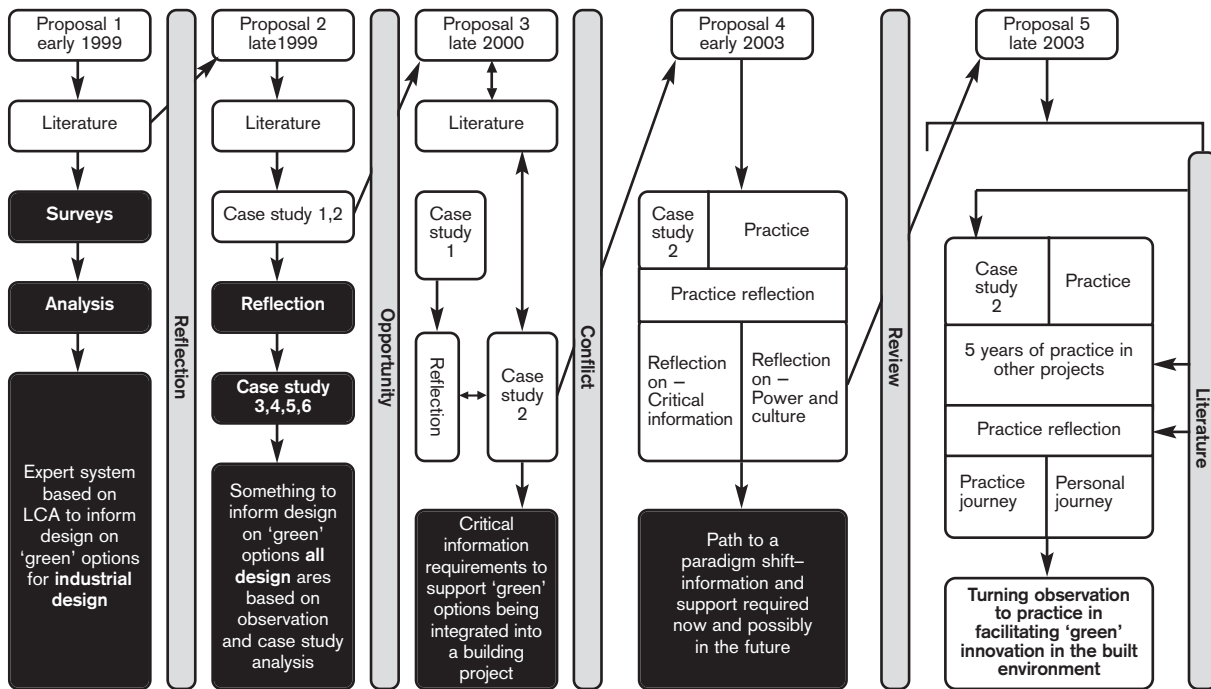


Figure 4 – PhD development over time (the dark boxed indicate those activities that were not carried out)

The research journey

I began on this path late in 1998. Returning from Europe at a loose end I contacted a friend at RMIT, learned of, applied for and was offered the opportunity to gain a PhD with a scholarship. I had no intention of further study, but with a love for teaching an academic career appealed. The initial direction set for the PhD by the primary supervisor was to develop an expert system for designers to integrate environmentally preferred ‘green’ options into design. This was aimed mainly at industrial design. Having a background in life cycle assessment (LCA) – the analysis of the impacts of a product over its entire life to identify superior design options – I planned to integrate LCA and a life cycle perspective into the research (**Proposal 1**).

As described in the ‘autobiography’ section of the preface, I have a Dutch background and am a great believer in cooperation, collaboration and pragmatic work that integrates the end user in the research to ensure it is relevant. Thus, I tried to involve some academics in the design programs (architecture, interior design, landscape architecture and industrial design) in the definition of what this expert system might encompass. A quote from my first vignette best describes the outcomes of my attempt to involve the designers (I wrote several of these. They each comprised of two to ten pages exploring significant experiences in my practice. It is discussed in more detail below):

120 Eyes rolled, there were deep
 121 heartfelt sighs and for the most, though I was humoured, it was definitely
 122 my impression that I was not a popular person and this was not something
 123 that the designers wanted to be involved in.

Excerpt 1 – Vignette Path 98-99 – text units 120-123

This combined with the experience of the research methods class I followed in the first six months showed me that I was missing something: I did not understand ‘design’ so how could I develop a useful expert system?

27 The research class was on a Tuesday afternoon, we all sat around a table
 28 and talked. Everyone introduced their topics and discussed issues from
 29 the meaning of knowledge to how this was reflected in design. I was
 30 fascinated! I wanted to know more and so I asked the question – a
 31 question which I believe will haunt me forever and will forever be the
 32 cornerstone from which people will be able to judge how far I have

33 travelled on this journey – ‘ is there a book I can read on how to
34 design?’. The reactions around the room, though all kind, were from
35 shock, through surprise to the kind of expression a parent has when a
36 child asks if they can fly. No, I came to learn, there is no book on
37 design, no book at least which is definitive or even comes close to
38 expressing what design encompasses.

Excerpt 2 – Vignette Path 98-99 – text units 27-38

These two experiences, combined with a few other closed doors and exasperated brush-offs led me to develop a simple survey and desk-based study, safely away from the nasty designers. This was rejected by the research committee. I almost gave up at this point: I mean, I didn't even want to do a PhD in the first place!!!!

I reflected on this time in a vignette I wrote in 2000 on my experience.

292 On starting my PhD I hoped to develop the (what in my mind's eye would
293 be THE) definitive expert system for designers to be able to integrate
294 environmental criteria into their designs.
295 To my surprise it was met, to a large extent, by a great deal of
296 resistance from the architects and designers with whom I discussed my
297 ideas. Without support I became disillusioned and changed paths to a
298 very safe – but very boring – topic in an area where I already knew most of
299 the answers. Nice, Safe, Warm and Cosy.....blahhhh!
300 Through a chance encounter and discussion on my change of direction with
301 an international visitor to RMIT, I was shaken out of my lethargy by a
302 simple comment asking me where my passion was for my research. Serious
303 reflection followed, informed by 8 months of getting to know designers,
304 and a new proposal was formed. No longer would I try to provide the
305 answer but try to define the question, look at it from a designers point
306 of view and actual practice, observe, participate, record and learn.
307 Working title: 'Inside the design process – looking at the integration of
308 environmental approaches – an action research investigation on the
309 potential of environmentally informed design practice.'

Excerpt 3 – Vignette Path 2000 – text units 292-308

The initial proposal, the nice safe one, is shown below in Figure 5. The intention was to do a literature review, develop surveys, collect the data, analyse it and develop a proposed expert system.

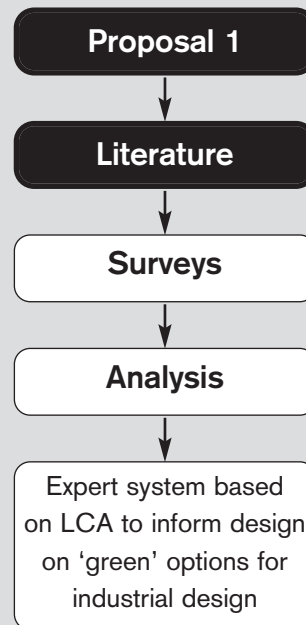


Figure 5 – Proposal 1 – integrate LCA into a desk-based study to develop an expert system for integrating ‘green’ innovation in design (light boxes are steps I did not undertake)

Reflecting on this proposal’s rejection and some of the experiences outlined above, and with the support of a visiting academic, I re-evaluated and decided to explore the design process. Aside from attending presentations and conferences whenever I could I was encouraged to participate in a design short course, just to observe and experience and then reevaluate my research. The short course was an intensive week-long course with the aim of introducing potential students to the School of Architecture and Design. I participated in the landscape architecture intensive. I loved it! And it was through this experience that I discovered that I was still interested in ‘green’ innovation and its integration into design, but that an expert system was not the solution. In fact I did not know or have a concept of what would evolve at the end of the research; I just wanted to observe, to explore the messy swamp I had stumbled into.

Interestingly I did not realise that it was a messy swamp to begin with. Before the two experiences quoted above I was confident I knew the lay of the land. After all, people aren’t intentionally environmental bandits, right? It’s just that they don’t have the right information and tools, right? And if you could provide them with this tailored information surely they would implement it, right?

Wrong!

Later I found that the research which had been carried out showed that though there was plenty of lip service to the idea of ‘green’ design it was rarely implemented (Brown, 2001; Owen, 2003; Wittman, 1998).

Thus two problems became clear for the research: the first was to understand design and the second was to work out why there was the cognitive dissonance between what the designers said and what they implemented in ‘green’ design.

To understand design I realised I could not turn to hypothesis testing scientific positivist methods, for you need to have a concept of what you are testing to frame it so that you can test it. I needed a more exploratory method, a way to investigate the field, to start painting the landscape and filling in the blanks. Later, I also came to recognise that in looking at the integration of ‘green’ innovation, the exploratory method also allowed me to observe what was actually happening in the design process and therefore get a better first hand feel for the barriers. So it was at this point, late in 1999, that my research moved from a hypothesis testing, quantitative, desk-based study to an experiential journey where I tried not to think on what I expected and just participated and observed how design occurred (**Proposal 2**).

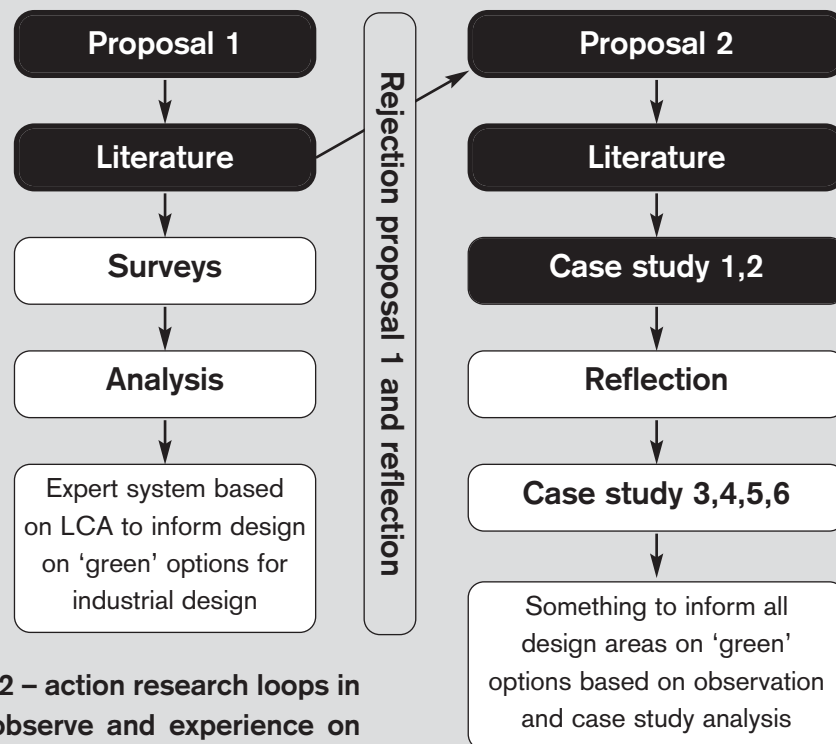


Figure 6 – Proposal 2 – action research loops in 6 case studies to observe and experience on site what occurs when ‘green’ innovation is integrated with design (light boxes are steps I did not undertake)

The method settled on was 'participatory' action research. The plan was to carry out six small projects (1-3 months each) with various design firms observing how they designed, while testing the integration of various 'green' initiatives. The method I intended to use is described by Zuber-Skerrit (1995) building on the work of Kemmis and McTaggart (Kemmis and McTaggart, 1988), and involved cycles of planning, acting, observing and then reflecting (Figure 7). My intention was to use the first two projects to test and refine the method of data collection and to learn more about design, then to focus in the last four, on the integration of 'green' innovation (Figure 8). I also planned to let the experience of the previous project help define and refine what I investigated in consequent projects.

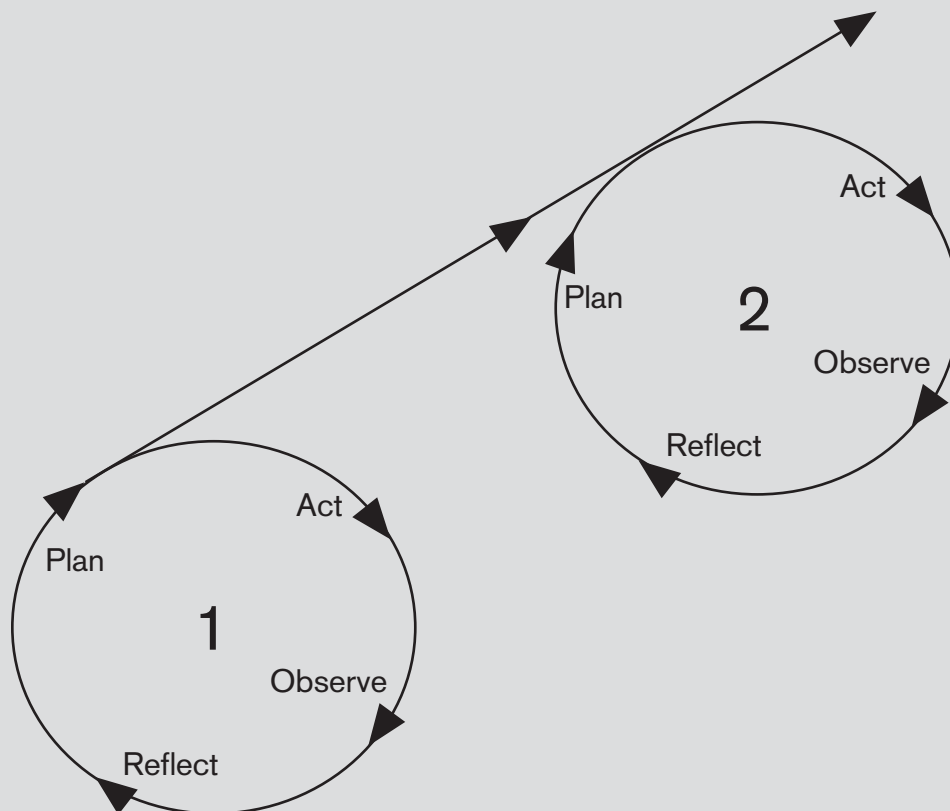


Figure 7 – The Action Research Spiral (Zuber-Skerrit, 1995: 13)

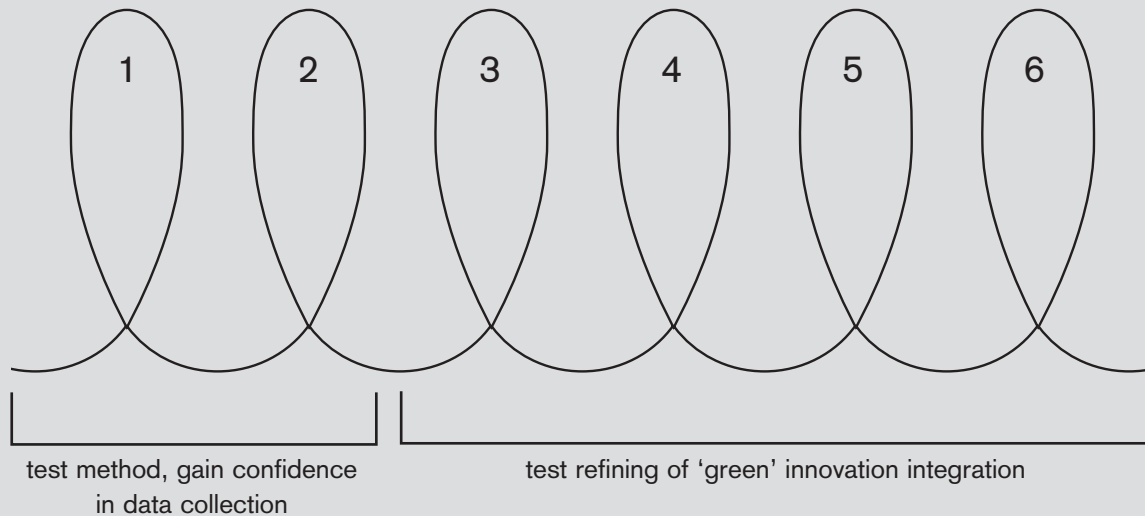


Figure 8 – Loop repeated 6 times, each project learning from the previous one

My first project started late in 1999, with an industrial design company developing mass market products. I will discuss my experiences at this first site in Chapter 3. After three months of collaboration on two designs where most of the time I was a fly on the wall (Forester, 1999) until they required my input, I was offered a position in an architectural firm working on a ten week project providing 'green' information for a Civic Centre being designed for a local council in Melbourne.

Taking up this opportunity I entered Cycle 2 of the research working on the Civic Centre design from early in 2000. It was apparent within the first month that the design process was not progressing and that the information they required of me could not be developed until the design was more resolved. As a result my involvement decreased from four days to three, then to two with the accompanying increase in actual weeks on the project. The experience and lessons from this project are described and reflected on in Chapter 4. Deciding to be flexible in my participation in the project was the first deviation in the planned six small action cycles. I decided that I needed to respond to the project and not to strictly adhere to my plan. I was responding to the field and the actual design process, not to an orderly representation of design. I was starting to learn why I had got the cold shoulder in my first attempts to talk about the 'expert' system.

Six months into my time with the architects I was given the opportunity to continue on the project with the clients, the Council. This enabled me to have ongoing input into

the 'green' innovation and follow it through with communication, workshops and translation into the design documentation and tendering. In Figure 9 this is represented by the third change in proposal.

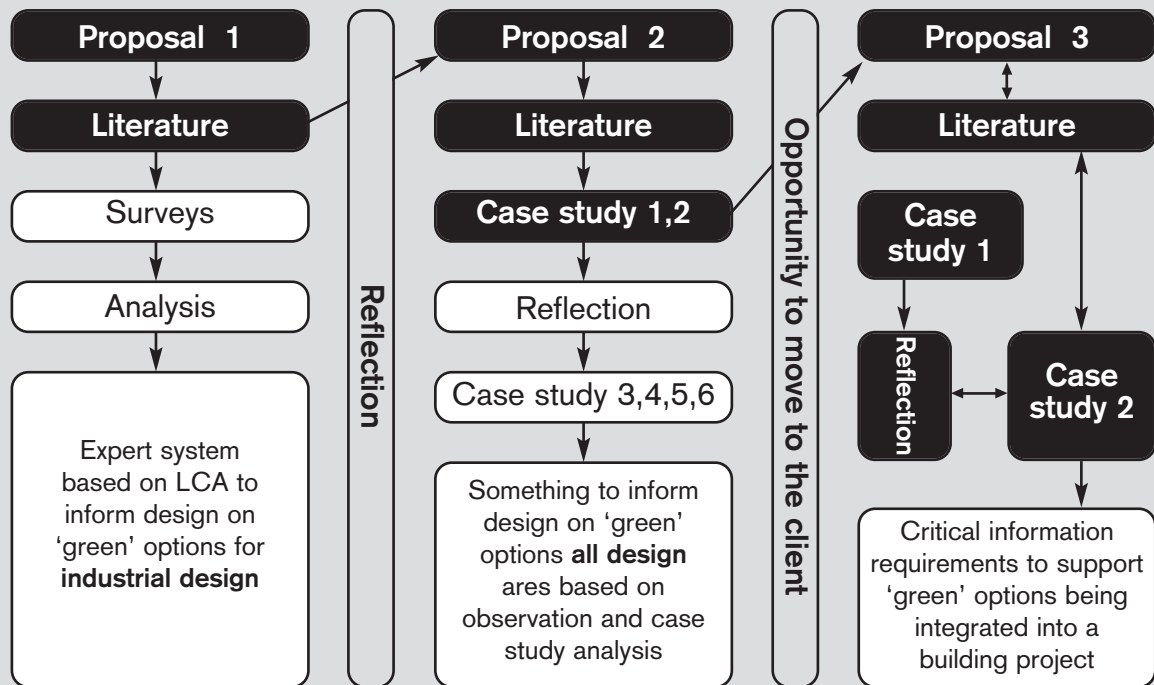


Figure 9 – Proposal 3 – taking up the opportunity to extend the case study to the whole building process (light boxes are steps I did not undertake)

This provided an opportunity of following the building process one step further and was deemed a valid change by my supervisors and an international panel of experts. At RMIT University every six months we have a postgraduate conference where the PhD and Masters students present their progress in front of national and international experts in architecture and design as well as their peers for criticism and feedback. I used these sessions to test my progress and to help in the decision making on methodological conundrums like this one—do I continue with my original six small case studies or do I change focus from design in general to design in the built environment and the whole process of integrating 'green' innovation in the building industry?

It was decided that continuing with this project and seeing the further implementation of the initial 'green' innovation throughout the process was worthy of the change in thesis direction and was consequent to the emergent nature of the research. Thus, I worked with the council from mid-2000 until September 2001. I spent two days a

week on average at the council working on various aspects of the project, communication of the ideas, development of specifications, tendering documentation, tendering schedules, seeking external funding for the various 'green' initiatives and developing strategies for facilitating learning from the project for the Council.

Work on site began in 2001 and I was given the opportunity to work with the agents in the next phase of the project: site implementation of the design. Again my supervisors and the biannual review committee were asked for their feedback on the value of continuing the project and again they supported the learning potential of sticking with this one project and changing the research method to look at only one case study instead of six.

In the period of 2001 and 2002, an interesting phenomenon occurred; through the experience on the Civic Centre project I was given the opportunity to develop the RMIT Sustainable Building Program—a research program aimed at delivering professional training and supporting research in the 'green' innovation of building projects. In 2002 I continued my work on the Civic Centre, but reduced contact to once a fortnight for half a day on site. This continued until the building's opening in August 2003.

Having taken the opportunity to grow the research, I made the serious mistake of not adapting my ethics procedure; in fact I did not even consider it until I had started writing up the results in conference papers and asked the agents involved in the Civic Centre to reflect on the results. Again, this is discussed in greater detail in one of the following chapters, but for the purpose of relating the methodological development, let me just say that they did not agree with my record or recollection of events and even less with my interpretation.

This posed a serious dilemma. If I could not get agreement on the case study how could I, in all honesty, present it as a central part of my thesis. How naive I was, thinking that my interpretation was the truth! Everyone sees and remembers things from their own perspective (Schön and Rein, 1994). What did this mean for the research? From a respect and ethical perspective, I decided I could not follow through with Proposal 3 and write the case study up fully and analyse it. **Proposal 4** was then developed early in 2003 in collaboration with my supervisors: I would reflect on **myself** in the case study and talk about the tools and information I developed to

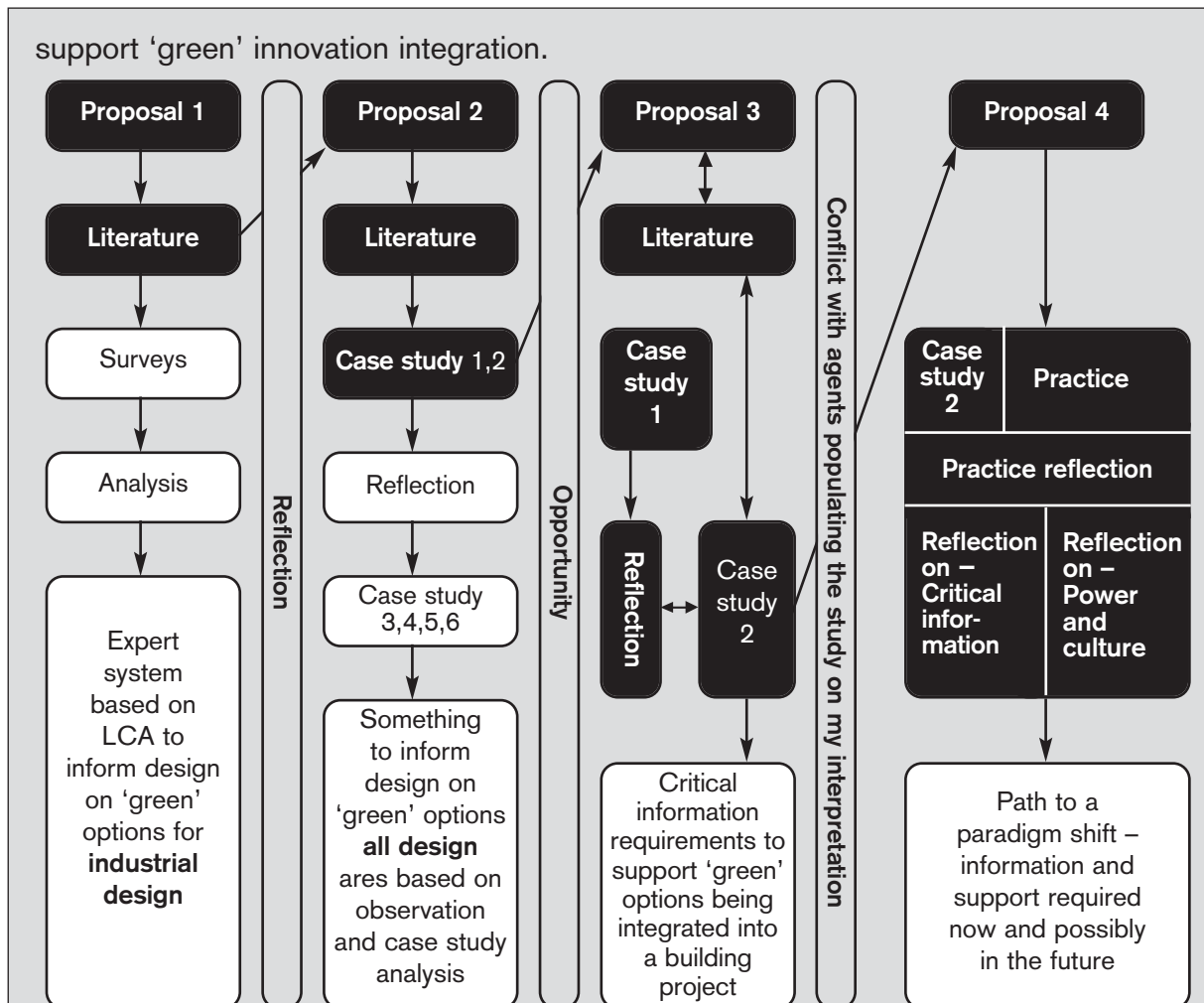


Figure 10 – Proposal 4 – critical 'green' information needs for the building industry, the impact of power and culture (light boxes are steps I did not undertake)

To develop the new direction I wrote a paper reflecting on the critical information requirements and tools to integrate sustainable innovation in the built environment. I presented this at a conference, and again in front of the biannual critique. The feedback from both was that it was not the tools or the information developed that was the interesting part of the research but the fact that I was actually seen as an 'expert' in this field now. The development of the practice of facilitating 'green' innovation in the built environment was actually the interesting outcome of the research. This led to the final proposal for this research, **Proposal 5**.

Revisiting Figure 4, it does not only demonstrate the evolution of this research project but also how my own action reflection cycle was working in the development of the research method.

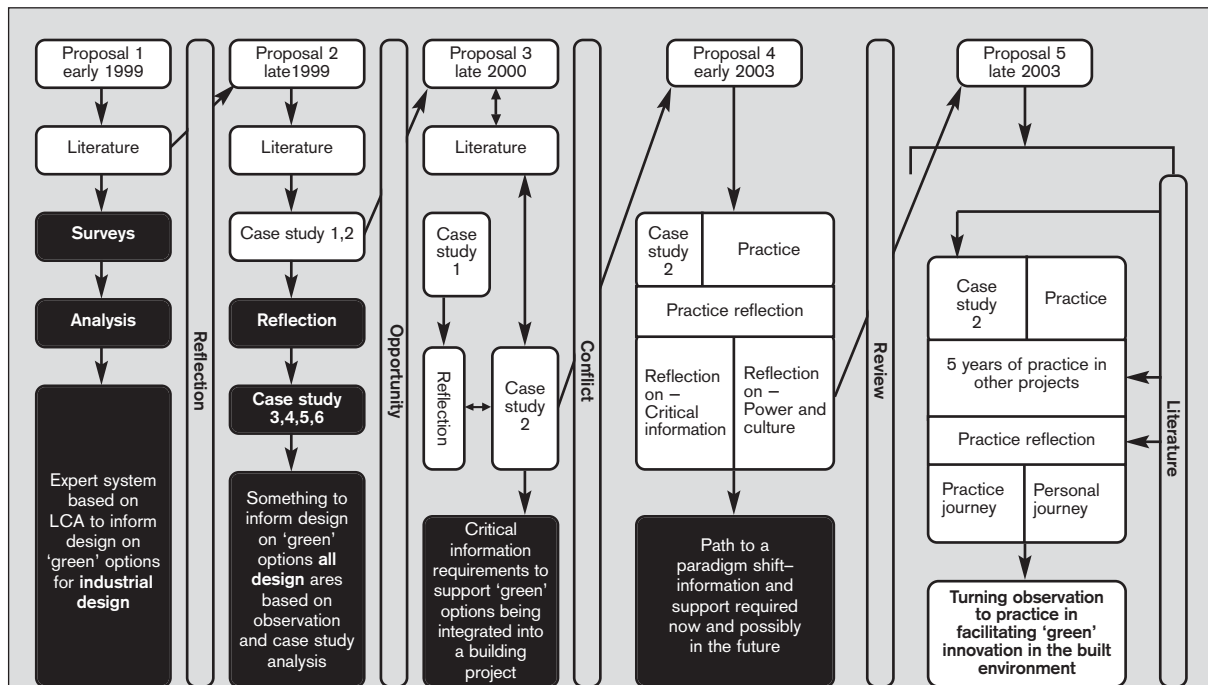


Figure 11 – Proposal 5 – facilitating ‘green’ building innovation – turning observation to practice (dark boxes those activities I did not undertake)

As discussed above each vertical grey section is a point of conflict and reflection that led to a change in direction instigated by the field work and collected data. The squares in bold were planned activities in each proposal that were left undone when the project moved on.

Illustration of the change from hypothesis to guiding questions

In reflecting on this part of the journey, the academic development of the researcher, of me, I will briefly also outline how the hypotheses and guiding questions changed over the period of the research. There are two reasons for doing this: the first is to further illustrate the evolution of the research and the second is to illustrate the shift from a positivist paradigm to a constructivist reflective development of a practice. The original research question was framed as a hypothesis with sub-questions:

- 33 The design stage of a product or service is the point at which the
- 34 potential to minimise environmental impacts is the greatest. A practical
- 35 tool for the determining environmental impacts is the Life Cycle
- 36 Assessment methodology (LCA). LCA is currently not being used optimally
- 37 in Australia because of the lack of knowledge and experience in the field.
- 38 This study will examine the following questions.

- 39 How can the use and application of LCA be optimised in Australia?
 40 What are the experiences in LCA in Australia?
 41 What have been the barriers to the development and application of Life
 42 Cycle Assessment and what methods have been, or can be, used to overcome
 43 these barriers?
 44 What are the trends in LCA usage and what are the expectations of LCA
 45 and LCA methods?
 46 Can a series of general principles be developed to aid LCA practitioners?

Excerpt 4 – Proposal 1 – text units 33-46

The second proposal, some six months later, had moved away from a hypothesis to a guiding question:

- 16 Can designers incorporate
 17 environmental information within their design process
 18 in the absence of specifications from the client,
 19 for example in the brief?

Excerpt 5 – Proposal 2 – text units 16-19

This shows a change to a more emergent method, reflected in the action research method chosen. This acknowledges that the research is a journey and that I did not know the end destination.

Proposal 3 was developed when the opportunity arose to stay with the Civic Centre project. Accordingly the guiding question changed to reflect the switch of focus from all design to the built environment, in particular:

- 193 The guiding questions were:
 194 • Are there barriers to the integration of 'green' options in a building
 195 project?
 196 • What are the different types of 'green' information that are needed at
 197 the various stages of the design process?
 198 • Does the provision of this information overcome the barriers or are
 199 there larger cultural issues within the industry and its constituent
 200 agents which may impact on the introduction of the 'greener' options?

Excerpt 6 – Rethink April 2003 – text units 194-200

Proposal 4 then took the project from looking at the case study for answers, to looking at my practice in the project and the tools and information I had developed to integrate

'green' innovation in the Civic Centre project and other projects. I was no longer proposing to write it up as a one case study with its ethical problems. It now focused on tools and information used in the building industry, looked specifically at critical information points in the building process and the issues of power and culture on 'green' building outcomes. The questions, which remained the same, were now posed from the perspective of the industry as a whole using the literature, the Civic Centre and all other projects carried out in the five years as non-specific illustrative examples.

Finally, in Proposal 5, which is what you are mainly reading in this thesis, the guiding questions took the analysis from first level data collection and theory development on the integration of 'green' innovation into the built environment to a second level that developed, reflected and theorised about a reflective practice in facilitating 'green' innovation in the built environment.

Guiding questions for this thesis were:

- How was 'green' innovation facilitated, what information was required, what were barriers experienced?
- What were the main lessons learned, and the main methods for overcoming the barriers?
- How did the journey progress?

Having outlined the development of the research and its intent, I hope that I have illustrated how reflection on the research and on opportunities presented by the field have guided this thesis.

Section 2.2.6 continued

Summarising the direction changes outlined above, there was a change in direction from:

- (1) survey/hypothesis based research;
- (2) to 'participatory' action research over 6 cycles;
- (3) to 'participatory' action research for one case study;
- (4) to looking at the tools and critical opportunities in the building industry; and
- (5) to finally a reflection on the growth of my practice.

As explained before there was a shift from looking at level 1 data—the tools I used and how they worked—to level 2 data—how I developed my practice, learned and facilitated ‘green’ innovation in the built environment. Figure 11 and the story above outlined the whole history of the research. Figures 12 and 13 illustrate the main change from first level data collection and theory development on the integration of ‘green’ innovation into the built environment (Figure 12), to a second level that developed, reflected and theorised about a reflective practice in facilitating ‘green’ innovation in the built environment (Figure 13).

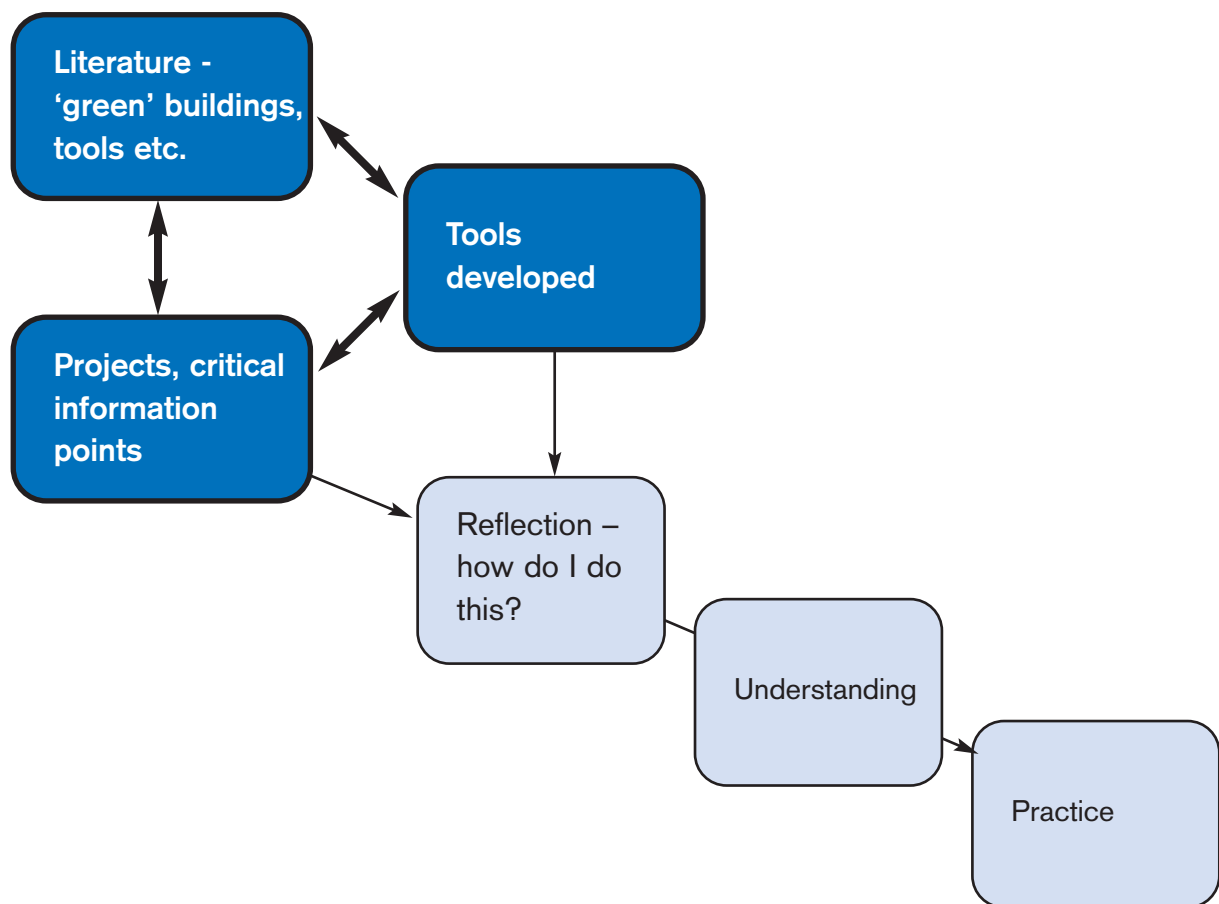


Figure 12 – Initial research focus on first order data—working in the industry developing tools, the main outcome is the tools and understanding when to use them

Learning through the use of first and second order data is a concept most attributed to Argyris and Schön (1978). First order data is what informs single-loop learning, usually seen when goals, values, frameworks and strategies are taken for granted. The emphasis is on *‘techniques and making techniques more efficient’* (Usher and Bryant, 1989:87 quoted by Smith, 2001: paragraph 19). Analysis of these data in my thesis

would result in new models, data, tools, and case studies, which I considered presenting in an interactive website alongside the thesis. In Figure 12 they are the darker coloured bold objects and relationships.

In moving to second order learning through second order data—that is my reflections on the situation, the research method and my practice—I questioned ‘*the role of the framing and learning systems which underlie actual goals and strategies*’ (Usher and Bryant, 1989:87 quoted by Smith, 2001: paragraph 19). The purpose is no longer about providing the perfect tool or model, but investigating why things work and do not work, looking at the systems behind the projects and the practice. Figure 13 shows a shift to a new set of bold relationships.

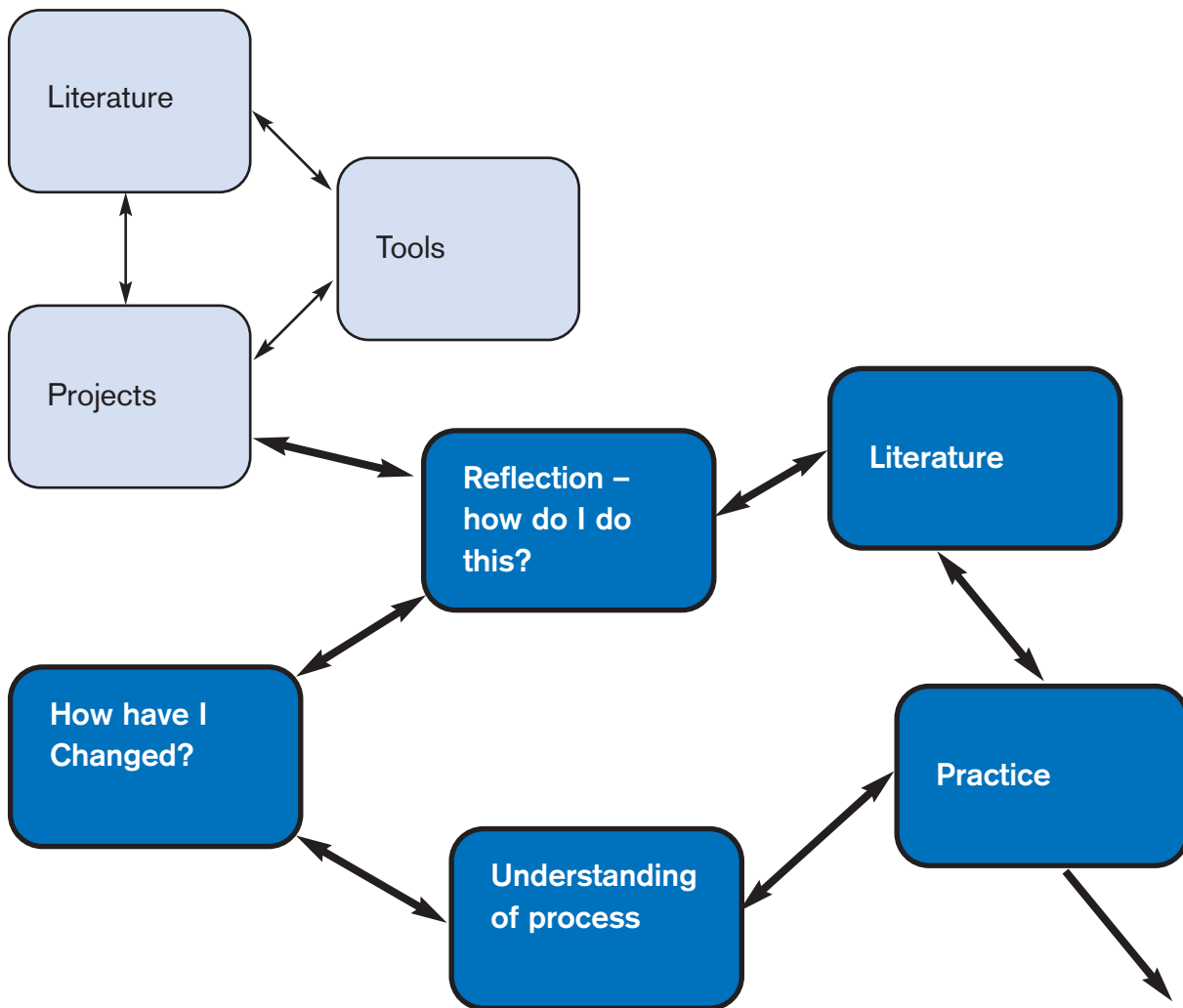


Figure 13 – Consequent research focus—second order data—reflecting on my practice in the industry, the main outcome is an understanding of the growth of a practice in this field

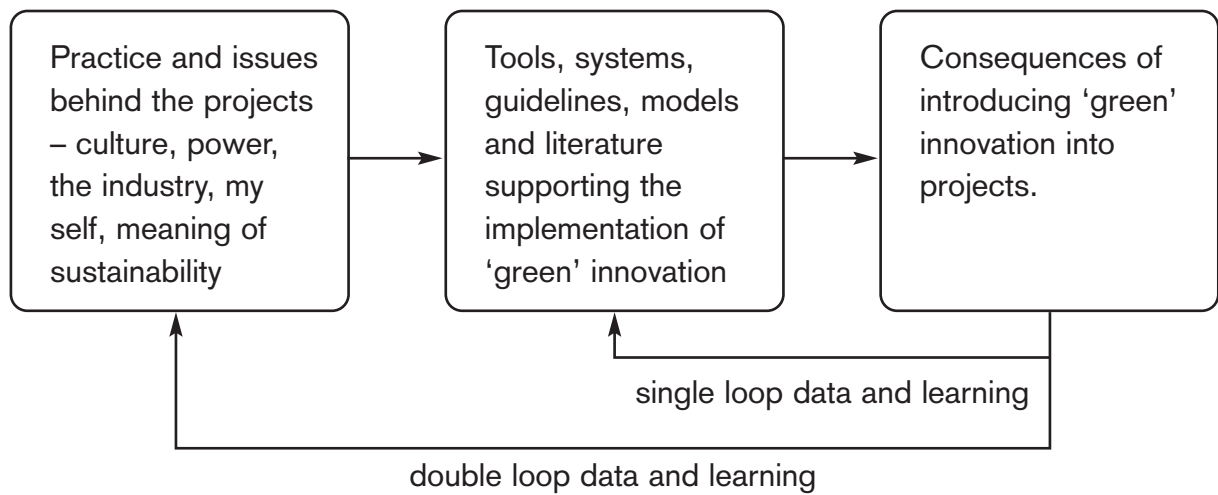


Figure 14 – Representation of single and double loop learning (Argyris and Schön, 1978 quoted Anderson, 1997 in paragraph 23)

Figure 14 is an adaptation of a well known single/double loop representation of learning by Argyris and Schön (1978). I had already used figures 12 and 13 to explain this same idea before coming across it. I have included it because I feel it summarises my discussion well.

The other concept that has informed my reflection and is linked to these different levels of learning, are the model 1 and 2 types of personalities. The theories-in-use that characterise model 1 types are *'strategies of unilateral control, unilateral self-protection, defensiveness, smoothing over, and covering up, of which their users tend to be largely unaware...And these strategies tend, in turn, to undermine attempts to implement interventions...'* (Argyris and Schön, 1991:86). Model 2 personalities are defined as being more collaborative, flexible and constructive (Argyris, 1982:102).

Field work

Below is a brief chronology of the practice, for all practical purposes, the field work. It illustrates the shift from one main project to a growing number of projects; the full chronology can be found in Appendix 1.

Table 3 – Summary chronology of field work

	Main tasks	Main data
1999 – PhD	Develop proposal Work on case study 1	Journal and relevant artefacts, documents, communications etc.
1999 – Other	Work at I-cubed as a member of the Telstra home team – 3 research projects unrelated to PhD – early learning, Medical record databases and digital asset trading environment	Records from project
2000 – PhD	Work on case study 2 (working 4 days a week for first 6 weeks then scaled back to 2 days for remainder of the year)	Journal and relevant artefacts, documents, communications etc.
2000 – Other	Research assistant on LCA related work One small project literature review of energy and housing	Field notes and records from project
2001 – PhD	Work on case study 2 (working 2 days a week until September then ? day a fortnight for remainder of the year)	Journal and relevant artefacts, documents, communications etc.
2001 – Other	Research assistant on LCA related work then offered a full time position at RMIT to develop ‘green’ building program (Sept) <ul style="list-style-type: none"> – International conferences – First ‘green’ building course, repeated in Sydney²¹ – Set up local government program²² – Wrote many project proposals and consulting tenders and came second in most²³ – EcoHome idea²³ – Property Council EMS project²⁴ – Asked to speak at 3 events 	Field notes and records from project
2002 – PhD	Work on case study 2 for half a day a fortnight	Journal and relevant artefacts, documents, communications etc.
2002 – Other	RMIT full time	Field notes and records

21 The ‘green’ building course was organised because I identified the need for training in the area of ‘green’ building technologies and techniques in Melbourne through my experience with the Civic Centre project. It was a 2 day course aimed at linking the leading practitioners in ‘green’ buildings in Melbourne to the people who wanted to explore the field—councils, developers, builders, architects, etc.

22 A ‘retainer program’ where a council would sign an MOU with the Centre for Design and we would be available for 12 month to help them with the implementation of ‘green’ building initiatives. This was the chosen format because each council is at a different stage and needs different support, and this gave them a funded ‘green’ building help line’.

23 This idea is explained in greater detail further in the thesis, but it was a research idea that was initiated by a local developer to demonstrate a ‘green’ home design that would be attractive to the mass housing market.

24 Development of a model environmental management system for the management of building operational impacts for the Property Council of Australia – Victoria branch.

	<p>Asked to speak at 7 events</p> <p>Developed EcoHome Australian Research Council (ARC) proposal, won and managed²⁵</p> <p>Second 'green' building course Melbourne and Sydney</p> <p>Wrote 6 proposals got 5 for consulting and research projects</p> <p>Many projects coming in through word of mouth</p>	<p>from project</p>
2003 – PhD	<p>Work on case study 2 for half a day a fortnight</p>	<p>Journal and relevant artefacts, documents, communications etc.</p>
2003 – Other	<p>RMIT full time</p> <p>Asked to speak at 11 events</p> <p>Managed EcoHome ARC</p> <p>Developed the Re-imagining the Suburb research project²⁶</p>	<p>Field notes and records from project</p>
	<p>3rd 'green' building course Melbourne (170 people)</p> <p>Wrote 4 proposals, got 4 (many small projects came in without need for proposals)</p> <p>Many more projects coming in through word of mouth</p>	

I will not clutter up this already complex chapter by explaining each project, but as each project becomes relevant it will be introduced.

2.3 Data collection

As Nick Bantock (2001: iix) in *The Museum at Pergatory* observes, 'it would seem that we spend our waking days gathering information—our experience, thoughts, and feelings all constitute a form of data'. The following points outline the data collection plan I used.

1. Participate in field activities and test data collecting mechanisms (journal / workshops / interviews / documents / plans / diagrams / correspondence)
2. Review data-collecting activities / review self in the data collecting / observe
3. Refine data-collecting activities

²⁵ The previous EcoHome research project was developed into a highly competitive research proposal for funding by the research council.

²⁶ Based on the idea of a multi-tiered research project over a whole development, this project is still in development and will combine social, economic and environmental research on the impact of outer suburban development with an aim of looking towards a more sustainable model of development in the future.

4. Participate in field activities / observe and record / reflect and record
5. Write vignettes of significant experiences
6. Write papers exploring particular areas of interest
7. Present papers and note responses and feedback
8. Participate in field activities / act, observe and record / reflect and record

As the above list of activities shows, there are many loops of data collection, interpretation, exploration and renewed data collection. I adopted an iterative approach to data collection and analysis. In the next section I describe the strategies employed and data collection in the field, the data analysis and presentation of the finding.

Due to circumstance, the amount of time that could be spent on the main case study changed as the research progressed. This impacted on the amount of data collected as shown in Figure 15. That is, the journals no longer had the volume of observation and shifted instead to being functional field notes with focused observations (Adler and Adler, 1998:87) and reflection where it was triggered.

...initial observations as primarily 'descriptive' in nature. Unfocused and general in scope, they are usually based on broad questions, providing a base for the researcher to branch out in myriad future directions. After observers become more familiar with their settings and grasp the key social groups and processes in operation, they may distinguish features of the scenes that interest them. At this point they are likely to shift to more 'focused observations,' directing their attention to a deeper and narrower portion of the people, behaviours, times, spaces, feelings, structures, and/or processes

Especially from August 2001 to December 2002 the journals and data collected for the Civic Centre project pertains mainly to the site meetings held once a fortnight. Similarly as the time spent working on the case study decreased, with its accompanying amount of research data, the amount of practice and related notes and artefacts increased. The bulge at the start of 2003 occurred when I went back to part-time work (2 days a week) so as to have time to write the vignettes reflecting on the Civic Centre case study and I began the proposal 4 thesis.

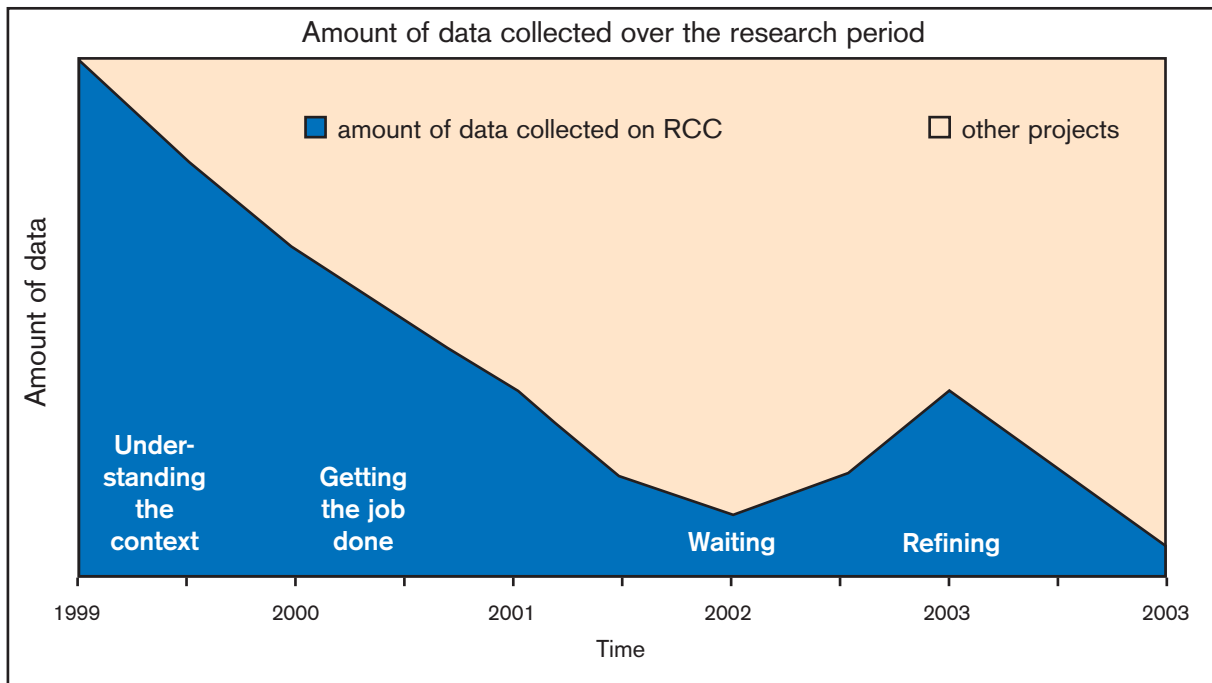


Figure 15 – Data collection in Civic Centre case study compared to other projects (representation of number of journals, files, disk space, etc. used)

2.3.1 Data collection from the literature

The literature for this research project was collected in all the standard formats—PDF files, photocopies from journals and books from the library, internet documents, media and conference proceedings. This was read, summarised and entered into an Endnote database. All hard copies were filed according to first author and date with a key word index. All the soft copies were saved in a dedicated folder with the first author date and short summary of the paper's title. Subfolders were divided into key words—sustainability, 'green' buildings, reflective practice, method and building/ architecture.

The literature presented is not exhaustive, as this is impossible, but all attempts were made to stay on top of the latest publications. This was done through weekly scans of the major research journals, searches of the internet using the search engine Google and monitoring of various discussion groups at both an academic and industry level.

The number of papers, book chapters, internet articles and conference papers collected was over 1000²⁷. I read through most of it, firstly by skimming through and then by a thorough read extracting relevant sections. Later, as the text of the thesis developed relevant quotes and concepts were placed into the discussion.

The main three areas of literature reviewed to achieve an overview of the field were general sustainability, the understanding the built environment and reflective practice. The first two form the background to the research and the latter is part of this chapter and my approach.

2.3.2 Data collection through a case study

Benbasat *et al.* (1987) support the choice of case study as a method of the research of the integration of 'green' initiatives in the built environment. This is because the research is not one of technological limits, as the technologies are available, but one of social and cultural ones where *'interest has shifted to organizational rather than technical issues'* (Benbasat *et al.*, 1987). The research is of a phenomenon and therefore lends itself to investigation by case study. As Yin (1994:13) puts it a *'case study is an empirical inquiry that:*

- *investigates a contemporary phenomenon within its real-life context, especially when*
- *the boundaries between phenomenon and context are not clearly evident'*.

I used a case study database that allowed for the collection and collation of all of the data obtained. It consists of at least four levels (Brownell, 1995; Yin, 1994):

1. case notes
 - field notes
2. documents/records/communications
 - original video tapes of workshops

.....
27 As an aside, this has resulted in many reams of paper being used—with their associated environmental impacts—not very 'green'. I have tried to minimise my impact by using recycled paper and planting about 87 trees.

- originals of interview questions (printed and electronic copies)
 - interview audio tapes and transcripts
 - printed and electronic copies of the verbatim interviews and the un-transcribed case notes
 - originals or photocopies of documentary data
 - drawings, plans, sketches and specifications
 - notes, minutes and review documents used in four PhD presentations made to an international panel in 2000, 2001 and 2003
3. tabular material
- literature (journals, books, manuals, theses)
 - websites
4. journal entries/ narratives/ vignettes
- journal notes and comments (there are 12 journals)
 - papers written on the project for various conferences
 - electronic and handwritten copies of data summary tables, matrices and figures from the analysis of the interview data

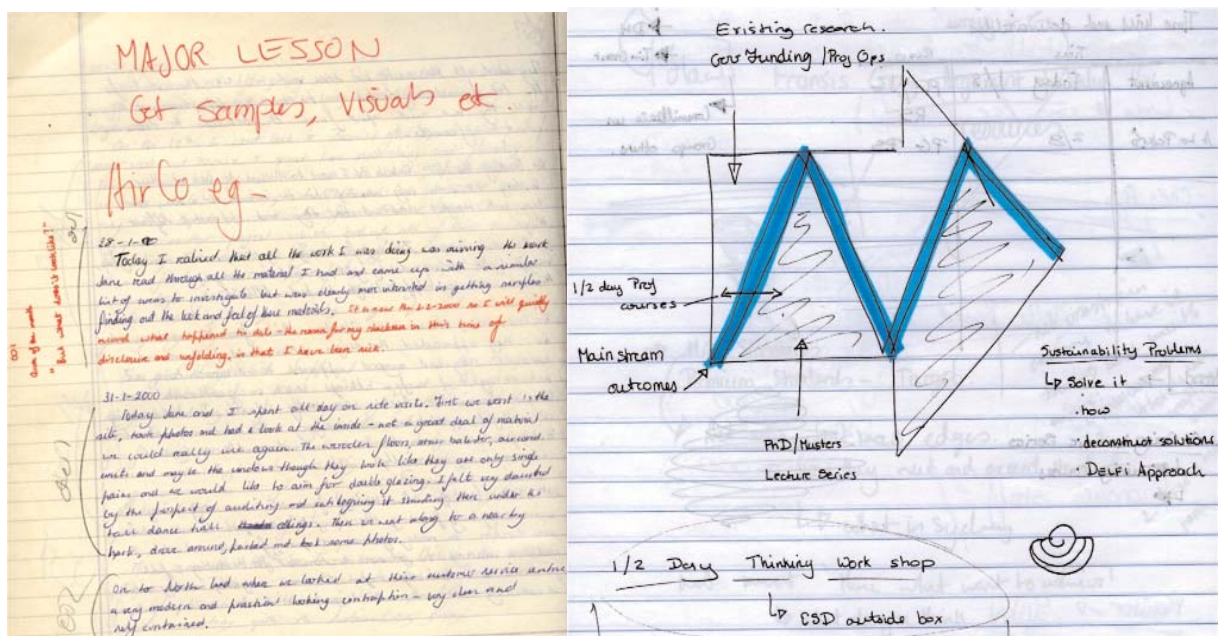


Figure 16 – Scanned images of a journal page

The initial intention was that the case study distilled from the data would be put through a verification loop with the agents so as to meet both the ethics requirements and the fundamental assumption of qualitative research, i.e. to facilitate the accurate representation of the phenomenon not as '*the researcher views it*' but as the '*participant views it*' (Marshall and Rossman, 1999:82). In the end it was not possible for several reasons:

1. The focus of the research had shifted to reflection on the researcher's own practice development so that the data shifted and no longer included a representation of the reality as seen by the other agents involved.
2. The scope grew from a limited set of case studies to a reflection on all projects undertaken in the five year period of the practice development. Many of these projects did not go through an ethics approval process as they were not initially intended as data for the PhD research. This is common in experiential research as explained by Clandinin (1998:161-2): '*some documents that eventually became field texts may have been created prior to the inquiry, or even during the inquiry but for a different purpose. Such documents became field texts when they became relevant to the inquiry*'.
3. In the initial attempts (before the focus was changed) to engage the agents in a review of some papers that were to be published, there was such conflict that it threatened the whole research project. This conflict was based on their perception that I was attacking them by reflecting on what did not work in the process. This is elaborated in Chapter 4.

Apart from the reasons given above, further support for not using participant feedback is given by Morse *et al.* (2002:8), who, argues that in many studies the participants are so abstracted through the deconstruction and analysis of the project, that having to write it in a manner which would facilitate their feedback might compromise the intention of the research: '*member checks may actually invalidate the work of the researcher and keep the level of analysis inappropriately close to the data.*'

Context is important in using case study as a research strategy. A case study is a 'system', and, according to Stake (2000:436), is '*both a process of inquiry about the case and the product of that inquiry*'. Miles and Huberman (1994:10) further define a

case as a *'focused and bounded phenomenon, embedded in its context'*. Therefore the actual description of the case study, the chronological story of the process, my journey and my understanding are important contextualising sources of information. Particularly in this reflective practice thesis, the story or autobiographical construction of the thesis aims to support this.

Having shifted, late in the research, from first level analysis of the case study to second level analysis of the practice, I needed data not just from the one case study but from all the projects in my practice. Luckily there was a great amount of data in the field notes, resulting artefacts and reports, but these were not collected at the time with this research in mind. Unfortunately they are therefore more pragmatic and not as rich in reflective content at the time. Later (in this thesis) I do reflect on them.

The data suffered from other limiting factors which are written about by others for example Robson (1993): time, lack of expertise, lack of confidence, naivety and sometimes being too close—the insider problem. Many of these cannot be dealt with implicitly in this research—they only come with time and experience. The last though, the insider problem, is an issue I would like to briefly address, and will do so under participant observation below, which has the same problems. What it all comes back to though is that the aim of this research is to be exploratory. This research is not meant to be repeatable but a record on my learning and thus the above are not problems, just issues to be aware of.

The stories do not tell us how 'generalizable' such actions might be, but they suggest possibilities and, therefore, hope. The dramas of skillful action in the face of difficulty turn readers' attention to the questions of perception, capacity, and judgment: how was this response possible? What kinds of education or knowledge or personality make such action possible? Here practice stories take the reader from an account of action to questions of planning theory: how was this possible and what role did interpretation and perception, skill and training, knowledge and analysis play? (Forester, 2002: paragraph 13)

Its value is placed more in the story of the journey, hopefully fostering some vicarious learning and understanding by the reader.

Guba and Lincoln (1989) pointed out that the ability to glean vicarious experience in research provides many of the same opportunities to learn as actual experience. Through this ability, readers are brought to new levels of sophistications that can facilitate a reconstruction of the reader's original knowledge of the subject. (Stewart, 2000:133)

Data collection in case study and practice through participant observation

The main underlying method for data collection for this research, and my practice, is participant observation. Being within the field I was inquiring about, particularly at the start when I was a complete naive novice, meant that I was just sitting there and soaking in what was happening. At the time I was often completely baffled but as part of the development of the research and the practice this was an extremely important first step. I have tried to convey some of this bafflement and accompanying frustration in the telling of the story of this journey.

Initially much of the recorded information was descriptive and unstructured; writing down everything observed often ending in pages of very little apparent value. Especially in the early years this resulted in hundreds of pages of notes and reflections. As depicted in Figure 15, conscious observation and note taking reduced considerably in the later stages of the research. I had not yet developed the filters (**selective observations**) that were used later to reduce the volumes of journal. Consequently, this also held true for my participation; initially I participated in everything, afraid of missing that crucial piece of information if I was not there. Later in the research I could be more targeted in my participation. Also, as I became more comfortable with the field, the observation became more **focused** and **structured**, asking probing questions or enticing reactions through informed comments.

This pattern resonates with the work of Walton and Gaffney (1991), which shows that this type of evolution is normal in an action research project.

'First, there is research – but little action... learning without practice...'. In the first case study I mainly observed and trialled the method of data collection. The first year of the data collection involved a steep learning curve particularly in understanding the agents active in the built environment, and their practice. It is shown by the volume of data collected, everything was relevant.

This is followed by '*[l]imited participation...*'. With more participation, through greater understanding of the industry and beginning to work on other projects the data collected became more practical and targeted.

Finally, there is a phase, '*largely [in an] action mode*', working on many projects, so comfortable in the practice role that little is recorded though almost everything which is, is of high quality and useful in the inquiry (Walton and Gaffney, 1991:126, their underlining).

Respectively my role as observer also changed as the research progressed. Initially it was passive, just sitting back and letting it all in. It then became more active as I became a part of the project group and started to get more responsibility for input and built relationships (Walton and Gaffney, 1991; Adler and Adler, 1998).

There are several criticisms of observational research; these are aligned to the insider problem introduced above. One of underlying issues in the insider problem is ensuring that observer bias does not affect the interpretation (Denzin, 1989; Schatzman and Strauss, 1973; Webb *et al.*, 1966) but this is impossible in a reflective, exploratory and personal journey. Therefore, I will attempt to '*compensate for my biases as a researcher ... I will continue to speak openly about my attributes that impacted the research journey*' (Stewart, 2000:81).

Thus, this type of bias is unavoidable in an experiential research project where the researcher is the subject and reflection on her practice is the theme. Therefore there will be bias, but I have tried to minimise it by using subjects' quotes, the autobiographical stories that try to bring the reader along on the journey (Forester, 1999; Richardson, 1998) providing vraisemblance:

...in presenting their data, observers can use verisimilitude, or vraisemblance, a style of writing that draws the reader so closely into subjects' worlds that these can be palpably felt. When such written accounts contain a high degree of internal coherence, plausibility, and correspondence to what readers recognize from their own experiences and from other realistic and factual texts, they accord the work (and the research on which it is based) a sense of 'authenticity' (Atkinson, 1990). Thus observational research derives validity from the vraisemblance of its textual renderings... (Adler and Adler, 1998:87-8)

This vraisemblance is also essential, in my mind, to facilitate the vicarious learning (outlined above) that I am aiming for as the core value of this research. Finally, I am minimising the impact of my bias by supporting any reflection, analysis and theorising with pertinent literature. For more technical description of validity see Section 2.6.

Significance is another criticism, i.e. that observational research lacks reliability, '*without statistical analysis to confirm the significance of observed patterns or trends, researchers cannot ensure that their findings are real and not merely the effects of chance*' (Adler and Adler, 1998:89). Through the telling of the stories and the engagement of the readers I have tried to give reliability to the research and the observations. As discussed previously this is an experiential investigative thesis and the value is in the reflection and depiction of the experience, not in its ability to be repeated or statistically valid correlations.

Having outlined the criticisms I believe that, without being able to carry out observation in the first stages of my research, it would not have been possible for me to start this journey. As discussed earlier my initial ventures into the field met with considerable resistance because I did not understand the context; if I had not stepped back and become just a fly on a wall for a time there would have been no practice.

Finally as discussed elsewhere the ability to observe, then participate, allowed this thesis to emerge (Adler and Adler, 1998); initially it allowed my understanding of the field to develop and then, in informing my practice, allowed me to participate, interact and reflect and thus grow.

Although not the only such method, observation ... draws both strength and weakness from its potential for creativity. Instead of working with predetermined categories, observers construct theories that generate categories and posit the linkages among them. At any point in the process, observers are free to alter the problems and questions they are pursuing as they gain greater knowledge of their subjects. (Adler and Adler, 1998:89)

This is exactly how the research developed, as I observed and learned. As I reflected and as opportunities presented themselves, I was able to adapt my questions, while my data gathering allowed the journey to move forward. As explained above, obser-

vation was but one of the methods applied in the course of the research; as understanding grew other methods were added.

Data collection in case study and practice through vignettes

The thesis is structured in a chronological manner showing the growth of my practice over time and reflecting on how this occurred. Each chapter is approximately a year in the life of the research (chapters 3-6). The central text which forms the material for the discussion of the chapter is presented in the form of excerpts from my journals and vignettes. These are separated into grey boxes as shown in the story of the research above. The narrative in the rest of the chapter is a discussion of the story, teasing out and reflecting on the lessons.

Vignettes have been used in quantitative as well as qualitative research. I used vignettes as a tool to take a critical experience in the research and expanding and exploring it. This became a reflective story expanding on the details of the experience, which may have only originated as a few lines in the journal, into a three or four page story. They then paint the full picture of the experience (Hill, 1997) as I saw it. This does not conform to the definition of vignettes given by Finch (1987) and others – where the vignette is hypothetical. But it is aligned to the definition by Finch that vignettes are stories that make reference to pertinent experiences in a study, illustrating important points in perception, beliefs and attitudes (Finch, 1987:381).

Stories are also seen as valid vehicles for the research as the aim is to illustrate growth, change and development in my practice (Forester, 1999). The aim is to *'educate the self and others, including the young and those, such as researchers, who are new to their communities'* (Clandinin and Connelly, 1998:155).

2.4 Data analysis

Data were collected via the journal entries, transcripts of interviews and workshops, documents, observations notes and other sources described earlier. This data was then reduced using the NUD*IST software by a process of selection into text nodes (codes) allowing for focusing, simplification, abstraction and transformation of the data (Miles and Huberman, 1994) enabling categories, themes and patterns to be identified

(Marshall and Rossman, 1999). The main value of the software to this thesis was that it became a database of my research, a method to link ideas, a framework within which I needed to think about my data to develop the themes. For example if I were looking for ‘frustration’ and the ‘integration of ‘green’ innovation’ I could quickly find all the references in my data to these two themes and therefore illustrate how integrating ‘green’ innovation can be frustrating. In the practice then I could investigate how to limit this frustration. In developing my ‘codes’ I created three levels. The first is a set of generic themes that I identified (level 1)—for example, the competence stage of practice. Level 2 comprises characteristics of the generic theme—for example, in the competence stage there are experiences of insecurity, fear and being overwhelmed (Dreyfus and Dreyfus, 2002: paragraph 39). Finally, level 3 comprises actual stories or pieces of literature that illustrate levels 1 and 2. This allowed me to look at how I developed over time and when I moved from one type of learner to another—from novice to expert.

In parallel, data were also reduced by extraction of key texts into a chronological spread sheet (Table 4), these key texts were identified as critical incidents. It included the case study data (outlined above), data from parallel running projects, reflection on the data and any relevant literature for all three. To a certain extent this represents a doubling up of effort but I felt it needed the overview the physical form gave me.

Table 4 – Chronological data reduction spread sheet

Dates	Case study Journal	Other projects	Other data	Relevant literature	Reflection
1999					
2000					
2001					
2002					
2003					

Journal 1					
date	BCC journal	Other projects	Other data	Relevant Literature	reflection
11.15.99_001	"The purpose of this journal is mainly to discuss and reflect on daily experiences which affect and influence my own development and the research I have embarked on."	Telstra projects Building LCA Courses	Importance of design in effective construction - http://www.ce.berkeley.edu/~tommelein/IGLC-6/fermoos.Tzotzopoulos.kobin.Loidb.e.pdf Design as creative chaotic process - http://www.ce.berkeley.edu/~tommelein/IGLC-6/fermoos.Tzotzopoulos.kobin.Loidb.e.pdf	Journals - Journey - action research...	
11.15.99_002	The method I will employ to stimulate my continued application to the journal is to work on it for 15 hour daily and to write about 3 or more issues. On weekends I will reflect on the work and write about that - a technique described by Fitzpatrick-Herion in Cherry 1999.				
11.15.99_003	I have a great deal to put into this initial entry -				

Figure 17 – One of the first pages of the data reduction table


Journal	BCC journal	Other projects	Other data	Relevant Literature	Reflection	
11.15.99_001	<p>Construction of the solar system - just a few wires need to be connected and get tied to do it.</p> <p>Electrical - is confused about what is in and what is out of his contract, pay him out - get him finished so painter can start doing tiles and tiling</p> <p>Having problems with gutter -</p> <p>CD - go to work with gutter to get him back in!</p> <p>What's the problem? All</p> <p>Don't know - sum up over one thing then leave. Say he will be in one day then he doesn't, come with 1 person and say he needs it... he's been a constant battle..."</p> <p>Bamboo floor - because of the problem with the delivery of the wrong flooring product - parquetry not bamboo lengths - they could only get pre-finished lengths, and the guys where laying it and only worked out 75% of the way through that it was all different colours, so need to sand them down, stain them and refresh them.</p> <p>Spash back can't get originally specified materials what about other options - recycled plastic, tiles...</p> <p>Argument about finishing off a section which looked very messy</p> <p>CD - it's finished - it's to going to take time or money we can't fix it</p> <p>Bill - but it is against drawing, against lift, against... if it crucial to the appearance of the street... critical for the design intent!</p> <p>CD - it will still because of the construction model</p> <p>Bill - then can't you look at it</p> <p>(I did look at it and there did say they could fix it...)</p> 	<p>Continuation part of the minutes</p>	<p>Enrolment - starting on the review of Commonwealth village</p> <p>RHD review - move away from tools to reflective practice</p> <p>JACCE conference - results of PhD</p> <p>Development of own research method for backing sustainable orientated research - triple helix method</p>	<p>www.atsc.com.au</p> <p>www.atsc.com.au</p>	<p>Wright et al 2001</p> <p>Simon Day and Graham Farmer (2000, 2001) The rhetoric and terminology change to follow such paradigms. They are eco-technic, eco-centric, eco-aesthetic, eco-cultural, eco-method and eco-central logic, where a logic is a specific ensemble of ideas, concepts and categorizations that are produced, reproduced and transformed in a particular set of practices through which meaning is given to social and physical realities (Hajer 1995: 44). The fact (meaningful to founding) image, but emphasizes the cultural aspects of a phenomenal structure rather than the mental concept</p>	<p>My PhD presentation was still for the more practice orient work until October to begin I was disappointed at the time there was no interest and no</p>

Figure 18 – Later example of data reduction table

This seems like a very orderly procedure; the reality was that all this was occurring simultaneously and was messy. I was trying to deal with the enormity of data while trying to retain the stories. This meant that while the NUD*IST and chronological data reduction was occurring so was the writing of vignettes. Themes developed through the spread sheet and data reduction was both informed by, and later illustrated by, the vignettes. Further, the vignettes were influenced by the data reduction process, as they highlighted a critical incident, and links were evident between the case study and what was occurring in practice.

2.4.1 Writing as thinking and as a form of data analysis

Various authors have discussed writing as an actual technique for data analysis, for working through problems:

At other times, I have really understood and experienced how writing can itself be a powerfully enabling and emancipatory form of practice. This is Lather's

test (1986) of 'catalytic validity', as it relates to my own empowerment through writing. (Roberts, 2003:267)

One of the main techniques I used for creating this thesis and reflecting on my practice was to write down the stories of my practice and then to integrate them with relevant literature in my digestion of what the stories meant. I would then present these ideas at a conference to get feedback from my peers. I did this in nine papers and eleven vignettes written during my research. The papers are listed by topic and title below, the vignettes are not listed as they were just a five to ten page document with ideas and descriptions outlining thoughts on a particular event.

Papers:

- On method: Application of PAR to the study of the use of environmental information in Design (Hes, 2000)
- Further development of practice method: A Triple Helix Approach: An inter-disciplinary approach to research into sustainability in outer-suburban housing estates (Sibley *et al.*, 2003)
- On the building industry power and culture: The Impact of a Dominant Culture on the 'Greenness' of the built environment – a response using a case study (Hes, 2003c)
- On tools and 'green' information: Possible Roles for Environmental Life Cycle Assessment in Building Specification (Hes and Grant, 2002b)
- On critical information points in the building process: Critical information requirements to support 'green' building projects (Hes, 2003a)
- 'green' decision making in the building industry: Concrete and Sustainability – Supporting Environmentally Responsible Decision Making (Hes and Bates, 2003)
- More decision making: Life Cycle Decision Making (Hes and Grant, 2002a)
- Defining 'green' buildings: Triple Bottom Line Approach To Capital Building Works – Pilot Case For A Municipal Council In Australia (Hes, 2001)
- Delivery of 'green' building projects: What the process of delivering 'Sustainable Building' can teach us about Construction Management Education. (Graham *et al.*, 2003b)

- The importance of education: What can the process of delivering 'Sustainable Buildings' teach us about construction management education (Graham *et al.*, 2003a)

In this way I was using writing as a form of thinking (Wolcott, 1990:21). I felt a lot of resistance to this at first. The short little book by Harry Wolcott called *Writing up Qualitative Research* spurred me on, particularly the section that started: '*writers who indulge themselves by waiting until their thoughts are 'clear' run the risk of never starting at all*'. I have never felt comfortable writing, partly as English is my second language, and partly because it leaves you open for rejection and criticism. I did not want to do that until I knew everything. It is only now that I really want to finish, that I am ignoring my fear and plunging on. To my surprise I have clarified my thinking significantly, not by waiting until my 'head ran clear', but by just writing my mess down and beating it into a shape I can share with others.

An important component of many of these papers was the collaboration with other authors in their composition. Through this process my knowledge was extended and new ideas brought into my practice. Further, I learned about my self in this process, to share ideas and refine them, the value of working with others, again the need and value of networks, and the ability to divide a task so that it became both a stronger argument but also took less time.

In the thesis one of the tools I use for reflection on the practice are the questions suggested by people like Peter Reason (2001) when looking at the data. Questions such as:

- Why did I do /am I doing what I'm doing?
- Thinking what I'm thinking?
- Feeling what I am feeling?
- Why do I think this course of action will be appropriate or effective?
- What other possible perspectives and experiences could enrich and inform the way I/we are engaging with the world? How can I access, represent, engage with, critique and re-create those?
- How am I the product of my culture and time? How can I transcend that context to illuminate and enrich what I do and who I am?

Many of these questions I applied retrospectively to the field notes, the stories from my journals and the thesis. These questions are part of the summary of each chapter outlining the data. I imagine that this retrospective use of Reason's questions is not exactly his intention; it would have been better to ask these questions each day, week or after each critical event. Nevertheless, they have provided some interesting insights into the development of the practice.

2.4.2 Reflection on the data analysis

Again this all seems like it follows consequentially: you code, you distil, you find relationships; then you memo, you write stories, and the memos add value to your reflection of the stories. If only! This process took months—great, frustrating months of trying to fit together the puzzle of experience, literature, memory, intention and academic requirements. At the end, what kept me moving was the before mentioned advice from Clandinin and Connelly (1998:156): *'[o]ne of the common laments of those who focus on experience in all its messy complexity is that they lose track of the forest for the trees and find it hard to draw closure to a study. There are no easy ways to sort this out beyond constantly attending to the researcher's purpose from beginning to end of the study'*. What was my aim/objective/main question again? Facilitating 'green' innovation in the built environment...right.

2.5 Insight development – grounded theory

Grounded theory is a qualitative research analysis technique whereby theory is generated from the collected data (Charmaz, 2000; Punch 1998; Taylor and Bogdan, 1998; Ryan and Bernard 2000). According to Martin and Turner (1986:141), grounded theory is *'... an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data.'* For me grounded theory is the way the results from the action research, participant observation and reflection—all the data—is summarised to result in the eleven insights that have fed into my practice. It allowed me to have the continuous interplay between data collection and analysis—the reflective loops.

To introduce this a little further: inductive processes are used to collect and analyse the data (Punch 1998; Charmaz 2000). Theories, concepts, hypotheses and propositions are developed from the collected data rather than from prior theories, assumptions or other research (Glaser and Strauss, 1967; Taylor and Bogdan, 1998). The theory (embodied here as insights) arose through iterative refinements—see Figure 19. In essence the theory (my insights) is allowed to emerge in my mind (Strauss and Corbin, 1998) as I analyse and think about the data, discovering and realising what occurred—in this case developing a theory of facilitating the integration of ‘green’ innovation in the built environment.

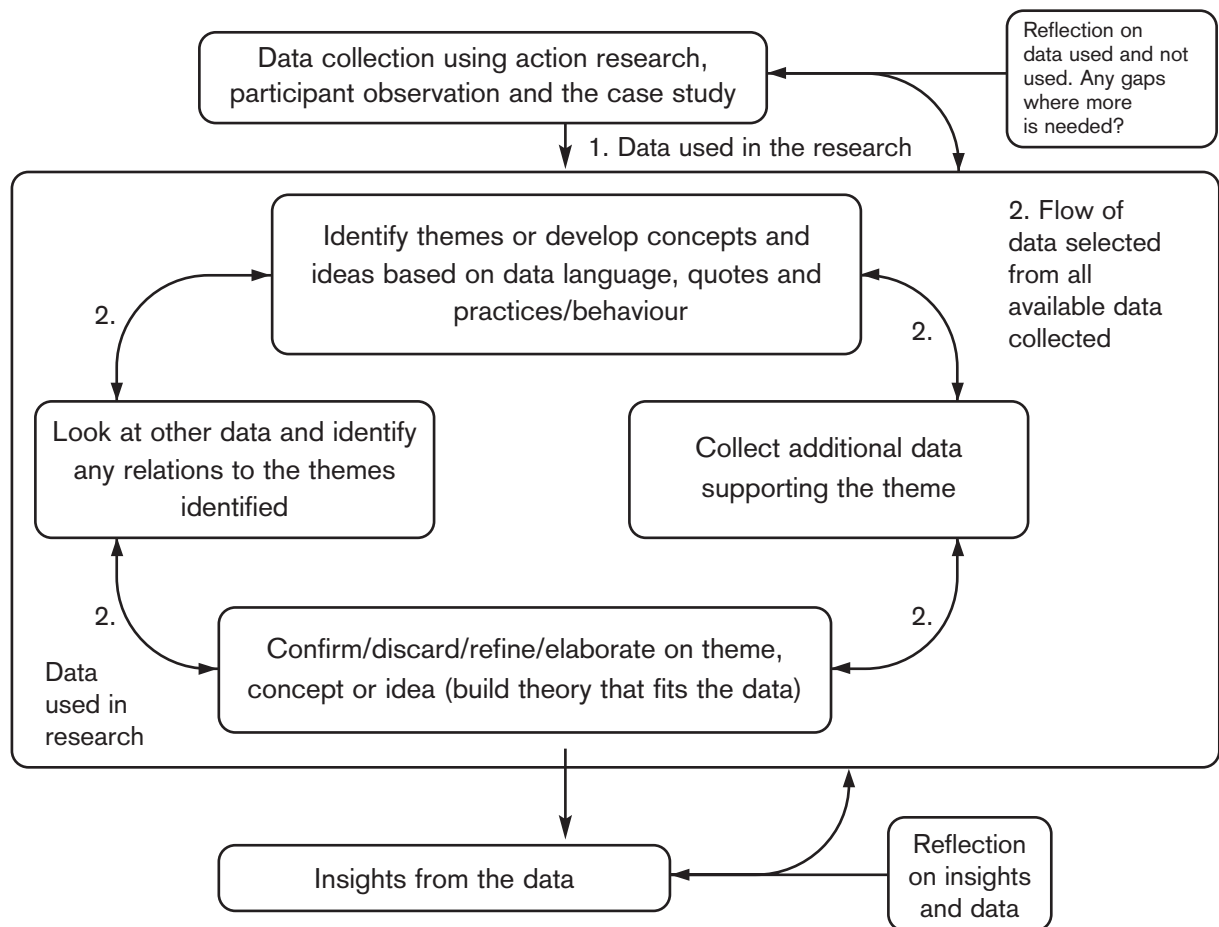


Figure 19 – Elements of the grounded theory approach, adapted from (Taylor and Bogdan, 1998:138).

Figure 19 shows that as data is accumulated, assessed, processed and reduced, the researcher develops themes; these are elaborated by further data collection or looking

at the literature. Themes are accepted or discarded and further evidence in the data is identified for the accepted theories. These occur in reflective loops and in this thesis mainly by the process of writing. I take a theme and write about it, look for other instances where a similar situation occurred, search the literature for similar or divergent experiences and reflect on what I learned from the process. I do this in reference to my practice. Taking Taylor's model one step further I also reflect on the data collected and how this influences what is deduced, looking backwards also at how the theory was constructed from the data. I diverge from the model in that this is an exploratory body of research and as such my aim is not to produce theory, but instead to produce insights that others in the future could take further and develop into theories.

Charmaz (2000:514) writes that '*grounded theory methods specify analytic strategies, not data collection methods*'. It is the interpretation of the data by the researcher that shapes the emerging codes in the grounded theory methodology (Charmaz 2000). This interpretive process, which has been the key to the research, moves through the cycle of review, refine, code, review, refine, code until meaningful insights could be made.

As discussed earlier 'emergence' is the key to grounded theory development. It is expected that the researcher does not enter the field with firm preconceived concepts, but rather these are allowed to emerge from the data as the research progresses (Strauss and Corbin, 1998). The notion that the researcher entirely suspends any theoretical knowledge, however, is criticised by Flick (1998), who argues that this is a common misconception about grounded theory. The personal narrative responds to this criticism by explicitly showing and discussing the journey, making visible any preconceptions and allowing for the evident emergence of the theory.

Part of the journey was to follow intuition and opportunities as they presented themselves in a reflective and contemplative manner. This is a valid activity in a research project that is seeking insight through emergence.

In this thesis, the objective was not to test a particular theory but to collect data and allow the data to 'tell the story'. This approach, I believe, aligns with—if not traditionally—the grounded theory approach.

2.6 Validity

The validity of reflective practitioner research is an area that some argue is a remnant of the positivist scientific method (Altheide and Johnson, 1998; Anderson and Herr, 1999; Roberts, 2003). I partly agree but, as argued by Morse without some reference to validity the research will lack rigour and suffer the criticism that '*[w]ithout rigor, research is worthless, becomes fiction, and loses its utility*' (Morse *et al.*, 2002:2). So I will briefly explore some of the issues. I do this because in a flexible and emergent study, as this one is, many questions can be asked of its validity, its rigour.

Hitchcock and Hughes (1995:105) define validity as: '*Validity is concerned with the extent to which descriptions of events accurately capture these events, for example, the extent to which the material being collected by the researcher presents a true and accurate picture of what it is claimed is being described*'. Reliability is sometimes confused with validity, so this looks at whether the researchers have measured what they set out to measure, the accuracy of the actual measuring instrument or procedure.

Validity is described in three areas: the data and data collection (DC), the interpretation (I) and the thesis (T).

I begin my discussion on data collection validity and interpretation by looking at the table adapted from Fraenkel and Wallen (2003). They list some of the validity issues, specifically observer impacts on validity, and their implication. I have added a comment in my response to each. I have focused on this aspect because my thesis centres on data I have collected through what I have experienced and observed.

Table 5 – Methods for dealing with data collection bias adapted from Fraenkel and Wallen (2003)

	Implication		Response
Observer bias	The possibility that an observer does not observe objectively and accurately, thus producing invalid observations and a threat to the internal validity of a study.	DC	In the data I have attempted to minimise bias by allowing the vignettes and papers to be reviewed by the agents involved.
		I	This is an autobiographical reflective journey that has inherent observer bias but by making the stories vivid and engaging readers go along on the journey and develop their own meaning as well as understand mine.
Observer effect	The impact of an observer's presence on the behaviour observed.	DC	Being part of the team and involved as an expert this is acknowledged. I affected what occurred, that was the point.
		I	I acknowledge my effect (to the extent I am aware of it).
Observer expectations	The effect that an observer's prior information can have on observational data.	DC	Effect increased over time as my expertise grew, the journal and vignettes, triangulated with external documents and correspondence, were used to minimise effect (Yin, 1994).
		I	I acknowledge my expectation where relevant.
Observer growth	The effect of the personal growth of the observer.	DC	I have undoubtedly experienced growth in many areas. My observations will have changed over time, I have tried to retain validity by acknowledging my growth and by making my growth transparent.
		I	In interpretation my growth has a significant effect, as I am writing and theorising about what occurred in 1999 in 2004, this cannot be eliminated but, through the use of vignettes written back at the data collection stage, has been minimised to some extent.

2.7 Ethical considerations

There are three types of ethical guidelines I used in my research. They are informed consent, confidentiality (the right to privacy and protecting identity) and consequences

(protection from for example physical and emotional harm) (Kvale, 1996). Each is outlined below with a description of how they were addressed for this thesis.

Informed consent

Informed consent is providing clear relevant information to the agents involved in the research. In the two specific case studies covered in this research, the case study principle was provided with a plain language statement including details of the research topic, overall purpose and an outline of the key themes. Other people involved in the case study were taken through the details verbally. Interviewee was asked to read and, when satisfied, sign a prescribed consent form, which included information on the project, its objectives and methods as well as the interviewee's rights to withdraw and comment on results before publication. Finally, the interviewee was given assurances of anonymity and confidentiality, and asked permission to record the interview or workshop. There is one place in this thesis where an image of some the participants is used; in this one case I received direct permission from the participants to use the image.

Confidentiality

All participants were informed that their name and their company's name would remain anonymous. A protocol for documenting and storing the tapes and transcripts was developed, including storage in a locked area.

Consequences

During the design of the interview and questions, the potential harm to the interviewees and expected benefits of participation in the study (Kvale, 1996) were taken into consideration. No harm could be foreseen though again, in retrospect, the study needs to be sensitive to the participants in its analysis and discussion of the results. The benefits to the participants are that they have been part of a learning experience that gives them a market advantage in 'green' projects.

2.8 Reflection

2.8.1 Reflection on the research journey and the main turning points

The graduate conferences were the major turning points of this journey. They provided the sounding board I needed to present my progress and to gain support and insights into challenges and opportunities the field provided. I felt insecure about the PhD process and these conferences gave me the confidence to move forward, to take up opportunities and helped to give validity to the changes in research methodology that were made.

2.8.2 Reflection on the data analysis

Again this all seems like it follows consequentially: you code, you distil, you find relationships; then you memo, you write stories, and the memos add value to your reflection of the stories. If only! This process took months—great, frustrating months of trying to fit together the puzzle of experience, literature, memory, intention and academic requirements. At the end, what kept me moving was the before mentioned advice from Clandinin and Connelly (1998:156): *'[o]ne of the common laments of those who focus on experience in all its messy complexity is that they lose track of the forest for the trees and find it hard to draw closure to a study. There are no easy ways to sort this out beyond constantly attending to the researcher's purpose from beginning to end of the study'*. What was my aim/objective/main question again? Facilitating 'green' innovation in the built environment...right.

2.8.3 Reflection on ethics in this thesis

Going through the procedure of writing the ethics approval was useful in defining exactly what I was planning to do. Unfortunately being an emergent piece of research the ethics procedure did not anticipate the change in the field. The procedures did not allow for the type of research that dealt with hundreds of people in an ad hoc manner depending on whether they were on site at the time. Though the principles of the design firms and their staff were part of the ethics procedure, by the end of the research period there had been a large number of staff turnovers. Furthermore, unexpected opportunities needing immediate reaction presented themselves in the

midst of fieldwork, for example a film crew turning up on site capturing key images and a meeting occurring with agents who were not expected. Lastly, as the focus of the research evolved, the agents brought into the research broadened beyond those under the responsibility of the initial principal designers.

To ensure that the research was ethical the following techniques were employed.

- Where unexpected opportunities arose I verbally assured participants that they would not be quoted or images used without their approval.
- The focus of the research became me and my practice and the agents involved in the field work no longer played a key role other than informing me, thus minimising their risk.

The lesson I take away from the experience is that ethics approvals need to have a reporting, reflection and resubmission loop. Particularly in research that is long-term and emergent, researchers need to be aware of the changing landscape and agents need to be protected by a more robust ethical procedure.

2.8.4 Refection on using a qualitative method for collecting and analysing the data

This research is about understanding, my understanding of the field and practice within it, looking at a situation and examining it over time, recording what happened on the ground with the real people working within the situation. I recorded my and their interactions, behaviours and activities and how they affected the outcomes of the project. My aim was to understand why these outcomes often were, or were not, what was expected. Qualitative approaches were chosen over quantitative ones for examining and collecting the information because, as Dohan and Sanchez-Jankowski (1998:477) describe, *'sociologists associated with qualitative research have generally held that aggregate data analysis using statistical procedures either misses important sociological causes of social action or emphasizes explanation (the hallmark of logical positivism) at the expense of understanding'*. The research strategies employed are discussed in Section 2.2 but all are related to interaction between me, the agents, the 'green' initiatives and the resulting artefacts. It is mainly a project looking at the 'talk' of the project—the interactions and reactions to a real situation and the 'back-talk'

created by me and others in reflecting on outcomes. As Myers (1997:241) points out '*[t]he motivation for doing qualitative research, as opposed to quantitative research, comes from the observation that, if there is one thing which distinguishes humans ... it is our ability to talk! Qualitative research methods are designed to help researchers understand people and the social and cultural contexts within which they live*'.

Further, as argued and demonstrated by the work of Kaplan and Maxwell (1994), if the goal of the research is to understand a situation from the point of view of the participants and its unique context, this is largely lost when textual data are quantified.

2.9 Summary

There are two parts to this summary: the research model and the knowledge gaps. The latter may seem a little out of place but as the literature is woven through the context and approach chapters this summarises the identified gaps.

2.9.1 The research model

Valerie Bentz and Jeremy Shapiro (1998: paragraph 1) wrote a very interesting book on conducting mindful inquiry or research by using awareness of self—personal, social and historical—to shape the research project. It is about 'empowering the research by putting the researcher, rather than the research techniques, at the centre of the research process.' This articulates how the research has developed. The research methods and the application of techniques to sort and collate the data were important but centrally it was about the development of the researcher during the research.

Figure 20 presents my model of the research method.

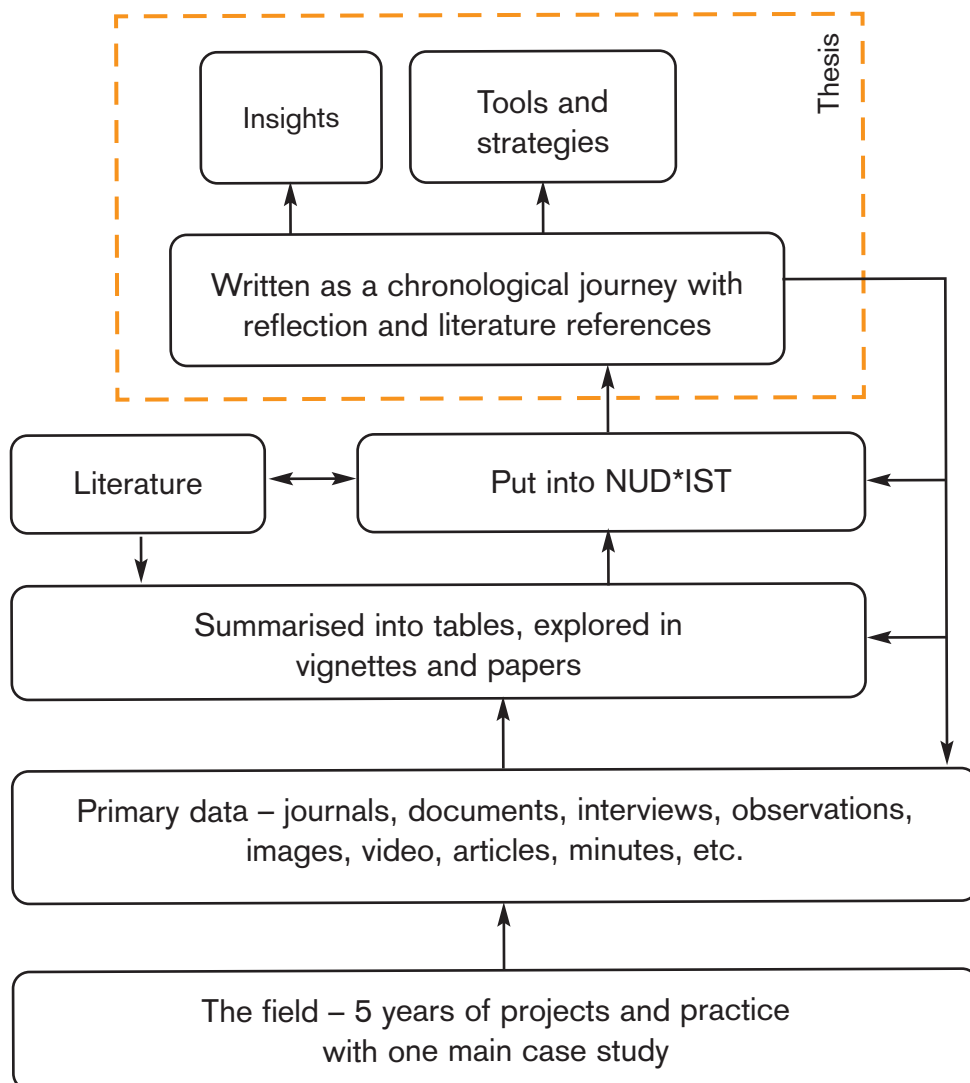


Figure 20 – Research model

2.9.2 The knowledge gaps

1. How can 'green' innovation be supported in building projects researched from within actual projects?
2. Can reflective practice be a part of researching this innovation?
3. Is reflective practice an intrinsic part of a sustainability practice in the built environment?

My primary passion is to improve the sustainability of our society. As discussed above, though the agents all agree that this is a good idea, progress to a more sustainable

built environment is slow. There has been research into why this is the case though most has been lab, desk or interviews/survey based not in the field with agents in the built environment (for example barriers in the industry research by Landman, 1999; Davis, 2001; Eisenberg 2002; barriers, codes and requirements for the industry Griffith, 2002; OECD, 2002; and, desk based reviews by Pearce 2002). One recent PhD, by a colleague Ceridwen Owen (2003), did focus on integrating sustainability within the architectural field, but again this research was based on interviews by her as an architect rather than observation of the process from within the process of all the agents involved in a building project. I wanted to understand the barriers from the coal face; in the practice of creating the built environment. To investigate the question Johnson (2000:351) asked: '*Why isn't 'green' innovation being taken up in the building industry?*'. That is, what happens in the practice of integrating 'green' innovation in a building project appeared to be a knowledge gap.

The second knowledge gap is the use of reflection in developing practice and researching, and integrating 'green' innovation into the built environment.

The results suggest that reflective practice is regarded highly and that most respondents could identify significant, long-term changes to ... practice resulting from it. (Paget, 2001:204)

I argue that the practice of integrating sustainability into the building industry is squarely in the 'swampy' ground. Sustainability and its integration into the built environment is, in my opinion, dealing with an area of great human concern. In Schön's (1979, 1983, 1987) terms it is swampy because rigorous positivist hard science does not offer tools to effectively study the integration of sustainability into the building industry. Many of the practices in this industry are based on non-linear creative activities, and the relationships between the agents in the industry are not easily or appropriately studied using rigorous scientific method. Sustainability is not simply defined by one field of science but is the interaction of many disciplines. Thus studying the integration of sustainability or 'green' innovation into this industry required observation, reflection, and the formulation of new strategies and opportunities based on the lessons learned. Much of this journey would therefore not have been captured if a hypothesis-testing approach had been employed—I wanted to explore the messy bits.

As Buchanan (1992) demonstrated, design, which is one of the highest impacting areas on 'green' performance of the built environment, is '*notoriously difficult to manage....[to the]... extent of being labelled wicked*'. He goes on to quote Horst Rittel that design problems are '*[a] class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing*' (Buchanan, 1992:15).

Reflective practice and 'participatory' action research has been applied throughout this research to acknowledge that my thesis was my own construction. By applying reflective practice I have a way of testing and continuing to test this thesis (Newman, 2000). Action research is presented by Farrell (1998: paragraph 12) as the fifth notion of reflection. '*It concerns the transformation of research into action*'. Farrell goes on to quote McFee (1993:178): '*It is research into (1) a particular kind of practice—one in which there is a craft—knowledge, and (2) is research based on a particular model of knowledge and research with action as outcome...this knowledge is practical knowledge.*' My interpretation of how Farrell summarises its applicability to the building industry is that the building industry is an interaction of the design professions (a conceptual and craft based discipline in the technical, making component of design) with traditionally a craft based professions in the building industry. The engineering professions also have a major role to play and to a different extend to architecture or design, they also have a conceptual, pragmatically making (craft) component. This leads for all three agents to practical knowledge and physical outcomes.

The third, and last, knowledge gap that this research was investigated related to the first two: is the use of reflective practice to support 'green' innovation in the building industry. This sounds similar to the second. The difference is that the second is about reflective practice as a research technique (developing theory using reflective practice) whereas this third is reflective practice as a technique in the building industry to integrate sustainability (reflective practice as a technique to resolve the messy problem of integrating sustainability into the built environment).

As discussed above sustainability or 'green' practice requires the acknowledgement of the discursive community to facilitate the resolution of disparate points of view. Meppem and Gill (1998) demonstrated the effectiveness of using reflection as a

central part of facilitating sustainable outcomes in land use issue resolution and planning. They had a process of review and reflection, using discourse analysis, both before and after project performance. Their emphasis was on the use of discourse analysis, so I am stretching their work to say that it informed their practice and allowed reflection. Salafsky *et al.* (2002) more specifically demonstrate the importance of reflection in the practice of conservation.

The literature looking at the integration of sustainability into practice is sparse. There is even less investigating its integration into the built environment, I found no literature that speaks specifically on the role of reflection as a valid process in the integration of 'green' initiatives into building practice. This revealed the final knowledge gap. Having said this, reflection is often not identified or singled out as an activity. It is part of the knowing-in-practice, i.e. we do it without realising it. When something goes wrong, or does not work, we try it from a different angle next time. Our environmental management systems (EMSs) have feedback loops that demand reflection on performance and then the fine-tuning of the plan and its continuous improvement. EMSs do not, on the other hand, specifically to look at the deeper issues of the practice itself, i.e. the reflection on reflection. This is where my research is innovative.

One last note: this research is inherently involved in culture, power and its relation to the professions and the industry, it is part of the swamp. To go into the background, the theory and the consequences of these areas for my journey is highly relevant but a thesis in itself. I do not confront these important issues, which are therefore a potential area of research in the future.

3 Stage 1 – Naive Novice

*Do you have the patience to wait till your mud settles and the water is clear?
Can you remain unmoving till the right action arises by itself?
— Tao Te Ching*

3.1 Introduction

This chapter is based on the first project, with an industrial design company. The results of this experience on the practice are discussed and used to demonstrate the novice status of the research and the practice. The section concludes with the main lessons learned.

3.2 Practice journey

Initially the Dreyfus brothers (1985, 1990) describe this as the period when the novice learns the tasks while in a safe environment, where the environment is deconstructed so that situations can be recognised without the need for experience, and specific rules are given for determining action in these situations. For me it was the **naive novice** stage. Naive because I was a complete novice, I had no experience or concept of what either design was or what it entailed or of qualitative social science based research methods. My naivety was highlighted in one of the first research vignettes written as part of the research method, outlined above (Chapter 2, Excerpt 1). The key parts of the vignette being text units 33-34, *'is there a book I can read on how to design?'*.

The context-free or 'safe', learning situation I used was a landscape architecture short course, where I experienced design consciously for the first time.

October 1999 – ... this was the experience which really brought me to life. I went along, listened, drew, walked, talked with the students and teachers...it was fabulous we redesigned a square and I very much enjoyed it!

Excerpt 7 – Journal summary 1999 – text units 43-44

3.2.1 Just observing – late 1999 – in the field FINALLY!

Dreyfus's description of the context-free environment could be seen as the classroom, or studio. Unfortunately, apart from the short course and the research methods class, I did not get the opportunity to learn in this novices' playground. Though I did not realise it I was skipping important ground work that would have prevented some future anguish. Still, the first case study with Delta design could be considered a relatively 'safe' platform in the swamp, especially as it allowed me to test the research method (Dreyfus and Dreyfus, 1985; Dreyfus and Dreyfus, 1990). It was safe because it was my intention to mainly observe and learn; furthermore the company was a 'friend' of the Centre for Design at RMIT University where I was based and supportive of the research project. On other levels though, work at Delta was not safe, because I had never done something like this before.

Having struggled in my first full year of research I was relieved, to be doing the research I planned in my second proposal. Delta is an industrial design²⁸ company based in Melbourne, Australia. All the names of the people involved have been changed to protect their anonymity. The principal of the company was Tom, a vibrant, fantastically busy man. The head designers, and the ones I had the most contact with, were Amy and Phillip; to a lesser extent I also had contact with the other four designers and an administrative assistant. The projects I was able to sit in on were the 'baby seat', the plastic safe and the automatic book borrowing system.

November 1999 – I started my first placement with Delta, ... his staff were so kind and supportive while I got used to how things worked. I sat in on meetings, went along to client briefings and just hung around observing. On the first day when I was introduced at the Monday morning meeting I felt comfortable enough considering I didn't have a clue how this was going to work. Some interesting comments from the diary entry of that day:
'Tom introduced my project which gave me the feeling he didn't really understand it'
'there seemed to be a lot of work, each designer having 3-5 projects on'
'Interestingly after this (project discussion), Amy went away and Tom started talking about confidentiality, my ethics and finally he let out that they were rather unsure and scared about having me aboard, but hoped to be able to learn from the experience'

Excerpt 8 – Vignette Path 1999 – text units 2-17

28 Designing mainly products for mainstream production and consumption.

On my first day, I took Tom through the ethics approval and assured him that I did not want to be a burden. We did not specifically define my role, and in retrospect should have, this was the first lesson. For the rest of my time at Delta I struggled due to this lack of a defined role. On the other hand I could not really define, at that point, what it was that I was going to be. My frustration was evident a few weeks into the placement:

November 1999 – After a few weeks I felt that there was no place for me, I wasn't adding value to anything they were doing ...

Excerpt 9 – Vignette Path 1999 – text units 19

I had a strong desire not just to observe but to have some input, so I produced a one page outline that I gave to all the people in the company:

Memo – what I can offer Delta

Based on what I observe by being part of several projects I can write a report on how the Delta designers work and integrate environmental information. I can offer suggestions of how this can be extended.

I can work out a standard template for how to present information for clients. I.e. list of materials used, suggestions for how to involve the customer (use, repair, disposal suggestions), suggestions on what companies can do more – eg disassembly for baby seats.

I can look at what the main environmental requirements are for overseas markets for various products – build a database for Delta to use for when I have left which has this info. This could be provided for Delta clients where they receive a little info sheet which they can use if they are thinking of exporting.

I can carry out quick LCAs if we are improving products – give suggestions which can feed into the design process based on this and then compare it with the new product.

Excerpt 10 – From document – Memo – What I can offer

I was trying to find a place for my knowledge. In retrospect I was not giving myself the opportunity to just learn and observe. I wanted to begin the interaction and integration of 'green' innovation immediately. Even given that the above memo circulated to everyone, the result was still not what I envisaged:

This did not result in any concrete input though I was asked things like: what is better powder coating or spraying, best production techniques to specify vacuum or injection, ...

Excerpt 11 – Vignette Path 1999 – text units 22-24

At this point I experimented by developing example information sheets and demonstrations of what I could do and tested it on the designers in a short workshop. I showed

what an information sheet could look like one for a product we were working on and another on a product for which I already had all the information. These information sheets were never used but the meeting offered an opportunity to develop a set of questions that Amy said designers used when developing a new project, and that 'green' innovation would need to integrate into to be successful. These questions were:

Where we start:

Who is the client or other?

What is the task?

What's the point of it? How does it add value?

What do we think we are trying to do?

Do we (the researcher and the client) have the same (and level) understanding?

Why are we doing it? What triggered our involvement or interest?

What are the drivers of the work: scientific curiosity, political or business necessity, ethical imperative?

How did we get involved: did we initiate it, or was it already on the agenda, was it voluntary or conscripted?

What is in it for us?

How did this work get on the agenda?

Why are we doing it now?

Who initiated, authorised and endorsed the work?

What values underpin the way the work is being framed and the techniques we will use to accomplish it?

What ethical and political issues are implicated by the work? What is our stance – privately and publicly?

Can we get a result?

What resources and costs are involved?

Initial 'contracting':

How are we framing and scoping the task or problem?

Is there a gap between where we are now and where we want to be?

Is it a gap in data? What needs clarifying and is there a gap in practice?

What has been done and tried already?

What can be learned from that?

What new things will we do?

How will this intervention make a difference – to whom – can we get a result?

What value will we add?

What contribution will each make?

What roles do we take?

What are our expectations?

What constraint and resources are available?

What yardstick will we use to measure success of our efforts?

What levels of commitment and energy for the task do we all bring?

Stakeholder analysis:

Who else thinks this is important and why?

Who else is likely to be affected or get involved?

Whose help and endorsement do we need?

How will we get it?

What are the needs and agendas of the stakeholders?

What levels of energy and commitment will and do they need to bring?

What is the level of our own energy and commitment?

At what point do we also want to walk away, take short cuts?

How will this experience change us?

Relationship management:

How close do we want to be with the clients and stakeholders?

What style of working will we adopt?

How do we handle authority and power relationships?

How do we deal with conflict?

How do we communicate?

How are these issues enriching or limiting the process of the work we are doing together?

What influence strategies will we regard as legitimate to use?

Understanding the context:

What is our understanding of the context in which we are working?

What is the lived history of the client system?

Do we understand it deeply in terms of vision, aspirations, culture, history, psycho dynamics, ethics and values?

Excerpt 12 – Vignette Path 1999 – text units 34-36 and document questions

These are rich and insightful questions. They illustrate the many competing areas that designers need to be confident in before moving forward with a project. Using Schön's reflective practice terminology, they are part of the designer's experience and knowledge-in-action, tacit knowledge. I was surprised at the depth and complexity of the decisions Amy made on a project.

I had never imagined the level of complexity that existed in making decisions on a design project but I was starting to understand some of the layers of this design complexity. Reflecting on this and thinking about how to fit 'green' innovation in really made me feel like I was walking deeper and deeper into the swamp. As it weighed me down and I got fatigued, I contemplated whether I was doing the right thing.

November 1999 – Reflection on meeting with Blocks. It was a funny kind of meeting, ...

After about ? hour I think I started to feel uncomfortable.

Having not been given a role or a 'name' I could sense the Blocks people were thinking 'who is that person'

At the end of the meeting I introduced myself as working with Delta as an environmental expert.

They had said earlier that they may be interested in exporting outside of Australia – I worked with this and said what I was working at and that it was useful especially if they were thinking of export – Tom said 'at no cost to you'.

This really worried me as it shows he is worried about a company seeing me as an extra unnecessary expense.

This ended up really depressing me as I thought I want to add value, not be seen as a burden, this feeling is increasing; when we got back I asked where I could sit and I really felt like the 5th wheel.

Excerpt 13 – Journal summary 1999 – text units 63-69

I would like to reflect on two parts of this excerpt and what I learned from the experience. Firstly, aside from the discomfort of being in a new environment, I was not introduced and therefore did not seem to have a role in the design team. My response was that every consequent meeting after this I ensured that I introduced who I was, my role and my interests.

Secondly, I was shocked at first by the fact that Tom said 'at no cost to you'. I had never considered that anyone might think that my being there was going to cost anything. Strongly related to not being given a role at the beginning of the meeting, it had never crossed my mind that this would be an issue. Now, on further reflection I think that Tom's words further highlight his insecurity about me being part of the team. We had not discussed and set up my role sufficiently, I was a scary unknown quantity. I reflected on this a few days later:

November 1999 – I am worried that the project at Delta is not progressing as it should, I have not made the project clear enough or my aims or their roles.

The problem now is how to go back.

What do I need to do to pull the project back on track–or– should I just continue to observe and learn from the process.

'Pulling it back on track' may very well limit the usefulness and depth of the study/ lessons/ experience.

I am really unsure how to proceed.

Excerpt 14 – Journal summary 1999 – text units 76-80

I finally did manage to do something useful at Delta. They were developing a new brochure and I worked with them to write a blurb they could use.

November 1999 – At Delta I composed an environmental statement for their folio.

I wrote down 4 possible options with my critique of them.

These I gave to Mary and Amy to look over.

As a practical exercise this was very informative of one of the fundamental needs of a design firm wanting to be more environmentally responsible – that is to define exactly what they see as important and advertise it.

This will encourage the application within the firm and will brief the client so they know it is possible (and can ask for it).

Excerpt 15 – Journal summary 1999 – text units 98-105

In the meantime, while trying hard to feel useful I was soaking in the experience. I was allowed to attend and observe several meetings with clients. This was a fantastic learning experience, especially seeing a demonstration of the above questions in action. The experience showed me how the designers worked and interacted with clients and their input. They prepared computer and physical models, then discussed these with the clients, developed ideas and passed on information on costs, materials, and so forth. Once the clients had left, they brainstormed with the design group to develop strategies. This sounds very linear and organised but from my point of view *'it was [a] very chaotic, nonlinear process—where ideas and discussions jumped from topic to topic... problem[s] would be discussed and through drawing and hand visuals the solution determined—though in my head or experience the solution was never actually articulated, this could be because I am still trying to learn the language; but could also be a designerly thing, they discuss the problem, discuss options and then move on to the next problem. Reflection: This kind of thing is sooo different from my thinking—they just discuss their own bits, and go on, no formal 'ok so that's how we'll do it!' I think it is probably a learned thing—if there is no critique then it must be ok and we go on ahead—very chaotic though!'* (Excerpt from Journal summary 1999 – lines 120-129)

This experience also reflected what I had read on design and the design process, that it *'is a fluid, holistic process wherein, at any stage, all the major parts have to be manipulated at once. In this sense, it is less like solving a logical puzzle and more like riding a bicycle, blindfold, while juggling'* (Maver and Petric, 2003:642). It also reinforced my choice of research method and particularly the difference between the design process as described and logical, and the experience of seeing a design evolve.

3.2.2 'Green' innovation in design

What I learned from the above experience in regards to the integration of 'green' innovation into the design process is described in this section.

The perception that being 'green' costs extra is very strong in current society, every research project on the barriers to 'green' innovation resulted in a strong comment by the respondents on the real or perceived increase in cost (Davis, 2001; Landman, 1999; Owen, 2003). Yet research projects that look at actual costs claim that this is not the case, particularly for buildings; even if there is a slight initial cost the benefit in running cost, image, longevity, and so forth outweigh that costs (Kats et al., 2003; Brick, 2003; Edwards, 1998; Garbarine, 1999; Horsley *et al.*, 2003; Snoonian, 2003). For instance:

The Costs and Financial Benefits of 'green' Buildings: A Report to California's Sustainable Building Task Force, 'finds that an upfront investment of less than two percent of construction costs yields life cycle savings of over ten times the initial investment.' (Kats *et al.*, 2003: paragraph 1)

On the one hand there are cost issues associated with the risk of doing things first, the need to do extra research and not doing things the way they have always been done. These are costs for any innovation, not just for 'green' initiatives. Particularly there are the initial costs, which may need to be born by the manufacturer while potentially giving the benefits to the consumer. On the other hand there are market advantages and differentiation potential due to the 'green' innovation.

The second 'green' innovation in design lesson I learned from working with Delta was that there was so much already required to carry out the design of a product that, without clear identification of 'green' innovation as a priority, there was no time to integrate it. Particularly as the 'green' innovation formed no part of the education of the designers or their everyday practice, integrating it into the design was too time consuming. The prioritisation of design aspects in the project came from the client; if a client did not want a 'greener' product they would not get it:

The greatest opportunity to improve the environmental performance of a product lies within the early design stages. Designers find difficulty, however, sacrificing cost or time spent on their product development to learn how to

make complex decisions about introducing environmental attributes into their products. Such decisions seem too large and far reaching. (McAloone and Evans, 1997)

The clients were not inclined to demand 'green' innovation because of the extra cost, perceived or not, and lack of consumer demand. If your consumers do not want a greener gadget why would you put in the extra effort to design one? In one of the projects I participated in, even with the potential market disadvantage of not meeting international 'green' product label criteria, the company did not see the need for 'green' innovation. Further, the designers were happy not to stress the point because of their lack of time and resources.

There was also one positive experience in the integration of 'green' innovation. If an option was easy to implement and fell within the existing tool box that the designer used then it could be integrated without client demand, for example using one type of plastic over another, giving preference to a paint treatment, minimising parts, including the recycling symbols, and so forth. This innovation needed to be at hand, with full specification and meeting performance requirements. For example, a more environmentally friendly paint option that did not last as long as the traditional option would not be considered, or if the paint only came in a matt colour and they required it to be shiny, the performance needed to be as good if not better.

The environmental information sheets were a good idea but without the above drivers only resulted in an extra task that would take the designers away from their other priorities. Most importantly the environmental information to go on the sheets was not readily at hand. For example it took me half a day to source a full set of plastic recycling symbols and, once I found them a further day to discover how they were intended to be used. This is the sort of time cost the design company could not afford.

In light of these quite prominent barriers, I looked at the 'green' innovation and how it might be integrated into the tacit procedure of the designers. I used the headings of the questions Amy introduced to explore where it could fit.

Where we start:

'Green' innovation potential:

Is the product they want designed going to an international market where there are eco-label requirements?
Would they be interested in a greener product – can you ask them?

What is the task:

- Are there 'green' opportunities?
 - Would they see the value?
 - Are there (potentially) 'green' drivers?
 - Can this project stretch our 'green' tool box?
 - Does this person have any concept of the 'green' potential?
 - Are there 'green' initiatives that can be incorporated regardless?
 - Is the innovation effective?
 - Will this cost time, money, resources and is it worth it?
 - Do we have the data or do we need to find them – how reliable are they?
 - Will it add or save costs?
-

Initial 'contracting':

- Do we consider 'green' innovation from the start?
 - Will the 'green' innovation be acceptable to the client, add value to the consumer and our practice?
-

Stakeholder analysis:

- Are there competing 'green' products?
 - Are there 'green' consumers?
 - Are there 'green' stakeholders?
-

Understanding the context:

- Is there any demand?
 - Will the client accept 'green' innovation and to what extent would they be willing to go?
-

Arch-i-lingo²⁹

The key lesson I learned in 1999 with all the experiences I had both at Delta and my other activities was the importance of speaking the 'arch-i-lingo'. I needed to learn to talk the talk of the designers, not only the words, but also understanding their, to me, chaotic working style. I had previously experienced the language issue in the first and second biannual research conferences I attended in 1999.

29 I used arch-i-lingo in my journals, at this point in my research all designer language was confusing and I used the same term whether discussing landscape, architectural or industrial design 'speak'. I realise now they each have their dialects, but at the time (1999 and early 2000) of experiencing this part of the journey it was hard work!

May 1999 – This journal started at the spring [graduate] school, ... at that time I was so overwhelmed I stopped writing after the [first] Friday lecture.

[my notes had] a column to the side with the arch-i-lingo, I did this mainly to ensure that whatever I wrote next would be in the right language.

October 1999 – It turned out to be an interesting exercise as this time [six months on] I actually understood what most of the people were saying, last time I did not.

I felt as though everyone was speaking another language.

This shows a great development in me.

I can now understand most of the Arch-i-speak though I struggle to use it...some words I do – like 'inform' has become my favourite.

As I [write] these in I cannot believe I didn't understand them at the time!

discourse – space – epistemology – react against discourse – animation – reflect – scenarios – inform – celebrate – interplay – conversations – artefact – serendipity – engagement – investigation – circuit – tensions – presence – actuality – potential – vocabularies of light – pallet – reactions – convergence – intervention – dialogue – fascination – narrative – remiss – left field – meaning of the rhetorical – falsifiability – dialectic – point of departure – critique – translation – inquiry – vehicle for examination – context – extrusion – ephemeral – formulation – perspective – intervention – emersion – insecurities – speculate – haptic experience – multiplicity – dimensionality – bring into play – the primary problematic – suggestive – perpetual mechanism – articulation critique – melancholy – impetus – rigour, rigour, rigour, rigour – juxtaposition – connectivity – perhaps – chronology of evolving practice – tangential – epistemology – Iconographic chaos and choices – Adventures through dialogue – dimensionality.

A comment from my journal 'in writing these down I think – even now – that maybe these words are not so foreign after all!!

But on initial exposure to narratives laden full of the above I was completely bamboozled.'

Excerpt 16 – Journal summary 1999 – text units 35-42

Some of the words, like 'space', seem simple, but it was written in the side column because of the way it was used so many times, with different meanings³⁰. For example I had never heard people use the word space as a description for an area of research; a sentence of the type, '*I am investigating the contested space between black and white*', at the time this type of sentence did not mean anything to me. Similarly, this was the case with most of the other words. As Schipper (1999) writes in his paper on phenomenology and reflective practice, I was at a point where my old 'language' no longer worked, I could not understand what others were saying and I could not communicate fully. I was quite frustrated by it. I thought I could speak and understand English, but this showed me a whole other level of dialogue that I needed to understand to be able to participate in the field. A journal entry a little later shows this frustration:

30 LeFebvre identified 23 different meanings (LeFebvre, 1974, translated in 1991 by Nicholson-Smith),

November 1999 – [comment by prominent architect] ‘a new designer needs to learn the language of ideas – of design’, don’t I bloody well know it! [my response in the diary]

Excerpt 17 – Journal summary 1999 – text unit 51

As shown above my technique for starting to learn these terms was to write them down when I came across them and then to look them up and whenever possible to use them in relevant text. I would often have a first stab at writing something then bring out the list and see if I could replace any of my plain words with these wonderful designer ones. Over time I no longer needed the list; I started to use the words where appropriate, though on the whole I decided to write as straightforwardly as possible—like a conversation. This helps in my purpose for this research, which is to communicate with a variety for people within the building industry, not just the designers. Further, by my conversational style I hope to elicit some ability to reflect on their own experience through mine—provide a vicarious experience (Stewart, 2000)—and in so doing support their own reflective learning.

3.2.3 Further development outside the field work

At the time of working for Delta I was still investigating my action research method. In my reading I came across ‘life long education’ and ‘environment education’. I got in touch with two relevant academics who lived relatively close to my university and visited them over lunch. It was an extraordinary experience that left me more confused and uncertain than when I set out.

November 1999 – My reflection on meeting in Geelong with two environmental education professors:
I still feel very much out of my depth – the old doubts that I can never do a PhD surfacing again – I mean...am I PhD material...I do think I am smart enough but am I academically inclined? I really think that I am not.
What is academically inclined – well it is the ability to read, absorb, and discuss intellectual material.
Why do I feel that I am not academically inclined – well this is best shown by example – no matter how many times I have read some papers I still don’t get them – some words like epistemology and dialectic etc no matter how many times I look up the meaning it just doesn’t stick!
Especially in situations like this meeting I felt I just wasn’t expressing myself clearly using the right words or saying the right things.
Especially when asked to recall who I have read – I couldn’t remember – and it wasn’t because of the pressure, I just never remember the names of authors, titles of books or anything – all I remember is the basics of what they wrote about – key points and useful quotes.
It is very frustrating!

Main lessons from the meeting:

1. let the method be organic don't sacrifice valuable lessons by trying to stick to the plan, act reflect cycle
2. let the context and the history influence the project visibly and make sure you capture, record and reflect on this influence
3. success is measured by the increase in complexity of the participants' understanding of the issues as measured by the increase in the depth of the debate....

Excerpt 18 – Journal summary 1999 – text units 82-92

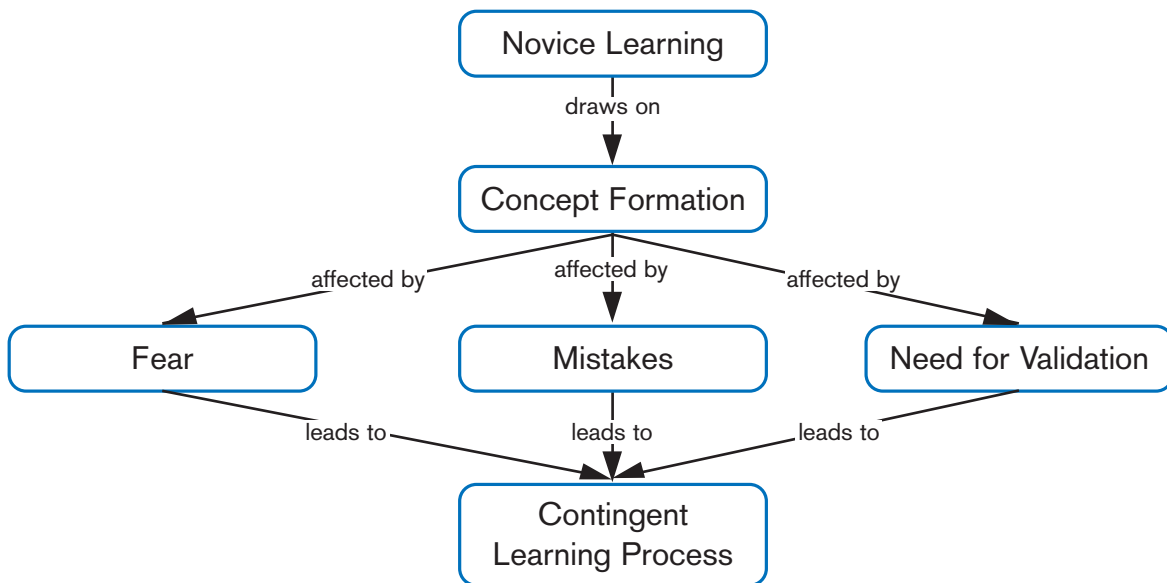
I include this excerpt in here to illustrate my insecurity about the research. My first two degrees were in science and engineering and, though the constructivist paradigm resonated with me, the airy-fairy research I was doing really frightened me. What was I proving? Yet, insecurity aside, I took some valuable lessons from the meeting—lessons you will see reflected in the research.

3.3 Reflection – 1999

The work of Daley (1998) showed that novices learn differently from experts. Figure 21 illustrates their concluding model on novices' learning. Daley explains that '*novice learning processes tended to be contingent on the process of concept formation and how that process was affected by fear, mistakes and the need for validation*' (Daley, 1998: paragraph 11). I reflect this in the above excerpts from the journals and vignettes of 1999. Particularly:

- concept formation – understanding design and learning the new language
- fear – insecurity about research, ability to be an academic, ability to add value
- mistakes – expectations from first project, the various types of irrelevant 'green' information provided
- need for validation – insecurity because of the lack of a defined role, continued need to be assured that the research was valid and heading in the right direction

Also Daley (1998: paragraph 11) states that novices are different from experts because they form concepts by spending '*a great deal of time "just soaking up information"*'. This is evident in the detail of the journals kept at this stage, where everything was interesting and relevant. It was an exciting time of discovery and learning.



Source: Daley, 1998, Figure 1 above paragraph 12

Figure 21 – Novice learning processes

'In concept formation, the learner generates hypotheses or problem-solving propositions that aim at defining the abstracted criterial attributes of the concept to be learned' (Ausubel *et al.*, 1978:100). There are echoes of Schön in this definition, developing theories and testing them while in action. I interpret this to mean that at the novice stage hypotheses or propositions begin to form and will later be the tacit everyday knowledge of the practitioner. The questions formulated with Amy are an example.

In my own journey I had several theories-in-action and resulting strategies for implementation such as certain types of information presentation formats, most of which failed in this case study as described above:

- My theory was that given succinct information sheets on the 'green' issues of their product—its main energy, material and water use—would be useful for companies in that they would be able to give clear information to their customers on the product's environmental performance. The designers at Delta thought they were interesting but not meaningful to the client if they did not specifically ask for it.
- My theory was that holding workshops with the designers from Delta on their products would give them the information, in an interactive format, which would help them to design products that were more environmentally responsible. The feedback from the participants was that the workshops were interesting but not

practical in their current practice because there is not the time or resources to invest in areas that the client is not demanding.

- The environmental statement was to provide Delta with a couple of sentences to add to their brochures so as to help them market themselves as ‘green’ product designers. My theory was that this would inform clients of the potential of ‘green’ design so as to create the demand that the designers cited as the reason they could not spend time on ‘green’ initiatives. Initial feedback was supportive but then it did not make it into their final brochure because the designers felt that this differentiated them in a market that was not open to it and might actually alienate some potential companies who saw no need for ‘green’ design.
- Direct answers to questions such as the powder coating question and recycling symbols were the most successful as they came from the designer’s own need. Once provided, the answers immediately affected how they did things—for example all parts made from appropriate plastics were specified to have recycling stamps on them.

The theory-in-practice that I trialled in this project was that this type of research method, observation and ‘participatory’ action research, would result in useful data that informed my practice and allowed for action loops to improve the research and data collection in the future. I believe this was successful. The result of the case study was experience in the use of the method and reflection on how to improve aspects for the next case study, and most importantly the successful capture of useful information on integrating ‘green’ innovation.

Other conclusions that I came to through the experience, and reflection on the data, but which did not inform my practice until the next project, were:

1. The need to use the right language. Both at Delta and at the design research conferences I noticed that I did not feel comfortable with the ‘lingo’ of design. Yet to research into the area and to participate in the process I realised it would be important to learn it. I realised it would be difficult to participate and reflect on the process if I did not understand what the players were saying. The second part of speaking the right language was that it was also important to listen to the client and make sure you understand their language. The Delta designers particularly emphasised how important this was.

2. The importance of introducing one's self and clearly defining one's role. I reflect in detail on this elsewhere in this thesis, but many of the problems I had at Delta and with my participation was because I had not done this thoroughly enough. I had not managed the expectations, partially because I did not know what these would be.
3. The benefit of playing the part. For example by speaking the same language (using the appropriate words, for example by not using alienating scientific language to designers or overly designerly language to scientists), looking the part helped create and support the connection between the designers and me.
4. Client demand needs to be present was the main lesson that came through with every Delta project I tried to integrate 'green' initiatives into. It was not a matter of providing the right information at the right time—my initial theory—but creating the 'space' for the designers to be able to add this dimension to the design, a 'space' that at Delta needed be supported by client demand and therefore time and resources for the extra work. Where initiatives could be integrated without the need for a great deal of resources, for example the plastic labelling, it was just a matter of facilitating the right information.

3.3.1 Reflection through the use of Reason's questions

I use questions as a way of progressing my story and also as a way to pause the narrative and engage the reader. You will also note that in different sections I use multiple questions that may be teasing out similar information. I do this consciously as I am using my writing as a thinking technique and by forcing myself to make rational coherent answers to questions I am developing my analysis. As introduced in the methods chapter I will use Peter Reason's questions to stimulate thought. For this initial period of my PhD the answers are:

- Why am I doing what I'm doing?

I started on the PhD because it was a job, something I had a vague interest in and provided an opportunity to come back to Australia with some stability. My interest in supporting the more responsible management of our society and background in environmentally friendly design advice ensured I had some curiosity for the PhD topic. I was challenged by my lack of understanding of the design professions, and

realising that I was not going to learn about it through books, I decided for an experiential approach—observing what actually occurred in the field. Furthermore, though I am well grounded in ‘green’ innovation and theory, I noted that most research carried out on integrating ‘green’ innovation into design was desk or laboratory-based. I could find no literature in 1998-99 that reflected on what actually occurred on site. Lastly, having discovered constructivist philosophies and life-long learning discourse I was keen to experiment outside my positivist comfort zone. After all, if it went wrong I would learn from it and move on.

– Thinking what I’m thinking?

Taking key quotes from my journals I can say that initially I thought I had all the answers. I was naive to think that it is just a matter of making coherent and rigorous information and tools available to people in order for them to integrate ‘green’ innovation into design. I was shocked and disappointed at the lack of support I received from the designers I approached. I just wanted their ideas and feedback on useful research into an expert system. On reflection I realised I did not understand design or designers. My lack of empathy with the design discourse is plain from the list of words I jotted down at the first and second research conferences. I could not speak the language. Most of all I did not understand the research process, ethics applications, research proposal applications, research methods, the usefulness of literature reviews or the need to understand my own theoretical framework.

– Feeling what I am feeling?

My feelings at this time were excitement, exhilaration, fear, disillusionment, anxiety, exhaustion and confusion. Everything was new, and the design process, designer attitudes, research expectations confused me. The thought of moving outside my field of experience scared me and led to anxiety. I was never sure I was doing the right thing. I needed to learn to deal with a multitude of new information at every level: how people interact, speak, develop and test concepts, resolve problems, the types of information used in design, new forms of communications particularly visual, and the level of theoretical knowledge people seemed to have. Finally I was excited and exhilarated to begin the research journey and to be able to participate in the design process.

– Why do I think this course of action will be appropriate or effective?

There are several courses of action to choose from: (1) to just observe and not become frustrated if there were parts of the conversation I did not understand; (2) to carry out qualitative experiential research; and (3) a trust that I could solve problems and deal with issues as they emerged instead of preparing for every eventuality.

When I moved my research from the survey and desk-based development of the expert system to a variation of exploratory, experiential ‘participatory’ action research with design companies, I went from knowing ‘just about everything’ to ‘just about knowing nothing’. In hindsight this seems a bigger step, more frightening, than it was at the time. I was intrigued about this new world and, with my new philosophy of life-long learning, I felt this course of action, this research direction was appropriate. I had learned to note down the experiences and information without immediately trying to resolve or understand them, because if I did I would have been incapacitated in the research.

Using qualitative research seemed appropriate for the exploratory, emergent, experiential inquiry. I was looking for tacit learning and phronesis (practical wisdom), not what could be found in books or seen in artefacts, but what actually occurred, the knowing-in-practice that designers seemed to have. I wanted to understand this from a participatory inclusive vantage point, to be part of the action, so as to understand why ‘green’ innovation might or might not be taken up in a project.

Finally, I trusted that everything would come together; insane because in 1999 I had a positivist science-engineering theoretical framework, which included the comfort of a null hypotheses and statistical validity. In my past I was detached from my research; all variables were accounted for. I decided to throw all this out in favour of a qualitative, experiential form of research because I wanted to understand things from the field, in the real world where you cannot control the variables. I trusted that by continuing the reflective loop, valuable outcomes could be distilled helping to fill the gaps in the knowledge I had identified. Particularly, I hoped to provide a different perspective that could help to improve the uptake of ‘green’ innovation in the future.

-
- What other possible perspectives and experiences could enrich and inform the way I/we are engaging with the world?

The experience of 1999 was messy. If I had my time over I would improve the contracting stage of the research, i.e. both the definition of my role in the design office and that of the participants' roles. I would also improve the data collection from the participants, and have more feedback and interaction so I could represent their voice in the research. I would deepen the reflection in the journal, and ask the questions I am using here to develop the experience.

- How am I the product of my culture and time? How can I transcend that context to illuminate and enrich what I do and who I am?

I recognised after the first conflict with the designers that '*I didn't get design*', my passion for a more sustainable future spurred me to explore why I did not understand design and what I could do to try to change this. As far as the research was concerned I attempted this through participation with design firms, reflecting on how they worked and how I understood how they worked. I began to attend seminars, exhibitions and read accounts of design and artefacts.

Therefore I was a product of the culture, of my ancestry and my education. Through the research approach I tried to explore a different way of looking at things. I would not call it transcend because I think that much of my experience in the field was still strongly tinted by my positivist roots, particularly in this first case study. I also do not think that you can replace one way of looking at the world with another; you just continue to build on your 'view' of how things work.

3.3.2 Reflection on the research journey – in the field

To a certain extent this time spent with the industrial design company was a great 'safe' platform in the swamp on which I could test out my research method (Dreyfus and Dreyfus, 1985; Dreyfus and Dreyfus, 1990). I was disturbed at this time because I did not entirely see it as just testing the method, but I also wanted to repay their faith in me by being 'useful' to them. At the end of the day I don't think I was, though I learned an invaluable amount on how to do the research I was proposing.

Through the process of keeping the journal I modified my technique of data collection. Instead of just writing everything down without structure I split my page into three, the bottom for reflective comments, the inner section for general notes and a margin on the outside for additional notes (see Figure 22).

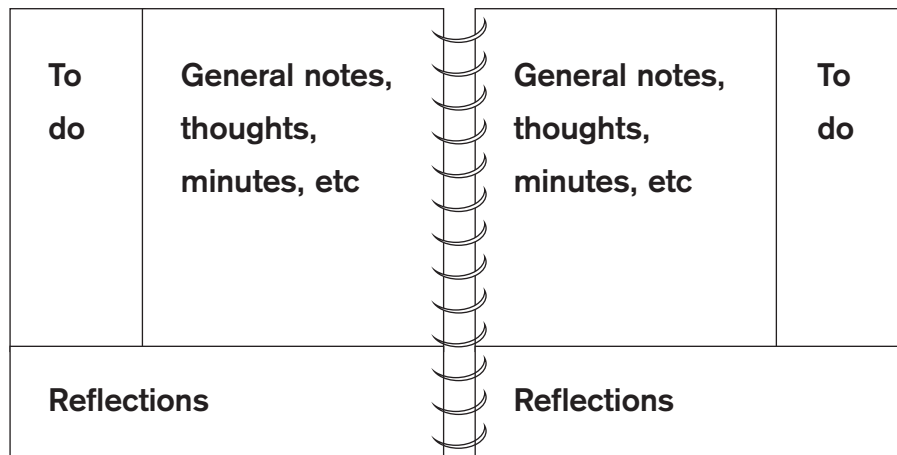


Figure 22 – diagram of journal lay out

November 1999 – The method I will employ to stimulate my continued application to the journal is to work on it for ? hour daily and to write about 3 or more issues. On weekends I will reflect on the work and write about that – a technique described by Fitzpatrick-Herron in Cherry 1999.

December 1999 – Decision to experiment with data collection: Research diary should include entries under the headings of: reflection, plan, action and observation – include a summary of what happened each day, storied questions, ideas for further work, guesses, hunches, dreams, diagram, drawings, mindmaps, observations and reflections on the diary. Basically the stuff I was doing already!

Excerpt 19 – Journal summary 1999 – text units 2-3 and 130-131

3.4 Summary

This chapter summarises the result of the first case study with an industrial design company. I had the opportunity to trial the research methodology: daily journal entries describing observations (Dreyfus and Dreyfus, 1990); participant reflections and other data such as drawings, documents, plans and so forth (Jick, 1979); and, vignette writing (Miles, 1990). The experience was intense and many of the barriers to the integration of ‘green’ innovation into design were noted: lack of time, experience, priority, information, client interest and market recognition. As a result I began to

understand design and through participation and observations experienced both the complexity of design and its power in integrating many facets into a coherent whole.

It was also the period where I explored 'participatory' action research and its potential in addressing my research questions. That is, could this sociological ethnographic tool be used in this situation? In the process of the exploration I wrote a paper using the work of Hult and Lennung (1980) to structure my approach and presented it to a conference on participatory action research, receiving positive feedback.

In reflecting on this journey to a 'green' building facilitator/consultant I have summarised the main questions my research focused on at each stage. At this point I was interested in fine-tuning the data collection, understanding what design was, and how it worked, and specifically how I could integrate 'green' innovation into the process. In summary the main questions at this stage were:

- Can I use the proposed method to gather meaningful data?
- What is design?
- What is sustainability in design?

Can I use the proposed method to gather meaningful data?

At this point I thought I was collecting meaningful data. As summarised above I experienced some of the barriers to 'green' innovation design and I learned about the design environment and the designers' way of doing things. Finally, I was able to collate the data from this time and reflect on my progress and adapt for the next case study.

What is design?

This was the fundamental lesson in this period. Design is difficult to define and impossible to describe in any meaningful model. It is a way of doing things, of integrating complex and disparate information into an artefact whether drawn or built.

What is sustainability in design?

Design has the capacity to greatly affect the 'green' impact of the end product but it needs to be balanced with all the other demands of the project – aesthetics, client demands, functionality, cost, etc. To be integrated at this firm, 'green' innovation

needed to be easy and cost effective with no time requirement or have an equal priority to these other demands, for example by being part of the client brief. 'green' innovation was difficult to implement if additional research was needed to facilitate its integration into the design, mainly because of the time constraints and competing requirements of the designers.

④ Stage 2: Advanced Beginner

4.1 Introduction

From my first experience in the field, exploring design and the integration of ‘green’ innovation, I learnt the following lessons, which resulted in some changes in my approach to the second project. The first was the most important:

- Ensure adequate introduction of the project, definition of my role and of the designer’s expectations;
- Closely observe the culture, language and dress of the designers and try to ‘fit in’;
- Use the new system of data recording, that is the page split into three sections;
- Reuse some of the ‘green’ information formats trialled at Delta: information sheets, workshops, environmental statements and direct answers.
- The first was the most important; I wanted to really ensure that the foundation was set for the research by ensuring expectations were clear.

This chapter will trace the transition from naïve novice to advanced beginner (Dreyfus and Dreyfus, 1985); I call it the transition from **naïve novice**, through the **shy observer** to the **observer/tentative practitioner** stage. I reflect on both the practice and the research journey. Though the latter is covered elsewhere there are relevant reflections and experiences occurring through this period which fit more coherently in the chronological telling of the story, so they are described below.

4.2 The practice journey

The **shy observer** stage, I define as the stage of discovery and integration into my ‘knowing’, drawing from my experience and observation of the design process to inform my understanding of the design context. For my ‘green’ building facilitation practice this began in 2000, with the second project in my research, a ten week project with a group of architects designing the Civic Centre for a council in Melbourne. They had engaged me through an email advert placed at RMIT looking for a

student to carry out research on 'green' initiatives for their practice. I had gone through an interview process before being appointed. At the interview we had discussed, in detail, my research and ability to support the practice. Still, I was quite apprehensive as my journal reflected: '*I was nervous but intrigued how this was going to work out*'³¹.

The architectural firm, I will call Beta, was headed by a charismatic energetic principle architect, Henry. The best way to introduce the other five team members in this the second cycle, is to refer straight to my first impressions of them:

Audrey – given this name because she seemed to have the grace of Audrey Hepburn with a Japanese simplicity and style. I mostly worked with Audrey as she was the project architect for the Civic Centre project.

David – the first person I met when I was interviewed for the research position. A handsome man in his early thirties, he had an exaggerated manner of speaking and gesturing that reminded me of an artistic David Attenborough.

Stef – a small intelligent, dangerously quick-witted Sydney architect in her early thirties, who was one of the project architects working at Beta.

Paul – the office manager and most experienced architect, apart from Henry. Paul had an air of control and efficiency. He was also extremely dry-witted and very funny, a trait he used to great effect to soften his management of people and projects.

Mary – the administrative assistant and office organiser. Mary was in her mid-thirties, diminutive, pretty with long flowing hair. She also had experience in interior design and was an organised, kind soul.

The office overlooked Port Phillip Bay and was at the top of five flights of stairs in a newly built modern apartment/office block. There was a great deal of glass and a mesmerising view of the brilliant blue bay from all our desks. They had prepared a desk for me that included a copy of the BDP Environmental Design guide (colloquially referred to as the BDP EDGe guide), a publication of the Building Design Professional and the Royal Australian Institute of Architects and an in-depth guide to all environmental issues in architecture written by the leading minds of environmental disciplines related to buildings in Australia. Henry said:

31 Excerpt from Journal summary 2000, text unit 26

Week 1 – [1st day] “to make you feel at home ...we got it (the Good Design Guide) because we thought it was important, but we haven’t had time to take it off the shelf”

Excerpt 20 – Week 1 – Journal Summary 2000 – text units 66-69

I sat down with Henry at the start of my time at the firm and went through the research directions and intentions, and outlined what I was hoping to get out of the experience. Firstly, we discussed the clients aspirations, in the form of a very brief half-page outline, in summary:

- minimise ongoing energy use
- minimise ongoing water use
- minimise waste production
- maximise the health and amenity of the building

We agreed that I would work four days a week, at twenty dollars an hour, for ten weeks. Henry asked me to write the environmental brief and my position specification reflecting the amount of time available for the project. I wrote my understanding of what was expected in my journal and prepared the environmental brief and position description, these were presented to the client—the council—and approved.

Week 1 – [2nd day] My main task will be to inform the design process with my research. ... I need to have impact into the contracts for the consultants. ... record the amount of time put into the project – of everyone associated with it

Excerpt 21 – Journal summary 2000 – text units 55-59

In summary I proposed that I would provide an outline of options that would fulfil the environmental objectives, with a view on incorporating the costs and benefits both environmentally and financially. Then I would work with the architects, clients and research bodies to provide practical and, where possible, sustainable options. The environmental objectives were:

- Minimisation of residual material to landfill.
- Maximum use of existing building.
- Management of the construction process to maximise material use and minimise resource consumption and waste.

- Non-toxic and healthy construction and work environment.
- Protection of natural environment through use of renewable resources (rain water, solar energy, plantation wood, etc.), recyclable resources, responsible manufacturing, installation and maintenance, based on a life cycle approach also pursuing quality and longevity considerations.
- Environmentally responsible public transportation options.
- Sustainable landscaping.
- Management of the operation of the building to minimise its economic and environmental effect.

The research work was to continue for ten to twelve weeks through the sketch design, design development and documentation stages.

Table 6 – Summary table of my planned input into the Civic Centre project

Period	Architectural process stage	Environmental	
		Activity	Outcome
	Consultation – prep. of brief	N/a	
	Sketch design	A. Familiarisation with project Objective specification B. Initial research and familiarisation C. Specific research	Input and discussion of relevant issues for sketch design
	Design development	Specific research (incl. regulatory and feasibility investigation) Finalisation of options Discussions working group and Council.	Input and discussion of relevant issues for design development cost benefit models Finalised and signed off sustainability measures which will be implemented where practic
	Contract documentation	Input into contract for consultants documentation – writing of report	Addition to contract specifying environmental responsibility report
	Contract administration	N/a	

In the position description I tried to specify exactly what I would be doing. From the lesson clearly learned at Delta I tried to ensure clarity and understanding of what I would be doing to a very detailed level.

So I started to work through the various tasks I had set myself to deliver the information the design team needed in the sketch design stage. Henry was excited about this opportunity to build in-house knowledge at his firm.

Week 1 – [Friday drinks] everyone did get excited when we were having drinks and I was talking about possible options like the rainwater tank, flexible solar panels and funding opportunities. I think Henry is most excited about building the in-house environmental knowledge which is a great platform for this action research project.

Excerpt 22 – Journal summary 2000 – text units 101-105

Yet immediately in my first week of trying to collect the information I started to feel frustrated and lost. Somehow I had got it wrong again.

Week 1 – The weekend! By the end of the week I must say I was feeling decidedly lost, without input from them on the type of info they need when, I go around in circles – collecting things, writing things up but not really getting anything done.

Excerpt 23 – Journal summary 2000 – text units 114-117

I could feel the clock ticking on all the things I had promised to do but without input from the designers on the sketch design stage I did not know what to provide them. In retrospect I did not understand the design process. The information I had set myself to collect in the environmental brief did not match the activities that were occurring at the office at this stage.

Information I was looking for	Activity in the sketch design process
Materials	Meetings about access and layout
Technologies	Meetings about connectivity
Lighting	Meetings about functions and activities
Recycling and reuse of old building	Discussion of abstract ideas of form and theory

Yet I only had 10 weeks and wanted to make sure I had fulfilled my promises. To keep the project moving forward I started to talk to everyone in the field who had experience with ‘green’ buildings: a neighbouring Civic Centre project which had inspired the council to require ‘green’ innovation in this project; a parallel project called 60L being developed in the inner city; government agencies of energy efficiency and waste minimisation; and the editor of the BDP EDGE guide.

One of the prevalent themes, both for the clients and the architects, was the cost, so I also began developing a cost spread sheet to identify 'green' innovations and their possible costs and benefits. At the end of two weeks at the firm I needed to present the outcomes of my research to the council, including an indication idea of costs and benefits. I found this was very stressful because I had no idea what I was doing; I had read a lot of case studies, collected a great deal of information and wanted to feed this into the design process. In my journal I reflected on this:

Week 2 – On the 19thhad a meeting with the sustainability group.. they liked all the work I'd done and we set the date for the first presentation of options to the wed 2/2/2000 [later changed to the 9th] I will try but need feedback from the architects to determine what is feasible.

Week 3 – frustration is mounting as everyone seems really busy finishing other projects and I feel the need to have some direction, on Monday afternoon I put my foot down and said I needed a meeting to get some direction but after the meeting I felt just as lost – basically I feel I know everything necessary until we actually start work on the design process.

Excerpt 24 – Journal summary 2000 – text units 131-136

Having the deadline of the ninth looming over me I went ahead and developed 'green' innovation options and costing. I was aiming for a list of 'green' materials to be considered in the design. I worked very hard at this, collecting information and developing a clear list of products, manufacturers and contact details. The following excerpt from a vignette written about this time best describes what occurred and illustrates the lesson. At this time I felt very lost and was really trying to achieve something tangible:

Week 3 – The researcher had spent weeks compiling a list of products for the architects to use as a resource when they need to choose materials in the detailing phase. Proud as a peacock the researcher handed it to the project architect. It took a few seconds to register, as the architect flicked through pages of carefully collated tables, that nothing was being absorbed. This was soon clarified as the architect turned and asked "but what do these materials look like?"

Excerpt 25 – Vignette Path 2000 – text units 397-403

This resulted in one of those well documented 'a...ha...' moments, when I thought 'of course you want to see what they look like', what a silly goose I am! At the sketch or concept design stage it is important to know what things look like and feel like, as well as the other characteristics. Researchers have written that often 'green' or sustainable initiatives are presented in a manner incompatible with the design process (Anderl *et al.*, 1999; Bakker, 1995; Erol *et al.*, 1999). This was my first experience of a clear mismatch; I needed to learn to look through their eyes, through their theoretical

framework, not my own. My response was to collect samples of all the materials in the list, which now make up part of the materials resource that I use at many seminars.

While trying to absorb as much as possible of the experience at Beta, and meeting their expectations of the information I would be providing, I was given the opportunity to go with Audrey on a site visit to several buildings which the council identified as working well and which they wanted considered in the design. Until then I had been quite uncomfortable with Audrey. Several times in my journal I mentioned that she seemed distant or quiet.

Week 3 – Apart from the frustration there was one day when Audrey and I went on a field trip around a series of sites, this was fantastic, and though we had broken the ice earlier in the week, with Audrey giving me a book she thought might be useful for my research, this was the trip which started the friendship. The most interesting part, through the increasing excitement and idea flow into the project, was something which happened at CERES. “the interesting part—as far as the research goes—was that at the start of the site there was a ‘sustainable’ house—this house had several solar panels on the roof and sitting in the garden and just looked mismatched and ugly—I said to Audrey ‘now this is just the impression I don’t want to give architects—sustainable options don’t need to be ugly’ Audrey sounded surprised and smiled ‘that is what we think when you say sustainable – ugly, solar panels and mud bricks’

Excerpt 26 – Vignette Path 2000 – text units 57-69

From this point our working relationship improved enormously; I guess she finally understood where I was coming from. Moreover, since I had accidentally said the right thing, I understood her reservations by her response. I had also an effort to look the part, buying a lot of black, taking care to dress designerly (in Melbourne this tends to be black, black, black, and some grey).

Because of the time pressures and the fact that options had not been narrowed down in the design, my ‘green’ initiatives table became very vague. Yet the meeting planned for the 9th was looming and this would be when decisions would need to be made.

Week 5 – I realised that the environment meeting to discuss the environmental strategies was Wednesday...I started looking through past documentation to start writing this up – then I realised this would be too detailed to be useful at a decisions meeting, so I looked at my building audit and tried to make it more relevant by putting columns for who to contact and what the process would be. But that leaves a whole heap of other options – I will do a lot of concentrated work tonight trying to summarise what the options are. It is all a bit scary because I don’t feel there has been enough talk with Henry and Audrey and I haven’t really prepared enough because I have felt a little overwhelmed and uncertain. When I returned (from lunch) I spent the afternoon continuing my attempt to put the options into some kind of presentable format.

Excerpt 27 – Journal summary 2000 – text units 231-240

I needed to be able to present the options and any environmental, social and financial costs and benefits. I did not have the time or the detailed information to be able to determine real costs and benefits. So for the purpose of the meeting and raising discussion I developed a qualitative code: for the financial and environmental costs and benefits a scale from minus four to plus four, the lower the score the less impact or more savings; and for social impacts a ‘smiley’ face for good, non-smiling for potential social issues, and skull and cross-bones for significant social issues to be considered. Three examples are shown below.

Table 7 – Examples from the ‘green’ initiative cost benefits table

‘green’ INITIATIVE	Upfront cost – material	Upfront cost – labour	Operational savings	Environmental saving	TOTAL cost/ benefit	Comment
High thermal mass	Nil 0	Nil 0	Some saving energy savings –2	Some energy savings –2	Cost –2 Env –2 Social ☺	Depending on the material used energy savings
Rain water recycling	Significant cost +3	Significant cost +3	Major savings –4 minor costs for maintenance 1 –3	Reduce use of mains water and associated treatment, reduction of water into storm water –3	Cost +3 Env. –3 Social ☹	Return on it is about 3-6 yrs. You need ensure there is continuous testing if water is to be used for drinking.
Black water recycling	Significant cost +3	Significant cost +3	Minor saving –1	Minor saving but good demonstration of commitment –1	Cost +5 Env. –1 Social ☠☠	Social issues and the Civic Centre will not produce significant amounts of black water

This method of representation seemed to work quite successfully and facilitated the active discussion of options with the Civic Centre project group—made up of the project manager and her superiors from the council, the architects, myself and the environmental officer from the council. This qualitative code was based on the experience of other projects, the case studies I had looked at and the opinion of experts in the field whom I had consulted.

While trying to develop some pragmatic information I had the opportunity to sit and observe a schematic design meeting. It is such a contrast to the apparent order of what I created above. It is best described straight from my journal of the day and some images from the drawings made.

Week 5 – In the afternoon we had a 2 hour schematic design meeting –
 – It was an amazing meeting (see drawings) the energy of the ideas, the fury of the expressions of them it was wonderful. The quote I wrote down from the meeting was:
“the way my brain is wired up, the ‘yes’ design answers all the questions”

Another thing which lingers in my mind is that the 'yes' design felt right for all of us – it just glowed with an energy of its own. ...

Excerpt 28 – Journal summary 2000 – text units 243-250

Figure 23 represents the excitement and creativity that occurred when Audrey presented her ideas of changing the building from a straight rectangle to two sections, one straight and the other at an angle, using up the entire site.

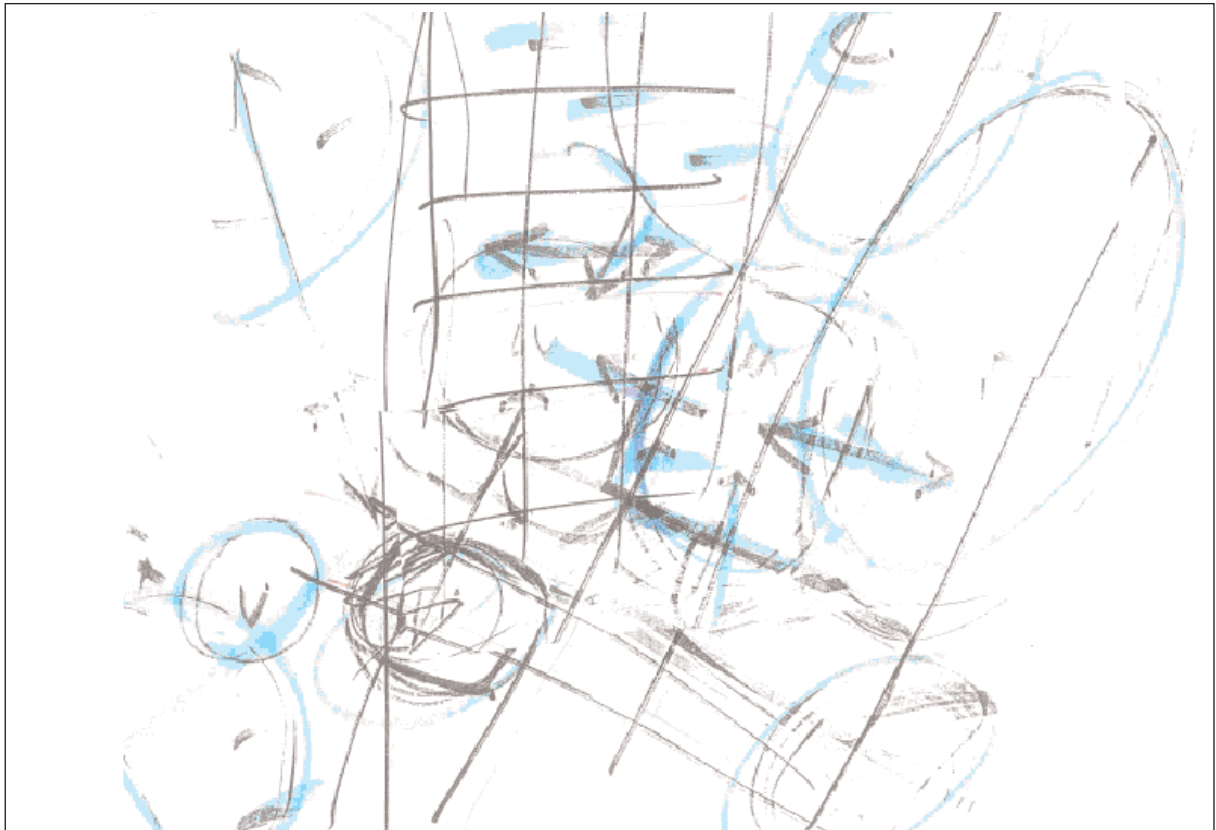


Figure 23 – Image of the discussion of the building

Though this experience was wonderful and allowed my understanding of the design process to develop to a deeper level, I was still frustrated and worried about the meeting with the reference group on ninth of February. So I decided to try the workshop idea, which had had good results at the Delta project. This time I wanted to videotape the proceedings to capture information while I could concentrate on participating. I prepared a one page introduction but this time I included some information on me and the project.

Week 5 – With the frustration of no direction and the obvious mismatch of information and requirements I organised a meeting with the whole office one Friday afternoon starting at 4:30 pm (this was changed 4 times and finally held on the 8-2-2000). I got some beers and

nibbles and prepared some material. This meeting was videoed. There was also a one A4 I handed out at the start.

Excerpt 29 – Journal summary 2000 – text units 243-250

I hoped that through this meeting I would get some support for some of the initiatives in the Civic Centre project and also get some understanding of the issues important to the design team.

We spent hours successfully discussing what the various environmental issues are, what people thought of different initiatives, what sustainability meant and discussed some existing innovative buildings. At 7:30pm we were all still hotly discussing issues and ideas when the video tape ran out and it reminded us what time it was. Slowly people started wrapping up the discussion, almost reluctant to let go of the very stimulating afternoon we had had. At this stage I thought I would experiment and throw in a curly one: 'so what you're saying is that design is a compromise...' I didn't get to finish my sentence. Everyone breathed in and sat forward. I thought 'oh, oh...'. Henry said in his booming authoritative voice: '*Design is NOT about compromise, when you compromise you both lose. You must solve and resolve the points of view. It's not about if you want Chinese and I want Japanese for dinner we get Indian, it is about let's get Chinese today, Japanese tomorrow. THAT is what makes the difference between an architect and a builder!*'

Reflecting on this afterwards there is an element of compromise even if you decide to have Chinese today as the person who wanted Japanese needs to wait till tomorrow. I think what Henry was saying with his metaphor was design is about finding that 'yes' factor I described before (the third option solves several problems, answers all the questions). I decided not to use the curly question technique again, because I found it too confronting and the reactions too unpredictable. As a result Audrey and I were asked to hold another meeting to outline the Civic Centre project and where it was up to. It was the first time I had to deal with architectural critique directed at me. My understanding for the profession deepened.

Week 5 – back at Beta we (Audrey and I) got 12 beers and pulled out all the drawings and gave everyone a preview of the building. BOY what an experience that was! I was completely exhausted by the end of it. Firstly they critiqued Audrey's design throwing up all very valid issues which she had or had not considered then it was my turn – I have not had to argue so hard, think so fast and justify myself as much as I had to at this meeting.

Excerpt 30 – Journal summary 2000 – text units 323-329

What the experience taught me is that to be an architect you need to be really sure of your ideas, you need to think on your feet, you need to be able to listen to what is said and formulate answers that show how your design meets the critique³². You need to articulate to others the tacit knowledge embedded in the designs.

Architecture equals building when referring to the artifact, the object for human habitation, or the craft of construction; it is unequal to building when referring to the canon ... The architectural canon is an effect of criticism, which institutionalizes the difference between architecture and building ... While criticism might not seem necessary to actually build, it is crucial to the act of establishing architecture as a cultural institution. (Gusevich 1991:8-11)

A single pen stroke may depict a multitude of decisions on many problems and you need to be able to express them. It takes a certain type of personality and training to be able to do this, to be able to stand up to the critique and make the design stronger through the reflection platform it provides. Further, it provided greater depth to my understanding of the 'green' innovation information that would need to be provided to architects. Either written answers in great depth need to be provided—very difficult and what the BDP EDGe guide attempts to do with some success—or a person who can become part of the process and who can stand up to the critique is needed. I decided to experiment with both. The first experiment involved the CSIRO, the highly respected scientific research organisation in Australia, to carry out thermal modelling and advice for the project. The second was to invite an international expert to a design workshop to discuss the use of solar panels in the design.

The CSIRO story – providing the depth of information in meetings and in reports

The CSIRO became part of the project to carry out thermal modelling on the building design, to provide advice on the embodied energy of the materials chosen for the design and to provide advice on the natural ventilation of the building. The CSIRO required the CAD files of the building but also exact information on what materials were going to be used. This presented the first problem of doing thermal modelling at this point of the design. To carry out realistic, accurate thermal modelling that is

³² Though my experience was at this stage only from one team of architects I had also experienced three post graduate research conferences and spoken to quite a few architects. It is a generalisation from a small sample, though. It simply reflects my thinking at the time.

relevant and can be used for design optimisation it needs to occur within the concept design phase. The agent carrying out the modelling requires information on the layout of the building, the materials used, the sizes of the windows and doors, what insulation is being used, how many people will be using the building and their occupation pattern. That is, the building needs to be fairly well resolved and the client definite about the functions, staffing, tasks etc. This level of resolution does not usually occur until the design development or even documentation stages at which time it is difficult to use the modelling for optimisation (Hes, 2003a).

Week 11 – Audrey was stressed after the meeting. She had to make a great deal of design decisions spur of the moment – material types, window sizes, glazing types etc. I spent a reasonable amount of time explaining that this info was needed for basic modelling and didn't mean that it was what was going to be used. She was really worried and visibly upset "I hate having to make these decisions, right here if I had known I could have spent my time..."

– This was very interesting from the point of view of the research – the info needed to feed into the modelling and the stage of the design just DO NOT correspond. I have seen this elsewhere, I have had to do a lot of guessing to get things done – eg electrical figures, water figures, number of people using the buildings etc.

Excerpt 31 – Journal summary 2000_2 – text units 59-71

As a result of my reflection above on this issue I wrote a paper that I presented at a conference in 2003 examining the critical decision stages of a building project and the conflicts in informing that stage. The result is a clearer understanding of how to manage the process so as to get the best information incorporated in the design stage at the optimal time. This is not always possible, but making it clear to both the designers and the information providers (whether modellers, engineers or other experts) that there are conflicts, and their form, supports getting the best possible collaborative outcome.

The second lesson from the incorporation of the CSIRO research was the clear articulation of the gap between the output of the scientists and the needs of the designers. This gap has been identified by others, for example, '*Herbert Simon was among the first [1976] to raise the issue of design as a response to the mismatch between scientific knowledge and the skillful practice of (university trained) practitioners*' (Binder, 1999: paragraph 2).

Week 15 – This information mismatch was highlighted by what occurred at the presentation of CSIRO's research into the thermal dynamics of the initial building design. Sitting around the board room table – scientist on one side architects on the other – the meeting began. CSIRO presented their results, assumptions, and methodology in detail. Time-poor

architects, sat there restless, willing to honour their expertise but only really wanting advice on how to build the building with optimal environmental performance. Numerous times the architects asked the scientist “well what should we do, are you saying we should...” but every time a direct confirmation of a direction was avoided. Reflection on this very interesting piece of footage needs to be extended, but, it is obvious that all the designers wanted was someone doing credible research to tell them ‘this is better and that is worse’, but those trained in the sciences only wanted to give facts while allowing others to make decisions (photos of workshop).

Excerpt 32 – Vignette Path 2000 – text units 412-426

The results of the CSIRO research was a rigorous 50 page document including all the climatic condition summaries, all the variables, results for each option over each month or the research year, references and assumptions. To try to make the research a little simpler to digest into the design I summarised them to a one page document outlining which options would achieve what savings.

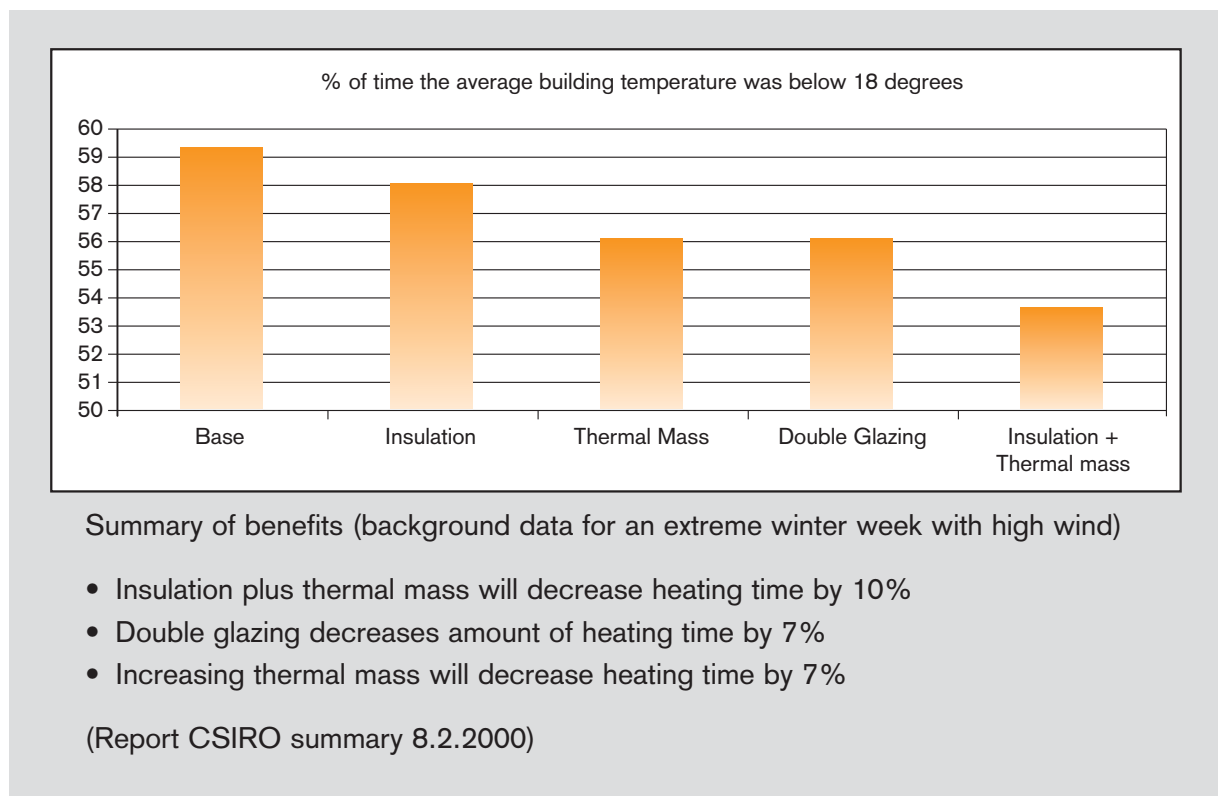


Figure 24 – section of the 1 page summary of the results from CSIRO report

I was starting to learn to become a facilitator, to be useful to the design team and slowly I was moving from a shy observer to an observer/tentative practitioner. As a method for presenting and integrating ‘green’ innovation information into the Civic

Centre project was successful, the recommendations were taken up—the building was insulated, appropriate double glazing used and high thermal mass material used. But it was a painful process, as the discussion above already showed. It caused discomfort for the designers as the information on building elements the modellers need, in many cases, had not yet been resolved—for example the type of windows.

Solar story – providing the depth of information in a workshop

My second ‘green’ innovation experiment was based on the success of the environmental and design definition workshop I had organised earlier and on my reflection on the critique experience. I invited a solar panel expert.

Week 11 – At 5 [solar expert] came in and we got the wine and cheese ... [SE] pulled out his pictures and we started discussing the various options, opportunities and possibilities for solar. Henry joined us after about 2 hour, we recapped and went on. I had high hopes for this meeting, hoping that it would inspire action to integrate solar into the building and develop a plan for the Australian Greenhouse Office funding round. As the meeting continued Henry became more and more excited, he could see it all before him – the wall was attacked as ideas poured onto the laminate with coloured pens. I invited [SE] because he was a PV integrated into the building envelope specialist...I kept trying to bring it back to an idea generating session ... All in all it achieved the objective of getting Henry thinking... – Henry thanked me for the Friday meeting, saying that he was still buzzing from the meeting

Excerpt 33 – Journal summary 2000_2 – text units 112-129

I believe this was my most successful attempt to integrate ‘green’ innovation into the project. It resulted in the idea of having a solar clad external façade for the building, an idea that resulted in its most iconic feature.

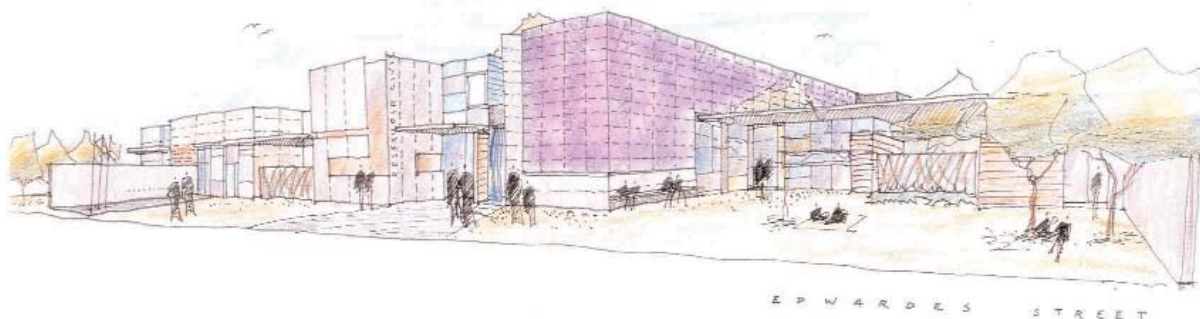


Figure 25 – original drawing of the building and solar façade



Figure 26 – computer model of the solar facade



Figure 27 – resulting façade – opening day August 2003

So why did this work? Thinking back to my experience with the critique, the lesson here is that architects in their design practice work with many ideas and concepts on many levels. To participate with these ideas in an interactive way needs an expert who can participate in the thought spiral, someone who is secure in their expertise and can communicate clearly to the designers what the options are and who also can listen and interact in the process of idea formation and critique.

It was about providing the right information in the right format. For, as Paul Newland stated in his PhD, *'undeniably there is now a wealth of information emanating from many sources which could be useful to designers. Unfortunately, this well-established*

scientific, technical and social knowledge about the built environment is in the main unexploited by architects and does not, therefore, become manifest in much architectural design. This situation is not new and was recognised some time ago by Powell (1968) who concluded that no matter how good or appropriate, if designers do not choose to access information, cannot access it, cannot understand it or cannot apply it readily, then it is of no value to them' (Newland, 1990: paragraph 2, his highlighting).

At the before mentioned meeting with the project group the options outlined in the initial quick cost/benefits study were discussed. Thus the initial 'green' innovation options were determined. Using workshops, some of these, for example the solar panels were integrated into the design. Some required expert research such as that commissioned by the CSIRO, while others, such as the energy efficient lighting, heating, cooling, etc. were passed on to the specialist engineers. In so doing the proposed 'green' innovations were further developed attempting to pin down in greater detail what the main benefits of the initiatives would be to the council. The purpose was to present the options to the reference group, which was made up of the building users, unions, relevant council staff and the project group. The meeting with the reference group occurred on 31 March 2000—a hot sticky Friday afternoon.

My intention at this meeting was to get the sign-off from the building users on the options we were proposing. It was also to get them excited, to start fostering ownership. Carrying out this exercise provided another major lesson for my fledgling practice—the importance of consultation.

Week 12 – [decision meeting with stakeholders], about 15 people had turned up and Henry was in front explaining developments in what we were going to do with the solar on the building. Everyone was very excited about the possibilities. Henry went on and drew an idea of what it might look like and went on about how it all worked together...

– I did a presentation on temperature variation and the benefits of widening the temperature range and resulting cost/energy savings. This went well, the only problem is that here is one lady who had a skin condition which requires her to be in temperatures under 23 degrees and we were hoping for a temperature range of 19-26, we will have to work that one out. Everyone

was fairly happy to agree with the temperature range though we will need to present it and get it signed off by another meeting. This was disappointing for me as I had hoped to sign these things off at this Meeting, it was the reason for all the preparation and effort for the meeting...

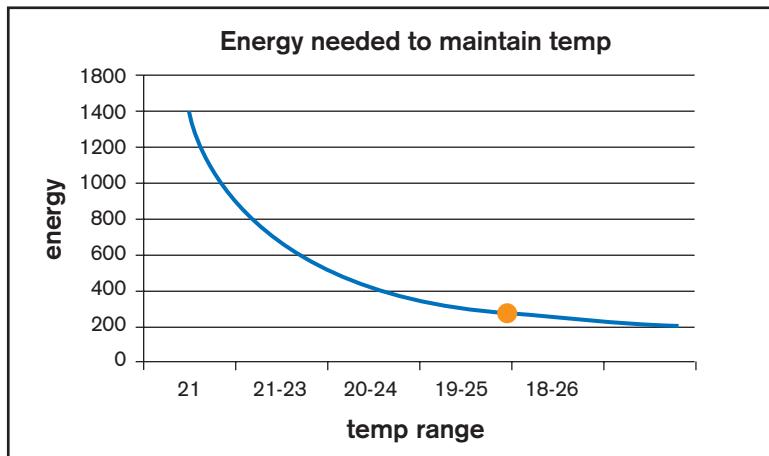
– Mr WTE (Water Treatment Expert) [made a] presentation of the rain water and black water. There were some questions and problems but they all seemed to be answered and everyone came out of the meeting feeling pretty happy.

Excerpt 34 – Journal summary 2000_2 – text units 161-180

In the end we did receive authorisation to broaden the temperature range with a compromise of a portable cooler for the lady with the ailment. Similarly the recording studio added that they needed to have the temperature range more rigidly set for recording processes. For their rooms therefore refrigerant air-conditioning was planned. The rest of the building though could now be designed for the broader temperature range resulting in an openable breathable airy light building with a significant reduction in energy use. Yet if we had not gone through the consultation process on the temperature and lighting we potentially could have had conflict.

I had expected other benefits from the consultation, such as the excitement from the people at the workshop. For my practice, the main lesson apart from the importance of consultation in avoiding conflict was the actual power of demonstrating what some of the 'green' initiatives were. For example, aside from agreeing on the broader temperature range, we also wanted consensus on the lighting levels, which were required to be defined in lux. What is a lux? How could we ask people to make decisions on what level of lighting they wanted if they did not understand the measure? So I developed a little exercise that showed what a lux level was. The meeting was in a naturally lit room on the corner of the council offices. It had fluorescent lighting and down lights that could be selectively turned on in three zones: all lights, fluorescent only, and down lights only. I took out a desk light and a lux meter and we slowly proceeded to see what the lux levels were for all the combinations of lighting options: natural light only, natural light with desk light, all lights, etc. Based on the exercise the participants agreed that the lower level of light was acceptable given that people were given access to individual task lighting.

Reflecting of this I was very happy with the outcome, but I think people were influenced by the excitement of the project. In addition to the lux meter and props at the time, I would have liked to have had the lighting modelled to be able to show the energy savings as people considered different options. This proved to be a very persuasive tool when we discussed the energy savings. I had discussed with the CSIRO what the energy savings were based on their modelling between the evaporative cooled open building at 19-26 degrees and closed refrigerant cooled building at a level of 21-22 degrees. The resulting graph was a powerful tool when discussing with the reference group what type of building they were happy with. Naturally the idea of an openable, user controlled, airy aesthetic was also very attractive.



Source: CSIRO discussion, a representation of factors not exact figures

Figure 28 – influence of temperature range on energy use

At the resolution of this meeting the reference group endorsed all the ‘green’ initiatives, expressing reservations only about the grey and black water treatment. These reservations seemed, at the time, to be adequately answered by the treatment system expert who I had invited to the meeting.

These were fantastic experiences. I continued to grow and learn what design was about and the potential for integrating ‘green’ innovation. At the end of March 2000 something happened which changed everything. The architect I had been working with closely since the start of the project, Audrey, left. She left under unexpected circumstances, with a great deal of stress and negativity.

Up until this point my journals were quite thorough. Each week I summarised what I had done during the week—meetings, research, input and so forth. I also noted how much time people were spending with me and on the project. When Audrey left I was disillusioned and angry at the whole experience, and the project had still not progressed past the concept design stage.

Week 12 – [Friday] The path really changed on the 31st of March, this was when Henry fired Audrey. He called us all into his office one by one ... told us why he had to let her go. Then he gave her 5 minutes to pack her bags and leave. This killed, dead, the incredible feeling of purpose in the office, and after that everyone in the original team left one by one as they found other jobs – in fact 2 people left without finding another job, they needed to get out so bad...to say I was dumbfounded would be an understatement...we were all shocked and angrv. Audrev had tears in her eves. Stef was livid and could not stop talking and David who joined us later was just very, very sad. I did not write in the journal again until the 26th of April! The effect on me was that I lost the passion for the project, I no longer took the thorough notes I had done before then, I did not keep the records and information up to

date. To a great extent I felt I was actually cheating by continuing at Beta's, David did ask at the time whether I was going to quit. I felt that the project was too important.

Excerpt 35 – Vignette Path 2000 – text units 227-258

I continued at the architects' office two days a week developing the information as I had outlined in the initial brief. But I also responded to the needs of the project, so for example if there was an opportunity to secure some funding I pursued it. The main task I set myself for this period was to ensure that none of the 'green' innovation integrated by Audrey was going to be lost, and so I prepared a thorough briefing for the two project architects assigned to the project, David and a new guy called Taylor. Taylor, in his early thirties, seemed enthusiastic with an impressive architectural practice background. Both were working on other projects at the time. Several weeks later David left and a third architect, Chris, joined the team and became the new project architect supported by Taylor. Chris had worked in London for many years, was in his late thirties and very serious with a thin face and small penetrating eyes.

There was no opportunity for me to brief Chris. He also started just as the pressure to get the concept design finalised was mounting so as to begin detailing and documentation. Further, at this time I injured my knee in and could no longer walk up the stairs, but effectively kept working on the project although now based at the council. Consequently, I saw very little of Chris, only popping in when there were critical sessions with the engineers or other strategic meetings. Also, at this time I went on a 2 month holiday. Moreover, since my hours on the project had decreased to 2 days a week, I needed other work to supplement my income; this was easily found at the Centre for Design at RMIT, where I had been a casual up to this point.

As a consequence it was not until the end of July 2000 that I was really immersed in the project again. I found that working with Chris was really frustrating; we did not seem to have the same rapport as I had had with Audrey.

Week 41 – [October 2000] I have been writing my PHD review paper and what this has brought forward is the difference between the interactions between the initial group of architects and the current. They haven't seen the commitment, the time and frustration I put into the project they just see me waltz in now and then making life difficult for them

Excerpt 36 – Vignette Path 2000 – text units 227-258

Having missed the first workshops, the initial five months of hard work on various proposals and ideas, echoing the experience at Delta; Chris was unsure of my role

and my intentions. It took me six months to develop a productive, mutually respecting relationship with him. Again, I had to demonstrate my commitment to the project, make it clear why I was working on the project and what the intended outcomes were. In this case study I had set myself the task to carry out the relationship building and the role definition and though I had done it initially it should have been repeated when the guard changed. The impact of the lack of continuity has been written about by other authors and it is a point I will return to later in the thesis.

4.2.1 Working with the engineers

I had spent time with the architects, developing 'green' initiatives which were integrated into the design, it was now time to work with the engineers and develop the specifications for the project. I learned that the engineers' task in the project was to develop the technical details of the plumbing, electrical cabling, structural elements and heating and cooling. The specifications described details of the project, exactly what was expected, for example the exact outline of how to carry out the concreting, what door handle furniture to use, and so forth. These documents, along with the drawings, then went to the builders and subcontractors in the market, so that they could quote a price for carrying out the work as specified.

Unfortunately I was no longer based at the Beta office and so could not participate in all the engineering meetings. Those I did attend taught me the value of the engineers, their knowledge and skill.

Week 45 – Lighting meeting – I was amazed. This guy really knew what he was talking about and what's more had thought about much of the stuff I was going to propose. He was proactive and knowledgeable.....One thing worth noting is that he was very confused about how the solar stuff was going to work with AC, DC and lighting...

- Structural meeting – This meeting was even more amazing. Not only the consultant James but also Taylor and Chris showed a real understating of the environmental issues. It was interesting how CSIRO's work had translated into general rules for the consultant: "my brief was to cut down on steel" things thought of were thermal bridging, keeping it simple to facilitate easy and quick building.
- Thermal mass Chris: "we need to do it this way because it is important to allow the thermal mass to make contact with the internal air"
- Steel trade off with timber – James said "I like this environmental stuff...if it isn't up to scratch you just say that's environmental vandalism!"...

– The main thing of note from these meetings is the complexity of it all, for example the electrical guy needs to know how to get his power points in but the structural guy needs to ensure the building will stand up, meanwhile we have chosen for high thermal mass – i.e. concrete and no skirtings so it is very difficult to plan the power points, not undermine the structure and have had to sacrifice flexibility

Excerpt 37 – Journal summary 2000_2 – text units 376 – 412

What is clear from my journal entries and later reflections and vignettes is that I was starting to appreciate the complexity of designing buildings. The architect designs the concept, the artefact and its embodiment of the cultural aspects of the project, though this is done with structure and services in mind, then the engineer designs the technical detail. These experts understand the intricacies of their profession and can come up with very innovative answers for the 'green' initiatives proposed if asked.

At the same time I became aware of two other factors: firstly that most of the expert engineering consultants work in isolation from one another, and secondly that they tend to specify systems for worst-case scenarios. One example of the impact of this 'silo' method with which the consultants work occurred in a meeting about another project:

Week 9 – In reference to this other job – the acousticians are miffed because they weren't called in earlier. The mechanical engineering and construction (documentation) occurred without ANY reference to the Acoustics, so not only does it need redrafting but it presents many other problems – e.g. duct size is not $6\text{m}^2/\text{min}$ and should be $3\text{m}^2/\text{min}$ max so as not to interfere [with the acoustics]

Excerpt 38 – Journal summary 2000 – text units 427-432

There were many examples of the over specification of systems. The Civic Centre project gives an example of both: the lighting engineer had designed the system to function at five watts per square metre—approximately a quarter of the usually lighting load in a building—but the heating and cooling engineer designed the system for the normal heat load generated by twenty watts; thus the system was initially designed to be larger than it needed to be.

Both these experiences showed me the value of involving the consulting engineers early and having occasional combined meetings, which need to be well organised to get the most out of the combined expertise. The last thing I wanted was to have all the engineers reporting on what they were doing without any interaction. Using this reflection I developed a standard collaborative engineering series of workshops. The first was an introduction to the project and each other, going through activities

including: ‘Where do you think your tasks interact/conflict?’; ‘What do you think the opportunities are?’; and, finally ‘How can we work together to minimise the conflict and maximise the opportunities?’. The result was a plan of collaboration parallel to the individual requirements of each engineer. During a break of several weeks, the engineers developed their various systems while there was individual interaction between the design team and the consultant. In the second collaborative session each reported on their own systems and any new areas of conflict or opportunities they encountered, followed by discussions on the collaborative plan and any progress made. The session concluded with a clear task division and plan for completion of the systems’ designs. In smaller projects this may be all that is required, but in larger projects a few more sessions may be needed as systems are finalised. On reflection I would add a third step which is a workshop with the engineers and the subcontracting system providers—all of them. The purpose: to pass on the learning from the collaborating engineers to the installers. Each session I also planned to include a short reflection on the process of the workshops, what worked, what did not and how the process could be improved.

Table 8 – Outline of engineering systems workshops

Steps	Purpose
1. Initial conflicts and opportunities workshop	Allow each engineering team to get to know the other, identify conflicts and opportunities and develop a plan for addressing both.
2. One or more intermediate sessions on progress of design and identified conflicts and opportunities	Allow each engineering team to present their systems as designed, report on how conflicts and opportunities identified in step 1 are being addressed. What further action is needed? Presentations and interactions with manufacturers if possible to clarify installation difficulties and opportunities.
3. Workshop with system providers	Pass on the learning from the engineers to the providers, ensure understanding is there about why things have been designed they way they have.
1/2/3 reflective 5 minute discussion on the collaboration initiative – used to improve the activities	

Unfortunately I did not have another project where I had the opportunity to trial this system, so the purpose for its inclusion in this thesis is mainly to demonstrate how reflection on what occurred in my practice led to the development of new processes to potentially overcome shortfalls experienced in the practice.

Importance of integrating things as early as possible

While now at the council I still participated in design sessions wherever possible. Late in August the design team was presenting the final designs to each of the user groups and getting their sign-off. Here I learned the cost of not integrating initiatives at the concept design stage. We had planned to put in showering facilities for people who cycle to work but we had forgotten to put in space for lockers. This small change had a cascading effect on one whole section of the building including the design time, structural engineer time etc., making it so much more difficult than if we had just put them in at the start.

On reflection, to try to ensure that all major 'green' initiatives were considered at the concept design stage in the future, a checklist was developed. There are opposing arguments about the usefulness of a checklist. One side argues that it is simple method to ensure initiatives are integrated at the beginning in a uniform fashion, the other that this encourages minimal compliance and reduces innovation. I can see the argument for both, but my counterargument is that a checklist facilitates a method to ensure you have not forgotten anything—like the lockers. Keeping in mind that you cannot understand all the opportunities that present themselves over the course of a project—'you cannot know what you don't know you don't know'. Therefore, I see the value of a checklist but not in isolation. I use the development of a checklist at the beginning of the project with the stakeholders to support the formulation of the definition of sustainability relevant to that project. This ensures some level of both consultation and reflection on what they see as the 'green' issues in their project. To provide some opportunity to think outside the square, or in this case, outside the checklist, I use this list as a part of the tools used in a project but not in isolation. It needs to be complemented by all the other techniques, tools and practice.

Enhancing agent competency

Hult and Lennung (1980) describe enhancing actor competency as one of the outcomes of action research. This is one of the measures of success of an action research project and is not only the adoption of learnings (in my case 'green' initiatives) but also their understanding and further integration into other projects—becoming part of an agent's practice or, as Hult and Lennung put it, 'enhancing their competency'.

This has been observed, in part, as the architects have used the experience to tender for other ‘green’ projects. Further, the architects on the project began to demonstrate some level of ownership of the environmental initiatives applied in the design, confidently able to ‘sell’ them to the clients. This is in part due to the nature of architecture and the inherent ability of practitioners to enchant clients with their design. The example below shows how even the most cynical of the team became much more at home with the ‘green’ initiatives in the design.

Week 33 – I noticed how much Chris was really in the environmental zone as far as the building went – from being completely anti and reserved he has taken it on board and is running with it as part of the things he talks about with authority. I am sure this is partly due to architects’ ability to incorporate client needs but it is also due to his pragmatic character. It would be interesting to see if he uses this stuff in the future...[21 days later] Thermal mass Chris: “we need to do it this way because it is important to allow the thermal mass to make contact with the internal air”

Excerpt 39 – Journal summary 2000_2 – text units 312 – 313 and 390-391

4.2.2 A different perspective

Relocating to work with the clients allowed for a different perspective of the integration of ‘green’ innovation into building projects—to explore the frames of those working in the project (Schön and Rein, 1994). Practice now consisted of development of information for the future users of the building, those holding the purse strings, and the community. During this time I continued to work with the design team as well but had in fact switched camps, residing with the clients of the project.

Outside the Civic Centre project I now also began to investigate other aspects of ‘green’ innovation in the built environment through projects of the Centre for Design. Primarily it was research into life cycle assessment tools for the building industry and a literature review into all research done on economic cost benefits of energy efficiency measures for housing. These projects again emphasised the need for clear communication of options, developing decision making frameworks to aid those in the built environment to choose tools and facilitate further research.

One of the main descriptive, reflective entries from this time in my field notes illustrates the move from advanced beginner to competence in the practice of facilitating sustainable building:

Week 41 – [From the conference held at Melbourne University: Sustainable Architectural Design – Is It Real] *'from my notes I think this conference supported a lot of my own ideas*

- move away from problem based mentality*
- Sustainability is a growing field*
- Transfer of knowledge is very important*
- Everyone needs to part of the solution*
- Needs to be driven by – clients, policy, innovations etc'*

Excerpt 40 – Field Notes 2.10.2000

This shows an ownership of many of the concepts I had been working on, demonstrating that I was starting to develop the knowledge and understanding of the integration of 'green' innovation into the built environment.

During this period I began to become aware of how important the work we were undertaking at the Civic Centre was. Being active in the field and actually getting dirty in the swamp meant a more evocative experience, a better story and learning-in-action resulting in the development of a practice responding to direct and actual situations. I call this the impact of 'just doing'. My personality is such that I get frustrated with endless talk and tend to take a problem, briefly analyse it in the context of my experience, develop a strategy and then just 'do' it and see what happens; then I reflected on the experience.

Having a physical example, an actual project, has personal learning and development implication for me as discussed above BUT it also has demonstrative and experiential effects on those in contact with the project. Seeing that it was actually possible was an incredibly strong outcome. The idea that this was becoming a practice not just a research project was born.

4.3 Reflection 2000

Reflecting on this year I was still learning in what Daley (1998) describes as the novice mode. There were definite examples of fear, apprehension and the need to be accepted and seen as valid. These influenced on my concept formation, and particular resulted in shifts in the research. In the middle of the year my frustration and my disillusionment with the project reduced the data collecting to almost nothing. The main concepts that began to form were: an understanding of the complexity of the design of a building; an understanding of the process of design and therefore a clearer picture

of how to involve 'green' innovation; and the importance of just doing.

So in this year I developed and tested several theories-in-action, some of these being more successful than others. These were firstly the various types of 'green' information:

- I provided information sheets on insulation, solar panels, water treatment options, materials and recycled materials from the old building.
- Very successful workshops were held with the architects on what 'green' innovation in architecture is, water reuse options, solar technology and the building's design. Workshops were also held with the building users and council staff, mainly to outline initiatives and get their sign-off on decisions.
- Simple summary i.e. the distillation of the main points from CSIRO's modelling of the Civic Centre into a one page data sheet was very successful.
- Database of materials was a great resource but had one large flaw and that was the lack of tangible samples. It became a more successful tool once samples were received.

The research method still seemed to be working, I was collecting useful informative data to reflect on, and more importantly I was learning and understanding. I introduced two new forms of processing and adding to the data while developing its depth, vignettes and reflective papers. Vignettes were particularly useful in describing critical incidents in a story and providing the space for reflection.

The main lessons I learnt were:

- design is a chaotic intense process of finding an answer that best satisfies all the questions;
- critique is a central element of design advancement;
- the number of people involved in the design process is much larger than I realised: acoustic, electrical, mechanical, structural, hydraulic engineers; landscape architects; planners; the clients; the building users; the community; the traders association and the design team;
- the actual design process involves concept/schematic design; detailed design; documentation and tendering;

- due to competing demands, all the players involved, the time limits and budgets, any ‘green’ innovation needs to be part of the architects’ knowledge base or introduced at the right time in the right way; and
- there are significant conflicts between some of the ‘green’ innovation tools and the design process—for example the thermal modelling.

4.3.1 Reflection through the use of Reason’s questions

As before I will use Peter Reason’s questions to stimulate thought. For this initial period of my PhD the answers were:

Why am I doing what I’m doing?

This question is better rephrased as why did I decide to take part in the project with the architects and then decide to stay? Furthermore, why did I decide to work at it part time and stretch myself and weaken the research by taking up work elsewhere, at the Centre for Design?

I decided to take up the project with the architects because I had received three emails drawing my attention to the project. The first two times I thought ‘no I won’t’ because my work with the industrial design firm was still ongoing and I wanted a break between phases one and two. Receiving the message a third time changed my mind and made me want to at least explore the opportunity. There was another very attractive side to the opportunity, it was paid! At twenty dollars an hour it was not much but I had given up my scholarship, because the work I needed to do for the scholarship was impeding all attempts to work on my PhD, so a steady income even for 10 weeks was very attractive. Once I had the interview for the position I became intrigued by the project and excited by the idea of being able to sit in on such a large design.

By the end of the first month I realised that four days a week was not going to provide the project with the right information because the design was progressing so slowly. By this time knew everyone in the project and felt some commitment to it. So I offered to cut down my time to three days and then two, the consequence being that I needed another job. Working the other three days at the Centre added

to my responsibilities and reduced the amount of work I could do on the research but did provide a parallel stream of opportunities to explore the use of 'green' innovation in the built environment.

Thinking what I'm thinking?

In retrospect my thinking changed a great deal during 2000. I started the year not knowing anything about architecture and the integration of 'green' innovation in a building design project and ended it lecturing to two hundred or more people on how to do it. This in itself is not a change in thinking, but illustrates my growth. The thinking that changed occurred through understanding the process, by walking a mile in the architects' shoes and experiencing what worked and what did not in practice. The best example of this change in thinking is the material spread sheet I was so proud of but that completely missed the mark, both in providing the right information and providing it at the right time. Here I changed my thinking from 'if you give people the right information they will make the right choice' to realising that a) I did not know what the right information was and b) I did not know the right time to use the right information.

Feeling what I am feeling?

My journal showed clearly that this year I had high stress and anxiety about the research. I was struggling with my research method while already in the field; I was struggling with myself; I was overawed by the complexity of the building design process and I was confused to be smack bang in the middle of a process that was completely different to what I was used to.

I reflected on and explored the research method through writing a paper and attending a conference on the particular research method. This left me certain that I was using a wrong method, for—though I was participating and acting—the other agents had little input into the research, setting of the goals, reflection, and so forth. Then I was given the opportunity to continue with the project onto its next stage, which meant I needed to change the method from six mini case studies to one major case study. Obviously this had consequences on the reflective cycles, research questions and potential outcomes. To resolve this I decided to call the method emergent as well as the research. That is, as the research progressed by

taking up opportunities so the method of carrying out the research adapted.

In some parts of the research I was struggling because I felt I needed to be more of an expert than I was and struggling because of my reactions to my insecurity.

Week 4 – Sometimes I really feel I let myself down by not being more guarded and dishonest. I tend to show I am not an expert, show if I don't know the complete answer. I guess people feel insecure by this. I really should work on this.

Excerpt 41 – Journal summary 2000 – text units 211 – 214

Though I was insecure and uncertain, this excerpt shows that I was honest and living the paradigm that we are all on a learning journey and cannot know everything about everything. I was comfortable to show myself as a non-expert, but I just was not expecting the reactions from others. I began to realise that to integrate innovation people need to feel secure about it, but they may not be happy to learn from it if it goes wrong. You need to play the role of expert even though you may feel that you know less each day— *'the more you know, the more you know you don't know'* Aristotle.

Week 39 – 18th September the morning was spent talking monitoring systems for the RCC. What amazes me is how much there is involved in this project. I find it incredible, frightening and too much to really think about without being scared off. So many things to think about , to organise and facilitate and so little time to do it all – let alone all the things which are too late and which I feel are slipping out of my fingers:

1. thermal mass – needs to connect solar to floor
2. curtains – a different solution which is more IAQ friendly
3. the B&G water system
4. the size of the case study
5. the solar system
6.

I want and need more time on the project but really cannot justify more time. Oh I'm just getting scared – I'll get over it!

Excerpt 42 – Journal summary 2000_2 – text units 431-445

I mainly dealt with this insecurity by approaching several experts; in particular I relied heavily on Alan Pears, a leading energy efficiency expert in Melbourne. He became my silent mentor. I had such success with this approach I quickly built up a network of people who I could call on.

I had never imagined that architecture and the development of a building could be so complex. I began to realise that one of the main barriers for 'green' innovation was the fact that there were so many competing processes and activities already

occurring in designing a building. Further, I experienced how with complexity came specialisation and, without good communication, the doubling up of some tasks while others were forgotten. This is described eloquently by David Riley: *'Design information for buildings is increasingly uncoordinated because it is formulated by specialists in various disciplines. This negatively affects the "completeness" of construction documents. In addition, significant waste can be found in the value chain of design information from the napkin sketch to the foremen in the field. Such waste includes the duplication of information and the recreation of existing information for alternative purposes and audiences during the design process'* (Riley et al., 2004 abstract). The idea started to develop in my mind that facilitation was a major opportunity in this industry.

The fact that I was overwhelmed by this new understanding shows part of the transition from advanced beginner to competence: *'[w]ith more experience, the number of potentially relevant elements that the learner is able to recognize becomes overwhelming. At this point, since a sense of what is important in any particular situation is missing, performance becomes nerve-racking and exhausting, and the student may well wonder how anyone ever masters the skill'* (Dreyfus and Dreyfus, 2002: paragraph 39). So I was ready for the next phase in the development of the practice.

The last feeling to investigate is the exhilaration I felt at times and the experience of the 'right design solution'. At times my journals are full of the adjectives—wonderful, exhilarating, amazing, inspiring, etc. I loved being in the design field, the way their creativity was used and the vital and flexible way of approaching and resolving problems. Being a fairly visual communicator myself I loved the way a few pen marks led to a few more, which led to a solution. It resonated with me. Yet much of my frustration, which appeared more times in my journal than the adjectives outlined above, was that there seemed little attention paid to resolution, developing plans of action and then keeping to timelines.

Why do I think this course of action will be appropriate or effective?

I developed several tools while at Beta, some of which I was able to test in the field, while others await an opportunity. They were effective because they were developed as a solution to a problem experienced in the field and the second is that they were responsive to the agents involved.

What other possible perspectives and experiences could enrich and inform the way I/we are engaging with the world?

There is so much relevant literature regarding how others have experienced and described the architectural design process; the integration of innovation into design; critique as a major development and reflection tool in design; and the need for a champion to be involved for innovation to be taken up in complex processes or projects.

I would like to briefly revisit an earlier quote in discussing the architectural process from a technical perspective: *'[a]rchitectural design is a multifaceted activity which requires, for its successful performance, a mixture of intuition, craft skills and detailed knowledge of a wide range of practical and theoretical matters. It is a cyclical process in which groups of people work towards a somewhat ill-defined goal in a series of successive approximations. There is no 'correct' method of designing [i]t is a fluid, holistic process wherein, at any stage, all the major parts have to be manipulated at once. In this sense, it is less like solving a logical puzzle and more like riding a bicycle, blindfold[ed], while juggling'* (Maver and Petric, 2003:642). I came to this research wanting to solve the puzzle of integrating 'green' innovation into design logically. At the end of my first year on the Civic Centre project I realised that there was nothing logical about the process and that it was so unlike the organised, engineered, planned, strictly managed, work I was accustomed to that I needed to throw out my preconceptions and look at the problem through the eyes of the designers.

'Green' innovation is not the first type of innovation that has gone through the process of being introduced and integrated in design. Research on access and disability innovation, fire and safety, quality and so forth have all been integrated at one stage or another. The difference between these and 'green' innovation is that in most cases they were regulated. Still lessons can be learned from the experience, particularly that the process can be promoted and encouraged by:

- Providing incentives to integrate innovation through the provision of information and education, and disincentives such as fines for avoidance, which is the main lesson from the integration of disability, fire and safety.
- Developing a market push by educating consumers, showing the advantages of the initiatives, for example getting better returns by increasing the

quality of a building's fittings.

- Showing the link between financial costs and benefits, that is that the extra fees and time needed to introduce innovation into the design are offset by the avoidance of fines, accidents and delays, while getting a higher return on investment.
- Demonstrating that higher resource costs, time and effort are only needed while the design team integrates the new knowledge it requires into their praxis, after which it becomes another thing to be considered in the design process.

In discussing the role of critique, I would like to reflect on its origins. Lackney (1999: paragraph 4) traces it back to the influences of European tradition, feeding into American education:

...looking to Europe for a standard, as Americans often did in the nineteenth century, many aspiring students saw the prestigious Ecole des Beaux Arts in Paris as the ultimate in architectural training. The Ecole's philosophy was imported to the United States, and most architecture schools in the early part of this century had at least one Paris-trained professor. The cornerstone of the Beaux Arts system was the 'design problem' assigned to the student early in the term and carefully developed under close tutelage. It began as an esquisse, or sketch problem, and ended in charrette. Charrette, French for 'cart', refers to the carts in which the finished drawings were placed at the deadline hour for transport to the 'master' for critique. The Beaux Arts teaching systems relied heavily on brilliant teachers and learning-by-doing. Competition was intense and the end results were beautifully drawn projects in traditional styles which were often defensible only on grounds of 'good taste' and intuition.

Thus, critique was used to assess student work based on whether it met the requirements of the project but also whether it was 'good'. 'Good' is subjective and is determined in many instances through the thoroughness and strength of the argument as well as its resonance with those critiquing. It falls to reason that anything that informs the design, to be successful, should also have this

thoroughness and strength of argument. As shown by the CSIRO example it is not just about having the technical expertise and rigour; there also needs to be an element of appropriate communication.

Critique is also used in other disciplines, for example when publishing papers in a journal; my point is more that in architecture it is central to learning process. Particularly in the developmental years of higher education where the student is moulded, architecture degrees for the most choose critique as the central form of assessment.

As I worked with the designers and engineers on the Civic Centre project I started to realise that the impediments to the integration of 'green' innovation were similar to those which I had encountered in my previous career in cleaner production and quality management. That was that a champion or central facilitator was crucial to the integration of the new information. Coming to realise the complexity of the building design and construction processes and already knowing the complexity of 'green' innovation, I started to explore the idea of a practice of facilitation rather than the development of more tools and information. Research in the design and construction industry supports this view: *'[t]his study found that for innovation to be successful, a champion is needed to lead a task force or working group at the initiation and implementation stages'* (Ling, 2003).

4.3.2 Reflection on the research journey – in the field

The main evolution in the research and research method in this phase of the project was the suggestion by Nita Cherry (a mentor to this research in the area of reflective practice) to use vignettes, to pick interesting phenomena that occurred during the research and to write a short 4 to 5 page story on what happened.

Week 39 – ... the best part of the day through was when I met Nita Cherry. She is just fab. We talked about my project and I felt I often talked too much, and she gave me some wonderful ideas and feedback. ...what I am doing is participatory observation drawing from aspects of action research where they enrich the data collection. She suggested a few things I will take up to ensure my data collection becomes richer. The first is to write stories of meaningful experiences 4-5 pages description of he did, she did, I said etc. then reflect on this. They're then bundled and sent to my collaborative team to also look at and give me feedback on.

Excerpt 43 – Journal summary 2000_2 – text units 641-651

It was through this meeting that I began to write vignettes. These have become a central part of the reflection process used in this thesis. Further, I took areas of interest and conflict in my research and tried to reflect and express them in conference papers. I found both of these reflective practices very valuable.

4.4 Summary

This year began with a short ten week project with an architectural firm looking at feeding 'green' innovation information into the design process. The information they required did not match their design progress and so the ten weeks grew to four months after which I was given the opportunity of working with the clients for the rest of the year. Deciding to take the opportunity to follow the integration of the 'green' innovation through the process resulted in a change of the research method from six short case studies to one central case study.

The questions driving the research were focused on the provision of the right information to the right person at the right time. I had moved from asking broad questions trying to understand design and sustainability in the built environment to investigating how to inform the design with suitable information on 'green' innovation. I had also moved from just engaging with the architectural discourse to interacting with all the agents involved in the built environment project. The questions and answers at this stage were as follows:

What 'green' information is relevant in design?

To answer this questions, I realised, that I needed to understand the design process. The relevant information at the concept design stage is general, conceptual and centred on where to place the building and what type of building it will be. It is then that the philosophy of the building needs to be resolved and the project team needs to decide how 'green' the building will be. In the Australian Green Star program they define the various levels of 'greenness' as: 4 stars for industry best practice, 5 stars for Australian excellence and 6 stars recognising international leadership. Reflecting the level of greenness the project team defines the types of 'green' technologies they would like to incorporate, thus information is needed on what is available and the costs and benefits, for example, solar panels, water recycling systems, thermal storage, and

so forth. Materials are thought about at this stage but only to the level that they reflect the type of building: heavy or light, high thermal mass, modern, high climatic control, and so forth. Also at this stage the functions and the initial designation of the spaces occur. It is critical to match the building type to the climatic opportunities and to have the building philosophy resolved.

Once the form, function and philosophy have been determined then the detailed design phase begins. The drawings become more detailed, the design is locked into place, engineering consultants are brought onto the project to advise on specialist systems and the materials used in the building are chosen. The 'green' information pertinent at this point are the material guidelines with samples, guidelines on the 'green' intentions of the building, detailed information on 'green' technologies and workshops to ensure optimal solutions with minimal conflict are being designed. Thermal modelling ensures that the optimal use of building design, orientation, materials, use of natural air and heating and cooling systems sits between the concept design and detailed design stages. To be useful and accurate, thermal modelling needs to have information from the detailed design stage on materials, window heights, sizes, occupancy, heating and cooling systems and, from the concept design stage of orientation, room sizes, ceiling heights, and so forth. Results of the modelling should involve the design team and the mechanical systems design team to ensure, given the assumptions of use, performance is as modelled.

Part of detailed design is the documentation phase. I pull this out separately because the type of 'green' information needed at this point is very different to the detailed decision making on materials and expert systems. The main part of the documentation stage is the development of the drawing and the specifications, which outline exactly how the building is to be built. All 'green' initiatives need to be drawn into the plans and written up as specific clauses in the specifications. Specifications are legal documents setting out to the subcontractors exactly what is to be done and what materials to use. Based on these documents subcontractors tender on the project. The level of detail is very important, from general clauses on what the project is about, saving energy, water and minimising waste to specifically naming products that can and cannot be used.

Each level of information described above is dependent on the previous, for example, if one of the aims is to avoid chlorinated products the impact is that in the detailed design stage alternatives to chlorinated products are identified, any resulting design changes made and the alternatives are specified in the documentation stage.

What ‘green’ information is relevant to other agents engaged in built environment projects?

Broadening the discussion above, this question guided the research to look at what ‘green’ innovation information is relevant to the other agents in the built environment: the engineers, the planners, the regulators, the users, the community, the clients and the modellers.

Agents	‘Green’ information needs
Engineers	Targets, understanding of the philosophy of the project, collaboration with other engineers, interaction with modellers
Modellers	Building design and orientation, room sizes, occupancy, window types and sizes, materials – insulation, walls, roof, etc., heating and cooling systems
Planners	How buildings meet regulations and ‘green’ innovation does not pose any local risks
Regulators	How ‘green’ innovation does not pose any risks
Users	‘Green’ innovations planned for the building and opportunity to discuss them
Community	‘Green’ innovations planned for the building and opportunity to discuss them
Clients	‘Green’ innovations planned for the building and the cost and benefits of each

How do I present this information usefully?

I trialled many different types of information deliveries while on this project. The most successful with the architects in the concept design stage were the exploratory workshops with a respected expert. For the clients at this stage the information needed to simply state the costs and benefits of each of the ‘green’ innovation options at a financial, environmental and social level. For the community and building users the information was presented in a slightly inspiring educational format—showing how many swimming pools of water could be saved, for example.

In the detailed design stage useful information was in the format of samples and manufacturer information, providing specifications and clearly stating the intentions of the ‘green’ innovation without making it sound difficult. The crucial part of detailed

design, in my experience, was to work closely with the specialist engineers to ensure that the best possible solutions are found for minimising the operational impact of the building. Targets are useful here but, as with checklists, they can limit innovation; the workshops described above provide a supplementary process for allowing innovation beyond the basic targets.

In developing the specifications there were several lessons, some of which will be reflected on in greater detail in the next chapter. Particularly at this stage my feeling is that the level of detail, which needs to go into the specification to try to ensure that every question is answered and every eventuality covered, makes for an indigestible and very, very long document.

I believe the above shows what the Dreyfus brothers describe as when '*the novice gains experience coping with real situations*', the advanced beginner learns to react to real situations, within specific contexts. In my reflection I describe this stage as showing a shift from the **shy observer** to the **observer/tentative practitioner**, signified primarily by consciously starting to respond to the practice needs of the agents I interacted with. This occurred through the application of observation techniques and the lessons learned from the experience of the design context, and resulted in my being tentative in the putting forward of 'green' innovation into the process, and again observing its impact.

These experiences—that one did not need to know everything, just facilitate the knowledge transfer and that it centred on the need to speak the right language—were the milestones that facilitated the transition from the **shy observer** to an **observer/tentative practitioner**.

⑤ Stages 3 and 4: Competence and proficiency

5.1 Introduction – the trouble-making greenie

In 2001 I worked for the council until September, averaging one and half days a week. This included working with the builders on site. I also extended my practice and began to work on other building projects outside the scope of the research. This practice grew as I was encouraged to set up the Sustainable Building Program at the end of 2001. The pressure of this new responsibility, in addition to the fact that the Civic Centre would not be complete until 2003, meant I took 2002 off from the research as it stood at that time. This chapter will briefly describe the main experiences of working on the Civic Centre project with the builders and the subcontractors; it also reflects on the other projects I worked on, teasing out how I had started to apply the lessons of the previous year into a growing practice. The main lessons of 2000 were: design is chaotic and intense; critique is central to design advancement; there is a large number of professions who participate in the design phase; there are distinct phases in design such as concept, detail, etc. and these all use different levels of information; competing demands influence when and how 'green' innovation can be integrated; and there are significant conflicts between some of the 'green' innovation tools and the design process.

The main methods for communication of 'green' innovation were:

- at the concept design stage: workshops, site visits and general information
- at the detailed design stage: material details – samples, costs manufacturers, technical details, briefs and targets for specialists engineering consultants, workshops with all consultants
- at the documentation stage: specific clauses and written detail outlining 'green' innovation, plans for technology and systems, legal contractual project delivery structure
- to the clients: cost benefits, social and environmental benefits, simple power points and explanations of the 'green' innovation

- to the building users: simple depiction of the costs and benefits, simple understanding of 'green' innovation

In relaying some of the lessons of 2001 and 2002, this chapter will outline a shift from the advanced beginner through 'competence' to 'proficiency' as defined by Dreyfus and Dreyfus. In my own words I described my growth as a shift from an **observer/tentative practitioner** to a **participator practitioner**, moving mainly from observation and reaction to more proactive action. This transition occurred with conflict and frustration, no longer frustration of not being taken seriously, but frustration of not being expert enough.

At the 'competence' stage Dreyfus and Dreyfus (1990:241) describe the practitioner as *'increasing experience, the number of features and aspects to be taken into account becomes overwhelming...this [stage] is frustrating'*.

5.2 The practice journey

When working with the local council, I was allocated a desk next to the project manager, Sandra, and supported her as much as possible in the communication of the Civic Centre initiatives. While working with Sandra, I began to understand the importance of the community to both the project and the council. I always knew they were closely interconnected and dependent, but I knew it in an unconscious, 'never thought about it' kind of way. I became aware how central the community is to all council decisions and therefore of the importance of clearly communicating to them exactly what was happening.

The community and traders had been consulted on the design of the Civic Centre, and now needed to be informed of the results of the consultation and given information on the project and timelines. As the old building was being demolished before construction of the new building, communication of the timelines, new facilities and alternative arrangements was crucial. There was one brochure developed during this period, and a website was set up to provide both background and logistical information. The brochure had information describing the project, its intent and who would be working on the project—the architects, engineers and construction managers.

At the end of 2000 the construction managers were selected. Previously, in discussions between the architect and the client, it had been decided to pursue the construction

management model because of the control the architect and the client could have on costs, quality and innovation. It was argued that since this project had a number of innovative elements it was important to have as much control as possible over the project. Requests for expressions of interest were placed in the media. Replies were processed, a short list was compiled, and those who put in a tender were interviewed.

The process for selecting the construction management company was very interesting. Though there were processes in place to check references and viability, and a rigorous set of questions on all aspects was required by the local council, the final decision seemed to be centred around a positive rapport. Once all the questions had been answered, all the requirements met and the level of professionalism assured it seemed to be determined by well the construction management team and the design team 'clicked'.

Having chosen the construction management team the next task was to finalise the contract and fees. This was a heart breaking process as some of the design and proposed 'green' innovations were lost. The excerpt below illustrates the process and my reaction to it.

Week 60 – quantity surveyor doesn't have allowance for 'green'...We are at the point there $1/2$ mil needs to be cut out of the budget to bring it down to 3.8 milSo at the meeting on the 28th...it was decided to remove the basement and water treatment systems. It was all very sad, but realistic and I must say I am relieved I always thought the water treatment was the most risky of endeavours.

Week 62 – ... The main change which I hope will be confirmed today is that the water treatment is going, this may or may not mean that the basement is going also, and I hope this means that the rainwater will stay anyway. It is very sad, really, such a waste of effort, all that time spend designing things which in the end don't get included. There must be an easier way to design and build a building! The next meeting was with the quantity surveyor about the budget. This went heartbreakingly smoothly

Excerpt 44 – Journal summary 2001 – text units 212, 231-239, 272-280 and 336-341

I learned several lessons through the above experience. The first was that, of all the crucial agents involved in the building industry, the quantity surveyor seemed to have the ultimate power, because they were able to cost all the options in a project, providing a decision making framework for the clients. Cost being the best understood language of decision making, the quantity surveyor has significant power to influence the 'green' innovations of a project. Yet the quantity surveyor had no structure for costing the 'green' innovation, implying that there was more risk associated with

integrating the 'green' initiatives! This is probably part of the reason for the perception that 'green' costs more (Davis, 2001; Landman, 1999; Owen, 2003; Rao and Brownhill, 2001; Thung, 1998). It is an easy excuse to make if there is uncertainty and greater perceived risk. My response is that, for future projects, I have teamed up with a 'green' quantity surveyor. Depending on the project he either becomes part of the team or if there is a quantity surveyor already appointed I organise a workshop between the two.

The second lesson was, as I wrote in my journal, the 'heartbreakingly smooth' process the quantity surveyor facilitated. Eighteen months of design, development, documentation and consultation were discounted in one meeting. The process was fairly logical, the questions asked were: where is the greatest cost for the least benefit, and where is the greatest risk? The main answers pointed to the black and grey water recycling system and the basement. This initiative was not the only victim; a whole list of building elements was removed in this meeting to bring the costs back to an acceptable level for the council. To come back to the lessons, it taught me firstly the need to have strong arguments for those elements you feel are crucial in the face of the added risk of 'green' initiatives; and secondly the need for clearer decisions on costs before putting in so much design time. The problem with this last lesson, as I reflected on it, was that it posed the chicken and egg question: you want to limit design development by influencing it with cost directions but how can you cost before design is developed, and does this also represent wasted effort? I believe this will always remain difficult but at least a quantity surveyor could be involved earlier so as to advise on cost repercussions of various initiatives.

As you can see from my journal extract I was relieved that of the 'green' initiatives the one that was removed was the black and grey water treatment system. I believed that this had the greatest risk. From the very beginning I advised that this was the initiative needing the most consideration (see Table 9).

Table 9 – Excerpt from the cost benefits workshop held early in 2000

Initiative	Upfront cost – material	Upfront cost – labour	Operational savings	Env. saving	Cost/ benefit	Comment
Black water recycling	Significant cost +3	Significant cost +3	Minor saving –1	Minor saving but good demonstration of commitment –1	Cost +5 Env. –1 Social ☹☹☹	Social issues and the Civic Centre will not produce significant amounts of black water

In retrospect, as we are going through a drought, it could have been an excellent leading edge initiative. But, as the aim of the project was to demonstrate and influence the community, the move away from a grey and black water treatment system seems justified. Justified because of the implications of demonstrating the technology; it would, if taken up by residents, not lead to an environmental gain. That is, a centralised black and grey water system such as our sewerage farms is a more effective way of dealing with black and grey water than each household dealing with its own, essentially because of the high maintenance and control required by the system, potential consequences to health of a poorly maintained system and the material intensity of individual treatment systems.

In my current practice this experience has taught me to present the facts on grey and black water recycling more strongly from the beginning and also to present the option of separating the two. Research has shown that there are benefits if you separate the grey water (showers, baths, washing machines and bathroom/laundry sinks) and black water (toilet, kitchen sink and dishwashers). Grey water on its own needs less intensive treatment therefore costing less and also posing fewer risks. Grey water is typically used for garden irrigation and toilet flushing. For buildings such as the Civic Centre or other commercial buildings the amount of grey water is negligible compared to the sewage and therefore such a system is not recommended. Meanwhile for households grey water can make up 50 per cent of the water disposed off and therefore offers an alternative to using potable water.

In conjunction with the quantity surveyor, the construction managers, the engineers and the architects, the designs were finalised. The first task for the construction managers was to begin to tender for all the jobs that needed to be carried out on site. Demolition was tendered quickly and efficiently. The construction managers were sceptical that the demolishers could achieve the 90 per cent recycling targets we had set. Colin, the construction manager, made comments such as:

Week 56 – “Don’t invite options – just tell them what you have to do –[Colin]
...Colin on demolishers “they just do what they have to do to get by”
...Colin stressed that we should not give the subcontractors options just tell them what they have to do and encourage any ideas over and above this.
... I showed him the EcoRecycle guide to demolition he at first said that you want to keep the amount of reading to a minimum and then went on to look at the book and say it looked ok with its catchy cartoons and simple text. But reiterated that they will barely read anything and are even less likely to fill anything else in – or even to do how we want it demolished and recycled and then check on them or it won’t get done.

Excerpt 45 – Journal summary 2001– text units 43, 47, 54-55, 78-84

This clearly shows his opinion of the subcontractors. He had very little respect for their ability to understand, contribute to the process or make decisions. There are several reasons for this, not all of which are related to respect, though they can be interpreted this way. A construction project is complicated and by specifying EXACTLY what people can and cannot do, you are reducing the risk of things not going to plan. The problem, though, is that in complicated projects it is impossible to plan everything. By taking away individuals' need to make decisions you remove their initiative to solve problems. Thus, if the unexpected occurs, they will wait for the project manager or another person with authority to make the decision, delaying the project. The consequent problem is that this takes away all sense of ownership from the contractor: why should he/she care or make suggestions? It is well known that it is often the person on the ground, the tradesperson, who has the most innovative logical insights into improvement but, without impetus to put these ideas forward, why should they?

The above excerpt also shows how little understanding there was of the demolition 'green' initiatives we had developed and written in the specifications (see excerpt from the specification below).

'green' initiatives in demolition

Environmental issues

Retain excavated earth for on site use, where possible.

Implement waste minimization strategies.

Monitor volumes of material excavated, demolished, disposed of and reused. Provide a written report to the superintendent.

Demolished materials

Ownership: Ownership of demolished materials is described in the **Demolished materials classes table**.

In accordance with the Waste Wise Program for Demolishers and Builders, demolition waste is to be kept to the absolute minimum.

Waste minimisation targets table

Class	Target
Salvaged for re-use	100% of scheduled items
Demolished for re-use	50-80% of demolished building materials
Salvaged for disposal	90% of remaining building materials
Demolished for removal	Minimum

Re-use: Contractor is encouraged to suggest re-use of demolished building materials on the works. If it is proposed to re-use demolished materials in the works, submit proposals.

Salvage: Recover without damage materials to be salvaged.

Removal: Remove from the site demolished materials which are the property of the contractor.

Arrange for disposal of any salvageable materials for re-use off-site. Do not burn or bury on site.

– Transit: Prevent spillage of demolished materials in transit.

Demolished materials classes table

Class	Ownership
Salvaged for re-use	Proprietor
Salvaged for disposal	Contractor
Demolished for re-use	Contractor
Demolished for removal	Contractor

Salvaged materials (for re-use in this contract) schedule

Item	Location for re-use	Disposition
Brickwork	Aggregate for concrete paving to south carpark	Crushed off-site and returned to site for re-use
Concrete	Aggregate for new concrete	Crushed off-site and returned to site for re-use

Excerpt 46 – Excerpt from 07 Demolition Specification

The subcontractors awarded the demolition tender were the only group that came in on time, on budget, met and exceeded their green targets. Colin was treating the demolition company as he did all the contractors, not realising that the industry had progressed significantly. They understood how to implement and manage the ‘green’ initiatives, understood the value of recycling, had the mechanisms in place to facilitate it and thus achieved a 94 per cent reuse and recycling rate.

This experience taught me that it was possible to implement the ‘green’ initiatives within a fairly traditional building and construction industry. The drivers for change were support from specialists, the government funded body called EcoRecycle, increased landfill costs and the development of markets for the materials coming out of the site. It is interesting to reflect that the rest of the project only managed to reach a 45 per cent recycling rate (discussed below). Briefly, this was because the management of the site had other priorities. Further, the demolition company was the only contractor responsible for the costs of their own waste, while the rest of the project involved 20 or more separate contractors who did not need to carry the cost

of the waste disposal. Moreover, while the individual contractors did not receive the support of the specialist, she did work with Colin to set up systems for the construction phase of the project. Unfortunately he left the project after several months.

5.2.1 Problems getting enough expressions of interest

Getting interest from the other trades was more problematic. A request for expressions of interest was put into the media. The excerpts below show the problems that were experienced:

Week 56 – It was agreed that the Expression advertisements include environmentally descriptive words such as 'green' and such like.

Week 60 – Expression of interest gone out on the weekend – not many calls...Out of the [ordinary requirement] like environment ... will make a difference in prices.

Week 62 – ...One thing I'd like to spend some time on here is the fact that we are not getting as many Expressions of Interest as you would expect on a job. I think this is partly because 'green' was emphasized so strongly. I am in two minds about this, firstly it prepares people for the level of commitment we expect but on the other hand it could scare those who have worked on similar projects because it seems too much. At the end of the day we want 'green' issues to be as run of the mill as ramps, no asbestos, etc.

Week 63 – ...Tendering – could be the \$50 [fee for sending the tender documentation] – hurdle to getting people interested

Week 65 – Site meeting...not enough EOIs...Environmental [emphasis] is frightening [them away]

Week 66 – ...Still having problems with not enough EOIs and the potential that the prices will be really high because they are so few interested parties.

Week 67 – ...Whilst the second last Expression of Interest documentation closed last Thursday, the responses continue to be poor. By way of paltry consolation, CM company, who are currently tendering quite a body of work are, too, experiencing great difficulty in obtaining prices and, in some cases, interest.

Week 82 – [review of tender problems carried out by project group] Tender problems:

- late entries
- having to go with the only one
- none in some areas
- over QS
- ...
- misunderstanding what is involved
- pressures of time and money
- levels of commitment

Excerpt 47 – Journal summary 2001 – text units 195-6, 206-7, 210-11, 424,428-435, 669-678, 691-703, 837-848

There was below average, in some cases, no, response. Why? The Civic Centre project team reviewed the poor performance with an aim to identify what had gone wrong. There were three factors at play. The first was that we were in a boom construction period and this was a fairly small project, so a slump may have overcome some of these problems. The second was that there was a fifty dollar fee to receive the project documentation. Finally, and the foremost lesson from this experience for me, was that we made the project sound too daunting, too ‘green’. This project was perceived as too different, too ‘green’ because the Civic Centre team had decided to emphasise the leading edge ‘greenness’ of the project. The advertisement for expressions of interest, which was fairly small, had mentioned the work ‘green’ six times. Thus, a buoyant industry, a fee just to receive the documentation and an overemphasis on ‘green’ innovation, resulted in the low response.

As you can see from text units 428-435 (week 62) I spent some time reflecting on the over emphasis of the ‘greenness’ of the project. My current theory-in-action is that this was a contributing factor to the low response rate and that the ‘green’ component should have been mentioned but not to the exclusion of other normal details. It should have formed part of the process and not been singled out immediately raising, dare I say it, a ‘green’ flag in the contractors mind. Further, given the nature of the market at that time, adding hurdles such as the fee for the documentation, though discouraging wastage, just made it all seem ‘too hard’.

For those companies putting in an expression of interest, Colin made an initiative aimed at ensuring that all contractors were familiar with the site, the documentation and the project requirements. He called these pre-tender inductions. All companies expressing interest were invited to a site visit and run-through of the relevant documentation before tendering.

Yet, when the tenders were received it was that they had not read the documentation properly and were still completely confused about the ‘green’ innovation components. There were two responses: the contractor ignored the ‘green’ innovation or they put in a price that was much higher than expected. The pre-tender inductions, though a good idea, did not work. Firstly, it was going to be compulsory for all contractors to attend pre-tender inductions to tender on the project, but when this resulted in several interested subcontractors leaving the process it became voluntary and therefore

poorly attended. Secondly, and this could be the topic of an entire thesis, the tender process does not support innovation, in-depth or realistic responses to the documentation. I will discuss this in greater detail below.

Briefly, when tendering for a project, usually between four and ten companies compete. That is, for the majority of those competing all time and effort put in to attend pre-tender inductions, reading specifications, interpreting drawings, dealing with innovation and writing proposals is wasted. Therefore, to develop a proposal the contractor needs to weigh up the project and the amount of time he or she can afford to spend writing it. The more complex and time consuming the process the less incentive there is to apply, especially in a market where there is plenty of easier work. Further, if they do decide to apply they organise it so that a minimum of effort is spent on preparing the tender, which leads to using parts from previous applications and a skimming through but not necessarily reading of the full documentation. I witnessed this in the applications we received:

Week 59 – Had a meeting with John from the CM yesterday afternoon and it was very interesting – of all] the EOI's only one had any mention of the 'green' issues we (I) expected they only mentioned it in connection with dust, etc.

Week 83 – All tenderers (react to the 'green' stuff with) 'shock horror' but (once you go through it with them) in nitty gritty ... [they] see it is ok

Excerpt 48 – Journal summary 2001 – text units 542-546 and 864-865

In the end it came down to negotiating with the winning contractors that they include the 'green' initiatives and clarifying any misunderstandings. For example with the concreter:

Week 82 – Bob the concreter [was] totally confused about the tender documents, this resulted in him adding things not necessary. Questions he asked:

- slag content? Where?
- Recycled aggregate?
- What to do about spoil?

Week 89 – ...a lot of misconceptions – like the concreter – price dropped once we talked to them and they go 'ok' how about doing it like this or using that...

Excerpt 49 – Journal summary 2001 – text units 851-856 and 980-981

Many problems could have been avoided if the tender documentation and specifications had been read thoroughly. This is not unusual; most people would say this is their

experience no matter what field they are in. For example, the high slag content cement, which caused so much confusion for the concreter, was specified by name in the documentation and is in fact a standard product. On reflection, this process of tendering for contractors is not efficient. It wastes the time of most them, and those who are successful have in most cases won because of the lowest cost of their proposal. It was only once they were selected, in the process of contract negotiation, that the rest of the requirements were negotiated.

Separately, from the lack of comprehension of the 'green' documentation, there was also a number of myths surrounding some of the 'green' innovation. This was my first encounter of resistance through misinformation. Often you cannot pinpoint the origin of these myths, but since they are mostly used as excuses or reasons why something cannot be implemented, you can hazard a guess as to how they evolved. For example, on inspection of the recently poured concrete, the structural engineer reported bleeding (discharge of liquid from the setting concrete). The first excuse given was that it was due to the recycled aggregate being used in the concrete, the next was that it was obviously due to the high slag and fly ash content of the concrete, but finally it was determined it was just a common problem related to poor pouring practice.

I call these myths 'furphies' and, as my practice evolved, combating these little stories became one of the keys to success. I use the word furphy because it makes it sound like a silly little story not to be taken seriously; it is less confronting than using the words 'lie' or 'deception'. It is an Australian word derived from World War I and is defined as:

***furphy** n.(pl. **furphies**) 1 a false report or rumour. 2 an absurd story. •adj.(**furphier, furphiest**) absurdly false, unbelievable: that's the furphiest bit of news I ever heard (Ludowyk and Moore, 1996, The Australian Oxford Paperback Dictionary)*

Closely aligned with the furphy barrier was that the 'green' initiatives being were the scapegoat for other problems in the project. This made me both angry and sad. The 'green' initiatives in the project did add to the cost, but for the most they were clearly defined costs that were signed off as an integral part of the project from the beginning, two examples being the solar panels and the rainwater tank. In this project many other

factors added to the cost of the building and had nothing to do with the 'green' initiatives. These factors are common in the building industry—delays, rain, material shortages, union problems, site conflicts, permit delays, utility delays, general industry attitude, contractor drawing conflicts, etc.

5.2.2 Tender evaluation

Once the tender applications were received it was time for their evaluation. Again a wonderful opportunity, I was allowed to experience the process, the decision and tools used in choosing one contractor over another. From the excerpt below you can see that the method used to evaluate tenders was a quantitative scoring system where points were allocated according to performance and the application. An environmental component, a 'green' schedule, was added but only became 5 per cent of the total score. Considering the emphasis on 'green' innovation in the call for expressions of interest and in the documentation this seemed disproportionate to me, but I was content to be able to observe how it functioned and also to see that it was at least considered.

Week 67 – ... John suggested that the 60% Price Attribute Weighting(s) be adjusted to take into consideration the Schedule 7 which deals with the Environmental concerns. All agreed. This will be done by reducing the Price, alone, component from 40% down to 35% which allows a 5% Weighting for Environmental, scored against that Schedule, whilst keeping the total attribute at the 60% Weighting level.

Excerpt 50 – Journal summary 2001– text units 691-698

I was able to develop and test the Schedule 7 (see Appendix 2) which was an interesting exercise, in that basically it was ignored. In retrospect for an industry that was just starting to become aware of 'green' issues, other than dust and noise, this schedule must have seemed, and was treated as, unnecessary and irrelevant.

5.2.3 Buildability

Though I was only spending a little time each month on this project at this stage I was learning constantly. One of the main lessons was buildability. I had not encountered the word buildability before engaging in this project. I had never thought about buildings needing to be designed in a manner that ensured they stood up. In addition to standing up I learned that there were ways to make them simpler to build. This Civic

Centre was intricately designed. The second construction manager, Ben, lamented at this fact, complaining bitterly how it would have been much simpler to build as three buildings, rather than an interconnected, cantilevered complex structure.

Week 59 – [Colin] buildability – normally at the start of the design – too late now

Week 60 – [Colin] “not an efficient building” (this related to the design and buildability not energy and water)

Week 95 – Henry said part of his job was to look at the design for savings but referring to the impossibility of having an impact at this stage he said : “after the horse is bolted” - referring to the [stage of the design and] unbuildability of the building ... in regards to the steel shop drawings “there is no a lot of buildability built into the drawings” Ben

Week 99 – Chat with Ben – pre the meeting “the problem with the buildability the cost in time and money are due to the inaccuracy of the design and the complexity of the elements: e.g. very difficult to get exact measurements of the concrete perimeter; eg see steel drawings brought up a great deal of anomalies – have to wait for Bricks, then concrete then etc – so will cost 4 weeks instead of 1 for lift shaft”

Excerpt 51 – Journal summary 2001 – text units 154,167, 206, 221, 222, 1152, 1158, 1159, 1175, 1176, 1222-1229

This added to the cost and time overruns from the beginning. It also showed the value of inviting the construction company to be part of the process from the beginning. There are logistical reasons why this is not currently done; the model under which this project was built required an extensive design and development period before construction was approved and so this would have wasted the time of the builder to get him working on the project at the initial stages. Still, one workshop with the structural engineer, the architects and ‘a’ builder would have had a big influence in maximising its practical buildability (Gil *et al.*, 2000; Gray and Flanagan, 1989; Riley *et al.*, 2004).

Buildability is such a strong determinant in the final cost and resource requirements of a project that several countries, for example Singapore, have buildability legislation. It requires all building designs to meet certain requirements to be awarded a permit for construction:

In 2001, we introduced the buildability legislation to promote the use of buildable design and new construction technologies. All new building projects with gross floor area of over 5,000 square metres must meet a minimum buildability requirement. (Speech by Dr Vivian Balakishnan, Minister of State for

National Development & Trade and Industry October 2003, BCA, 2003: paragraph 4)

It is this type of intervention, which my time in the field, showed me to be something designers abhorred. Seeing it as limiting their ability to create and experiment with form and function. As I discussed previously I see the value of checklists, guidelines and requirements but also the need to support design, so I use them as a tool but in my practice plan to approach the problem through a workshop or charrette.

5.2.4. Right information at the right time

The next experience was negative and still bothers me. It involved the mechanical system providers. As discussed previously, the building was designed to be primarily cooled by evaporative cooling, with only a small area cooled by refrigerant systems. The cooling systems dump their water every time they are switched on. The contractors made many suggestions including installing timers to reduce the amount of water lost. These timers came at a small cost. The project team wanted some quantification on the volume of water that the timers would save. The mechanical engineering consultants advised that the amount of water that would be saved was not significant and thus the additional cost not justifiable. The contractors were very disappointed at this response since the cost was only minimal and, after all, 'Isn't this supposed to be a 'green' project?' (quote from contractor). They had really done their best to put forward good ideas but the system to recognise and reward this was not in place.

Week 89 – Mechanical – 160 litre water dump every time the evaporative air conditioner is switched on or off – how many times would this occur – i.e. turn on and off? Can you adjust the bleed (not in notes – from memory – the mechanical people suggested a special timer etc device to save the water but could not quantify the water savings and at an extra cost of \$1,500 this was not accepted. They were very disappointed at this as they thought it was a great idea, their input and ownership of the project went down after this – in my eyes)

Week 91 – Hydraulic and mechanical consultants don't think the timer for the evaporative cooling will save water ... The mechanical suppliers submitted an alternative to install a timer to each evaporative cooler dump valve system to save water, at an additional cost. Council have decided to go with what is designed, following advice from the Consultant.

Excerpt 52 – Journal summary 2001 – text units 992-1029

Why was the project manager so quick to dismiss this suggestion in a way that made the contractors feel unappreciated? Unfortunately the contractors could not clearly present the case for the timers. What was needed was a clear statement on how much water was currently being lost and how much would be lost with the new system, succinctly with the financial cost and savings.

Since this information was not present from the beginning the project team turned to the consulting engineers, whose correspondence shows that they did not feel that there would be significant savings. Their expert opinion combined with the extra cost was what determined the final decision. But at this stage, even if the idea were not to be embraced, there needed to be some recognition of the initiative made by the mechanical contractors. I believe this is what I feel the most disappointed about, the fact that the way the project was structured and how this decision was made squashed their enthusiasm and initiative.

The lessons I take from this are firstly to have some real tangible rewards for initiative and secondly when making arguments for additional or new technology ensure that the facts are all simply presented, right from the start.

5.2.5 Demarcation issues between existing trades and ‘green’ technologies

One of the other interesting onsite experiences I had with the contractors was between the old trade electricians and the new trade of solar installers. The solar panels were purchased as a separate package, as it was a mechanical system with a completely separate installation, warranty and contract to the electrical trades. But at one point the two must meet: the solar energy needs to come to the electrical box to be distributed to the building and the grid. It took nearly three months and countless meetings to be able to sort this out. No one wanted to be responsible to the connection, it was neither of their jobs.



Figure 29 – inverters converting the solar energy to compatible energy to be used in the building and exported to the grid

The onsite stories

There were two new experiences that I needed to learn to deal with and incorporate into my practice while on site: the first was being one of the only females on site, the second was the derisive attitude of some of the subcontractors.

I have never felt intimidated as a female; I have felt intimidated due to a lack of knowledge or expertise, but never because I was a woman. The initial project team was made up of the two project architects, principal architect, construction manager, site manager and foreman. These were all men. The only other female was the council project manager. I had not really noticed any bias though, attributing it all to be being the greenie trouble maker and not to being female. It was not until Sandra pointed it out to me on the drive back to the office after a particular incident that I realised that there was some sexism involved.

Week 62 – ... I met Colin easily and we had a chat, we had the 1st meeting with the police – 5 of them turned up. Sandra and I were the only females, and to be honest on reflection I don't think I would get a word in if Sandra wasn't there. I hadn't thought about that till just now...it popped into my mind because on the drive back to the office Sandra commented on the gender imbalance.

Week 63 – A good meeting I think, except I very much feel that I am being ignored – mind you if I really have something to say I will. But it is also a lack of respect, I think. This is a problem – with the material I have been reading I should be able to work out how to deal with it. Some specific examples are that I asked Colin to bring along relevant bits of the EOI, he said yes the 1st time, yes the second time, the third he said Peter [project administrator] had a copy and then when I asked Peter he said no he didn't and then Peter said '*no Dominique wants the EOIs that have come in*' did it finally click ..he answered that '*oh there's too much of that you don't want a copy of all of it – why don't you organise with [the office] to come in a look through it.*' So the previous times he said yes without registering what I said – or – it was that Peter was making the point for me – or – (and this is the worst option) he was just shutting me up and had no intention of sending me anything, believing it would all work out at the meeting when we discussed the options. Sandra picked up on it last time that it was funny working with a group of men.

Excerpt 53 – Journal summary 2001 – text units 319-324 and 505-521

There were no more occasions where I reflected on feeling discriminated against though I was conscious of it from that point on.

The other pertinent site issue, which concerned me far more than the male domination of the project, was the attitude of some of the tradespeople on site. They seemed to really not care I felt 'they did not give a damn'! Hidden in that small sentence was the most significant lesson for 2001. Thus I learnt that it is not only about providing accurate, concise information, the systems, policies and framework for the integration of 'green' innovation. When the participants do not care, do not understand why it is important, even with adequate information all you will be doing is spending your time chasing them with whichever stick you have built into the project.

This realisation had been developing over time, but it was at this time, when I made this reflection, that I changed my approach to the research and my practice. I concluded that people need to want to change; you can force them but that is not change, it is compliance. As many researchers have shown 'green' innovation in the built environment it is about a more cooperative, collaborative process of design, development and construction (for example Boden, 1996; Rohracher, 2001; Hewitt and Wilkinson, 2002) not requiring compliance. Thus, I decided that from this point on I would concentrate on developing tools, systems, guidelines, case studies, the expertise and stories that people could turn to when they choose to want to investigate 'green' alternatives. There was another reason I had to take this stance: it was at this point of the research that I began

to feel the burden of how slowly the move to sustainability was occurring, while the urgency increased. It was incapacitating. For example, books have been written about the need to reduce our impact on the earth by factors of four to ten (Hawken, 1994; Weizsäcker *et al.*, 1997; Hawken *et al.*, 1999; Adams *et al.*, 2001), yet with most of the efficiency measures we are putting into place we are only really achieving around a factor two reduction in impact.

This change did not mean I distanced myself from the research; in fact it became more important to remain involved to continue to see where the path was leading. Over the period of 2001 and partly into 2002 my involvement was reduced to half a day a fortnight, but I continued to experience the integration of the design into the building. The change to such minimal involvement occurred late in 2001 when I was offered a full time position at RMIT University to start up the Sustainable Building Research Program. But before I reflect on the transition from one exploratory project to a broader practice I will take a detour into an area that began to fascinate me as I reflected on what was occurring at the Civic Centre site. It was the role of the various agents, their culture and their power, and its influence on the outcomes. It all started when I reflected on a journal entry from early 2001 (I briefly revisit a couple of entries because of their relevance here):

Week 56 – “Don’t invite options – just tell them what you have to do –[Colin]
 ...Colin on demolishers “they just do what they have to do to get by”
 ...Colin stressed that we should not give the subcontractors options just tell them what they have to do and encourage any ideas over and above this... A very interesting day – I don’t believe how difficult it all seems, and how much double handling there seems to be. Colin was talking about writing up the prelims – I said – “**haven’t the architects already done that**” he said yes they had but he hadn’t had the time to look at them yet. These were the prelims as specified by the council specs and they don’t have any environmental stuff in them at all so he was thinking of putting some kind of general environmental clause at the front – I said “**in the architects prelims there is this clause:**” and showed him – he said “**yes but we need to be more prescriptive – tell them exactly what they must do**”...We seemed to be talking in circles, and doubling up – it is all very scary. Colin said ... “**you have to realize that these guys just want to do the job with the least fuss, time and most cost. They have been doing this for 30 years and won’t want to change.**”

Excerpt 54 – Journal summary 2001– text units 62-77

From the above extract you can clearly see that the construction manager had little faith or trust in the subcontractors. Further, you can also see that he had not thoroughly read the material provided from the architect and did not think that it was

prescriptive enough. I was intrigued by this lack of respect and the power games played. I was interested in exploring how they affected the 'green' outcomes. I found that the agent cultures and power inhibited many of the potential innovation opportunities because they were so narrowly, inwardly, focused that among other things they missed potential synergies. Further, the attitude of control over the subcontractors removed their ability to make their own decisions and use their own judgement, apart from being frustrated that they needed to get approval from the architects for everything; it also led to a loss of ownership and responsibility. Consequently it led to delays, times when work could not progress because approval was needed. This added to frustration and feelings of powerlessness, so the agents involved in the construction of the Civic Centre rebelled by, for example, deliberately not following the site rules on waste separation. It was interesting to see firsthand the personalities and their use of power on the site, and particularly the impact it had on the subcontractors.

5.2.7 Site inductions

The process of disseminating the 'green' initiatives on the project was through site inductions held with all new agents coming to the site. A set of notes was prepared for these inductions; these were as simple as possible discussing only those parts of the project pertinent to the subcontractors. I sat in on one of these inductions. Reflecting on the experience I think I may have made the site foreman nervous and therefore he did not seem as confident of the material. It was also evident that he did not understand the material on the 'green' initiatives.

I decided that in future the induction part of the site management needs to be addressed. This is after all where most of the people who work on the site first come to hear about, and hopefully understand, the 'green' initiatives. This is where their participation and ownership can be fostered. The person holding the inductions needs to understand the initiatives and support them. This was not the case in the Civic Centre project and, I believe, was partly responsible for the poor performance on some of the waste and material minimisation initiatives on site.

Two of the aims of this construction period were to reduce the amount of materials wasted and optimise the amount of materials used. Designated bins were placed around the site for materials that could be recycled, including concrete and masonry,

steel and other metals, plasterboard, cardboard, plastic and timber. Contractors were encouraged to order only the materials they needed with only a five per cent margin. In Australia this margin can be between ten and twenty per cent.

The material that was recycled or diverted from landfill totalled 1239.25 m³ while the material sent to landfill totalled 1577.5 m³. This represents just under 45 per cent diversion from landfill, and this was very disappointing as we had aimed at 70 per cent. The volume of waste was also large and therefore the checks and controls to ensure minimal over ordering were possibly also a little lax.

There were several interesting consequences of keeping records on all the waste leaving the site (Figure 30). The first was the influence of the construction manager and the second the effect of staff turnover.

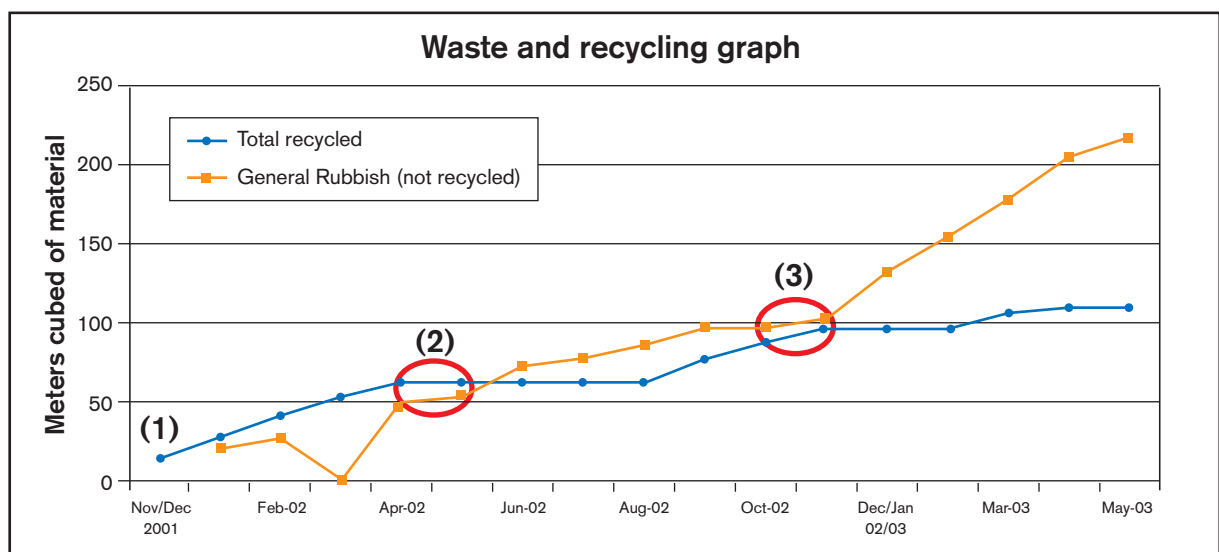


Figure 30 – waste recycling through construction phase

The project was managed at different times by three construction managers. The first was Colin (1), the second Ben (2) and the third Martin (3). Colin was amiable but dictatorial and confrontational. Ben was the friendliest and most participatory manager; he actively worked with the unions, lent a hand on the site and was on good terms with all the contractors. He had a proactive attitude to the management of the site and the waste. Though, taking waste as an indicator, waste did go higher than recycling, but he had just turned this around when he was moved to another project. Martin like Colin also had a very confrontational style of management on top of which

he was very reactive. Once he began, on site waste skyrocketed. The minutes from that period showed that there was constant pressure and reminders to improve performance and that was continually ignored. The excuses given were:

- no room on site
- previous recycler would no longer take the material – e.g. plasterboard
- subcontractors were not cooperating, recycler delayed providing appropriate bins

Nothing can be generalised from this data, but what it taught me and the theory-in-action it helped me to discover was that a participatory, proactive, ‘get in there and get your hands dirty’ approach to site management provided the best results.

The second lesson from the above graph is the impact of staff turnover. When a different construction manager joined the team it took some time for them to become familiar with the project and its requirements. In the case of waste, it can be clearly seen that both the diversion from landfill and the volume of waste increased dramatically as staff changed. I conclude from this is that in projects where there is a level of innovation, from the very initial discussion with the project teams and tenderers, continuity of staff needs to be highlighted. Systems need to be put in place to support the retention of staff and effective handover. That is, there needs to be a better mechanism for ensuring the accountability of the management of the site and better mechanisms to ensure subcontractor cooperation. This could be achieved through:

- stricter contractual agreements
- better education of the management and site workers
- ensuring that there are auditable procedures in place; and, that there is a handover policy for when there are management changes – either personnel or organisational.

5.2.8 Growing beyond the Civic Centre project

Most of 2001 was thus spent on site setting up and evaluating the tenders or with the council participating in various activities in relation to the project. These included the development of brochures, websites, a documentary, and case studies, administering

the two grants we had received and taking the lessons from the Civic Centre to develop generic tools for the council's capital works staff.

At this point I started to extend myself outside the Civic Centre project, starting to take the lessons learned so far, reflecting on them and using them to inform new projects. I helped the council to develop guidelines and procedures for all new and existing capital works—buildings and infrastructure. This required several things to be researched and integrated: policy, guidelines and tools. The policy needed to be developed and integrated into council everyday practice to ensure that 'green' initiatives were considered alongside disability access, cost and so forth. Once the policy was in place the requirements needed to be outlined, for example the policy might stipulate that all buildings meet an energy efficiency rating without giving any guidance on how to meet these. Thus, one of my additional responsibilities while at the council was to support the development of the policy, the guidelines and any supporting tools.

The lesson for my practice, one of many, was that any change to a greener building industry is not just about putting in a policy, or providing the tools, or as I thought at the beginning of my research just providing the right information. I started to see that the industry needs to be seen and understood as a complex system and that any move towards 'green' innovation requires an equally complex support network of 'green' systems. From then on, every project I undertook I approached from the point of view of facilitating a 'greener' outcome by working with and supporting all the agents involved.

At the start of 2001 I was still mainly working on the Civic Centre project and supporting my colleagues at the Centre for Design as a research assistant. I also undertook a five week international trip to discuss my research in America, the United Kingdom and Sweden. I presented five papers during this trip, three of which were exploring the Civic Centre project and the integration of 'green' innovation. I also started to put in proposals for 'green' building projects; the first was with the same council to be the ESD consultant on a different project. I lost the tender to a well known 'green' architect in Melbourne. The second was to be involved in the master planning of a community centre in one of the premier alternative technology and life style facilities and 'green' education precincts, Centre for Education and Research in Environmental Strategies (CERES) in Melbourne. The initial task was to document the

energy efficiency opportunities, the second task to integrate this with the architects and the third to write the case study of the project on completion. This I won with the support of an engineering team responsible for the modelling and energy simulations of the final design. Previously, in 2000, I had won a small project to do a literature review on all the energy efficiency and cost benefit studies done on class 1 buildings (houses) in Australia and was working on a project of a colleague of mine looking at LCA tools and the Australian building industry.

On returning to Australia from my trip I continued to work on the LCA tools and CERES projects. The trip itself did not teach me a great deal other than I was doing something novel and that no other current research was approaching 'green' innovation in the built environment from a 'participatory' action approach.

I will not go into detail on the other projects other than to highlight the main lessons for my practice. The first was that, through the Building LCA tools project, my colleagues and I developed a decision-making framework to try to simplify this very complex area. This became a key part of my future practice—how the information is presented so that people can understand it while simply and quickly accessing exactly what they need at the right time. The decision-making framework asked simple questions that led the user to a suitable solution. For example, if the user only wanted to look at energy efficiency then LCA was not relevant and other tools were suggested; if the user wanted to simply choose the best product this would lead to one set of tools; while if they wanted to carry out a comprehensive analysis, it would lead to another (see excerpt from website below). Though this framework was seen as the most successful part of this specific research project (as it clarified LCA and ensured that the user understood it's relevance to their question) it did not result in a great uptake of LCA, because it allowed most people to understand that LCA was not the tool that could answer their questions.

What decision are you trying to make?

- I want to 'green' my building
- I want help choosing materials
- I would like my building to be energy efficient
- I would like my building to be water efficient
- My main focus is waste minimisation
- What do and don't I do about data
- What tools are most appropriate for my project
- I am interested in optimising Indoor Air Quality

Excerpt 55 – Excerpt from Building LCA decision making tool³³

Apart from the two projects I won, both of which were very small, 2001 was the year for coming second. Over the remainder of the year I put in a further eight proposals, the result being a close second every time. Just writing the tenders and putting the team together for each project was a rewarding learning experience and provided a basis for my practice to build on. I started to realise that I was quite a good networker, a person who could easily chat to people and draw out future collaborative opportunities. This was not a skill I was taught or actively developed but one that developed, in my opinion, through my interest in their experience and how I could learn from them, thus looking for opportunities on how we could collaborate.

Several other main turning points occurred in 2001. In response to a workshop on research potential in our faculty I outlined the gap in support mechanisms for councils who wanted to engage in 'greener' practices. This was based on my experience with the Civic Centre and the various talks I had given. Through this conversation, with the support of my colleagues, the first two-day Greening the Built Environment course was developed. Aimed at supporting local government it attracted the full quota of thirty participants and resulted in a very successful and enjoyable period of learning. Our approach was not to teach the course ourselves but to invite experts in each relevant field in Melbourne to present their stories. The result was a varied experience with practical lessons, case studies and technologies presented by accessible local people. The intent was that, if the course participants wanted to pursue a specific direction in the future, they would have the details of a local expert to call on. Part of the course was also the case study and materials room, which allowed product suppliers, regulatory agencies and case studies to be displayed during the coffee and lunch breaks. The final initiative that was integrated into the course was the invitation of ten of the RMIT postgraduate planning students. Our intention was to add people to the course, to support students interested in 'green' innovation and finally to allow local government representatives and students to network. Feedback from the course was excellent.

All of this was very gratifying, yet the best outcome from the course was that it led to

³³ <http://buildlca.rmit.edu.au> last accessed 11 June 2004

the development of the local government support program. Instigated with two councils who attended, this program provided them with the resources of the RMIT for twelve months for a certain fee. The activities carried out during this time were tailored to the councils' needs, and ranged from workshops with their designers and maintenance staff to the development of policy and planning tools and support on building projects such as the Civic Centre.

The above shows how the lessons learned in the previous chapters were being employed and tested. The first was the course and workshops with local experts telling their stories; the second was the advantage of having physical products and examples to touch and feel; and the third was the provision of flexible learning and advice environments supporting appropriate levels of intervention for different organisations.

As a result of the success of the above in September 2001 I was offered a full time position at the Centre for Design to develop the Sustainable Building Program (SBP). The consequence was that I continued work on the Civic Centre project for only half a day a fortnight on a voluntary basis. One small project that was won after the launch of the SBP was for the Property Council of Australia, the Victorian Chapter. The project was to work with an environmental management company to develop a model Environmental Management System (EMS) for building operation. Similar to the Building LCA project, this resulted in a simple decision making framework that supported any organisation wishing to implement an EMS—ten steps with all the associated prewritten forms, letters and other paper work required to meet international standards³⁴. This project reinforced the lessons learned from the Building LCA project: simplification, preparation and clarity. Further, it brought out another side of my practice that I had not been aware of—I was good at simplifying things and describing them visually, capturing a complex concept simply and clearly. In describing the proposed method for carrying out the Building EMS project I developed the following diagram (Figure 31) describing the four levels of the internet application we were proposing.

34 see <http://www.propertyoz.com.au/vic/EMS/index.htm>

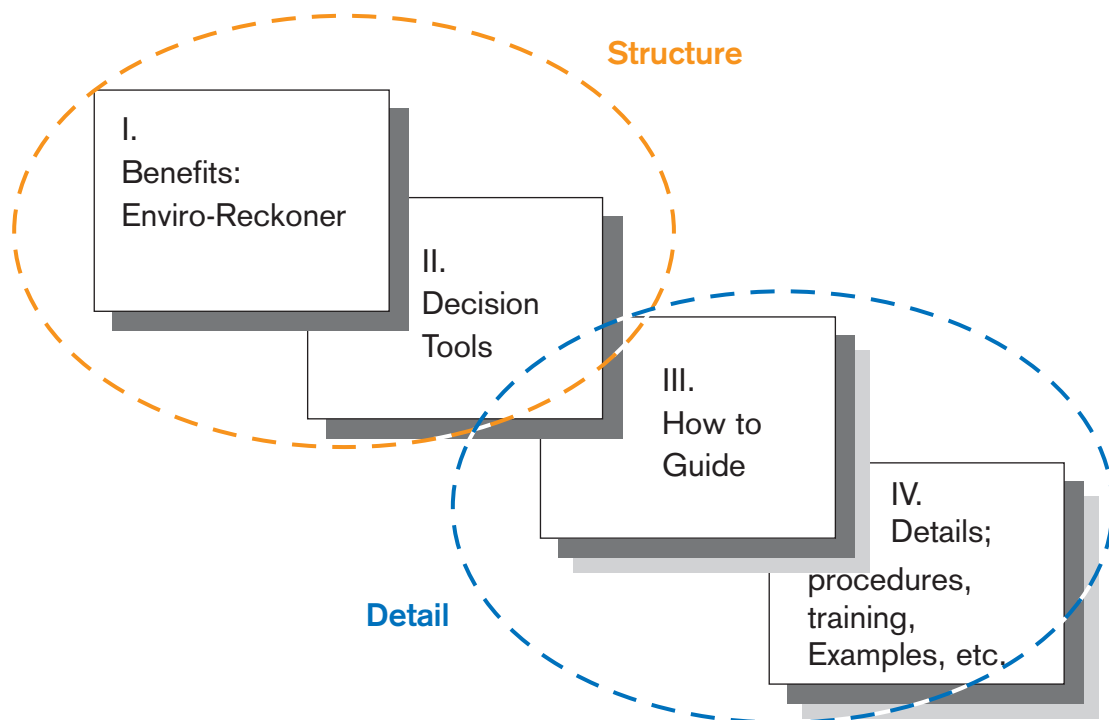


Figure 31 – building EMS diagram

The first layer was the enticer, the page containing the information on why a business should go to the expense and effort to look at an EMS. The second layer contained a straight forward calculator that simply estimated the savings potential both financially and environmentally of implementing an EMS. The third level contained the actual EMS ten step process while the fourth level provided the model documents, proformas and tools. The intention of this method of representation was to isolate the phases of the project and to provide the Property Council with a potential division of the information between members and non-members--levels one and two available to everyone, levels three and four, with most of the detailed information, available to members only.

In conjunction with the project mentioned above I continued to bid for and come second in various tenders for projects. I also continued to develop the vision for the program I was establishing. In October of 2001 I was invited, through a referral, to run several workshops with the Urban and Regional Land Corporation (URLC now VicUrban) on developing a prototype environmentally friendly project home. With the support of the water authority, the builder and VicUrban I developed a research proposal parallel to the workshops. The intention was that if we could work with the builders to build the home it would be beneficial to have a research project to actually assess the performance of the project. From these beginnings it took a further 12

months to develop, entice relevant industry support and win an Australia Research Council grant. I will discuss the repercussions of this project later.

Recapping, at the end of 2001 then I had just started the Sustainable Building Program, I had built a considerable network of experts through the 'green' building courses and the failed tenders and I was starting to initiate and develop a considerable research project. I had moved from the **observer/tentative practitioner** to a **participator practitioner** and had started to become more proficient (Dreyfus and Dreyfus, 1985), moving to a level that I term **tentative practitioner facilitator**.

In this **tentative practitioner facilitator** stage I saw my practice moving from observation and reaction to proactive teaching and facilitation, actively seeing gaps in the knowledge and formulating action to consciously fill these gaps. As discussed above this shift is illustrated as the practice at this stage grew beyond this one project to the Sustainable Building Program at the university, a research program based on industry collaboration, teaching and knowledge development strategies.

I took twelve months off from the research at this stage, waiting for the building to be finished and people to move in. This gave me the opportunity to develop the research program, as part of the SBP, which I saw as separate from the research. At this stage my research was still focused on one case study, one journey and reflection on what 'green' innovation worked and what did not in that one specific case.

So in 2001 I was exploring the answers to the questions:

- What 'green' information is relevant in what stages of a built environment project?
- What if I don't have the information?
- Where do I find the information?
- How do I present this information usefully?

In 2002, in retrospect, the questions were more directed unconsciously at how to develop a successful practice:

- How do I best develop the 'green' information that is missing?
- Why isn't the available 'green' information being implemented?
- How do I support its implementation?

I explored these questions through a series of projects, both consulting and research. Having kept the records of the project outcomes and the relevant field notes I can look back and reflect on this part of the journey.

The most influential practice development occurred in the EcoHome research development. This was my first attempt at building up an academically rigorous research project through the Australian Research Council (ARC) process. There was some pressure from the university to develop such a project but my view was that it provided a mechanism to get the funding and support to carry out the research I had envisaged. I have to admit, at the outset, that while the idea of the project, the partner management and the structure of the research in broad terms were my responsibility, the actual writing of the successful proposal and its academic acceptability was not my only due to my input. I was supported by a very strong and knowledgeable team of colleagues at RMIT University. My main role had been to conceive the project based on the opportunity offered by the VicUrban workshops and the industry partner interest.

My experience thus far had shown me that research in this area needed to be broad, cross-disciplinary and inclusive. It needed to consider not only the social but the environmental aspects of the 'green' debate and integrate results in a format palatable to all agents. It was this thinking that led to the three-tiered research project with inter-linking research in the fields of sociology, technology and design; the latter specifically on agent dissemination of the results. I started to describe this type of project as the 'helix' method of sustainability research. A method developed and define as: a meta-research method that allows for separate research projects to occur in parallel in the same physical space, on the same artefact. Each answering research questions in their own field while collaborating at specific intervals to develop cross disciplinary positions on broader questions. In this case: one project looking at the technical opportunities for 'green' innovation in housing; one project looking at the social acceptance of the same innovation; and a third looking at the housing design industry and how it could utilise this innovation. The aim is that, at the completion of three years of research, the outcomes could be tailored to the industry agents, and that there be a physical artefact which demonstrated the results—so it could be touched, felt, physically sat in and learned from. This project was in development during the whole of 2002.

Meanwhile the 'green' building course was offered again, and was again very successful, leading to further retainer partnerships with councils in Melbourne, these now growing to six. The course was also offered in Sydney with similar success, again using where possible local experts. At this time I also began to teach home builders in Victoria in a program called the Housing Industry Association (HIA) GreenSmart builders program. In teaching this program I noticed that I had made the transition which Dreyfus (Dreyfus and Dreyfus, 1990:242) described from competence to proficiency:

As soon as the competent performer stops reflecting on problematic situations as a detached observer, and stops looking for principles to guide his actions, the gripping, holistic experiences from the competent stage become the basis of the next advance in skill. Having experienced many emotion-laden situations, chosen plans in each, and having obtained vivid, emotional demonstrations of the adequacy or inadequacy of the plan, the performer involved in the world of the skill 'notices', or 'is struck by' a certain plan, goal or perspective. No longer is the spell of involvement broken by detached conscious planning.

Since there are generally far fewer 'ways of seeing' than 'ways of acting', after understanding without conscious effort what is going on, the proficient performer will still have to think about what to do. During this thinking, elements that present themselves as salient are assessed and combined by rule and maxim to produce decisions.

In the course I asked the builders to each bring a current project they were working on for practical sessions in which they practised applying their new skills to their own projects with my support—a fairly normal teaching technique. The interesting part for me, and the thesis, is how easy it was for me to just 'see' the solutions for each builder. They would agonise about how to apply a certain principle and I would be able to sit with them for a few minutes and lead them through the thinking to have it simply and effectively solved. One builder in fact turned around and commented, '*geez you're really good at this, you should set up a company*'. I had got to the point where I no longer had to think about the rules, look up strategies in books, I just 'knew' how all the disparate bits could be combined to solve a problem. Moreover, I could bring the builder along on that journey. Now I am not saying I knew all the answers, I did not, and made it clear to the builders that if I did not know the answer I would find it for

them and show them how to find it at the next lesson.

It was also at one of these courses—I ran four in 2002 with 20-30 builders in each—that two interesting things occurred, one of which changed my practice for ever, the other changed how I looked at the practice.

A few days before one of the courses started I had taken a bus load of university students into the mountains to look at some of the forests that were being clear felled. The disturbing experience was still very raw as I started teaching the builders. As usual, I got everyone to introduce themselves, and one of the last people was a gentleman from the State Government run timber industry association, the Timber Promotion Council (TPC). The teaching was going well, the participants responsive, until I got to the part of the course on choosing materials in 'green' homes. You can see it coming, I started to talk about responsible timber choice and all my anger and sadness about the recent field trip overrode my commonsense and I gave an impassioned (and totally unnecessary) speech about what is currently occurring in our forests. It was not until afterwards I remembered the timber representative and realising what a mistake I had made I went up and spoke to him. In my rant, I did not lie or embellish the truth, I just told the group the facts, but only the facts from one point of view and in graphic, forceful language. As a result, the TPC wrote a letter of complaint and I was called in for a chat. I wrote a letter of apology acknowledging the lack of balance in my speech and the fact that it was not appropriate. Irrespective of the stress of this experience in reflecting on it I came to realise what a position of power I had attained and that I should be much more responsible. In all future courses, lectures and presentations I have tried to present both sides and also be a little less recklessly passionate (on the outside).

Aside from this lesson, I still had to appear in front of the TPC, so I prepared for war, propaganda and accusation. I immersed myself in the topic. On the morning of my meeting the State Government announced its forest logging policies and resulting ban of logging in certain areas. The result of this was that instead of a panel of TPC heavy-weights (they were at an emergency meeting on this much greater threat), I was left with a young gentleman in his late twenties or early thirties. He was petrified. He presented the TPC's view and through his performance I saw that he really believed in what he was saying. He honestly believed that their management of the forests was

for the best interests of the environment and Australia's biodiversity. For every study I had showing how bad the practice of clear felling was, he had one on how good it was. For every study I had on better methods to support a more sustainable management and governance of the forests he had one which showed the economics and why it was not possible to 'harvest' the forest more efficiently. For every economic study I had on the short term gain and long term loss of the current strategy—strategy where the trees are seen as free—he had counter arguments on how the regenerated forests were better than the treeless cow fields that society seems to think were more appropriate. I realised that we were seeing the issue from our own paradigms. This man was not being an environmental bandit, in fact he firmly believed he was part of an organisation that was doing the right thing, in his eyes he was the good guy. He firmly believed in the studies and information his company had developed, just as I believed in the research and studies I had collected. In realising this I just simply humbly apologised for my behaviour in the class, assured him that I would not repeat it and started to question him on TCP's policies, trying to understand his position. This realisation allowed me to start seeing things with greater empathy for the 'other side', which would prove useful in future conflicts. These thoughts and my reactions to them, the change in my attitude and approach all occurred while in the meeting—I was truly reflecting-in-action.

The second revelation was that at the conclusion of the above mentioned course one of the other builders came up to me and said, 'You really are evangelical about this, aren't you'. What a shock this was to me! I went into denial initially. No, surely not! Surely I was not becoming like those people of the religious sect I was involved in as a child! Evangelical is bad, bad, bad...or is it? After my first shock I realised that he was right, I had just swapped one religion for another. Consequently I needed to accept that this was part of my way of doing things and therefore I had to make sure that I did not fall into the trap of preaching. I had to put in place systems so that I would not act as the unquestioned expert, but that I would present things simply, fairly and as unbiased as possible so that people could make up their own minds. This is now part of my reflection-in-action when I deliver my courses and lectures. I have not mastered it yet, still getting on my high horse occasionally, but I am now aware of it and can usually adjust in time, which I do by balancing my presentation with the opposing views.

Above are discussed the major lessons for 2002, below a description of several small projects that reflect the growing pattern in my practice. Firstly, through the EcoHome project a strong relationship with VicUrban was built and they invited me to work on a 9-15,000 home development called Aurora. The intention was to develop a short guideline on material selection for the builders. The Aurora estate was designed to push the boundaries of sustainable housing development including material selection. The result was a small flipchart offering environmentally preferred materials for all the various elements of a home. Though the flipchart was seen as a simple and user-friendly tool the greatest success of the project was the industry workshops, where all suppliers of materials in the flipchart were invited to show their wares to the builders. It allowed the builders to discuss issues directly with the suppliers and dispel any furphies by being able to ask questions and get responses straight from the experts, manufacturers and suppliers.

The second project was an open space guidelines project which took four disparate guidelines for open space design—safety, shade, access and mobility—and compared them to determine where they conflicted or overlapped with a view to simplifying the four guidelines into one simple flipchart or guideline. This project is interesting for two reasons. First, it represents yet another example of how the emerging practice took complicated messy situations and tried to simplify them; second, the project was referred to us because of our growing reputation of being able to change messy information into simple clear tools.

Having taken a twelve months break from the research, I ensured that I did not lose track of the Civic Centre project by attending the site meetings once a fortnight. I continued to take notes and reflect on these meetings though the journals and data collected are sparser than during the first two years.

From the Civic Centre project, the main experience in 2002 I will reflect on is the impact of the models 1 and 2 of personality as defined by Argyris & Schön (1991). As discussed earlier, from my point of view the third construction manager, Martin, was an argumentative, reactionary manager who laid blame rather than sought solutions and alienated many of the agents working on the project. Using Argyris's terms I would say, he seemed to portray all the qualities of a model 1 personality. As introduced previously they exhibit '*strategies of unilateral control, unilateral self-protection, defen-*

siveness, smoothing over, and covering up, ...’ (Argyris and Schön, 1991: 86). The accuracy with which this quote reflected how I perceived the situation was profound. Many of the problems on the site were (again, in my opinion) if not caused, perpetuated by the model 1 attitude. One example was a big argument involving the architect, the structural engineer and the site manager. The image below shows the problem, the bent reinforcing rods; and the excerpts from my journal show my version of the discussion (note that this occurred in 2003, but it is one of the best examples I captured in my notes).



Figure 32 – Bent reinforcing steel

Week 169 – Disagreement between Martin and Taylor: argument about the bending of the reinforcing steel... Taylor “the council should not have to pay for fixing this”... Martin “well how did you expect us to get the scissor lift in?”

[my reflection afterwards] this was done because it was an opportunity to move things along. Martin thought he was doing the right thing as he is seeing opportunity and taking advantage of them not realising the structural implications. But because of his adversarial attitude not seeing the implications and resolving the problem. But he thinks he is doing his best – very frustrating for all of us. I think he may not have the skill to manage a project like this.... but it is no fun for him either getting criticised by everyone. He needs some positive feedback.... I didn't help either – I brought up the bins and asked if for the last 3-4 weeks we couldn't make an effort to reduce waste by 10% just to make an effort. Martin talked about not having room etc all good reasons but no discussion of possible solutions. You need a 'can do' attitude to do this kind of work not a 'this is why not'. The problem is that this is dangerous, the steel for example will get stressed and will not be structurally sound and therefore the wall will not be as sound.... But it is all because the understanding of 'why' isn't there because as Martin said 'the whole industry does it'

Excerpt 56 – Journal summary 2003 – text units 34-69

To the completion of the project I was never able to find a way to work productively with Martin. I was not able to find a way of overcoming his barriers to 'green' innovation, particularly the waste minimisation strategies, of the project. In the future,

I will, when interviewing and checking references of people, try to ascertain whether they are a model 1 personality, for as Argyris and Schön clearly point out these are not the types of people to get involved in any innovative work. If I do come across such colleagues in the future I will now be able to recognise the problem and be able to plan and implement strategies to minimise any negative impact.

5.3 Reflection – 2001 - 2002

This chapter contains snapshots from the journey in 2001 and 2002. In these two years the practice first emerged, where I had to make the decision to leave my career as life cycle assessment specialist and explore 'green' building opportunities.

Reflecting on this period I was still learning in what Daley (1998) describes as the novice mode. In fact, I think one will always have aspects where one is a novice. New experiences, unexpected events, conflicts, and so forth will always create discomfort, fear and anxiety and require some reinforcement of validity. They will instigate new concept formation, or as mentioned previously, new theories-in-action to be developed and tested. The main concepts that began to form during this period were: an understanding of the complexity of the construction of a building; an understanding of the process of construction, particularly site management, tendering and the importance of staff continuity on site; and the implication and influence of power, culture and control on the building process and built results (Bourdieu, 1991; Bourdieu and Passeron, 1990; Davis, 1999; Habraken, 1998).

The theories-in-action I developed and tested during the construction period were fairly limited due to the reduced amount of time I was active on the project but nevertheless some were developed and tested. Firstly, though, I wish to point out the various ways I used to introduce 'green' information into the projects:

- Physical presence at site meetings—This had varied success, in most cases simply being present ensured that any decision made considered the 'green' agenda.
- Support of specialists—Giving specific support from a waste management specialist to the demolition company was a very successful way to assist them to not only meet but exceed the recycling goals for the demolition of the old Civic Centre building.

- Site inductions—They were not a successful method of information transfer to those starting to work on the site, which was partly due to the lack of experience and understanding of the foreman holding the inductions; partly due to the novelty of the ‘green’ requirements; and partly due to the lack of understanding and therefore interest of the subcontractors.
- Tendering ‘green’ schedule—This was a failure, where the only companies that even attempted to fill in this schedule were the demolishers. Most companies had no concept of what was required as they had never needed to have environmental management systems, be water efficient or recycle their waste. Also having these requirements was fine in a competitive market, but when few complied it was left to be negotiated once the contractors had been appointed.
- Participatory short course—This was a successful format for the presentation of the information on ‘green’ housing innovation, those builders who attended gave very positive feedback on the course, most left with personal examples of implementation plans.

Theories-in-action tested during this period and the lessons learned as a result:

- ***Given the right bins, waste would be separated and recycled – Wrong!*** If a bin was used, which was not even the case sometimes, it was whichever bin was closest. As discussed above the reasons for this were the culture of the building site workers, the lack of incentives, ownership and responsibility of their respective tasks, and rebellion. The new theory in action is that providing a supportive environment with incentives and clear responsibilities as well as the right bins in the right place will facilitate better performance.
- ***Given a clear understanding of the expectations of the project, tenders would meet ‘green’ requirements – Wrong!*** Most of the tender documentation was not thoroughly read before application and the ‘green’ schedule was ignored. Pre-tender inductions were organised but they were poorly attended. It was not until contract negotiation that many of the ‘green’ requirements were discussed and clarified. This was done face-to-face, not in writing. The resulting theory-in-action being that specification can be made simpler with less detail so that there is a greater chance of their being read and that, where possible, verbal explanation of

the requirements is more effective as it is interactive and clarification can be provided in real time.

- ***Translation of drawings, plans and specifications into a built project only required effective communication – Wrong!*** As discussed above the most effective method of communication was the face-to-face contract negotiation phase where the contractor can afford to spend time and effort on the project.

The last two results raise many questions about the effectiveness of the tendering process; this research does not have the scope to explore the issue other than to acknowledge it and its implication on for 'green' innovation. The implication is that more effort needs to be put into the contract negotiation stage under the current system.

Overall the main lessons I learned were:

1. Construction is a coordination problem, where reliance on forty or more agents and companies often results in unexpected delays costing time and money—I had never been part of a process that is so chaotic, with so many variables and so many agents. Learning about its complexity, through experience, allowed me to reflect on the added importance of creating a supportive environment. It also taught me how important it is to try to pass on the purpose, aims and passion of the project to those working on the site. My theory-in-action is that an understanding of the project and the availability of information, systems (both incentives and penalties), tools and infrastructure to support the agents will encourage greater ownership and therefore proactive decision making on the project.
2. Power, culture and control have significant effects on project outcomes. By observing and experiencing what occurred on the site I started to understand and see the power, culture and control issues present. I also observed the impact they had on the 'green' initiatives. I explored this lesson I explored by writing a paper on the consequences of the outcomes of the Civic Centre project. Writing the paper made me more aware of the importance of this lesson. An entire thesis could be written just on this issue. This is further discussed in the final chapter combining relevant experiences from the other chapters.

3. Models 1 and 2 personalities have significant impacts on site progress and the implementation of 'green' innovation. My experience showed me the impact of a model 1 compared to a model 2 construction manager. Again this was a fundamental lesson that will be elaborated on in the final chapter.
4. There was a market and a need for 'green' building innovation experience in Melbourne. My research was quickly and simply turned from one project, which was part of my PhD research, into a research program running separate projects in commercial building, housing, local government and materials. It seemed that people were waiting for support in their decision making and implementation of 'green' innovation. I am fond of saying: *'I am not an expert, I just know a little more than some people'*, and that is how I feel about this successful research program within the university. I am not discounting hard work, but the conditions must have been ready for such a program to develop so successfully. My feeling has always been that 'I am riding the crest of a wave and am just lucky I was paddling in the right area'. In fact, some of the increased uptake and demand for my practice is due to a general increase in interest in 'green' innovation.
5. Broad courses providing access to expertise, examples and physical samples provide a catalyst to integration of 'green' innovation. I was surprised at how successful the courses that were run in 2001 and 2002 in Melbourne and Sydney were. It seemed that mixing local expertise, case studies, actual products and some simple clarifying theory was a perfect mix that allowed people to focus on what aspects they were interested in while still receiving an overview. The networking and additional projects that spun off from the course were an unexpected bonus.
6. The most confronting lesson was that with increased expertise comes increased responsibility. I grew up a little due to this lesson. There is more than one point of view in the 'green' building innovation field; these points of view should be allowed to be part of the discussion. The discursive nature of sustainability is part of its character and needs to be acknowledged and transparent. Being more environmentally and socially responsible is a moving target and therefore flexibly inclusive approaches need to be taken in collaboration with all the stakeholders.

7. The final lesson, which follows on from the previous one, is that ‘green’ innovation projects need to be flexible and responsive to the situation, client and organisation. As discussed above there is no one answer, one tool or one method; the multitude of stakeholders and agents involved in the built environment requires an approach that is reflexive and responsive to the opportunities and problems of each project.

5.3.1 Reflection on the research journey – in the field

During 2001 my original PhD project was a shambles. I furiously tried to keep up with my journal entries and with collecting all the relevant information, drawings, images, plans, minutes, and so forth. Meanwhile I was also doing a job and needed to meet the requirements of the council, the builders and the Centre for Design. In an attempt to continue to collect data and reflect in my journal I changed my format to ask direct questions:

1. What occurred?
2. What went well and not?
3. What to improve?

Excerpt 57 – Journal summary 2001 – text units 309-314

Also heeding the suggestion made by Nita Cherry, I began to write vignettes of the various key experiences and events in the research. In reflection I was, in that period, concentrating on the ‘job’ not the ‘research’. I did not understand what the research really was; after all I was there taking notes responding to the field, providing solutions.

In this period I was also getting very frustrated with the project, typically experiencing what Dreyfus and Dreyfus described as the main learning conflict at the competence to proficiency stage. I was frustrated by my lack of time and ability to have all the answers. I dealt with it by starting to build and rely on my network of experts. A second frustration was the complexity and enormity of the Civic Centre project—the words frustration and fear and their synonyms appear frequently in my journal. Most of these eased as I started to gain a deeper understanding of the building process and reminded myself that this was part of my research and just to go with the flow.

Week 55 – Site meeting Civic Centre – got there at 9am (meeting set for 9:30) met COLIN the construction manager. His first comments were rather attacking “why are we knocking

down a perfectly good building – aren't we trying to be environmentally friendly?" Still I think this is not a bad start – though his thinking is great as he is looking for potential – hmmm I am feeling out of my depth again!

Week 56 – A very interesting day – I don't believe how difficult it all seems... We seemed to be talking in circles, and doubling up – it is all very scary. Jim said (and you can see this from the notes of the meeting ... Pretty disheartening stuff really. I was interested to see what will happen. Also the meeting seemed a bit of a waste of time ...

Week 63 – A good meeting I think, except I very much feel that I am being ignored – mind you if I really have something to say I will. But it is also a lack of respect, I think. This is a problem ...

Excerpt 58 – Journal summary 2001 – text units 4–9, 63,73-73, 86-87 and 506-508

Journal reflection was not as thorough as it had been previously, again this was because of the time pressures and because I did not really understand their value.

The research review carried out in 2001 confirmed that I was heading in an interesting and unique direction that would add knowledge to the field. As in the last review I was so exhausted by the stress and effort of the preparation and presentation I found it very difficult to write coherent notes and reflections. My main aim for this review was to secure approval to take twelve months off from the research to focus on the development of the Sustainable Building Program. The final conclusion was that I could have the twelve months off and that they felt I had enough experience and data to begin to write the thesis without collecting further data. I argued that I needed to see the project through to completion, and therefore needed the time off to allow construction to be completed and the building to be occupied. My reflection on the review was brief:

Week 92 – ...this was a nerve racking and exhausting presentation and to be honest my mind was not attuned to thinking, reflecting or remembering what occurred. There were great discussions and everyone seemed to think I had done enough and should write up etc. there were very clever suggestions but I was too tired to be able to absorb them...

Excerpt 59 – Journal summary 2001 – text units 1107-1111

My plan of action for my next review in 2003 was to get a separate scribe to take notes for me to reflect on because, as shown above, I was not capable of absorbing the feedback fully due to the stress of the experience.

The research journey in 2002 had even less content. I had taken the year off, so I paid very little attention to my journal or data collection from the Civic Centre project. My full focus was on developing the Sustainable Building Program. The one painful lesson I did

clearly learn in 2002 was the limitation of my proposed research method. Having written my vignettes of various incidents, I wove them into a paper reflecting on my experience with the architectural firm. I intended to publish the paper in an action research journal. I sent this to the architects to read and reflect on. I was not prepared for their response. The excerpt from my journal sums up my confusion over this experience:

Week 118 – I don't really know how to start this reflection. Just had a meeting with Henry in regard to a paper which I am writing on my research. He was very upset at the paper as he felt it did not represent his practice. After the initial confrontation which was several weeks ago where I burst into tears (I was sick and could not cope with his comments and misunderstandings – stemmed from his mistrust of me I think – believing that I was attacking – this came through to a lesser extent today) I did make it clear though that I had sent it to him for his feedback and had no intention of putting him in any light just describe the methodology and illustrate its application.

Anyway the meeting today really highlighted the difference between my records and Henry's memories and it also represents how I have moulded my paper and records to show what I expected to be the outcome.

Many of the issues we discussed were misunderstandings through me trying to illustrate something where there was a change and Henry seeing this as derogatory. My head hurts.... But it also showed how painful and necessary this really was for me – keep me honest. My dilemma is in a few areas:

- the process wasn't managed well. How do I deal with it, as Henry said we probably didn't spend enough time defining where Beta architects was before I started.
- within the design etc there were many problems and bad management – does this reflect on the outcomes of the research
- how do I resolve the different memories between Henry and myself without losing the integrity of the records!

Is there any integrity as it is my journal which records my experiences?

Excerpt 60 – Journal summary 2002, text units 67-93

My response to this experience was to realise that I would never be able to reconcile the differences. If I could not resolve the paper and vignettes on my experience with the architectural firm that was sympathetic to the research, what chance did I have with the other agents? I could imagine the construction management company or the unions not understanding the research needing to be candid. Therefore, I needed to reconsider the part of my method that sought to ensure validity by asking the agents involved to read and have input into the vignettes. But did this mean that I could not use any of the data or the research?

This was a dilemma, if I could not get agreement on the case study how could I, in all honesty, present it as a central part of my thesis. How naïve I was, thinking that my interpretation was the truth! Everyone sees and remembers things from their own perspective (Schön and Rein, 1994). What did this mean for the research? From a respect and ethical perspective I decided that I could not follow through with research proposal 3 and write the case study up fully and analyse it. Proposal 4 was then developed early in 2003 in collaboration with my supervisors. I would reflect on myself in the case study and talk about the tools and information I developed to support the 'green' innovation integration.

To further develop this change in research direction I wrote a paper reflecting on the critical information requirements and tools to integrate sustainable innovation in the built environment. I presented this at a conference, and again in front of the biannual critique. The response was that they could understand and agree with the change in direction but felt that looking at the critical information and tool requirements was not the most interesting part of the research. What was really interesting was the development of the 'green' building facilitation practice.

Other authors (for example, Morse *et al.*, 2002:8) also agree that there is limited value in getting feedback from other participants and that it does not ensure validity, so I could still use my stories and my vignettes.

Reflection through the use of Reason's questions

- Why am I doing what I'm doing?

To answer this question I really need to ask a few others: what am I doing, why am I doing it and what has changed?

Firstly, I continued my PhD research through working with the council and later with the construction team. This decision was supported by the research panel, because it seemed fitting with the emerging nature of the research. It changed in September 2001 when I was offered the full time position at the Centre for Design to set up the Sustainable Building Program. I accepted because it was challenging and it allowed me to put some of my experience into practice, and I felt that it would fill the gap I identified in the research. The result was that I needed to take a step back from the research to concentrate on the program, which was also made

possible because the Civic Centre project was over time, the completion only expected in 2003.

The other major change was that I decided in 2002 that I could no longer proceed with the PhD as a case study analysis due to conflict with various participants as described above. I do not usually shy away from conflict but I did not want to alienate the agents who had so trustingly allowed me into their world. The result was a change in direction looking at all the practice that had developed and analysing the critical information needs and requirements for the integration of 'green' innovation.

- Thinking what I'm thinking and feeling what I am feeling?

During these two years I grew from a fairly insecure observer to a proactive, if tentative, facilitator. This change occurred because I began to understand how all the pieces of the built environment worked. I had also started to trial various methods of interacting with this field and getting 'green' innovation to be integrated with some success. The increase in confidence that accompanied these successes supported the development of further projects leading to more experience and so forth. Having a mechanism by which I recorded and reflected on my experiences was a crucial component of the change—successes were successes and failures were lessons. My confidence also grew through the support of the network of experts I was building; crucially I was frustrated by my lack of knowledge, not hindered by it as I was able to call on one of the local experts. Interestingly most offered this support freely, in particular Alan Pears, Paul Murfitt, Jan van de Graaf, David Oppenheim, Andreas Sederof, Ceridwen Owen, Chris Reardon and Andrew Walker-Morison, seeing this as a mentoring role that builds capacity and supports the further implementation of 'green' innovation.

- Why do I think this course of action will be appropriate or effective?

I believe that this course of action, in regards to setting up the SBP, was successful partly because of the tangible and visible experience I had with the Civic Centre, and I was associated with a university and a well known proactive research centre. I think another reason is because of who I am and my approach to the field, that is, someone who is not (too) afraid to fail, who proactively reflects, learns and tries new approaches, someone who respects those she works with at all levels and finally

someone who seems to be fairly confident. The change in the research direction has already been discussed above; though appropriate in retrospect I wish I had continued to spend time on the research, particularly in the collection of data and writing of vignettes. The research continued to be effective, though, as this chapter shows.

Was the development of the SBP effective? Yes, it has survived, grown in size, reputation and capacity and will hopefully continue to do so. Has it created real change, integrated 'green' innovation? It is quite early in its development, though the number of projects carried out and people taught suggest that there is some success.

- What other possible perspectives and experiences could enrich and inform the way I/we are engaging with the world?

One of the biggest disappointments of the research to date was the inability to go through the reflective loop with the agents involved. I believe that, if I had handled things differently, set up the research more thoroughly, I would have been able to gain much deeper insights into the project. My problem was that I was responding rather blindly to the opportunities that came along without really understanding the research process and therefore unable to reflect meaningfully on the implications of the response. If I had my time over, I would have carried out the contracting stage more thoroughly. I would also continue to reflect and evolve the ethics application and spend more time analysing the results and reflecting on their implications.

5.4 Summary

2001

The guiding questions that were central to the work done throughout 2001, what I call the participating practitioner stage, illustrate a slow growth in confidence in the practice, a growing understanding of the complexity of built environment and highlight the continuing search for how to present appropriate 'green' information in a relevant format to the right agents. In summary the main questions and answers were:

Which ‘green’ information is relevant at which stages of a built environment project?

Table 10 below was developed at the end of 2002 and used all the experiences described to date to answer the above question. The table was developed for a research and consulting project developing the ‘green’ innovation section of a master plan for a \$200 million aged care facility. Its intention was to clearly articulate the information and systems required to ensure effective integration of ‘green’ innovation.

Table 10 – Example of process tasks in a ‘green’ building project (Walker-Morison *et al.*, 2003)

Project phase	‘green’ priority				
	Energy/GHG	Water	Waste min.	Materials	IEQ ³⁵
Master-plan/ feasibility Study (cost plan A)	Develop energy brief	Develop water brief	Develop waste brief	Develop materials brief	Develop IEQ brief
General	<ul style="list-style-type: none"> – employ ESD³⁶ consultant – develop benchmarks for each area – develop broad targets for each area – develop consultant briefs – carry out review of buildings to be retained and biodiversity of the site 				
Schematic design (cost plan B)	Energy and thermal modelling	Detailed water budget			
General	<ul style="list-style-type: none"> – refine targets in collaboration with project team for inclusion in contracts – develop reporting and check documents for all ESD areas – set budgets for water and energy – develop concept which complies with brief – demonstrate consideration of options developed at master plan stage – report on progress – carry out review of buildings to be retained and biodiversity of the site (if this has not occurred at the master plan stage) 				
Design development (cost plan C)				Check that materials specified comply with brief	
General	<ul style="list-style-type: none"> – check detailed design against budgets and targets – develop monitoring techniques including equipment needed and protocol documents – report on progress 				
Documentation (cost plan D)					
General	<ul style="list-style-type: none"> – update specifications to ensure they support intent of brief – check specifications comply with brief – check contract documentation against budgets – report on progress 				
Tender process					
General	<ul style="list-style-type: none"> – develop pre-tender induction for each trade – include ESD areas in tender assessment documentation – include ESD areas into contracts – report on progress 				

35 Indoor Environment Quality

36 Ecologically Sustainable Design

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Construction	Develop energy reporting checklist	Develop water reporting checklist	Ensure waste systems are in place	Develop material use reporting checklist	Develop IEQ reporting checklist
General	<ul style="list-style-type: none"> – develop environmental management plan for site – develop induction for trades with construction team – construction design checked for compliance with budgets and objectives – set prescriptive requirements – detail ESD area accounting procedure agreed and applied – monthly report on progress 				
Commissioning	Test and fine-tune systems	Test and fine-tune systems		Check materials used	Test IEQ
General	<ul style="list-style-type: none"> – report on initial compliance with budget and objectives/requirements – ensure the development of detailed operation and maintenance materials provided with any training required – report on ESD areas and additional costs, problems, lessons etc. 				
Defects liability/ final hand-over				Develop materials schedule	
General	<ul style="list-style-type: none"> – Active and demonstrable program of building tuning and adjustment to suit occupancy and actual operation – Final demonstration of compliance with budget, objectives and any prescriptive requirements – Develop simple building user 'how-to' with phone numbers for all maintenance people – Set up maintenance schedule and reporting mechanism – Put black box in building with as built plans and ESD area schedules (e.g. materials list) 				
Facility operation & maintenance					
General	<ul style="list-style-type: none"> – Report on maintenance schedule 				
Refurbishment	Do a cost benefit analysis on improved technology				Refer to materials schedule
General	<ul style="list-style-type: none"> – Ensure refurbishment represents a net environmental improvement 				
Demolition	Use black box to plan recycling and reuse schedule				

Further, in a collaborative paper with two colleagues, Peter Graham and Gerard Coutts, I used the experiences from this period to develop a concept of the activities and capabilities needed to implement 'green' building initiatives (Graham *et al.*, 2003a).

Table 11 – Summary of the project management activities and capabilities important to successfully delivering the sustainability agenda

Project Phase	Initiation	Planning & design	Procurement & construction	Completion & handover
Process activities	Understand sustainability agenda. Integrate sustainability agenda into project budgets and schedules. Planning implementation of sustainability strategies. Communication and advocacy of sustainability agenda to stakeholders.	Monitoring and reporting on time, cost and quality implications of sustainability strategies throughout the design process. Approving design strategies through the project steering committee.	Selecting procurement strategies that enhance communication and accountability for achieving sustainability goals. Communicating with trade sub contractors. Team building & Motivating to foster an attitude of 'working together on sustainability'. Monitoring progress and providing feedback.	Explaining operation of sustainability features to building users. Ensuring commissioning documentation is provided.
Understanding sustainability goals	Communicating sustainability goals to all stakeholders			
Professional capabilities	Managing relationships between stakeholders			
	Planning the implementation of sustainability goals at each project phase			
	Leadership & advocacy to keep sustainability goals on-track			
	Motivating project teams to effectively implement strategies			
	Empowering project team and stakeholders by educating, explaining and translating sustainability issues into vocationally relevant language.			

What if I don't have the information?

If I did not have the information I consulted one of the experts in my network. Most importantly I did not allow this lack of information to create a barrier for the project. I would acknowledge the lack of information and then ensure that I found a suitable solution if it was available. If it was not available I would develop a small or large project to try to produce it.

Where do I find the information?

Related to the solutions I developed above I extended my network of contacts and developed a relevant 'green' innovation information base, grounded in my experience in the field.

How do I present this information usefully?

The final guiding question of 2001 was: once I had the suitable information, how would I present it and ensure that it was useful? My experience back in 2000 had shown me the importance of presenting things to the agents in the right format and language. I therefore tried to look at each situation through the eyes of the agent and then tried to simplify and clarify. This approach led to various user-friendly flipcharts, websites, decision making tools, workshops and courses.

2002

Remembering that this was a period of focusing on the new program I was developing and that I had taken time off the PhD, the questions underpinning 2002 changed significantly. This phase I call the **tentative practitioner facilitator**—where I became confident enough in my knowledge and networks to begin to be more proactive in developing the practice. It is when I began to experiment with the facilitation role as opposed to just information provision. The questions now focused on the identification of gaps in the knowledge and showed more specific reflection on the barriers to the integration of ‘green’ innovation in built environment projects. No longer looking for information, I knew where to find what was there; no longer unsure of the agents, I could focus on what was actually stopping the process; no longer the naïve novice who started in 1999, I now understood the field and could look deeper. The questions and answers were:

What ‘green’ information is missing?

Understanding some of the needs of the agents I had worked with, I now started to look into what the barriers were and what could be done to minimise them. At this time I identified builders and the trades (such as electricians, plumbers, etc.) as barriers due to lack of support. The plumbers have since then developed a ‘green’ plumbers’ network and the other trades are also exploring similar programs. I actively set up projects that tried to fill information gaps when I encountered them.

Why isn’t the ‘green’ information that is available being implemented?

A lack of training and information is often reported as a main barrier (Coleman and Robson, 2000; Davis, 2001; Landman, 1999; Owen, 2003; Rao and Brownhill, 2001;

Thung, 1998), but through my research I found that there seemed to be a great deal of information available, the main problem being that it was often widely dispersed and topic-specific rather than holistic. Throughout 2002 I explored why innovation was not being implemented and found that it was mainly due to uncertainty about performance and cost and therefore risk. I also found that the construction industry was happy to continue to do things as they had always done, preferring not to try new things, especially if there was added risk.

How do I support its implementation?

My response to minimising the barriers and supporting the implementation of 'green' innovation was to try to clarify risk by organising workshops and courses with providers of 'green' innovation, removing the furdies and providing clear and simple information.

Finally...

To sum up, these two years represent the gestation period of what I refer to as my 'Jack-of-all-trades' practice. More than any other achievement, at the conclusion of this period the practice was truly born; I began to tender for work outside the research projects. Interestingly it was also the time when, with the encouragement of colleagues, I had significant input into the development of the first 'green' building course in Melbourne, June 2001.

It is difficult to pinpoint when the shift from observer to practitioner occurred as these things are never black and white, but in late 2001 and early 2002 I was being asked to speak at a series of conferences and events. My practice was no longer about observing and learning; it became more a question of integration and application. Apart from the courses, I was involved in several projects that were centred on communicating 'green' building information and innovation in simple formats: developing a decision-making tool for the application of Life Cycle Assessment (LCA) and LCA tools for the building industry, developing an environmental management tool for the Property Council, developing checklists and guidelines for several councils and material choice flipcharts for home builders.

I interpret this as becoming a **tentative practitioner facilitator**, moving from observation and reaction to proactive teaching and facilitation; actively seeing gaps in the knowledge and projects and formulating action to consciously fill these gaps. This is illustrated by the Civic Centre project in the development of monitoring regimes, a film documentary, a reflective case study and the translation of lessons from the project into general supporting information for other practitioners—even this thesis to a certain extent. It is also evident in the development of the multi-tiered, cross-industry, cross-disciplinary, collaborative EcoHome project. The shift is illustrated at this stage by the growth of the practice beyond the one project into the ‘green’ Building Research Program at the university; into a research program based on industry collaboration, teaching and knowledge development strategies.

6 Stage 5: Expertise?

6.1 Introduction

Having spent four years on this journey I started to see the link between my approach to the sustainable building field, the integrated multidisciplinary way my practice had evolved and the whole sustainability paradigm. That is, that sustainability needs a new way of approaching 'green' building issues (Hes, 2003b), a collaborative, transdisciplinary and cooperative approach (Boden, 1996; Hewitt and Wilkinson, 2002; Rohracher, 2001). This chapter discusses some of the additional lessons I learned in 2003, how I developed my unique practice and method for carrying out projects, and finally discusses the whole idea of being an 'expert'.

This chapter is different to the previous ones in that I no longer consciously trialed new 'green' initiatives and information presentation techniques, and I no longer looked at my field of study from an outsider's perspective. Therefore my journals were very scant, only really acting as field notes with the occasional brief reflection.

6.2 The practice journey 2003

One of the first interesting events of 2003 was feedback from the subcontractors on one of the products used in the Civic Centre. Minimising the toxic emissions from products used in the building was one of the aims of the project. Therefore mechanical fixings, water-based paints and adhesives were chosen. Further, we specified the lowest possible emitting timber products.

Briefly, research has shown that emissions from oil-based paints, adhesives, carpet, plastics and timber products such as MDF, particle board and laminates, affect people's health. These emissions are small carbon-hydrogen chains called volatile organic compounds (VOCs)—for example formaldehyde—which cause headaches, nausea, skin irritation and so forth when they are above a certain concentration. Moreover, some people are more sensitive than others to these emissions, particularly if they are exposed to them over long periods of time. For a 'green' building we wanted

to minimise these effects on the subcontractors and the people who would be using the building. Therefore, we specified that contractors mechanically fix elements, avoiding glues and adhesives if possible. If they needed to be used we specified the use of water-based alternatives. We also specified the use of low-emission timbers.

As a result the site did not smell like a new building. One day I came to the site for our project meeting when I noticed a furore on site; the subcontractors were up in arms, complaining bitterly about the stink of a new product being used in the building. I had to hide my mirth. I thought this was funny for two reasons. Firstly, this product which is used all through the industry. The contractors would not have thought twice about it in any other project, where its emissions would have just joined all the other emissions. Yet because we had very little smell on site this product really stood out. Secondly, I wanted to smile about the amount of conflict these same contractors had caused because we specified low emission products. One of the subcontractors even went to the extent of using a furry that a product was not available so as to be able to use the stock standard high emission product.

This story shows how many of the contractors only noticed the toxicity of the environment they worked in once they were offered an alternative. I realised, once again, the value of just doing it. Having a physical artefact, where people can have real experiences, is far more powerful than actually explaining things to them in theory.

I have discussed earlier that the last construction manager, Martin, did not understand and was not inspired by the 'green' initiatives on the project. He already had so much to worry about he did not appreciate the extra complication. This was particularly apparent when it got to the bamboo flooring specified for the project. The floor space of the function room and meeting room together added up to 150 m². The flooring was designed as a sprung floor. Since the Civic Centre project wanted to avoid hardwood timber, bamboo was chosen. Initially, on developing the specification, the architects had sourced a 20 mm deep and 1.8 m long bamboo product.

1800mm long x 130 wide x 20 thick end-matched T&G boards from 'Bamboo Floors' or similar approved

Excerpt 61 – Specification 18Ttimflr.doc

One day, three-quarters of the way through the project, I was at a site meeting when the topic was raised over which hardwood product they were going to use for the function room. I was shocked and quite strongly put the position that we could not have a hardwood floor as this would undermine all of the other 'green' initiatives in the building. All the great initiatives would be overshadowed by the fact that people would be walking into the main function hall and asking about the flooring product. In Australia, at that time, we could not source an independently certified, affordable, hardwood flooring product. Moreover, bamboo is seen as a more renewable product than hardwood as it only takes seven years to grow to a point where it can be harvested and used for flooring while hardwood takes decades to grow. Also, bamboo is a grass, so it can be cut at its base and keep growing.

Martin said they were considering hardwood because he was having trouble sourcing the bamboo. It took a further two months to source the flooring and get samples. It then became obvious that the right size was not available, the only alternative being 15 mm wide by 900 mm long. It is not difficult to source bamboo, and I had provided Martin with seven suppliers; it was just that other priorities slowed down the process. Finally, the order was put in and the flooring structure changed to support the smaller bamboo lengths. The products finally arrived and there were a few more delays as other trades, such as the painters, finished. Eventually the day of installation dawned, the flooring specialists arrived and opened the boxes and found parquetry. Boxes and boxes of 300 mm by 300 mm bamboo parquetry! As quickly as possible the manufacturers were contacted and luckily they had the equivalent amount in stock, which was delivered the next week. Three-quarters of the way into laying the floor the contractors realised that the supplier had delivered a bamboo product with different stains. I started to understand why people avoid innovation! Luckily, as you can see in the figure below, the different stains did not detract from their final appearance; leaving it like that was saving money, time and environmental impact.



Figure 33 – Bamboo floor on opening day, August 2003.

I took on board several lessons from this experience. The first was that it is imperative to ensure that the products which are specified in the design actually exist. For example, the bamboo product was specified and outlined as: ‘1800mm long x 130 wide x 20 thick end-matched T&G boards’ while in fact no 20 mm thick bamboo products exist. This occurred because a standard specification system was used and the availability of a standard product assumed, while putting in a currently non-standard product type ‘bamboo’. The second lesson was the ease with which the specification was ignored and another ‘standard’ product put forward. As Martin did not understand the reasons behind the decision to use bamboo it is understandable that he should turn to products he has experience with. Therefore, fostering understanding for the ‘green’ initiatives is an important part of supporting proactive decision making. Lastly, I learned that it is important to put in systems that incorporate the checking of orders as they are delivered to the site, particularly if the products are out of the ordinary.

I met some academics and construction professionals in Brisbane at a recent conference on sustainable and smart construction (Riley *et al.*, 2003). They presented the results of their project: rebuilding the part of the Pentagon that had been destroyed in the September 11 tragedy. Their approach to ensure that the contractors had both the experience and the physical example of the construction of the new section of the facility was to build a model, 10,000 square feet of actual building. The building of the ‘case study’—called the Universal Space Plan (USP) lab—allowed the group to demonstrate all the materials and technologies to be used in the project, while leaving an actual artefact to go back to as a reference.

The USP lab is 10,000 square feet of office space in Wedge 2 that has been modified and rebuilt several times as design concepts were developed and

tested. The Wedge 2-5 design build team including prime contractor Hensel Phelps Construction and Studios Architecture developed this innovative design lab that reintroduces components reminiscent of the building's original design and purpose including open office bays and use of enhanced natural lighting. The USP lab provides a testing bed where decision makers can see the concepts evolve first hand and test the practicality of their decisions before implementing them on a larger scale.

This is expected to cut four years off the renovation time of the whole building, and many millions off the budget while having the 'green' benefits of reducing construction waste and the impacts of landfill, using materials which are environmentally friendly, recyclable or biodegradable, and increasing the use of natural light (Anonymous, 2002).

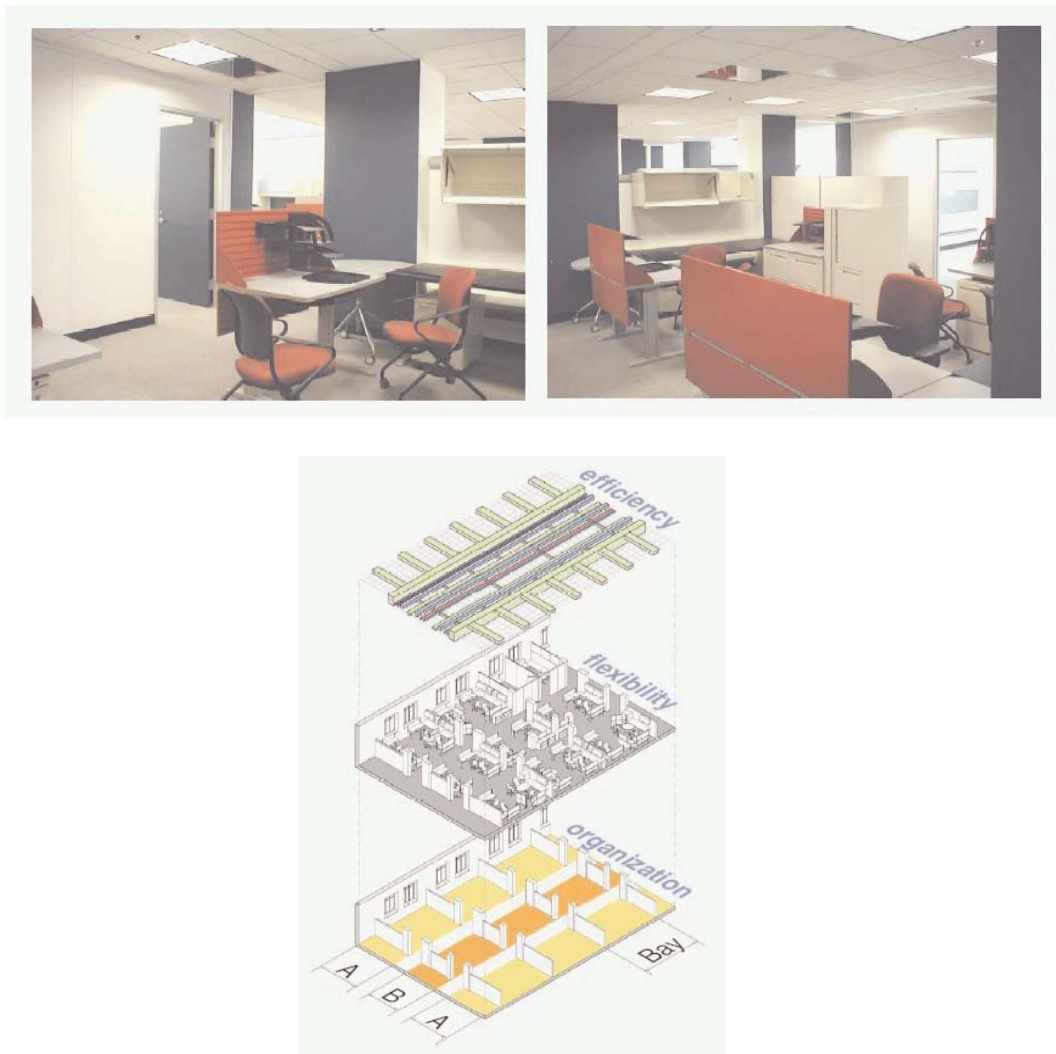


Figure 34 – Images from the Pentagon USP lab (Images used from official pentagon renovation website, Anonymous, 2002, slide 3)

6.2.1 Occupation of the Civic Centre

Before moving on to the other projects I worked on in 2003, the Civic Centre has now been in operation for twelve months. The final part of the story of this project therefore concerns how people have actually experienced the building. It is expected that most buildings go through a settling stage in the first year of operation. Systems are adjusted and various elements changed and fine-tuned as the building is used through the summer and winter months.

Firstly, I would like to reflect on the performance of the building. The energy bills to date have almost met the expected energy use targets—our target was 70 kWh/m² per year³⁷ and the twelve months of bills show a performance of 83 kWh/m² per year. An excellent result for the first year of operation; the council and staff in the building believe they can reduce this by a further 20% now that they understand the building and its systems.



Figure 35 – Civic Centre information kiosk and monitoring system

37 The entire building's estimated energy use was based on the number and types of electrical fixtures, computers, security devices, etc. Energy consumption has been estimated to be 70kWh/m² per year, this is below the average for the council at 200 kWh/m².

Late in the project it was decided that the solar panels would not be continued to street level and that an information sign would be used. Decisions around the sign where made in my absence.



Figure 36 – Back lit Civic Centre sign

As a result it was designed to be back lit by a series of fluorescent lights using 2.8 kW per hour, which is more energy used than for all the lighting in the rest of the building. It shows how small decisions can affect the entire outcome of a 'green' initiative, in this case energy efficiency. The lesson is that a 'green' facilitator, with responsibility for how a project performs, must either be involved in all the decisions being made, or ensure that those making the decisions have the understanding to make the best 'green' decisions.

Part of the story is also about the building users, who moved in during September 2003. This period included some very hot summer days and two 'one-in-a-hundred-year' storms. A session was held with the building users in March 2004 to see what they thought. These sessions highlighted one main flaw in our consultation with the building users in the design development phase. Most of the users participating in 2000 had now left their positions. The new staff did not understand why various decisions had been made or many of the design features.

For example, in one area between the café and the maternity and health area it was decided to put in a door so that when classes such as yoga were held they could have some privacy. Initially there was not going to be a door. Logically, in retrospect, mothers going to the Civic Centre now close the door each time they go into the space to ensure their children do not run off into the rest of the building. Having never been designed for frequent use the door is heavy and unwieldy for the elderly or for people with prams. There are daily complaints about this.



Figure 37 – Door between maternity and health and café

Similarly it was decided that people would have task lighting so that we could minimise the amount of background lighting. This was not passed on to those fitting out the building and there have been complaints of low lighting levels, especially in the evenings. The absence of these task lights might be thought to artificially lower the energy consumption, but the relative effect on energy consumption of the ten or so task lights is minimal.

The main lesson is that passing on the wishes and input of those initially involved in the decision making is crucial. Having some continuous feedback and interaction with the building users is essential, especially when they first move into a building. They need to understand why things were done the way they were done. At the Civic Centre this was not the case and it led to the large number of complaints in regards to the door, as mentioned, the lack of light, and the heating and cooling systems.

On the opening day of the Civic Centre questionnaires were handed out to people attending the opening. The feedback praised the building and its 'green' initiatives;

some interesting comments on the educational value of the building were received. People seemed to like the aesthetics and the environmental outcomes, with one person commenting, *'the Civic Centre looks good and makes sense'*. When asked what specifically they had learned one visitor said, *'I learned that Darebin Council is actually thinking about what it is doing and not just spending'*, while another, a renowned expert in the 'green' building field in Australia, commented that it was *'great to have another real example'*.

6.2.2 The rest of the practice

The Civic Centre project was only a very small part of the practice at this point. The main projects developing during the year were the EcoHome project, the Re-imagining the Suburb project and the briefing documents for a major commercial headquarters. These are relevant to this thesis because they demonstrate the growth in my practice and the increasing success in bringing together people within the industry to carry out 'green' innovation.

EcoHome

The EcoHome project was funded with an Australian Research Council (ARC) grant. This project was developed with VicUrban (old URLC), the semi-government land development authority. Winning the grant was a welcome surprise. After so many months of putting the project together and writing the application, it was now time to recruit the PhD students and start the process. This all took longer and required more effort than I expected, though I was surprised at the high calibre of the applicants for the two positions.

The main lessons from the EcoHome project were the power of working in a cross-faculty and cross-disciplinary manner and the value of having a physical artefact for people to be able to see 'green' innovation in practice. It was difficult to set up initially and it remains contentious as social science, design and engineering have very different perspectives of the way a PhD should be administered and what it should entail. The strength of getting different minds looking at a problem from different perspectives is a depth in perspective and experience that I had hoped for but still found surprising. The project was the basis for my helix method as described in

Chapter 5. From this collaboration in the first year five refereed papers have been written and several tools developed for industry.

Reinforcing the lessons learned in the Civic Centre project, the EcoHome was about providing a real physical example that people can visit. It was not about presenting a 'sustainable' house, but one that pushed the current norm in project housing to a 'greener' level. As such this house is expected to save—compared to an average home—about 60 per cent of energy, 50 per cent of water, have very good air quality and use environmentally responsible materials. Most of this will be achieved at a competitive price. Thousands of people will visit the home and there will be many advertising and media occasions involving the home in the first few years. Further, there will be research done on the industry, the costing, the environmental and the social performance of the home. This project will be ongoing until the end of 2005. Current results are promising.

One key lesson from this project was the importance of actually producing a home that looked like every other, taking the social factors into consideration. A graphic demonstration of the dangers of not fully accounting for the social issues is the near complete failure of the ACF Greenhome, completed in 1993, to influence the housing market. This was due, to a large extent, to lack of consideration of the market drivers, preferences and demographics in the project-planning phase. The Greenhome was a technical fix that ultimately had limited social or market currency (Okraglik, 1995). We tried to avoid what Jones (1998:238) argued was the outcome of houses that integrated 'green' features holistically: that they '*displayed the ungainliness and self-consciousness of all prototype products*'. We attempted this by working closely with contemporary project housing designers and a home builder who mainly wants to sell the product in today's market. The two projects, the ACF Greenhome and the EcoHome illustrated my theory-in-action that we cannot change people just by saying this is better for the environment; we need to demonstrate what is possible within their current paradigm while providing a vision for what could be possible in the future, leading, hopefully, to a paradigm shift by choice in the future. This is discussed further in the next chapter.

Re-Imagining the Suburb

The development of the EcoHome project facilitated the further evolution of my practice. Based on the success of setting up this holistic project with VicUrban, they explored the potential of expanding the research to their 8500 home development called Aurora. What attracted VicUrban to us, apart from the EcoHome experience, was our cross-disciplinary approach. Based on initial consultation the 'Re-imagining the Australian Suburb' project was developed. Much more ambitious than the EcoHome, it included collaboration between engineering, social science, geography, building construction economics and our research centre. This project offered us the opportunity of doing research on a whole new suburb, not only the Aurora development, but the development bordering to the east, also being run by private developers. Further there is a 'green' wedge between the two, allowing for the exploration of development and biodiversity.

A series of projects were defined with academic partners from each area and further industry partners sought such as the local council, State authorities, utilities (water, electricity, etc.) and other stakeholders. The intention is that though each discipline develops, writes and administers the research program, but it all falls within the umbrella of the Re-imagining meta-project. Having only initiated this in 2003 there are no results to discuss, though out of the six research directions developed, one is the EcoHome project, two have been awarded ARC grants and one has been funded privately with a further two to be put into ARC this year. The projects are:

Project 1 – EcoHome social, engineering and design research (ARC linkage 2002 awarded)

Project 2 – Biodiversity and suburban planning (ARC linkage 2003 awarded)

Project 3 – Governance and community building in suburban planning (ARC linkage 2003 awarded)

Project 4 – Water saving initiatives environmental and economic outcomes (privately funded 2004)

Project 5 – Sustainable housing development and planning (ARC linkage 2004 awarded)

Project 6 – Affordability, life cycle costing and housing elements – affordability over time (proposed application ARC 2004)

To ensure cross-fertilisation of the project, the current plan—though this will be revised as we gain experience and assess the dynamics of the projects—is that all project information will be based on a shared website and an online discussion forum and there will be annual mini-visioning conferences. I am most excited by the latter as it will allow those working on the projects to present results, discuss the project and carry out workshops to identify gaps. This I hope will lead to further collaboration and integration of research outcomes and the visioning of potential future research areas.

There is still a chance that this project will fail, but what interests me is how in five years I have learned enough to be able to develop—even imagine—a project of this size. Again, I have not developed this all on my own; I had the idea, brought together the people and provided the meta-incentive and vision.

Dreyfus and Dreyfus (1990: paragraph 54) describes this phase as an expert dealing with a complex situation with an *'immediate intuitive response'*. To achieve a more sustainable future, my view has become, that we need to deal with the complexity of situations. I can understand why people prefer to stay within their own expertise as it can get complicated to work with other disciplines. They are comfortable in their modernist paradigm. I began to see, through my research, that to approach 'green' innovation a new paradigm was needed—a paradigm where the messy swamp between the disciplines was clarified and integrated into the search for solutions. Yet the individual disciplines are still very important, with a long history and expertise. I therefore experimented with providing a framework for facilitating links between researchers. Supporting them to carry out detailed research into their own areas of expertise, while creating links and exploring the 'swamp', my hope was to support the development of holistic solutions to complex, messy problems in the built environment. In arriving at this conclusion I am mainly following my intuition and the insights I have gained over the course of this research. I cannot imagine how else we are going to start to explore the messy swamp between the disciplines and explore the interactions and complexities in order to build a 'greener' society. Further, without exploring these areas, I do not see how we will be able to set up the understanding and the framework to make decisions in the future as unexpected situations occur. Sustainability is a

moving concept; we live in a dynamic world where things are always changing as are our levels of understanding. Things that are common practice may over time be shown to be unsustainable and require change. This does not mean that we stop trying to be more sustainable—more ‘green’—just that we need to be flexible in approach, ready to integrate new developments and also accept that there are different paths that could be taken. As explained in the context chapter, becoming more sustainable is a complex journey spanning many disciplines; further it is a contested direction with little consensus on which way is best or deals with its complexity. For this reason, I was exploring the tactic of a transdisciplinary approach, allowing room for specialisation, in this latter part of my practice. It is too early to assess the long-term feasibility, but the early results are encouraging.

Brief development for a major commercial headquarters

The final project I have chosen to reflect on from 2003 is the development of a brief for the commercial headquarters of a utilities company. Initially we were asked to develop a short briefing document and an assessment of the environmental and cost viability of the construction of their new headquarters, considering various locations and financing alternatives. I developed the project into a five-phase research program. The main questions they wanted answered were:

- Should we refurbish our current building,
- build a completely new building in a new location,
- or build a completely new building in the current location?

They wanted answers in terms of environmental, social and economic costs and benefits. They also required the development of a brief that then could be used to ensure that whatever choice they made was passed on to the relevant contractors.

Knowing that I did not have the expertise to be able to handle such a task, I managed to put together a team of consultants including Melbourne’s foremost ‘green’ architect, a highly experienced technical and functional brief writer, a market and property assessor, and a ‘green’ quantity surveyor. The calibre of the team was very high and the outcome of the project is expected to be a thorough and holistic review of the environmental, social and economic opportunities for the company, and a strategic,

functional and technical brief. This is another example of my practice of trying to find the best answer for the client by a collaborative cross-disciplinary project. This project is only in its initial phase but is progressing smoothly.

Finally, though I will argue further down against the idea of being 'an expert', in the five years of being involved in this research I am now seen by others as an expert. During 2003 I did not put in any competitive proposals, most projects being referred to the Centre. Further, I was asked to review the Commonwealth Games Village proposal, peer review the new capital works guidelines for the State Government and speak at a Senate inquiry into sustainable housing development. I had, in those short years, become an expert, at least, in the opinion of those in the industry.

This led me to ask myself: What was the tacit knowledge I had built up? What made me an expert? What profession was this expertise grounded in?

The main tacit knowledge is not, on reflection, knowing all there is to know about 'green' initiatives. I only need to know some of it and where to find the rest. What I realise is that I know how to integrate it, how to make sure I know what the question is and therefore provide an appropriate answer. Further, I know the people to call on to support the solution(s) provided in a holistic manner so as to facilitate the best chances of integration. I can see a danger in this as for some projects it may result in a solution that is too complicated for the client and therefore not used. I will need to be wary of this through constant internal and external reflection on the project as it is developed through questioning my ideas and getting feedback from the clients.

I might know less than each type of agent in their field (architect, engineer, plumber, etc.) but have enough grasp of each that I do have a great deal of understanding of their field plus the experience of their integration in the system. This is where my 'expertise' lies. Further, I have experienced the success and failure of various forms of intervention and so my approach has the potential of being successful. I also believe that there are always areas in which one is moving from novice through to expert; as we encounter an anomaly we get frustrated, explore, theorise and reflect. This process is not a one-off experience.

Whenever I am asked for my 'profession', whether it is on travelling forms or in casual conversation, I always need a moment to decide what to say. Usually I resort to

researcher, but this is far from accurate. I have defined my job in this thesis as a Sustainable Building Facilitator, but this is not a profession, it does not meet any of the criteria outlined in the literature chapter. Possibly I am just a 'green' innovation facilitator currently working in the built environment. In simple terms I am someone people and organisations turn to when they want support in building more environmentally and socially responsible buildings. To answer the question posed above regarding what profession I am grounded in, I do not have an acceptable answer in the contemporary sense of the understanding of a profession. Particularly since my 'profession' is grounded in a mixture of engineering, science and architecture combined with a large dose of what I believe is called management and educational theory.

6.3 Reflection 2003

In reflecting on 2003 I would like to firstly discuss the idea of expertise. Becoming an expert in 'green' innovation integration in the built environment was after all the aim of the research—as the title suggests 'Facilitating 'green' building: turning observation to practice'. Have I really reached expert status? There are many researchers who have tried to define expertise by the knowledge of a person, starting from Socrates who in exasperation determined that experts knew nothing, to Dreyfus and Dreyfus who define experts by their tacit knowledge, their knowing-in-doing. In summary:

- As experts could not describe their knowledge '*Socrates... concluded that none of these experts knew anything and he didn't know anything either*' (Dreyfus and Dreyfus, 2002: paragraph 17).
- '[T]he matters that set experts apart from beginners, are symbolic, inferential, and rooted in experiential knowledge... Experts build up a repertory of working rules of thumb, or "heuristics," that, combined with book knowledge, make them expert practitioners' (Feigenbaum and McCorduck, 1983).

Others have tried to define expertise by what they do:

- Visser and Hoc (1990) concluded that experts have many mental models and mix and match them in opportunistic ways,
- Other computer technology researchers surmised that experts have a more efficient way to recognise problems that require similar solutions (Chi *et al.*, 1981).
- Similarly, Allwood (1986) writes they are faster and more accurate, and have

better tactical and strategic skills (Bateson *et al.*, 1987).

- *When things are proceeding normally, experts don't solve problems and don't make decisions; they do what normally works.* (Dreyfus and Dreyfus, 1985:30-31)

They have a constructivist method of learning (Daley, 1998).

The work of Daley (1998) resonates with my thinking to a greater extent than the work of the others (who are mostly computer science based theoreticians) with my experience of being on a path to expertise, though there are elements in all of them that could be discussed. In presenting their results on a study of novice and expert nurses Daley (1998: paragraph 19) concluded that an expert uses '*constructivist learning... [and] solidly grounded their learning in the needs of their clients and the context of their practice*'. They are saying that expertise is an approach, not a state of attainment. They further reinforce my experience that I do not need to know everything, just where to find it and that it needs finding: '*[e]xperts also indicated that they would actively learn new information because "that is what I need to know to work here"...Experts also described that this active integration of concepts included their ability to "improvise", to "pick up little things", to "draw on other professional experiences", and to "draw on personal experiences"*'. They also identified the ability to see the bigger picture as I have described above, which I was continually doing. Finally, they also identified that experts seemed to seek out their own knowledge and that they '*primarily learned through a process of dialogue and sharing. Experts would "go to the person with the best information, whether the person is a physician or nursing assistant" and then they would "toss around ideas" or "listen to what that person knew"*' which is again reflecting how my experience had developed in the practice (Daley, 1998: paragraphs 19 and 20). Figure 38 is taken from this paper and identifies the links experts use to base their decisions on: client needs, the practice setting or context, developments of concepts and their integration, previous experiences and bouncing ideas off respected others.

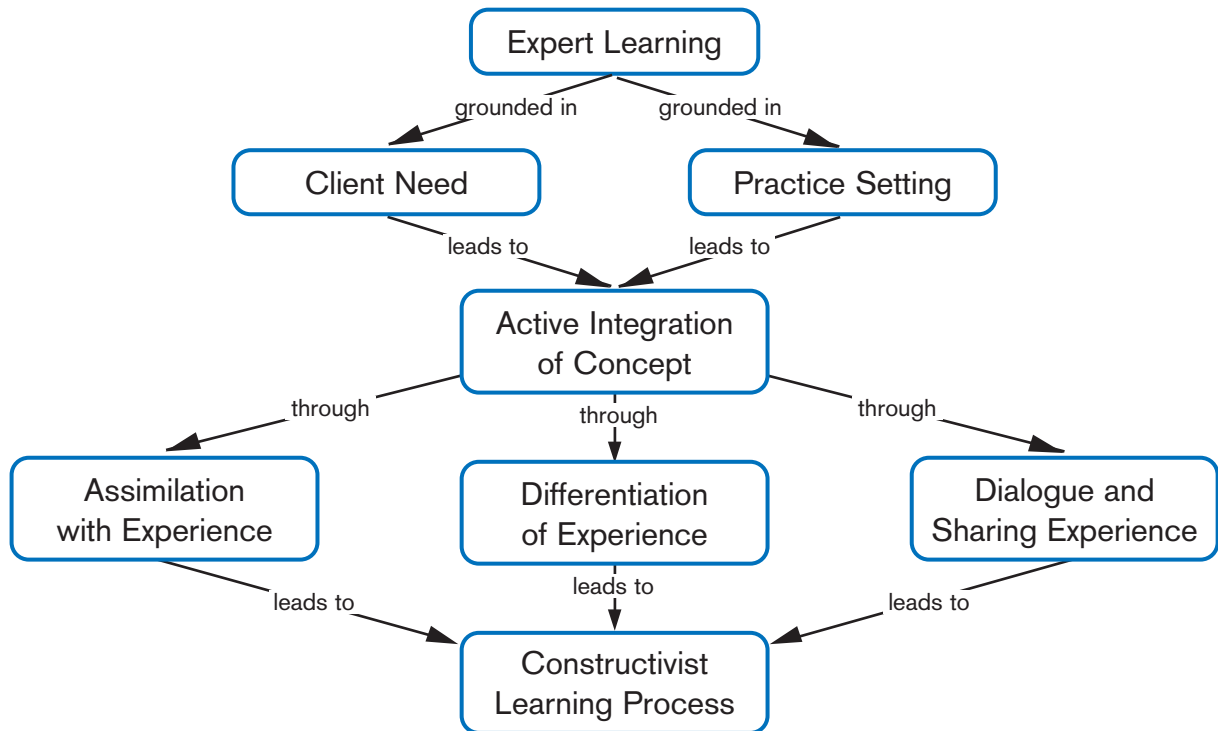


Figure 38 – Daley expert learning processes (Daley, 1998, above paragraph 19)

Have I become an expert? In my opinion, I had definitely adopted the expert's learning strategies as outlined by Daley (1998). I also was able to improvise and intuitively respond to situations which suggest I had the tacit knowledge Dreyfus and Dreyfus (2002: paragraph 54) uses to define an expert.

The proficient performer, immersed in the world of his skilful activity, sees what needs to be done, but must decide how to do it. The expert not only sees what needs to be achieved; thanks to a vast repertoire of situational discriminations he sees how to achieve his goal. The ability to make more subtle and refined discriminations is what distinguishes the expert from the proficient performer. The expert has learned to distinguish among many situations, all seen as similar by the proficient performer, those situations requiring one action from those demanding another. That is, with enough experience in a variety of situations, all seen from the same perspective but requiring different tactical decisions, the brain of the expert performer gradually decomposes this class of situations into subclasses, each of which shares the same action. This allows the immediate intuitive situational response that is characteristic of expertise. (Emphasis in original.)

Yet, having only a few years of experience, I believe that at this time I am in the proficiency stage. As I build up more experience and participate in more projects I may move on to become an expert but I am not at that stage yet. Intuition is part of my daily practice and particularly informs how I frame projects and problems, but the recognition of situations and the variety of responses appropriate to facilitate more immediate responses still has room to develop and improve. I see *'what needs to be done rather than using a calculative procedure to select one of several possible alternatives'* (Dreyfus, 2001:40).

Still I believe I exhibit the key terms in Dreyfus's excerpt: immediate and intuitive. In my earlier thinking about this phase of my practice I did not call it 'proficient' or 'expert' but the **intuitive facilitator practitioner** stage. Demonstrating what Schön (1983) calls knowing-in-action, no longer tentative and in many cases not consciously aware of how I practice, but just doing this naturally giving time to reflection, growth and, what I believe is crucial, not only facilitation but initiation.

The main lessons for 2003 were:

1. There was a real role for a person to facilitate the collaboration between academia and industry to support the integrating of 'green' initiatives in the built environment.
2. The practice functioned most successfully when looking at the whole picture, allowing for detailed specific research.
3. The demonstrated strength of a multi-disciplinary approach that supports specific expert research while engaging the specialists with each other to discuss collaboration, conflict and opportunity.
4. Working holistically means that there is a need for a broader support base, nobody can know everything, and a strong team and network is essential.
5. The importance of actual artefacts and actual hands-on experience, particularly for pragmatic trades and industries.
6. Fostering understanding for the 'green' initiatives is an important part of supporting proactive decision making.
7. In a large project, building a prototype of the designed space, the materials to be used, the infrastructure and the mechanical systems has many advantages.

What is interesting to me is that the lessons of 2003 are entirely different to those of the previous years. Whereas in previous years my questions and lessons were centred on understanding the industry, its agents and the 'green' information they required; this year the lessons were primarily on how to grow the field, provide the research and project support to facilitate continued implementation of 'green' initiatives and develop research and opportunities to move the 'green' agenda forward. Also, I did not consciously trial new ways of presenting 'green' information, I did not write extensive notes because I no longer 'saw things' that I needed to write down and reflect on; I inherently understood them. I had turned complete observation into almost complete practice. This is not ideal either, and therefore beyond the thesis I am exploring how to bring observation back into the practice for the value of reflection. Trying to understand the reasons behind experiences will help me to continue on this journey.

6.3.1 Reflection through the use of Reason's questions

For a different perspective I would like to reflect on my experience of 2003 using Reason's questions.

- Why am I doing what I'm doing?

The practice facilitated the integration of 'green' innovation into projects such as the Aurora estate, the headquarters, the Commonwealth Games Village and the Housing Industry Association (HIA). These opportunities presented themselves mainly through word of mouth. I undertook them because I could see their potential for moving towards a greener built environment, and because running a program at the university brought in research and income. Though it may seem that 2003 was a fantastic year of consolidation of the practice, of nearing expertise, I actually feel most dissatisfied. The newness, the learning and expansion of understanding was not as strong as before. I feel this is partly because most of my time was spent trying to meet the requirements of the clients, the university and the industry; that I had no time to reflect, to stop and grow myself. Having changed and learned so much over the previous years this is not surprising.

- Thinking what I'm thinking and feeling what I am feeling?

Related to the question above, I understand my disappointment with the research, the thesis and with 2003. The research had become a job. My intention for the

future is to make time to tease out the lessons and reflect on the practice, to plan for, try out, improve upon and to continue to grow. This is possibly what Dreyfus meant by proficiency, so busy just doing the job, no time for reflection, even though time is saved as most of the decision making has become intuitive and immediate.

- Why do I think this course of action will be appropriate or effective?

Making time for reflection and growth is appropriate in the next phase of my journey because, I hope, it will bring back the excitement of greater understanding and engagement with my practice, make it more than just a job. My growth in the last five years had been through observation and reflection on this observation, leading to practice.

- What other possible perspectives and experiences could enrich and inform the way I/we are engaging with the world?

Is the technique of recording critical incidences and reflecting going to continue to be an effective technique? There are some strong criticisms on reflection:

I have doubts about the virtues of reflection per se. Reflection is just as likely to produce unrealistic and untested delusions of expertise (or hopeless self-condemnation, or self-justification, or blame, or...) as it is to produce positive learning and development. It may be a necessary condition of expertise, but it is self-evidently far from sufficient; and as a necessary condition, it may well be an epiphenomenon—a spin-off, rather than a cause. Although much ... professional practice emphasises reflection nowadays, it may well be mistaking style for substance. (Atherton, 2003: paragraph 13)

Reflection taught me so much over the last five years I would say that it is a valid technique for developing practice when balanced by reading, continued testing of the results of the reflection and discussion of the results with peers. I agree with the above comment that on its own reflection is simply that; it needs to be integral to a process of practice—reflect/review, theorise, act, review/reflect, theorise, act, etc.

6.3.2 Reflection on the research journey – in the field

Apart from minimal entries into my journal, field notes and relevant documentation, my main method of research in 2003 was through writing reflective papers on various elements that interested me. I wrote one paper on critical information points for 'green' buildings (Hes, 2003a), one on the impact of culture and power on 'green' innovation in the built environment (Hes, 2003c) and one with two colleagues on the importance of education in supporting 'green' building projects (Graham *et al.*, 2003a).

Near the end of the year I was asked to write a chapter in a book on *Sustainable Stories – Reflective Stories of Sustainable Practices at RMIT University* (Holdsworth and Caswell, 2004). I took this opportunity to put at least an outline of my thesis and my latest thoughts on paper. This was an activity I would highly recommend to anyone writing a thesis. Forcing myself to write a 5000 word essay summarising my thesis laid the foundation for the final work. It ensured that, when I sat down to write the whole thesis, I already had my arguments worked out and structure defined. Moreover, I was just itching to get into it because I was able to show people my intended direction and get feedback. Therefore, I was not **as** afraid to spend three months writing the full thesis. Lastly, I could not wait to sit down and write because I found it very difficult to limit the story to 5000 words; I wanted to write the whole thesis in that chapter.

6.4 Summary

The key words are immediate and intuitive, and in reflection of the journey this is described as the **intuitive facilitator practitioner** stage. Demonstrating what Schön (1983) calls knowing-in-action, I was no longer tentative, and in many cases no longer consciously aware of how I practice but just doing things naturally.

The questions which are still guiding my research at this point and which have been part of this stage are mainly around improving the practice, continuing to improve the facilitation of sustainability innovation in the built environment and continuing to develop expertise. Further in the future, a question would be: how can I facilitate the integration of suitability information into the practice of all agents in the field? Lastly, in the scheme of things, is my practice really necessary or is it just a phase of development in the industry? In summary:

What can I do to facilitate better implementation of ‘green’ initiatives in the built environment?

I found through my experience in 2003, reflecting on all four years of the practice, that what I was doing was facilitating the implementation of ‘green’ initiatives. When I first developed the above question I did not know that a facilitative practice was where I was heading. I was successful because I was bringing together the right information, at the right time, with the right people, in the right format.

Is my practice needed in the long term?

As I discuss in greater detail in the last chapter, I aim to educate through facilitation and by providing real physical examples knowing—as I said earlier that we cannot change people just by saying: this is better for the environment. We need to demonstrate what is possible within people’s current paradigm, while providing a vision of what could be possible in the future. This will lead, hopefully, to a paradigm shift by choice in the future. Therefore, the answer to this questions for me is ‘no’, the practice of facilitating ‘green’ buildings will ideally not be long term, though there will be other areas of innovation into which the skills I have learned throughout this research will allow me to shift.

7 Discussion – insights gained

We are moving from a period of understanding the concepts of sustainability to the actual practice and implementation of technologies and techniques. This is a transition from the theoretical to the practical, from running models to reality...

Rob Bennett, manager of the 'green' Building Division and the Research and Policy Division at the city of Portland Office of Sustainable Development.³⁸

7.1 Introduction

It has been a wonderful five years. The journey I have been on has changed me significantly. The landscapes I have visited and been able to populate with real understanding have facilitated the successful integration of 'green' innovation in the built environment. This chapter represents an unpacking of my bags from the journey—bags that did in fact not exist when I first started; I needed to identify the bags before filling them with my understanding. Here I therefore pull out and focus on key lessons, hopefully growing the depth of the understanding of those experiences.

Inspired by the format used by Karen Stewart in her recently published doctoral thesis 'Choice, challenge, change' (Stewart, 2000), I will discuss the main insights of the research. Throughout the preceding chapters I have discussed, in some detail, the main lessons of the practice. Each insight is outlined and then discussed. In doing so I am reflecting on **my** insights, **my** journey and **my** understanding. As the method employed in this research does not allow for generalisation, I hope by being candid, by telling the story of my practice, that the reader can be a voyeur on my journey. That those reading can, to some extent, look for parallel or vicarious experience.

To illustrate the potential of this type of thesis I would like to give an example of some feedback from the editors of the sustainable stories book (Holdsworth and Caswell, 2004), to which I contributed a chapter. This chapter summarises the main threads of my thesis. Their comments reflect the power of this type of vicarious experience: *'Tricia and I both thought...yeah this is exactly how it felt for us...it really drew us with*

³⁸ http://www.djc-or.com/Magazine/index.cfm?page_editorial_id=29489# last accessed 26 June 2004

you on your journey and made us realise we had gone through something similar' (S. Holdworth [Global Sustainability RMIT University] 2004, pers. comm. 31 January).

7.2 Insight 1: this is how I did a PhD

Being almost finished it may seem a little late for this insight, indeed I wish I had had it earlier, but it seems you need to go through the process to really understand what it requires. The insight is that I now understand what a PhD requires.

Even as I write this I am not sure this is everyone's idea of a PhD. From a positivist perspective nothing is proved, no hypothesis, formula or model to show for the five years of work. Its validity and integrity lies in its engagement with the reader and the ability of the reader to gain some understanding and possibly vicarious experience through the telling of the story.

Some might argue that this is just what Lather (1993) refers to as a '*victory narrative*': I have succeeded in gaining insight into the integration of 'green' innovation into the built environment; I have created a practice, a successful research programme with the support of my colleagues. The description of it as just a victory or hero narrative could be given but would miss the intention of the thesis. I hope I have illustrated both my victories and my failures and shown how I learned from them—it is the learning that is central. As Atkinson (2000:160) describes '*[a]t the point of writing, it is the critical dialogue with myself and within myself which drives my knowledge forward*'. This then returns to what I understand about a PhD: it is a journey of your own learning, your own growth. It is a journey where you begin to understand how to build an argument, how to do sustained work in a specific field and collect and analyse data to support your argument. Mostly, it is about exploring something of interest to yourself and being able to use knowledge that has been developed by others to grow and understand your journey. Further, it is about describing the journey to take the knowledge further.

In this thesis I identified the gaps in the knowledge that I wanted to investigate as being:

1. How can 'green' innovation be supported in building projects by researching the process from within actual projects?

2. Can reflective practice be a part of researching 'green' innovation in the built environment?
3. Is reflective practice an intrinsic part of a sustainability practice for the built environment?

My main aim was to increase the integration of 'green' innovation within the built environment—a very pragmatic aim leading to a pragmatic experiential thesis. I could not explore this area without actually participating in real building projects, without learning and applying reflective practice techniques and without understanding sustainability and the built environment.

The research was not proving that 'a + c = b' and it was not about quantitative research through the use of interviews, surveys and questionnaires. The research was concerned with looking at the messy bits of integrating 'green' innovation in the building industry. It was exploring the actual techniques and interventions that did or did not work in the field. Due to the immersion in the field the results could not be replicated, no rules of thumb developed. There is only an experience described and then, hopefully with some transparency, how I integrated them into a practice.

On reflection, a PhD is about learning a process, whether it is in chemistry, architecture, management or any other field. A PhD is: identifying something to research, developing a method to find the answers you are looking for and then being able to bring those reading the research along with you, as you explain the process you went through and the results. The key though, for me, is that you instil a trust in the reader, that you apply a transparent and appropriate level of effort to ensuring the results are unique and fill a gap in the knowledge. You show that you understand the journey you have been on.

I say throughout my thesis: 'If only I knew then what I know now'. I imply that I would have changed my method, my data collecting, my awareness, my commitment, my approach and mostly that I would not have been so afraid. Yet, this would have led to a different thesis, a different journey and a different outcome. The only lesson I would in take with me if I could start over is the knowledge of the process and therefore I could have been less afraid and less bewildered.

As I started with the intention to explore the messy bits of integrating ‘green’ innovation in the built environment I believe that, though messy itself, the resulting process or method was successful.

7.3 Insight 2: the right information should be provided at the right time to the right people and there needs to be an incentive

When I first began this research I believed that it was just a matter of providing the right information; the expert system was going to make everyone design much ‘greener’ artefacts. Until writing this section and rereading the journey I still believed that the right information was important but it needed to be in the right format, at the right time and to the right people. Yet reflecting deeply I still felt this was not the whole story; why was it not feeling ‘right’? Then I realised that I still idealistically believed that giving the right information at the right time in the right format to the right people was enough. I was still as naïve as when I started. I realise now that people do not change without incentive. The incentive facilitated the ‘green’ innovation in the projects I worked on, the right information at the right time to the right people supported how far the innovation progressed, but that initial push needed to be there.

It is thought provoking for me to accept the above outline of my insight. It was not until I started writing this that I realised I was missing the mark and added the underlined part of the insight. It was not me at all, or the practice, that created the ‘green’ shift; the incentive to shift needed to be there to begin with! On reflection I do not think this decreases the value of the practice, just changes its focus. The value is still in supporting the integration of ‘green’ innovation, which through its success then provides incentives for others. The key word in the previous sentence is ‘success’, and the ‘green’ innovation facilitation practice needs to support agent integration of innovation successfully. As innovation is risky, the practice needs to focus on supporting its integration by appropriate responses at the right time to the right people.

Having never focused on the incentive side of the research—possibly an area to move into in the future—I would like to do so briefly. Incentives for ‘green’ decision making are quite strong in Melbourne at the moment. Many local councils, as part of their governance, are committed to improving the environmental and social performance of their municipalities and provide both voluntary and mandatory incentives to this end.

The State Government is also committed to 'green' initiatives aimed at supporting a more sustainable future, particularly in the area of energy and water reduction. Further, pushed by the current drought, the resulting water restriction, and the push for energy efficiency, the householder is also starting to look for other greener alternatives—markets for recycled paper products, low impact detergents, organic foods and non-genetically modified food are growing. Markets are also showing superior performance for companies who have ethical and environmental policies and products through greater profits and stability. Finally, for the built environment, aside from the pressures produced by the above regulatory and financial agents, there are industry lobby groups such as the 'green' Building Council and research showing improved performance of employees in 'greener' buildings (Kats *et al.*, 2003; Sims, 1998), particularly improved the return on investment (Anonymous, 2000; Brick, 2003; Carlton, 2003; Douglass, 2001; Edwards, 1998; Garbarine, 1999; Horsley *et al.*, 2003; Kats *et al.*, 2003; Magliano, 1998; Snoonian, 2003; Sterner, 2002; Welsh *et al.*, 1999; Zachariah *et al.*, 2002). Incentives are therefore increasing; for this reason effective integration is crucial and this research on developing a practice in the field is timely.

The thesis gives several examples of providing 'green' information to different agents in the building industry. Most crucial for me was that the integration should begin from the point of conception of the building: '*[i]t is much easier and cheaper to maximize the benefits of 'green' planning and design by addressing issues in the initial stages of a project*' (Wilson *et al.*, 1998). In my experience, echoing those of other authors, it is at this conception stage and in the initial design stages that the greatest potential for minimising environmental and social impact exists (Burgess and White, 1979; Chapman, 1998; Dewberry and Fletcher, 2001; Graedel *et al.*, 1995; Lewis *et al.*, 2001). Effort in facilitation at this stage provides the greatest benefit, but as the design is still very fluid, it needs to be exciting, creative and inspiring while having the technical achievability/capability underpinning it. This balance of inspiration and technical expertise was mainly achieved, in my experience, through the use of expert workshops and site visits. The main lessons were to involve most of the experts in some capacity from the beginning, and to ensure that communication spanned all the engineering fields as well as cost and building expertise. The research also identified areas of conflict between the design stage and the decision-making stages, and the potential for adding value through modelling and other technical input from experts.

Continual input from the technical team in the design process with an understanding of the limitations of this input, for example the modelling, and crucially effective communication between all the agents, sums up the theory of practice I distilled from the experience. If a project requires modelling carried out on the design then the modellers need a final design including materials and expected building usage, heating and cooling strategies. To ensure that the building design responds to the results of the modelling there will need to be iterative steps with all the agents and the modellers.

Once the design has been finalised those constructing the building need to understand why the building has been designed the way it has, they need to be on the journey with the design team, and their appointment early in the design phase is therefore helpful. The main lesson for my practice was the importance of continuity of staff and good handover facilitation if there is a change. This is true for all stages, but particularly in construction due to the relationships the site managers have with the many agents working on the building.

During the construction period and the handover and use stages of the building, continuing the relationships established at the design stage with the building users is crucial. The users of the building need to understand how the building works and their role in its effective use.

7.4 Insights 3 and 4: the fundamental role of design and architecture

The third insight stems from my lack of understanding of the role of architecture and design, I had no concept of the complexity of the building design profession. As the role of design is so fundamental to the potential environmental and social impact of the built environment (as discussed above) ensuring that 'green' innovation is accessible to the architects and designers is crucial. Its accessibility needs to be supported through education, the provision of adequate information and tools, but mostly through an understanding of the designer's fundamental impact and therefore responsibility. There were many examples in the projects undertaken in the five years where decisions were made purely on aesthetic grounds to the exclusion of social and environmental considerations. The right of the designer to make such choices is not

questioned. It is not, in my opinion, a result of negligence but oversight due to a lack of experience and understanding of the social and environmental consequences of particular decisions. Therefore any practice working on the integration of 'green' innovation at the design stage needs to ensure that the designers are aware of the consequences of decisions, understand the principles and feel empowered to make aesthetic decisions without compromising 'green' objectives.

The fourth insight is the importance of critique in integrating 'green' innovation into architectural design. I had experienced critiques throughout the five years of biannual graduate conferences. I even experienced it within my fledgling practice but it was not until reflecting on critique and its role within architectural education that I identified its power in informing design practice. The particular story I refer to is in Chapter 4, excerpt 30, my first experience of being within a critique. I concluded that architects in their design practice work with many ideas and concepts on many levels. To participate with these ideas in an interactive way needs an expert who can participate in the thought spiral, someone who is secure in their expertise and can communicate clearly to the designers what the options are and who also can listen and interact in the process of idea formation and critique. It was about providing the right information in the right format.

This was a far reaching insight; I needed to become confident to be part of the critique process, to actively engage in it to integrate 'green' innovation, particularly in the concept design stage.

7.5 Insight 5: allow agents and participants to have their own voice – discursive community

When I began the research I believed that 'sustainability' was a simple concept and ideal; you did the best you could to minimise your impact and where possible were regenerative (added social, environmental, economic value). I did not think that anyone could argue against such a concept. I came to realise that sustainability is a contested subject and that people did in fact have different concepts of its meaning, for example from making greater profits to self-sufficiency. I came to realise that this contest was an integral part of sustainability and that all opinions needed to be acknowledged to find the best solution that worked for all the agents—allowing for conflict, respecting

it, using it to search for solutions and therefore encouraging ownership of the solution. This is not possible when you say that their view of sustainability is not valid. Initiatives can therefore not be prescriptive but need to reflect their contexts, allowing each agent to reveal his or her voice.

This may seem to argue that individuals can continue to act as they do in their current practice. This is not what I am arguing. What I learned was that you cannot make people change, only provide incentives, information and tools so that when they want to change, they have the knowledge to base their decision on. People can be forced to change but will only do so willingly if it is their decision, in their power. Sustainability, being a moving target, needs willing 'buy-in' and therefore people need to feel that their point of view is valid and accepted if not agreed upon. Meppem (2000:49) puts this much more eloquently:

Understanding cultural change is therefore not a prescriptive, but primarily a descriptive approach that allows new ways of seeing problems and new functional coalitions to address these to emerge, without pre-determined value-laden constraints acting as a barrier to this evolution.

As I have discussed, sustainability is messy, but so is allowing people to have their opinion and trying to solve problems inclusively of their disparate points of view. Yet, I think, it is essential for development of long-term 'green' practice. This means that I try to '*... recognise the tensions and contradictions that are part of planning for sustainable development and that are inevitably glossed over or assumed away by an emphasis on technical rationality ... recognise and explore diverse knowledge meanings, to help interpret and develop sustainable planning practice*'. (Meppem, 2000: 50)

This does not make finding a solution easy, but it means accepting if not resolving differences, creating trust and working collaboratively—all relational connections—building understanding and encouraging ownership. It will hopefully also create acceptance of decisions made, so that situations like the one where hardwood nearly replaces the specified bamboo, or when the waste was not separated into the right bins, or when aesthetic decisions invalidate other initiatives, do not occur.

7.6 *Insight 6: innovation in the building industry requires continuity and management by people with predominately model 2 personalities*

As introduced previously, 'green' innovation in the building industry requires continuity, both in trying to retain the site team and having systems in place for adequate handover should one leave. In choosing the site team, the main manager, according to the observations I made, should be predominantly a model 2 personality (Argyris, 1982; Argyris and Schön, 1978). That is a manager who is flexible, reflective, cooperative and constructive in his or her practice. This insight was mainly the outcome of the experiences from the Civic Centre and my reflections on some of the outcomes, or lack there of (for example the reduced waste recycling during construction).

Successful integration of 'green' innovation causing minimal conflict seems to require continuity of practitioners. One of the main lessons of the Civic Centre project supports the Hewitt and Wilkinson (2002:8) argument that: '*Continuity is a major contributor to sustainability, and its attributes—reflection, consultation, cooperation ...*' At this stage of introduction of 'green' building—a new way of doing things, new technologies and new frameworks—it is important that there is continuity in the project team. This is not only due to the increased requirements of all the agents but because a successful 'green' building project requires a shift in culture to a more cooperative collaborative one (Boden, 1996; Rohracher, 1999). For the Civic Centre project the main problem, which caused the majority of the barriers and resulted in suboptimal performance, came from the fact that the project churned through three project architects, three construction managers and two project managers.

Other researchers have concluded that a lack of attention to the people issues has dire impacts:

Within the construction industry the combination of an increasingly fragmented design process, the insatiable demand for detailed information and growing client expectations in the delivery times, has placed greater emphasis on the need for effective communication, however information exchange is notoriously inadequate resulting in poor project performance. Both traditional planning and management techniques and risk analysis and management have failed to

uncover the most disruptive factors on projects which lead to duration overrun. It is now being understood that the loss of key project personnel is highly disruptive to communication and the absence of recognition and allowance for this eventuality results in a significant under-estimation of uncertainty. (Chapman, 1998:235)

Chapman's research goes on to summarise the problems caused by staff change and the knowledge drain, including time and cost overruns, defective outcomes and projects failing to be completed. Another related issue, which Chapman discussed, is that under the current sequential design process much of the detailed understanding of the design is 'in the head of the designer' (Chapman, 1998:237). This exacerbates any problems, particularly if there is a change in staff. I experienced the need to go through relationship building stages with the architects and project managers each time they changed. It was suggested above that a collaborative team with all the agents should be set up early on in the design stage to support innovative projects. This would also support the knowledge transfer from architect to the rest of the team. The problem of handover is not solved by this strategy but with a handover system in place at least the agents understand the project and the other people involved and therefore the job of handover is facilitated.

An integrated design process is needed to achieve 'green' attributes, and this places great demand on the design team. The integrated design process primarily involves increased interaction and communication among design disciplines, due to the increased interplay between building systems. In an integrated design process, building systems are designed in parallel, rather than series, so that the cumulative effect of design decisions concerning one system can be evaluated on other systems. This process departs from established 'sequential' design processes, where various disciplines contribute to a design with limited interaction with other disciplines. This new design approach presents a major challenge to creating coherent and complete designs, and typically requires increased expenditure of project resources for design services. (Riley et al., 2004)

Expectations are that this adds time and cost to the building program, but in a recent project carried out on the Melbourne City Council's Council House 2 (CH₂) the project

manager Robert Lewis said, *'the integrated design process did not cost any more than what was budgeted for a traditional design process, was conducted with full documentation and costing in 12 months and the tenders came in on budget'* (R. Lewis [project manager CH₂, Melbourne City Council] 2004, pers. comm. 22 March 2004). This project is currently under construction.

Facilitating this type of project structure and ensuring its successful completion requires management to be flexible, collaborative, cooperative and constructive. These are the attributes of a model 2 personality as defined by Argyris. Briefly, Argyris (1982:86) describes the governing values of model 1 as:

Achieve the purposes as the actor perceives them

Maximise winning and minimise losing

Minimise eliciting negative feelings

Be rational and minimise emotionality.

Bob Dick in his action research website summarises this as producing *'adversarial and defensive action strategies, poor relationships, and poor learning'* (Dick and Dalmau, 2000: paragraph 81).

Argyris (1982:102) through his research described the characteristics of model 2 as:

Valid information

Free and informed choice

Internal commitment to the choice and constant monitoring of the implementation.

Dick's definition aligns with the above description of model 2 strategies as *'less defensive and more collaborative, [they] are also more conducive to effective relationships and learning'* (Dick and Dalmau, 2000: paragraph 81).

This is therefore the type of relationship fostered by appointing agents who are model 2, as this will facilitate a collaborative environment necessary to achieve an innovative 'green' project. I specifically use the word 'foster', as I agree with Dick and Dalmau (2000) that people can exhibit both model 1 and model 2 which depends on the level of stress and conflict they find themselves in (Chapman, 1998) and the task itself.

Therefore, a cooperative collaborative working environment where there is minimal power struggle and a supporting project group will encourage model 2 behaviour.

These model 2 strategies though, are not common in practice, particularly in the building industry where power relationships, litigation and a history in the craft professions has contributed to a risk-averse, slow-changing, low-innovation and reactive industry (Chapman, 1998; Hirota *et al.*, 1999; Lehrer, 2001; Marosszeky *et al.*, 2002). Further research needs to be done on how to foster this type of working relationship within the building industry. Looking for project managers, designers and other agents whose experience reflects this type of attitude is therefore the best strategy for achieving a cooperative proactive project group.

7.7 Insight 7: power relationships and the culture of the building industry affects the success of the 'green' innovation

From the experiences of my practice I noticed in various projects how the relationships between the agents impacted on the 'green' outcomes of the projects.

Below is a short overview of the control, relationship and power issues observed in the Civic Centre case study and a summary of my perception of how they influenced the tensions and outcomes of the project.

As discussed in Chapter 4 the architects on the Civic Centre project purposely tried to make the project more 'multidisciplinary and interagency' (Hewitt and Wilkinson, 2002). The engineers were invited to workshops, targets set and issues discussed with them at length. They all understood the 'green' agenda. The problem was that some (though they all thought this was an excellent project and were glad to be involved) would go back to their office and treat the project as any other, applying the same technologies, tools, set of beliefs and values. Similarly, once the construction management contract had been let with specific 'green' requirements they soon returned to their 'culture', applying the tools, set of values and beliefs in their usual practice. They wanted to be involved in a 'green' project to make them more competitive without realising that to be successful requires a change in their cultural framework. This misunderstanding of the needs of the project created a conflict within the project that affected not only the 'green' initiatives but also the timelines, costs and quality.

The power relationships were quite clear in the Civic Centre project: the architect needed to be consulted and approve all changes; the construction manager's role was to manage timetable activities and package up problems so that the architect could make decisions on them. The client—the council—attended project meetings and signed the cheques, emphasising the need for the project to meet user needs, its timelines and budget. This role changed in the last nine months with the council's taking a greater project management role. The focus from that point was on getting the building built as quickly as possible; the 'green' goals, though important were no longer the main priority. Nevertheless, if I made an issue of an oversight, it was usually rectified—unfortunately I had to be present at the right time to wield this power. This highlights the need for external involvement of a 'green' expert in the implementation of 'green' innovation in these types of projects—until the 'green' knowledge becomes part of the cultural framework of the agent. This is especially true as a 'green' project challenges the cultural framework (specialisation) of the past 100 years. A sustainable building project requires a multidisciplinary, risk sharing, cooperative and long-term perspective (Boden, 1996; Hewitt and Wilkinson, 2002; Rohracher, 1999).

Below is a brief discussion of my perceptions of the relationships between agents involved in the Civic Centre project, and how they affected the project outcomes. It is fair to say that for this case study the *'web of human relationships'* between all the agents reflected what Davis (1999) described as *'predictable ways they deal with each other'*. Moreover, the management of these relationships was the key point that affected the outcomes, both positive and negative. On reflection the relationships that needed to be strengthened were between:

Engineers and architects—there was a fear of risk-taking within engineering, so there was a tendency to revert back to systems that had worked previously. Therefore systems were over-engineered and did not meet the energy saving goals that had been set.

Engineers and other engineers—it is vital that the various experts interact. This is not typical. For example, the electrical engineer designed the lighting to a level of 5 W/m² but the mechanical engineer still assumed a heat load from the lights of 20 W/m².

Construction manager and the architects—the model of construction management selected by the clients meant the architect needed to be part of all decision making on site. Therefore there were delays and frustration as issues of design were sorted out. This would have been minimised if there had been a more thorough explanation of why things were designed the way they were and the importance of the ‘green’ aspects of the project. Also needed were clear, enforced targets and reporting structures.

Construction manager and the subcontractors—the site was not a happy place partly due to the control of the architect and partly due to the personalities on site. The project team had the best intentions of being ‘green’ but the agents were trying to fit it into a ‘business as usual’ cultural framework. Further, the subcontractors did not get the support they needed to understand the ‘green’ initiatives on site. Though they were taken through an induction process, this was not taken very seriously and there was no follow-up.

From these short descriptions it becomes apparent that ‘...*the various disciplines and agencies continue to stress their autonomy rather than their interdependence, and that adversarial rather than cooperative attitudes are implicit in membership*’ (Hewitt and Wilkinson, 2002). The decision making occurred mainly at the architect level, nominally approved by the client and informed by the input of the other professionals as well as the building users and to a lesser extent the community. Under the construction management model used, most on site decisions also required the architect to sign off though the construction manager controlled on site issues like waste disposal, cleaning, etc. The overall control therefore fell strongly under the responsibility of the architect.

This could explain why some of the conflicts occurred in the project. The sense of ownership fostered by having some power and control and not having to report everything through the architect may have produced a better result. It would have fostered a healthy building culture (Davis, 1999) and potentially a happier site, though the question remains whether it also would have led to losing more of the environmental initiatives.

Response on a general level to the threat posed by power culture conflicts on site are difficult to formulate. Being aware of their impact is the first step, and then trying to

minimise their effect when they are observed, depending on the context, is the next. Again this comes back to fostering a cooperative, collaborative, constructive team, which might prevent conflicts altogether, and which creates an atmosphere that deals with such conflicts before they have an impact.

7.8 Insight 8 and 9: the need to integrate ‘green’ innovation in the current market, the importance of demonstration projects and looking to the future

The eighth insight was that it is not possible to force people to change, they must want to. Demonstrating and just doing it provides a good medium for integrating ‘green’ innovation into the built environment.

As discussed at the beginning of this thesis, I assumed that people would want to change given the right information, but as discussed previously I did not realise that they also needed a motivation to change, something other than ‘it is good for the environment’. There needed to be some immediate incentive.

In general, it was my experience, that there was a resistance to change. When looking at the current built environment and then projecting to the future, our current situation appears to be such a long way away from a sustainable society that it is easy to conclude that only a catastrophe can provide the magnitude of incentive to create the change needed. Through the experience of this research I have seen real, if incremental, change and with a mixture of interventions in the immediate market. Therefore, in looking to the future I believe we can move towards sustainability without major disruption. Like a child learning to walk, or for that matter someone on a new practice journey, one starts with small aided steps that lead to larger steps in the future. Supporting the implementation of ‘green’ innovation by providing context free learning environments, then providing support for tentative integration into practice—and so forth through the development of expertise—will set up the framework for change. It begins therefore with education, the provision of short courses, integration into existing built environment discourse, industry workshops and tangible examples.

Further, in working with the agents in the built environment, there are very strong cultures (Davis, 1999; Hewitt and Wilkinson, 2002; Lehrer, 2001; Nadler *et al.*, 1997),

architects, builders, engineers. Also the stronger the culture the more difficult it is to introduce change. Sathe (1983), in management literature, has shown that resistance to change is a result of the size of the change multiplied by the strength of the culture. Therefore the steps taken in transition need to be very small, with accurate information, supporting frameworks and policies.

Moreover, agents active in the built environment mainly possess a tacit knowledge, knowledge-in-action: architects in design, builders in construction, engineers in technical system design. Supporting the integration of 'green' innovation therefore needs to respond to this tacit knowledge appropriately. Christensen and Birou (2002: paragraph 16) suggest that tacit learning methods need to be used, that is methods which 'show' as opposed to explicit learning, which is based mainly on 'telling'. That supports what I have found in my practice: demonstration projects, hands-on workshops and application to actual artefacts seem more powerful than lecturing and providing information.

My ninth insight was that small changes now potentially support a paradigm evolution. I believe that we cannot wait on our journey to a more sustainable society until we know all the answers, or until all agents are ready for change. Though this may occur it would only be due to some extreme event. If this event occurred and there was no research—no attempts at integrating 'green' innovation from which lessons could be drawn—then decisions would be made arbitrarily, potentially not improving the situation. By creating small changes now, demonstrating 'green' innovation, providing supporting tools and information, starting to educate the agents and the community we are creating a vision into a possible more sustainable future. It may lead to a paradigm evolution.

Owen (2003:49) eloquently argues why it is a paradigm evolution, not a paradigm change:

From a contemporary postmodernism position, therefore, rather than a 'paradigm shift', the notion of 'paradigm evolution', which embodies a multitude of values and positions and a recognition of the uncertainty of the future and a connection with the past, may be more theoretically plausible.

When we start the change process by demonstrating what is possible now within the current market, we begin to develop the information and the experience to support our future evolution. The term evolution resonated with the concept of this research; it

evokes the idea of change and growth without needing to define what the end point will be. As I have argued in this thesis, sustainability is a fluid concept, a moving target that will change as factors affecting our lives change. In my practice I observed changes taking place that support a move to a 'greener' society. I see some initiatives leading to short term changes that work with the market as it is and others as medium term changes that build on them to shift the market, if slightly, leading to a critical mass in the future where the evolution occurs. Currently, as I write the third draft of the thesis the shift is away from sustainable to regenerative. I discuss this evolution in the section on recommendations for future research at the end of this chapter.

Short term initiatives are gaining acceptance; people are beginning to hear that our way of life is under threat and this is followed by education and projects demonstrating how to minimise this threat, leading to the development of tacit experience. Medium term initiatives for example are the introduction of 'green' requirements, specialist practitioners, and development of parts of the community adopting the 'green' initiatives. One of the key movements I have witnessed in my practice is a shift away from segmented specialists to a more cooperative, collaborative, risk-sharing model. Specialists are still required but they now integrate their skill into the whole and talk to all the other parties to ensure improved cohesion. Farmer says this movement away from Cartesian logic *'which led to the development of ever more specific and defined specialist disciplines is being challenged by the new physics which views the universe as a fluid and dynamic amalgamation of inter-relationships. Biologists such as Rupert Sheldrake are returning to the 'whole' after finding that the traditional scientific methodology of examining the 'part' not only failed to substantiate orthodox theories but refused to acknowledge many of the phenomena so obvious to the naturalist. Physics is again paralleling philosophy'* (Farmer, 1999:205).

Recent research into the built environment has shown that the movement from a market based culture to a clan culture—from every person for themselves his own to shared risk—has resulted in greatly improved delivery of artefacts. Quality, safety, cost, and on-time delivery were all improved (Marosszeky *et al.*, 2002). Their descriptions of the market and clan cultures are reminiscent of Argyris's (1982) model 1 and 2.

Using this framework, it was found that projects achieving below average performance showed a strong orientation towards market forms of culture,

which are paradoxically, results orientated. The management styles (implicitly) inherent within this culture are focused on short-term goal attainment and project managers are 'hard-driving' and competitive. This type of culture focuses on the individual and his/her ability to produce. These forms are not conducive to developing co-operative, open, team environments, but rather, adversarial, conflict-ridden projects concerned with individual, or organisational, self-preservation.

Conversely, projects that produced above average results exhibited considerably weaker Market characteristics while possessing strong traits associated with Clan types of organisation. These are organisations that place a premium on team cohesion, consensus and morale and are led by managers with a mentor or facilitator style—they were people orientated. They recognised and were receptive to the needs of the individual and the team as a whole. It logically follows that this approach to managing projects is most likely to nurture an environment conducive of proactive, committed, and open team working. (Marosszeky et al., 2002:10-11, his emphasis)

The idea of providing short and medium term objectives while looking towards the long term is starting to address one of the main problems of today's society: the lack of time. Sustainability needs to be considered a long term project, something we work toward and are responsive to. Our political framework, consumer society and perception that we need everything 'now' are not geared for this type of thinking. They are some of the reasons that make sustainability such a difficult concept to aim for and the consequences of unsustainable life styles seem so far away. Yet this short term focus is changing:

It is universally acknowledged that today's society is facing great changes and that the drivers of such changes are major and interconnected trends, such as economic and cultural globalisation, the spreading of connectivity, the rise of information and knowledge economy, the evolving of the environmental issue and the search for sustainability.

All of this, in spite of its turbulent and unforeseeable manifestations in everyday life, clearly shows some indications of a mid-long term perspective: society, in

its whole, and single enterprises and even single subjects will have to revise their frameworks for interpreting reality, their objectives and their modus operandi. Obviously, this will require time and concentration, which are the very two existential and operative conditions that seem to be lacking today. (Manzini, 2000: paragraph 1 and 2)

This is echoed by Cole (2001:3):

*The American environmentalist Stewart Brand in his recent book: *The Clock of the Long Now – Time and Responsibility*, argues that society is on the “pathological path of the short attention span”, thinking only about the immediate future. This condition is occurring at a time when environmental responsibility demands that we need to take the long-term view.*

What Manzini and Cole are alluding to here is the time we need to reflect on our actions, learn and accept our mistakes, to think of their consequences and to consider options rather than just reacting. Therefore, any move towards a more sustainable future in the built environment needs to support innovation with relevant information and tacit experience and to educate the community and the industry about reflection and an acceptance of learning from mistakes while supporting the movement from a model 1 to a model 2—from adversarial and defensive to more collaborative. All of this requires planning, as it needs to be done in small steps that are not perceived as risky and do not create conflict. This agrees with a recent study published by the Dutch Government on the National Milieu (Environment) Plan 4 (NMP4):

Transition to sustainability by NMP4 [Dutch National Environmental Plan 4] is meant “a transition is a gradual process of societal change in which society or an important subsystem of society structurally changes...” (Rotmans et al. 2000:19 quoted in Kemp and Loorbach, 2003:7, my emphasis)

A transition is the result of the interplay of developments that sustain and reinforce each other. Transitions are not caused by single variables—a price change, policy act or a new technology—but are the result of developments in various domains which sustain each other: technology, economy, institutions, behaviour, culture, ecology, and images/paradigms. The process of change in a transition is non-linear; slow change is followed by rapid change when things

reinforce each other, which again is followed by slow change in the stabilisation stage (Kemp and Loorbach, 2003:7, my emphasis).

Currently, the building industry has identified resources to support it in this transition process including *'compliant codes, readily available cost comparisons, statistics on benefits, expedient resolution of code conflicts on 'green' building techniques, material specifications, lower initial costs, expedient permitting processing, supplier's directory, 'green' tours, 'green' building training, interactive website, hassle free inspections, trusted central source, and consumer knowledge of benefits'* (Anderson *et al.*, 2000:6). NMP4 reflects these needs by the provisions they are putting in place to move to a more sustainable environment:

- *To deal with uncertainties, through the use of scenarios...*
- *To keep open options and deal with fragmented policies: to stimulate knowledge and technological change, to pursue innovation and incremental improvements, to take a multi-domain view with attention to all relevant actors.*
- *To have a long-term orientation and to use this for short-term policies.*
- *To pay attention to the international aspects of change processes and find solutions at the right scale.*
- *A set of specific tasks for the government: to stimulate, mediate, engage in brokering services, create the right conditions, enforce its laws and engage in steering. (Kemp and Loorbach, 2003:7)*

Interestingly, my argument is that this is only the information and innovation component of the evolution. What is missing is the culture changing reflection component that will maintain a move to sustainability. Industry is unaware of this component and programs such as the NMP4 are not responding to the need for facilitating change.

In this paradigm evolution, or transition, a well known model (Rotmans' transition model—Rotmans *et al.*, 2001) can be used both to place this current research in context and to help inform the medium and long term needs of 'green' practice.

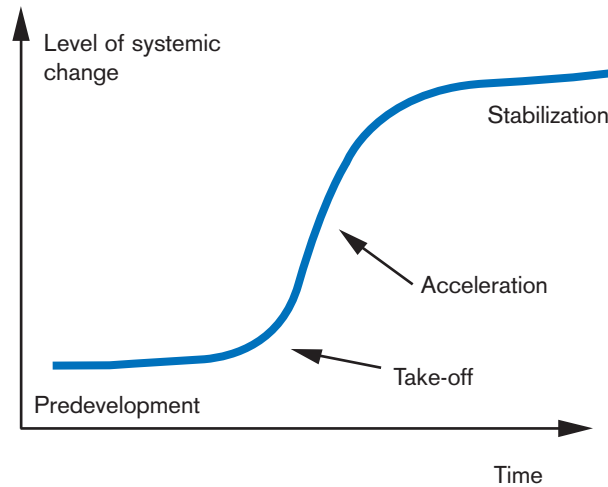


Figure 39 – Four phases of transition (Rotmans *et al.*, 2001)

Initially, in the *predevelopment* stage experimentation and the development of tacit knowledge is supported. There will be little take up by society as a whole, but the body of information will be increasing to a point where there is take-off. This is where the 'green' innovation in the built environment is currently placed, just before take-off. At take-off things begin to shift, leading to a breakthrough where '*structural changes take place in a visible way through an accumulation of socio-cultural, economic, ecological and institutional changes that react to each other; during this phase, there are collective learning processes, diffusion and embedding processes*'. Finally there is '*the stabilisation phase the speed of societal change decreases and a new dynamic equilibrium is reached*' (Kemp and Loorbach, 2003:8). This transition has been shown to be gradual, spanning 25-50 years.

The movement therefore from experimental to take-off is dependent on large scale uptake by society. This thesis has been about developing understanding on the practitioner's side of the equation—what is going on in design, construction, engineering design. I was looking at how to support the building industry in 'green' innovation. To a certain extent I could see the demand from clients increasing and wanted to explore how to support uptake through looking at the real experience in the industry of trying to meet this demand. 'green' demand is seen as one of the main drivers that will support a change to a more sustainable built environment (Mead, 2001). Moving to the take-off and breakthrough stages of 'green' innovation uptake in the built environment will be dependent on how successful these innovations are seen to be, therefore it is imperative to support the industry at all of its levels.

One of the arguments that is often put forward, because it supports current short term thinking and reactive tendencies, is that we do not know what the future holds, so why worry about it? Moreover, technology will fix the problems we will face in the future. I feel that though technology has the potential to fix many a problem, it is the reactive, end-of-pipe attitude that is the danger. We are not looking behind the problems to discover why they occur. As Jenks puts it:

The problems of a modern technocratic civilization will always keep one step ahead of any amelioration because the reigning ideology of continual human growth—both numerical and economic—is unrealistic. It will continue to manufacture new problems, equivalents of the greenhouse effect and the hole in the ozone layer. No matter how many piecemeal solutions to these are instituted, the problems will go on multiplying because, for the first time in history, humanity rather than the Earth has become the dominant background. The players have become the stage. (Jenks 1993:126-7 quoted in Williamson *et al.*, 2003:27)

I am not suggesting we all go back to Stone Age self-sufficiency. There is a valuable place for advances in technology in supporting a 'greener' built environment. I am arguing against the blinkered trust that technology will fix all ills without looking at the causes of the ills. Technological innovation is one of the potential facilitators for 'green' innovation in the built environment as it allows more efficient use and management of resources; this is but **one** aspect of 'green' innovation. Yet I agree that, though being only a small part of the solution, the appeal of high tech buildings could be the '*Trojan horse bringing change into a hostile camp*' (Hagan, 2001:61).

In summary my experience in developing this practice has shown me that a multi layered approach needs to be taken to integrate 'green' innovation into the built environment. This approach needs to take into consideration the culture of the agents active in the industry, creating the least possible conflict by fostering a model 2 (cooperative and collaborative) relationships. Development of information and experimentation needs to be supported while looking to the future and preparing for the possible take-off of societal demand for 'green' innovation.

7.9 Insight 10: the need for the facilitation of sustainable buildings

The building industry did not need an expert system or more explicit knowledge but tacit understanding through facilitation. It needs the relative safety that relying on someone else's expertise provides, just as a novice or beginner learner needs to feel safe.

In reflecting on the past five years I came to realise that what I was doing was facilitating. I did not have all the answers so I was not the expert. Neither did I belong to any of the agent professions. I was part of the design, planning, construction and regulatory teams. My role was to integrate 'green' innovation and facilitate this through collaboration with all agents involved.

I became a problem solver, a coordinator of relevant expertise and information at the appropriate time. To a certain extent what I was doing was similar to what a designer does in bringing together disparate information to solve a particular problem—in my case providing the interface between the available expertise on 'green' innovation and the building team over the life of a project. The most important requirement was the ability to speak the language and understand the culture of the agents involved. However, I hope that my kind of practice is only a short-term practice though, only needed while the industry assimilates the knowledge needed to provide 'green' options. In the long term, architects, designers, engineers and builders will have their own skills in integrating 'green' innovation, particularly if the procurement and delivery models allow for a clan-like, constructive project structure to be set up.

7.10 Insight 11: using reflection and observation to build a practice in sustainable innovation in the built environment

Observation and reflection is needed because 'green' innovation is a relatively new concept, integrating it into the built environment is even newer and as such many mistakes will be made as experience grows. Further, 'green' innovation holistically working on many levels of a building project is also complex as sustainability is a very complicated, all encompassing concept with many points of view. Moreover, the building industry itself is complex—they are all swampy, messy fields with many 'wicked problems'.

Sustainability is a wicked problem:

Consequently, there remains a great deal of uncertainty regarding the meaning of sustainability. The expansive definition, which includes social and cultural as well as ecological concerns, more readily accommodates the ideal as well as the imperative for integration, since sustainability can be construed as a 'wicked problem'. (Owen, 2003:200)

Architecture already deals with wicked problems:

There is a certain veil of mystery accorded to the design task, and it is generally supposed that design cannot be taught in the same way that science can be taught, given the 'wicked' nature of architectural problems. (Owen, 2003:21)

A reflective practice approach ensures that systems are in place to capture these lessons and translate them into future action. It allows for openness and an ability to look back at experiences with similar complexity to resolve present problems and plan future action.

Integrating 'green' innovation in the built environment is a wicked problem. Not only is it dealing with many competing facets of sustainability while dealing with different agents over different time scales, it also has to deal with culture clashes—'the way do things'—and be able to guide or facilitate a different type of behaviour. Williamson *et al.* (2003:66-67), discussing sustainable architecture, describe the artistry of design practice and its integral use of reflection as solutions are proposed. They describe how the process of design as iterative and sometimes this leads to unexpected 'back-talk', and initially discarded ideas can suddenly become more relevant as the requirements of a project become clearer.

In a building project it is not possible to foresee every eventuality. Even in a project where documentation is thorough and costings complete, unexpected events may occur. In immature discourses the chance that solutions and opportunities are overlooked is high. I believe reflection is therefore an imperative element of the messy practice in design and the built environment. Also the collaborative and cooperative model of learning and management should be part of the practice, providing the ability

not only to deal with immediate problems but also to look behind the problem and deal with any underlying issues.

But there are those who criticise reflection; these are criticisms that could extend to this thesis, and its validity. Atherton (2003), quoted in Chapter 6, for example, says that reflection could produce unrealistic untested delusions. I interpret this criticism to mean that reflection alone is insufficient to support the development of expertise. I agree, reflection is a tool to use when assessing an event, a critical moment, and its strength is that it allows you to look at tacit practice and the reasons behind an event. It allows you to develop an understanding and a way to evaluate and review an event and plan a future response. Its value is in the depth and persistence of the reflection and the answers found through the reflection, not the process itself.

Observation is also a key element in the development of my practice. Without observation skills, while being sensitive and open to the context in which the practice occurs, it is more difficult to reflect effectively. Observation allows the observer to learn the language and the culture of the group and pick up non-verbal cues. In this fledgling practice, as a novice, observation and reflection on the observation was a key to developing my practice.

I recently came across the work of Atherton criticising reflection and suggesting a different model of developing expertise. In proposing the components of expertise, shown below in a diagram taken from his work, he suggests that he augments the work of Dreyfus: *'[i]t is consistent with their model but provides a slightly different perspective: it concentrates on exploring the components of expertise, rather than the stages on the way to it'* (Atherton, 2003: paragraph 13). He defines the elements as:

- Competence as *'the simple ability to perform the requisite range of skills for practice'*; in my case having the explicit knowledge on 'green' innovation and technologies or where to find them.
- Contextualisation *'is knowing when to do what. It is the additional skill of flexibility, discrimination and discretion which enables a practitioner to select the appropriate method for the situation'*. I would argue this is the tacit knowledge of experience, enhanced by reflection. For example, I now know when and in what format to show architects' information on materials for a project. If I had

not experienced in practice what occurred when I first tried to integrate material information I would still be giving out lists of manufacturers without cost and samples. This is a simple example of discrimination, I may have discovered the same information by carrying out surveys, but the immediacy of the experience helped shape my future practice in a stronger manner than survey results would have.

- Contingency *'is the greater flexibility to be able to cope when things go wrong. It implies a great depth of understanding of the situation, which can be drawn upon to develop a strategy for action which does not simply rely on predetermined recipes.'* Reflecting on this, 'contingency' is about having built up the resources to cope—knowing more, having enough others to call on, having the personal resources of strength not to panic. I believe I show a development of this 'contingency' in the five years of this research and also the ability to develop innovative strategies.
- Creativity *'is the capacity to use all the "lower" level skills in new ways to solve new problems'*, this is when innovation occurs, when you listen to the unexpected talk-back and try a new direction.

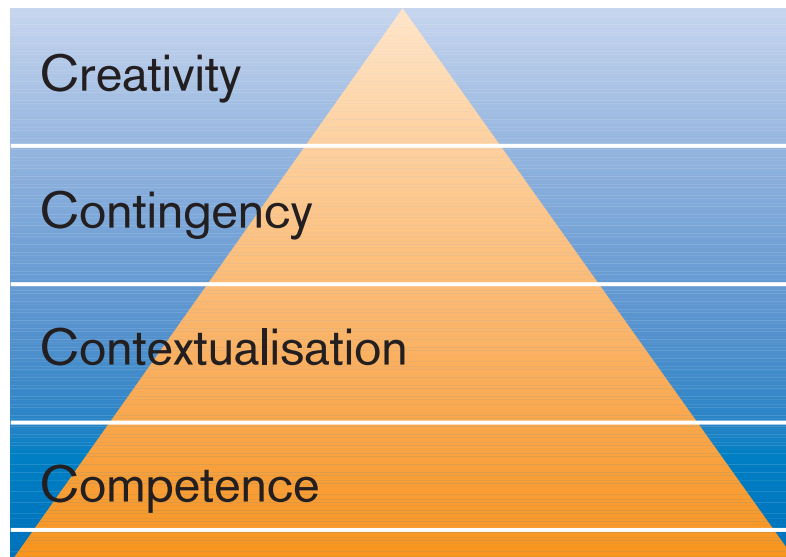


Figure 40 – Atherton model of the components of expertise (Atherton, 2003: after paragraph 14)

Atherton's argument is that the broader the triangle the greater the expert. Dreyfus's stages are seen as leading to the development of the broader components. I have seen evidence of all the components in my practice and would argue that the reflection process, both conscious and unconscious, helped in the successful development of this practice over such a brief period of time.

Atherton's model highlights another aspect of this research: as I tend to be a facilitator, my competence, as defined by Atherton, is more in facilitation of 'green' innovation itself than in 'green' expertise. This is because the aim of my research was not to become an energy efficiency, materials, solar, indoor air quality, or water efficiency expert, but to observe the building process and experience the issues relevant to the integration of 'green' innovation into the process. My expertise was therefore developed in the facilitation of this information rather than the information itself. Through experiencing the problems and reflecting on them I have come to realise that to integrate 'green' innovation into the built environment requires a transdisciplinary approach to the development of solutions. It needs facilitation and the bringing together of the various ways of knowing. Therefore I try to understand the questions and how to answer them, with the help of the knowledge that a *'transdisciplinary orientation recognises how problems are conceptualised will largely define the solution sought'*. (Meppem, 2000:48)

7.11 Conclusions

My journey has led me from the researcher who started on this journey in 1999 as someone who did not comprehend what an architect or what design represented, or how 'green' innovation could be relevant within this field, to someone who has built a practice effectively integrating 'green' innovation into the built environment. It is a practice that proactively looks, observes the practice and the field, and initiates projects to fill knowledge and experience gaps so as to more successfully implement greater sustainability. The diagram below shows Dreyfus's (2001) definitions of professional development, my own reflections on my development and the questions I was asking at each stage, which illustrate in part the development of the practice.

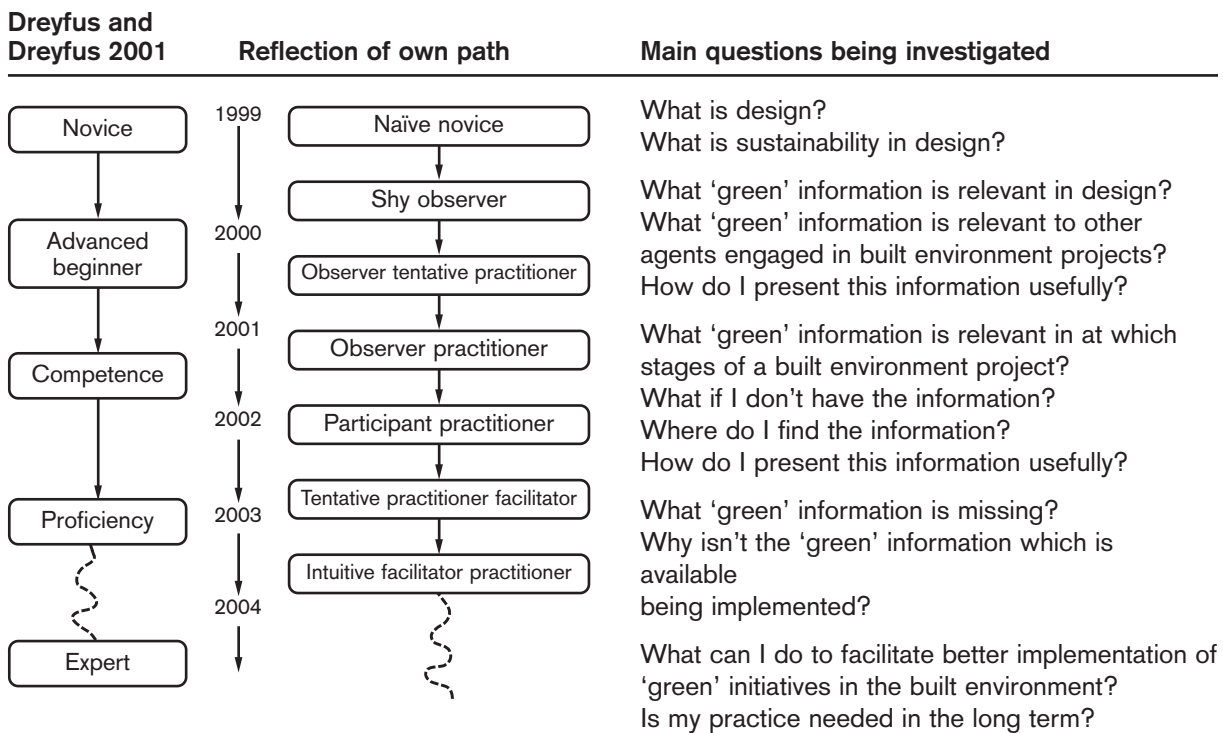


Figure 41 – Journey of observer to 'green' building facilitator

Thus, the practice has moved through Dreyfus's steps from novice to expert, in the process developing a method for approaching sustainability research and highlighting the importance of Boyer's (1990) definition of scholarship, i.e. the importance of stepping back (reflection); connection and identification with all the players in the built environment; developing real world applications based on theory and research; and, importantly, learning to communicate in the right language to the right agent.

The 10 insights outlined above (without the insight into how to carry out a PhD) mean that for my practice I attempt to provide credible correct information while working with local, state and federal governments on potential incentives. For the practice of 'green' innovation facilitation this means a dual approach one supporting the development of incentives the other the information to meet the demand the incentives create. The third and fourth insights argue that 'green' innovation needs to be integrated from the very beginning; this means that a key role in the practice is to ensure that the design professions have the knowledge to influence the clients. Insight 7 was that the building industry has a strong culture and power division and that this affects the success of the integration of innovation. For the facilitator this means that it is important to allow all stakeholders to have a voice in the integration of 'green'

innovation and that the fostering ownership (insight 5) of 'green' innovation is a very important component of the practice. Also, the power and culture characteristics of the agents means that small steps need to be taken with clear credible explanations, tools and simple implementation strategies (insight 8 and 9) to provide certainty; physical build examples are a key mechanism for this. More difficulty the anecdotes in this thesis show the need for continuity of agents working on innovative project. Further, these agents need to have a constructive and cooperative attitude which is fostered by clear explanations, the building of trust in the team, the minimisation of stress through adequate resourcing and the minimisation of conflict (insight 6). Finally through this thesis I have demonstrated the need and importance of reflection in a 'green' facilitation practice, particularly in a complex industry such as the building industry (insights 10 and 11).

7.11.1 Future research

This journey has only been a brief glimpse into the integration of 'green' innovation in the built environment. It is my experience and is therefore a one-off piece of practice. The degree to which it can be generalised is difficult to determine. There is a great deal of scope for future research. It is a very immature field and there is little in-depth knowledge about most of the areas I have only just touched on. The most exciting area for future research is in the shift from sustainable to regenerative design. Trying to attain sustainability or to maintain the status quo so that we can continue to live as we live is no longer enough, we should be aiming to add value to the environment and social milieu of a project—to gain a net benefit from any project. The definition of this for the built environment, the development of experience, tools, case studies, and so forth are part of the research opportunity.

Taking the tools that I have developed in response to experience and carrying out additional quantitative research over larger samples of the application and refinement of these tools would be a useful research direction.

One of the tools I would have liked to discuss in greater detail is Table 10 in Chapter 5. This tool outlines the process tasks needed at each stage of the building process and could lead to a research project looking at all the agents within each task, outlining their opportunities and risks. What particularly interests me is the 'messiness' between each

of the agent's professions, what opportunities are there for minimising this 'mess', and working more collaboratively.

Another potential area of future research is suggested by the work with Delta and the other project where costs and the lack of market demand are used as barriers. The experience with the industrial design company, for example, highlights how strong the influence is of market perception and demand in integrating 'green' initiatives. How can demand be created or other incentives devised? There is a strong body of research into 'green' consumerism and innovation uptake and incentives, which would be interesting to look at. Also this study could extend into actually looking at the performance of 'green' products and buildings over non-'green' ones, building on studies already carried out (for example Kats *et al.*, 2003; Matthiessen and Morris, 2004) to answer the question of whether it is the demand that drives the innovation. Demand as a driver for innovation seems to be what various participants alluded to, but there are many examples of research and development of new products that actually create demand—for example the walkman, mobile phones, etc.

I was also fascinated by how I learned in this research, how I changed and was able to incorporate different theoretical frameworks. In Chapter 3 I say, *'I also do not think that you can replace one way of looking at things with another, I have a feeling that you just continue to build your 'view' of how things work'*. This constant shifting of our theoretical framework in response to learning and the problems faced is an area this thesis could not delve into, but would make interesting future research from a reflective practice perspective. It is not so much swapping one set of glasses for another but getting a stronger set of glasses, and different lenses for different uses—microscope to binoculars.

What is missing in this research to a certain extent is the voice of the tradespeople. The tradesperson is the agent responsible for the final articulation of the building. I attended a recent Australian Government workshop on setting energy performance targets for Australian Government accommodation which concluded that one of the areas where 'green' innovation is failing is in the translation of design intent to actual performance. Many four and a half star designed buildings are not even performing at 2 stars when finally built. Identified as an issue in this research, the future exploration of this gap is crucial to further support the integration of 'green' innovation.

One of the most interesting areas that had to lie beyond the direct scope of this thesis, although it was always implicitly present, is the impact of culture and power on project outcomes. I touched only briefly on my experience of their impact on ‘green’ outcomes; at one stage I contemplated going into more depth as it seemed so significant, but realised this would constitute a whole new PhD. Furthermore, aligned to the tradesperson discussion above, there is an opportunity for future research to go deeply into the impact that current building industry power and culture issues have on construction performance. Though outlined briefly above in the discussion this is such an important area with such consequences it would be interesting to research specifically. Similarly, the induction process, which is such a fundamental part of creating ownership and dissemination of innovative projects to those on the ground seems to be one of the areas that is never investigated.

In Chapter 5 I briefly discuss the limitations the tender process experienced at the Civic Centre project. One major limitation is that the tender process is based on a large set of drawings and specification that the majority of the potential contractors do not read thoroughly because of the small chance of winning the contract. Research needs to be done to look at the history of the current tender process, what the implications are—not only environmentally—of the approach with a view of developing some other system that demonstrated propriety while not wasting people’s time. If innovation is going to be part of the built environment practice contractors need time to be able to read, understand and realistically respond to projects. This relates also to the use and detail of specifications. If they become so complex and detailed that contractors do not have time to read them, is there another more effective way of communicating aspects of the project? Their main role seems to be as a way of demonstrating intent, and for pointing to if things are not built correctly. The satisfaction of being able to see it rectified must certainly be outweighed by the enormous costs. Surely there must be a way of having it done correctly in the first place. It would be interesting to research, particularly due to the complexity of the building process, the number of agents involved.

I find the furphy story in Chapter 5 another fascinating research opportunity that I could not pursue in this thesis. How deep is the practice of finding an excuse so as not to need to change or consider a new alternative? Why is such an excuse perpet-

uated? Naturally this leads into the whole paradigm of change and the perceived aversion to change.

7.11.2 So what?

The research gaps identified in the literature were:

1. How can 'green' innovation be supported in building projects researched from within actual projects?
2. Can reflective practice be a part of researching 'green' innovation in the built environment?
3. Is reflective practice an intrinsic part of a sustainability practice for the built environment?

I have answered these questions in the above discussion and throughout the thesis. I have provided my response to the issues I encountered while participating in 'green' building projects, successfully building and developing several projects and having input into the planning of many more. I have shown my use of reflective practice and argued why reflective practice should be an important part of every sustainability discourse because of the conflict ridden, contested and discursive nature of all the people who need to be involved in any 'green' project.

To close...

This thesis has been a reflection on a journey of the development of a practice that facilitates sustainable or 'green' innovation in building projects. I have tried to avoid self-indulgence while at the same time giving an honest and detailed account of my journey. The main criticism on the work stems from Dey's (1993) comment '*[t]he trouble is, of course, that we tend to see what we want to see and hear what we want to hear... We tend to make more of the evidence that confirms our beliefs and pay less attention to any evidence that contradicts them*'. There is only one voice, mine. By being candid about my journey, directly showing excerpts from my journals at the time, discussing my interpretation of the events and my reflective action, I have endeavoured to create a transparent process that shows my thinking. In so doing I hope I have

created a vicarious experience for the reader and that you can draw some parallels to your own experience and possibly develop new insights. I hope I have achieved what Bentz and Shapiro (1998:5) term good research:

Good research should contribute to your development as a mindful person, and your development as an aware and reflective individual should be embodied in your research.

Concluding I would like to refer to the quote from Roberts (2003:iv) who summarises this research much more eloquently than I can:

The thesis represents a sustained inquiry into the dialectic of how I and others shape my practice and how my practice shapes me and influences others.

I hope that this story will continue to influence others and that I will be able to continue to be shaped by it as we move into a challenging, frightening, dynamic and hopefully more sustainable future.

You can know the name of that bird in all the languages of the world, but when you're finished, you'll know absolutely nothing whatever about the bird. You'll only know something about people in different places, and what they call the bird. So let's look at the bird and see what it is doing – that's what counts. This is how I learned very early the difference between knowing the name of something and knowing something. (Feynman and Leighton, 2001:14)

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Appendix 1

Chronology of PhD research

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Date	Main activity	Data collection strategy
Feb 1999	Began	
	Telstra home team and the research into online childhood education – introduction to Piaget and constructivism	Project documents
April and October 1999	Postgraduate Design conferences	Journal
Nov 1999	After several iterations of the proposal it was accepted	Proposals and communications
	Participation in 1 week landscape design course	Journal
	Case study 1 - option with landscape architect (Cath Stutterheim) on the redevelopment of Elwood creek - abandoned	Journal, ethic approval
	Case study 2 - Started at Delta – industrial designers	Journal, ethic approval, project documents, drawings, computer files
Dec 1999	Interview with Beta for the Civic Centre project – 10 weeks full time research	Journal, ethic approval, project documents, drawings, computer files
	Delta started on parking garage lighting system and automatic library borrowing system	Journal, ethic approval, presentations, group discussions, documents, drawings, computer files
Jan 2000	Began work at Beta and reduced work at Delta to 1 day a week	Journal, ethic approval, group discussions, interviews, observation, videos
	Design development at Beta – working 4 days Audit old building for reuse Work with clients and architects to develop sustainability measures	Journal, ethic approval, group discussions, interviews, observation, reports
Feb 2000	Stopped working at Delta due to time constraints	
March 2000	Design development at Beta – working 3 days Water issues dealt with Design session and idea development for solar on the building Major presentation of sustainability options to the stakeholders – temperature, lighting, and water Project architect was fired Eco-Recycle Victoria funding application	Journal, ethic approval, group discussions, interviews, observation, copies of sketches and plans, presentations, reports
	Other projects: - LCA courses - Proposal writing	field notes, reports, communications, computer files
May 2000	Cut back to 2 days a week	As above, began work on documentary
	Other projects: - Short courses - Proposal writing	field notes, reports, communications, computer files
July 2000	Other Projects: - SOE – project on indicators for human settlements	field notes, reports, communications, computer files
Aug – Dec 2000	Documentation development based at Darebin council – 2 days Involvement of user groups	Journal, group discussions, observation and presentations, tender documentation, reports and specs, website
August	Other projects:	field notes, reports,

2000	<ul style="list-style-type: none"> - asked to tender on another council project - ALARPM conference 	communications, computer files, 1 st refereed paper
Sept - Dec 2000	<p>Other projects:</p> <ul style="list-style-type: none"> - Building LCA project - Literature review of cost benefits research on energy efficiency initiatives in class 1 buildings 	field notes, reports, communications, computer files
	<p>Other projects:</p> <ul style="list-style-type: none"> - Short courses - Proposal writing 	field notes, reports, communications, computer files
Jan – August 2001	Based at council 2 days a week began working on site with construction managers ½ a day a week	Journal, reports, observation, minutes
Feb 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - Asked to Speak at GEMnet (Government Energy Managers Network) - Tender preparation 	Presentations, field notes, reports, communications, computer files
Mar 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - ESD checklist for Darebin - Tender preparation 	Reports and communications
April 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - CERES master plan - CERES energy plan - Invited speaker US, conference Sweden and Sheffield - Tender commonwealth games 	Presentations, field notes, reports, communications, computer files, conference papers
May 2001	Attending conferences	Journal notes and conference proceedings
June 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - Building LCA courses – Perth, Adelaide, Brisb, Sydney and Melb - EDGE article - Build LCA website - CERES master plan - Energy Forum - SEAV - 1st green building course 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
July 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - development of local government programme – Kingston, Banyule - Austin Hospital tender - EPDS - Development of link b/w education and green building projects – master plan 	Presentations, field notes, reports, communications, computer files, conference papers
Aug 2001 – Dec 2002	Attended meetings at the site every fortnight for ½ day	Journal, reports, observation, minutes
Aug – Sept 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - Offered full time job at RMIT to develop green building programme - Property Council of Australia (Vic) environmental management system for building management project - Facilities Management Tool Box tender 	Presentations, field notes, reports, communications, computer files
Oct - 2001	<p>Other projects:</p> <ul style="list-style-type: none"> - Building LCC LCA course - AWM focus group - ABEC proposal 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and

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		feedback
Nov - 2001	Other projects: <ul style="list-style-type: none"> - LCA Roundtable - Presented RCC and LCA - EcoHome and Funding Idea - AHURI - Building Course Sydney 	Presentations, field notes, reports, communications, computer files, conference papers
Dec - 2001	Other projects: <ul style="list-style-type: none"> - development of component of challenging sustainability online course - proposal writing 	Presentations, field notes, reports, communications, computer files, conference papers
Jan - 2002	Other projects: <ul style="list-style-type: none"> - EcoHome project - Proposal writing - EMS PCA project 	Presentations, field notes, reports, communications, computer files, conference papers
Feb - 2002	Other projects: <ul style="list-style-type: none"> - EcoHome project - EcoHome proposal development - Proposal writing - EMS PCA project - Prep for Teaching into Building and Construction Economics - 1st and 3rd year - Prep for Teaching into Industrial Design - 1st, 2nd and 3rd years - Challenging Sustainability online course - Guest speaker at AIQS (Australian Institute of Quantity Surveyors) on LCA and building 	Presentations, field notes, reports, communications, computer files, conference papers
March - 2002	Other projects: <ul style="list-style-type: none"> - EcoHome - ARC application development - LCA professional development short course - Review of Watsonia Library - Banyule council - EMS PCA project - writing paper for AUBEA - writing paper for Agenda 21 conference on RCC - Expert guest for Maryborough educational precinct - Teaching - ID and BC&E Teaching - ID and BC&E 	Presentations, field notes, reports, communications, computer files, conference papers
April - 2002	Other projects: <ul style="list-style-type: none"> - EcoHome - ARC application development - EMS PCA project - Development of brochure for green building programme - Teaching - ID and BC&E 	Presentations, field notes, reports, communications, computer files, conference papers
May - 2002	Other projects: <ul style="list-style-type: none"> - EMS PCA project - Teaching - ID and BC&E - Prep 2nd Melbourne green building seminar - Running of 2nd green building seminar 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
June - 2002	Other projects: <ul style="list-style-type: none"> - Prep 2nd LCA LCC course - Speaker at master planning meeting of Boorondara - EMS PCA project - final ppt - Teaching - ID and BC&E - Kingston building checklist - MOU with MelbourneCity Council - Writing proposals 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
July - 2002	Other projects: <ul style="list-style-type: none"> - LCA LCC course 	Presentations, field notes, reports, communications,

	<ul style="list-style-type: none"> - Write LCA conference paper - Attend AUBEA and LCA conferences - Melbournecity council flagstaff pavilion project 	computer files, conference papers, course notes and feedback
Aug - 2002	<p>Other projects:</p> <ul style="list-style-type: none"> - Book case study on RCC - Started teaching HIA green Smart course - Teaching – ID and BC&E 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Sept – 2002	<p>Other projects:</p> <ul style="list-style-type: none"> - ARC for EcoHome awarded - Teaching – ID and BC&E - BC&E logging tour - HIA course – trouble with timber council 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Oct – 2002	<p>Other projects:</p> <ul style="list-style-type: none"> - Organisation of EcoHome ARC project (contracts) - HIA Course - Teaching – ID and BC&E - Prep 2nd Sydney green building seminar - WA trip – EcoSpecifier concept 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Nov - 2002	<p>Other projects:</p> <ul style="list-style-type: none"> - invitation to run 2 day workshops at Brib city council on materials and green building spec - Teaching – ID and BC&E - Hassell aged care master plan ESD project - HIA Course - Running of 2nd Sydney green building seminar 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Dec - 2002	<p>Other projects:</p> <ul style="list-style-type: none"> - Hassell aged care master plan ESD project - Embodied energy of materials AURORA project - National Bank UROP scholarship - EcoHome contracts and project set up, interview for students - MCC review and course development - Open space design guidelines 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Jan – Dec 2003	<p>Attended meetings at the site every fortnight for ½ day</p> <p>Post evaluation</p>	Journal, reports, observation, minutes, interviews, guidelines
Jan - 2003	<p>Other projects (theoretically only working 2 days a week):</p> <ul style="list-style-type: none"> - Open space design guidelines - Ger EcoHome student set up - Peer review DSE ESD Guidelines - AURORA materials workshop prep 	Presentations, field notes, reports, communications, computer files, conference papers, course notes and feedback
Feb – 2003	<p>Other projects (theoretically only working 2 days a week):</p> <ul style="list-style-type: none"> - Open space design guidelines - Supervise NZ student masters – Angela Foster - Paper AUBEA II x 2 - Paper SASBE x 2 	Presentations, field notes, reports, communications, computer files, conference papers
Mar – 2003	<p>Other projects (theoretically only working 2 days a week):</p> <ul style="list-style-type: none"> - Open space design guidelines - MCC toilet project - EcoHome construction 	Presentations, field notes, reports, communications, computer files, conference papers
Apr – 2003	<p>Other projects:</p> <ul style="list-style-type: none"> - Stockholm conference paper with Jon - EcoHome project management - Green loo project 	Presentations, field notes, reports, communications, computer files, conference papers

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May – 2003	Other projects: <ul style="list-style-type: none"> - EcoHome project management - green loo project 	Presentations, field notes, reports, communications, computer files, conference papers
June – 2003	Other projects: on leave all month	
July – 2003	Other projects: <ul style="list-style-type: none"> - AUBEA conference - Teaching in Singapore – construction management Lit review on housing and sustainability in Australia 	Presentations, field notes, reports, communications, computer files, conference papers
Aug - 2003	Other projects: <ul style="list-style-type: none"> - City West Water project proposal - SASBE papers - ID teaching 	Presentations, field notes, reports, communications, computer files, conference papers
Sept – 2003	Other projects: <ul style="list-style-type: none"> - EcoHome builders and developers survey - EcoHome project management - ID teaching - Bovis Lend Lease research - City west water mini project 	Presentations, field notes, reports, communications, computer files, conference papers
Oct – 2003	Other projects: <ul style="list-style-type: none"> - EcoHome builders and developers survey - EcoHome project management - development of Re-imagining the suburb project and specific ARC project - assesment Singapore - assesment ID teaching - Bovis Lend Lease research 	Presentations, field notes, reports, communications, computer files, conference papers
Nov – 2003	Other projects: <ul style="list-style-type: none"> - SASBE conference - EcoHome builders and developers survey - EcoHome project management - development of Re-imagining the suburb project and specific ARC project - Bovis Lend Lease research - City West Water redefinition of project 	Presentations, field notes, reports, communications, computer files, conference papers
Dec - 2003	Other projects: <ul style="list-style-type: none"> - City West Water project contracts - Write sustainable story - Write chapter on green star - EcoHome project management and stakeholder meeting 	Presentations, field notes, reports, communications, computer files, conference papers

Appendix 2

Schedule 7 - green tender requirements

SCHEDULE 7 - 'GREEN' TENDER REQUIREMENTS

Environmental Responsibility - Systems and Work practices

Trade

Registrant's Name

1. Environmental Policy and Management
 - 1.1 Is there a written company environmental policy?
 - 1.2 Is your system according to a recognised system such as ISO 14000?
 - 1.3 Is there a company environmental management manual or plan?
 - 1.4 Are the environmental responsibilities clearly identified for all levels of staff?
2. Environmental work practices and procedures
 - 2.1 Has the company prepared a waste minimising operating procedures or specific instructions relevant to its operations?
 - 2.2 Has the company prepared a water minimising operating procedures or specific instructions relevant to its operations?
 - 2.3 Has the company prepared a energy minimising operating procedures or specific instructions relevant to its operations?
3. Environmental training
 - 3.1 Is environmental training conducted in your organisation?
 - 3.2 Is a record kept of employees training and induction programs?
4. Previous experience

4.1 Has the company worked on previous projects which required minimisation in:

- water
- waste
- energy

5. Inspections

5.1 Are regular environmental inspections undertaken?

5.2 Is there an environmental reporting procedure?

5.3 Is there a standard environmental inspection checklist?

6. References

Please provide at least 2 references

7. Documentation

Please provide a copy of the contents page of:

- The environmental policy
- The environmental management system in place
- The inspection checklists
- Any awards and programs you have participated in such as the Banksia award, Waste wise program, etc.