



Australian Housing Supply Chain Alliance

Housing Supply Chain Model for Innovation Research Report

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Project 10-01: Housing Supply Chain Model for Innovation

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EXECUTIVE SUMMARY

The Australian National Housing Supply Council (ANHSC) estimates that around 3.2 million additional dwellings will be required in the next 20 years to accommodate a population growth from 2008 to 2028. Moreover, the ANHSC also forecasts that the current demand-supply gap of 178,400 dwellings will increase to approximately 640,000 by 2028. According to the Australian Bureau of Statistics (ABS, 2010), the country currently needs to be building 17,400 homes every month. Housing supply, however, has oscillated between 10,000 to 16,000 dwellings per month since 1990. Based on the average number of approvals over the first three months of 2010, the current supply is around 14,500 dwellings per month. The shortfall means we are faced with a crisis in our capacity to plan, design and construct to meet our nations needs unless we act immediately to improve our capacity for a more efficient, effective and innovative supply system.

The aim of this research is to undertake a case study analysis of successful delivery of an innovation to the Australian housing construction industry. This study is conducted on the “innovator group”; that is, the group that created the idea of an innovation for the housing sector and then were intimately involved in creation, development and diffusion. It is apparent that there were key players involved in this process which are representative of various organisations along the supply chain – designer, developer, subcontractor and supplier. Much rhetoric states that integration of the supply chain actors will solve construction problems, however, in reality **we know little beyond this in the Australian context as there has been little research conducted previously**. This study will examine in detail the process undertaken by this particular group to deliver an innovation to the housing sector which required an integrated construction supply chain model.

An underlying assumption of this study is that we can develop a more structured methodology by understanding a successful exemplar. The methodology will describe characteristics towards developing a pathway for supply chain integration that could in the future guide and enable more effective delivery of innovations - either incremental or monumental, construction product or construction process or construction system, that will improve the performance of the industry. The case study analysed is an example of an innovation that is outside the normal practice of the supply chain participants and their usual business and work processes.

The objectives of the study are to

- Identify the barriers and enablers to the creation, development and adaptation of the innovation
- Examine the characteristics of the process of integration of the construction supply chain towards the creation, development and adaptation of an innovation
- Define characteristics and initiate the development of a methodological process pathway to innovation creation, development and adaptation for an integrated housing construction supply chain

The overarching research question addressed is: “What is the pathway for creation, development and adaptation of an innovation by the innovator group?”

Project outcomes include:

- Final research report
- Publication of two conference papers and one journal paper. The conference presentations will be Australian ERA rated A conferences [CIB international conference]. The journal shall be an ERA rated A* or A publication.
- An Industry Based Case Study Information report will also be developed. This would be a coloured graphical short brochure of 4 pages that summaries the key findings of

the study and is suitable for distribution to selected participants nominated by FMG. Hard copies of the brochure will be developed as well as a web version able to be downloaded.

- Industry presentations. The presentations would be organized and sponsored by industry associations and involve Professor London and industry participant as nominated by the Alliance

This report comprises 6 sections and the following table summarises the research process for the study and provides a roadmap for this report.

Summary	Recommendations
1.0 Introduction	
<p>There are significant problems in the supply of housing in Australia. The housing sector typically represents 50% of the construction industry. Housing research in the past has focussed on policy and planning problems as the way to address supply challenges. To date the housing supply debate has been largely focussed on housing demand, affordability and land supply. Very little attention has been paid to challenges experienced by those involved in the design and construction stages of supply.</p> <p>One of the suspected overarching key causal factors of poor housing supply is the lack of coordination and integration between supply chain actors. It is proposed that a more cohesive supply chain would prove beneficial to all housing sector stakeholders. The development of integrated supply delivery solutions has not been extensively recognised in the Australian residential sector. Ad hoc examples and applications by some major building companies have seen some limited success. However, these achievements nor the detail of how supply chain integration is achieved has not been diffused throughout the sector and thus has had little real impact on overall sector performance. Whole-scale industry improvement requires a concerted effort to undertake a stepwise change. A key to the solution is to investigate successful examples of integrated supply chains which have resulted in productivity and/or innovation performance improvements.</p> <p>This case study examines in a detailed manner the creation of an innovative system.</p>	<p>1.1 Alliance members need to promulgate the industry problems more widely and the Alliance positioning of construction supply research to key policy and decision makers as well as our own organisations and various stakeholders and the industry at large.</p> <p>The findings are of interest to large and small players in the industry. The Alliance needs to develop a Dissemination Strategy to promulgate findings from this study. The research is a focussed case study and tells the story of the creation, development and adaptation process that took place from a human organisational and process perspective rather than a technical perspective. This story will be of interest to many in the industry and if the methodology can be applied to other examples of the creation of an innovative system. The Dissemination Strategy should be explicitly developed and the research report forms the basis to extract material. Industry members of the Alliance team should provide input to ensure the 'voice', language and message is relevant to the specific audiences.</p>

Summary	Recommendations
2.0 Theory	
<p>There is not an extensive discussion on theory in this report however the theory that underpins this study is positioned within construction supply chain research and blended with innovation diffusion theory.</p> <p>Construction supply chain research</p> <p>A central idea of supply chain theory is that holistic supply chain integration relies upon each firm at each tier in the supply chain knowing and aiming for a common objective. Although this fundamental principle is a long standing assumption within the supply chain theorists domain it is still one of the most basic problems in relation to developing integrated supply chains and creating holistic performance goals for supply chains. Much rhetoric states that supply chain management will solve problems, however, we know little beyond this within the housing construction supply chain field. There are a range of tools and techniques that can be applied from other sectors that are 'tried and true' that have been proven to achieve more cohesive supply chains, in particular the well known theory and practices from the Toyota Production System also often referred to as Lean Production. Accompanying lean production is practice and theory to support that practice on supply chains. However, it is critical that an understanding of the sector specific challenges associated with the unique housing sector supply chain problems are considered as well. The investigation of the concept of the supply chain for innovations in the housing sector has not been undertaken in the Australian research community and for that matter in the international research community. It is noted however, that there is an emerging area of research on construction innovation in a more general sense.</p>	<p>2.1 This study may contribute additional insights to construction supply chain economics theory and where this occurs the research team should publish the findings.</p> <p>This study contributed to additional insights in the construction supply chain research and should be published in academic publications.</p> <p>Just as significantly the findings provide insights for practitioners (ie housebuilders, materials manufacturers, materials suppliers and subcontractors) embarking upon creating innovation systems in the future. The findings should be published in formats suitable for industry audiences. The industry member of the Alliance should drive the publication of the brochure to industry.</p>

Summary	Recommendations
2.0 Theory	
<p>Diffusion theory</p> <p>Rogers' theory of Innovation Diffusion (1962; 1995) provides an initial framework through which examination of the diffusion of an innovation can be examined. Rogers (1995) defines the diffusion of innovations as the process by which knowledge of an innovation is transmitted through communication channels, over time, among the members of a social system.</p> <p>One would anticipate that to create, develop and diffuse an innovation in a fragmented industry such as the residential sector would require collaborative efforts between firms along supply chains. It would also require a champion or group of champions who have enough resources and 'pull' to enable the development of the innovation. Beyond these propositions we do not know any more detail of the characteristics of the innovation process or methodology which would integrate the supply chain and achieve innovation creation and/or diffusion. It is too large to study both creation and diffusion and so the study was limited to the creation phase. The economic environmental conditions that underpin the supply chain impacts the organisational power to effect change in the supply chain through the upstream and downstream relationships. Therefore this study may contribute to the existing but emerging body of theory around construction supply chain economics.</p> <p>The emphasis in past diffusion research has been on investigating:</p> <ul style="list-style-type: none"> the members of the social system as the unit of analysis, and the second phase of the diffusion process which is the adoption by others in the industry following initial creation by an innovator group. <p>Consequently this has resulted in two key gaps in research understanding of:</p> <ul style="list-style-type: none"> the <i>process</i> undertaken by members of the social system as the unit of analysis the first phase of the innovation process which is the initial creation of an innovation by an innovator group <p>Rogers (2003) also outlined the innovation process as consisting of a sequence of five stages including: Agenda-setting, Matching, Redefining/restructuring and Clarifying.</p>	<p>2.2 The methodology of innovator group pathway to delivering an innovative system can now be described and further case studies can enhance validation of the findings.</p> <p>The data collection and analysis was framed so that a detailed examination of the experiences of the innovator group were identified. The key discussion points (themes) should be matched to the innovation phases. The themes can then be explained as either barriers or enablers. The barriers and enablers were matched to the stages of the diffusion process.</p> <p>The contribution in relation to diffusion theory should be highlighted and then published in academic and industry circles. This study represents a very detailed examination of an exemplar case study on creation and development of a housing innovation however it still has limitations in wide scale applicability that must be acknowledged. Regardless of this limitation because there have been very few housing sector innovations there is still merit in acknowledging the contributions to the theory and practice of creating new ideas/products that impact upon the business and work practices.</p>

Summary	Recommendations
3.0 Methodology	
<p>Research Design Strategy</p> <p>An underlying assumption of this study is that there is a structured methodology which can be developed to describe a pathway for supply chain integration when creating and delivering innovative systems. The narrative inquiry approach provides an opportunity to uncover stories to highlight the organisational, communication and economic factors impacting on the process undertaken by the innovator group to deliver an innovation to the housing construction industry. The technique of story analysis was used as it offered a way of connecting different stories from key protagonists to understand the innovation process and in particular changes that took place over time. The various experiences of the participants from the cluster of organisations which were involved in the successful delivery of the innovative concrete footing system were captured through a simple technique of narrative analysis which relies upon systematically collecting and analyzing stories which exemplify the significant experiences of the key players.</p> <p>The empirical part of the study involved three key phases:</p> <ul style="list-style-type: none"> ▪ Exploratory Description of Case Study: Describe the chronological history of the development of the innovation including key players, events, drivers and decisions. This will also map the development and then the transition into more widespread adoption. This involved interviews with key players who were involved in the innovation process and their recollections of events and decisions. It also involved an analysis of key documents. This involved 7 key organisations and interview length was between 1-3 hrs. ▪ Critique of Process: A more detailed critique of the process including the factors affecting adoption. It involved the identification of the barriers and enablers for creation, development and adaptation of the innovation. ▪ Development of Integrated Supply Chain Innovation Methodology: The actual process was described and then the critique of barriers and enablers allowed the development of a structured methodology of 'best practice' for innovations requiring an integrated supply chain approach. The study focused on the organizational, communication and economic contextual factors as they relate to the technological innovation rather than the technical factors of the innovation [i.e. the waffle footing]. It is apparent that the technical innovation has been reasonably well documented already 	<p>3.1 The Alliance team should explore the marketing potential of the narrative 'story' approach in an industry brochure and also public presentations. The academic team should publish as this methodology will contribute to research methodologies in the academic community.</p> <p>The narrative inquiry approach and story analysis technique is well suited as a technique to this particular study. It is a way of piecing together a mosaic of different stories from different actors to develop an overarching understanding of the people, events and processes. The 'story' approach should be capitalised upon to disseminate the findings. We should generalise and abstract the key findings so that audiences can connect and the Housing Innovation Methodology becomes the key message</p> <p><i>What is the story of creating an innovative housing system?</i></p>

Summary	Recommendations
4.0 Results	
<p>Barriers and Enablers</p> <p>The stories from each participant were collected and connected and then matched to the five stages of the innovation process including agenda-setting, matching, redefining, clarifying and routinising. Barriers include:</p> <ul style="list-style-type: none"> ▪ professional jealousy whereby engineers chose not to adopt the system as they were in competition with the inventor of the system ▪ negative perceptions and attitudes to the innovation and to change ▪ high costs incurred by the distributor of the footing system which in turn resulted in inflated prices of the system ▪ lengthy and costly patent disputes and adversarial litigations <p>Further to this a various enablers to the innovation process were also raised including:</p> <ul style="list-style-type: none"> ▪ mutual understanding and trust and strong support between participants to create a solution ▪ shared but different business motivations and shared but different altruistic motivations ▪ participants shared philosophy towards risk taking which was influenced by the following considerations; economic rewards, trust in the credibility of other players and the authority and influence associated with specific participants whose support for the waffle footing system offered its members the confidence to adopt the system ▪ explicit and appropriate identification, alignment and integration of capacities between participants ▪ development of alliances or relationships and collaborative efforts between participants to access required expertise and capacity for the innovation process ▪ acquisition and use of <i>artefacts</i> in developing reputation enabling credibility to be associated to the innovation. It was important to provide evidence [ie 'artefacts'] that were clearly understood and well accepted by the industry; these included accreditations, approvals and production of publications. They were critical for initial acceptance and also wider diffusion of the innovation <p>The formalisation and ownership of intellectual capital through patents emerged in the story of the footing system as a very important part of the story. The lack of protection of intellectual property offered by the existing Australian patent system does not appear to be a conducive environment for innovative behaviour. There seems to be little incentive or reward for innovative behaviour at an industry level. The creation of innovative products and systems rely upon the <i>heroic</i> efforts of a select few organisations.</p> <p>In summary the individual meta stories from each participant was a useful starting point for identifying key barriers and enablers. The different experiences between participants were then cross-compared to identify any common themes. Further to this the inter-organisational process undertaken by the innovator group participants in the creation, development, adaptation and diffusion of the footing system was examined. Finally, linking the barriers to the enablers begins to bring some clarity to an innovation process pathway.</p>	<p>4.1 The Alliance should ensure that these barriers and enablers are published in the industry brochure.</p> <p>Organisations embarking upon creating an innovative system that impacts upon many stakeholders in the housing industry should develop an overall plan and feasibility study which addresses the barriers and the enablers identified.</p> <p>A powerpoint presentation has been developed and has been inserted as part of this Executive Summary.</p> <p>4.2 More investigation into the patent system is needed.</p> <p>The protection of intellectual property for the creators of innovative products and/or services is a significant issue which needs to be considered particularly in an industry where the pace of innovation is low. It is an experience that is not common to many in the industry and therefore creators of an innovation are exposed. This is a high risk and can be costly. The participants in this study did not seem equipped to deal with this complexity.</p>

Summary	Recommendations
5.0 Discussion	
<p>Implications for Practice: Innovation Process Pathway</p> <p>The firms within the innovator group were concurrently participating in two different processes:</p> <ul style="list-style-type: none"> ▪ an <i>organizational process</i> whereby each firm individually experienced the five stages of the innovation process including agenda-setting, matching, redefining, clarifying and routinising ▪ a broader <i>inter-organisational process</i> whereby numerous firms entered and left the process in response to the specific requirements of the different phases of innovation creation, development, adaptation and diffusion. <p>A key finding of this research is a more refined categorisation of firms within the innovator group. The firms within the innovator group had various roles to play at different phases of the innovation process in the successful delivery of the concrete footing system. There is an accepted broad classification of “innovators” and yet this probably does not capture the specific characteristics of the different types of innovators. Although this may seem at first like a theoretical construct it actually has real world implications, particularly with respect to ownership of the innovation and the intellectual capital invested and thus who owns the intellectual property – this relates to the business proposition. It also allows those involved in the creation of the innovative system to reduce the impact of the barriers and in turn transform barriers to enablers through the management of the cultural and social capital. We propose the following definitions:</p> <ul style="list-style-type: none"> ▪ Innovator-creator: those who are responsible for initiating and creating the innovation. ▪ Innovator-developer: those who contribute towards the design and development of the innovation ▪ Innovator-adapter: those who contribute to the innovation by modifying/adapting the innovation ▪ Innovator-diffuser: those who enter at latter phases and contribute to the innovation by promoting or diffusing the innovation 	<p>5.1 Publish the description of the innovation process pathway as a generic construct more widely to industry in a brochure and/or presentations/forums. The findings of the study should be presented to the organisations within the Alliance. The findings should be presented to the academic community.</p>

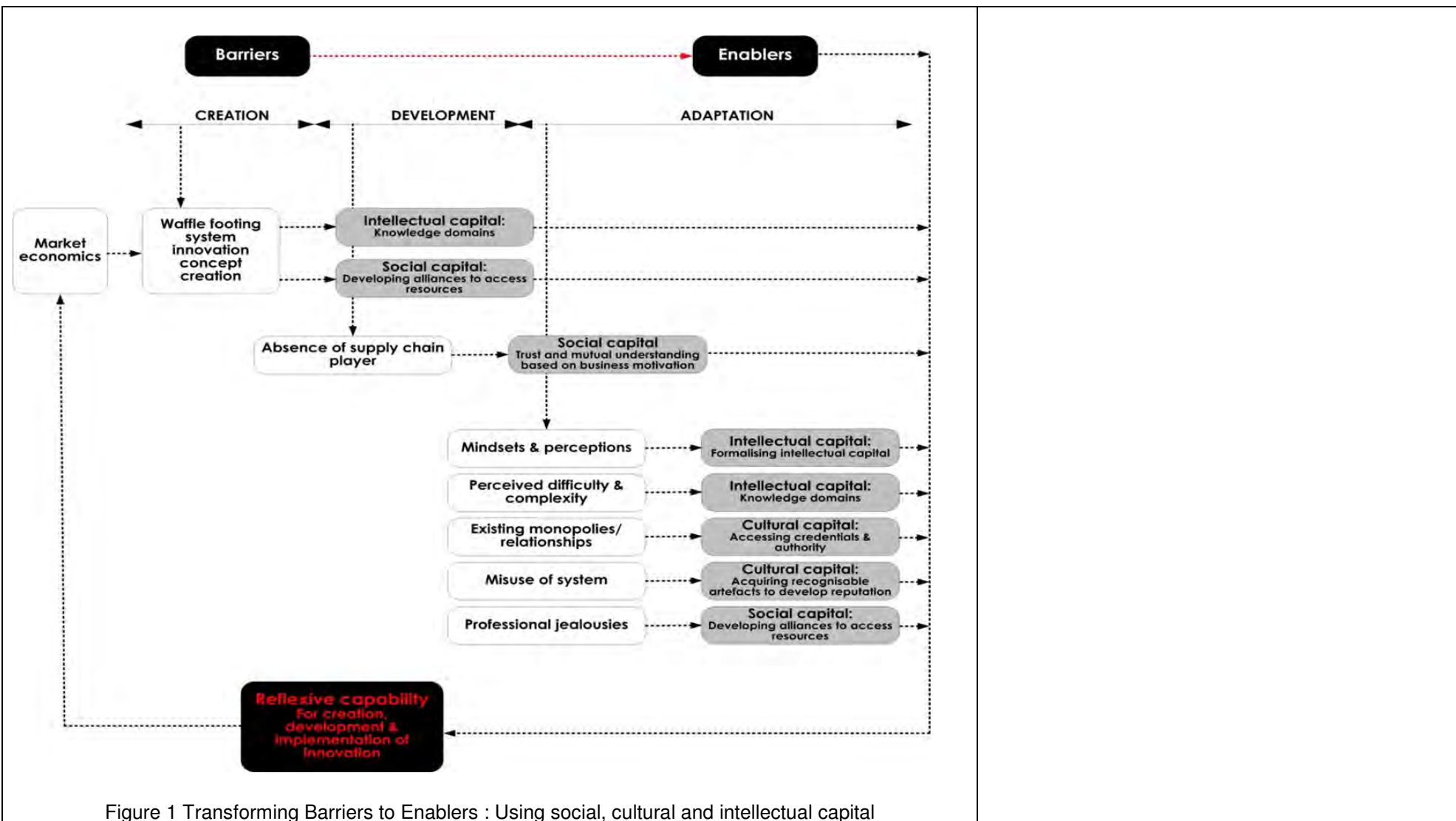


Figure 1 Transforming Barriers to Enablers : Using social, cultural and intellectual capital

Summary	Recommendations
5.0 Discussion	
<p>Transforming Barriers to Enablers : Using social, cultural and intellectual capital</p> <p>The analysis demonstrated that at each stage the firms experienced different problems resulting in the need for appropriate strategies to suit the changing requirements of the innovation process. Instead of simply identifying the barriers which occurred at each stage of the innovation process, a more useful approach undertaken in this research has been to identify common themes in how those barriers were overcome. The way that the innovator group overcame barriers can be mapped to how social, cultural or intellectual capital (or a combination of these) was used. Thus the management of human capital is how barriers are transformed into enablers.</p> <p>To make sense of the way in which the players used social, cultural and intellectual capital we can turn to a sociological theory known as Reflexivity theory quite readily. In our interpretation a reflexive capability approach to the innovation process suggests that at any given time one would require a specific set of resources in terms of social, cultural, intellectual and financial capital. Successful innovators often seem to have awareness, whether conscious or not, of the specific capital required at various times and an understanding of where that capital resides. Furthermore it involves understanding the ways to access the various forms of capital in response to the creation, development, adaptation and diffusion of the innovation. A general theme running through the analysis is the fluid nature of the different forms of capital and their interconnectivity. The analysis has shown that the various forms of capital can be easily transformed into or leveraged into other forms of capital.</p> <p>Innovation Pathways Methodology</p> <p>Pre Creation Market Analysis</p> <p>As indicated by the diagram in the first instance the group needs to develop a clear market analysis and business proposition for the innovation. This early stage analysis will be iterative but such questions will include: Who are the competitors of the innovative system? What financial and IP stake does each player involved in the creation of the innovative have? Who will own the innovation? What type of ownership mechanisms will be developed? It also raises questions such as: Who will be most affected by introducing this new innovation? ie Who are the competitors for this innovation and how will they try to influence the introduction of the innovation into the market place? This sort of analysis needs to be completed by each organisation involved in the creation of the innovation so that risks can be identified. Not only does the</p>	<p>5.2 After further studies to validate these findings a much more useful and detailed innovation assessment tool/decision framework could be developed.</p> <p>5.3 Develop communication plan adapted for different audiences</p>

innovation group need to identify this at the organisational level but more widely across the sector as well. For example, if we introduce a new footing system who are all the stakeholders that will be impacted by the introduction of this new system? Who will lose market share? Who might gain market share?

Creation

In this phase the concept for the innovation was created and various players were identified as being significant contributors. In this case study after the creation phase where there was a reasonably clear understanding of the need for supply chain integration as the champion of the group saw that the most significant barrier in the development phase was the potential absence of particular key supply chain players. The strategy was to identify intellectual capital required to take the innovation forward and in so doing identify key knowledge domains. As the start up phase was considered to be reasonably high risk there was a careful consideration of the level of investment of resources. Therefore at this stage the group developed alliances to access the resources needed. This involved identifying typically like minded people in the industry who were willing to take a risk and were excited about the proposition on the table. This is essentially identifying social capital that is needed in the group.

Adaptation

After original creation the group moved into the next phase of adaptation. In this phase we saw modifications to the original design as pilot testing was completed. Importantly though another player came into the group who provided a greater capacity to distribute the system to the market. This player clearly was invited into the group because of trust and mutual understanding matched with a clear business motivation.

Adaptation

The final innovation phase before the whole scale diffusion was another form of refinement of the innovation that is the some adaptations of design due to constructability requirements. In this phase we saw much more significant market penetration and competitors essentially began to sit up and take notice. Because the innovation became a much more plausible proposition and had now had testing, piloting, evaluation and approvals from regulatory authorities some significant barriers came into play. Five main barriers were identified as indicated in the diagram. One such example was the difficulty of changing people's mindsets and perceptions that the innovation was a worthy system. The strategy in this instance was to seek various ways of demonstrating credibility through technical publications, alignment with various professional associations, awards and creating alliances with other leading players in the industry. The group took each particularly barrier and developed a strategy to counter the challenges that they were facing and we have identified the particular form of capital that was used in each strategy.

Innovation Project

FMG Engineering & RMIT University
Professor Kerry London
Ms Jessica Siva



1. Ideal Functional Supply Chain



2. Ideal Functional Supply Chain



3. Ideal Organizational Supply Chain



4. Network Supply Chain



5. Regional/Cluster Supply Chain



rationale

SCM can be investigated towards:

Creation of innovations in value chain

Analysis of problems/parts in chain

Improve holistic productivity

Improve performance through investigation of inefficiencies

Describe current state

Trial new processes



Project 10-01:
Housing Supply Chain Model for Innovation

outcomes



Pilot for the Alliance

Describe value chain case study exemplar

Document innovation process

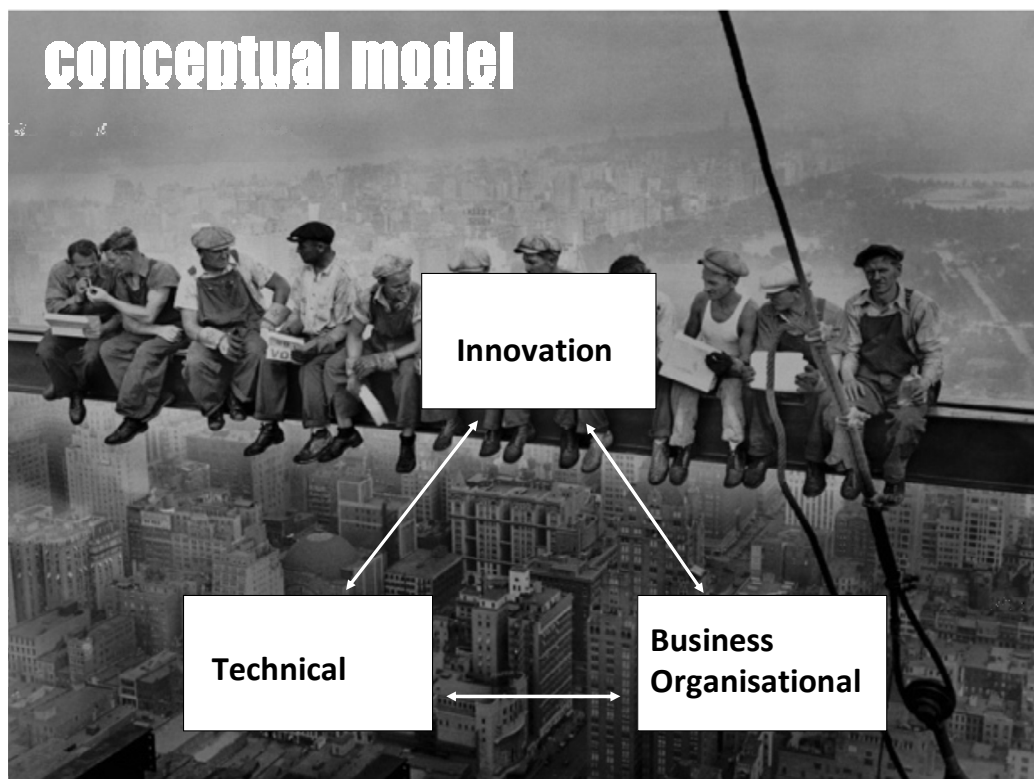
Demonstrate rigour

Create credibility

Communicate findings



conceptual model



Aim

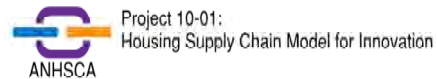
undertake a case study analysis of successful implementation of delivering an innovation to the housing sector which required an integrated construction supply chain model.

Research objectives

Identify barriers and enablers

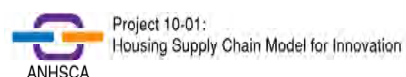
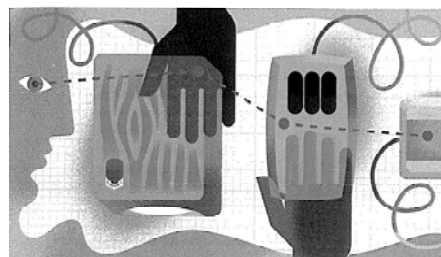
Analyse process and key themes for innovation

Develop a methodological pathway



Creation myth

**the innovation journey of
creation, adaptation,
development and diffusion
typically requires a supply
chain**



Rogers' Diffusion Theory
Five stages of the innovation process

Agenda-setting
Matching
Redefining
Clarifying
Routinising

Key phases of innovation:

Creation of the innovation
Adoption of the innovation

theory

INTERDEPENDENCIES... SILOS... CHAIN...



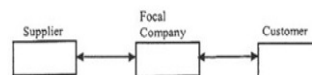
methodology

Phase 1 exploratory description of case study:

chronological history of the creation and development of the innovation including key players, events, drivers and decisions.

Phase 2 critique of process:

detailed critique of the factors affecting creation, development and implementation; the barriers and enablers



Phase 3: development of integrated supply chain innovation methodology process



Project 10-01:
Housing Supply Chain Model for Innovation

Data collection

- interviews with 7 key players
- 60-90 minutes
- 1-2 interviews
- identify stories & confirm findings
- documents

Interview questions:

- background: role related to innovation
- recollection & stories of key events
- experiences related to barriers & enablers
- key players.



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Housing Supply Chain Model for Innovation

Narrative analysis

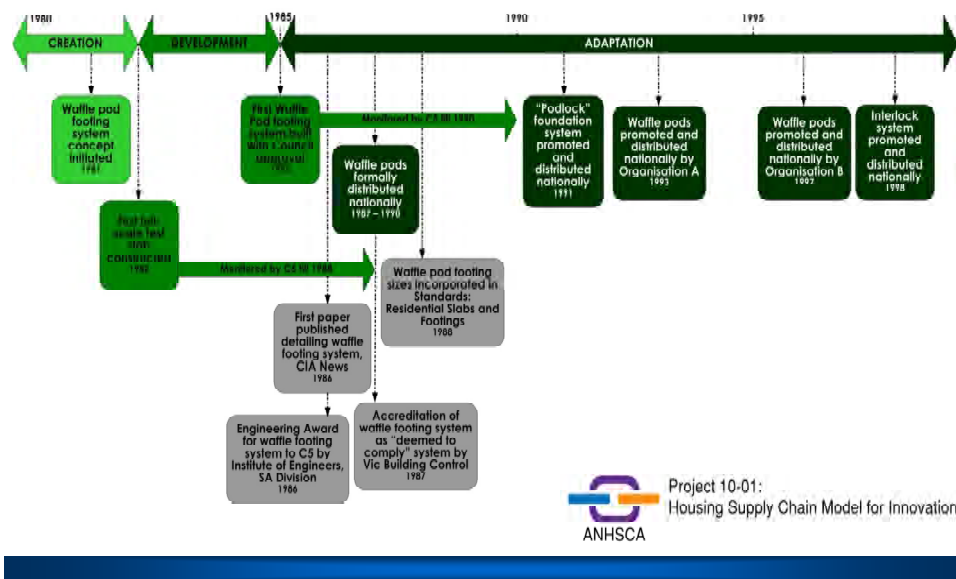
Stage 3: Re-ordering of stories into chronological order to form a “metastory”

AGENDA SETTING				MATCHING		REDEFINING	CLARIFYING	ROUTINISING	
STORY 1 Overseas experiences "It reminded me of the landscapes around Durban...I thought why can't we cut & fill as we did over there"	STORY 2 Paid to think about things "had a break one day...I'm paid to think about things"	STORY 3 Dealing with unknowns – traditional looking "when you hit rock, you called the customers & said 'you're going to have to pay more money...so you're offside'"	STORY 4 Multistorey carparks & waffle pods "can't we do that same stuff over here?"	STORY 5 Inefficiencies & revenues "they were selling reasonably well but not as well as we wanted to get revenues up...the margins in housing are terrible because of the inefficient way we did things"	STORY 6 Developing value propositions "in discussion with my marketing people I said 'if you could put a price on the market fixed, no extras would that be a value proposition? They said, god for it!"	STORY 7 The diary demonstration "I want that: I can measure it, I can see it, I can do it quickly"	STORY 8 Developing alliances "I was cost controlling...I was just the poor old builder...this was where we had that alliance"	STORY 9 Pushing through "I took the concrete gangs to [the engineers] offices...ran seminars on how to put a box together...I was determined & you have to champion that"	STORY 10 Innovation integrated with systems "that was the actual first system built...from that point it became accepted & we were pricing our land & house packages with it...we could give a fixed price"

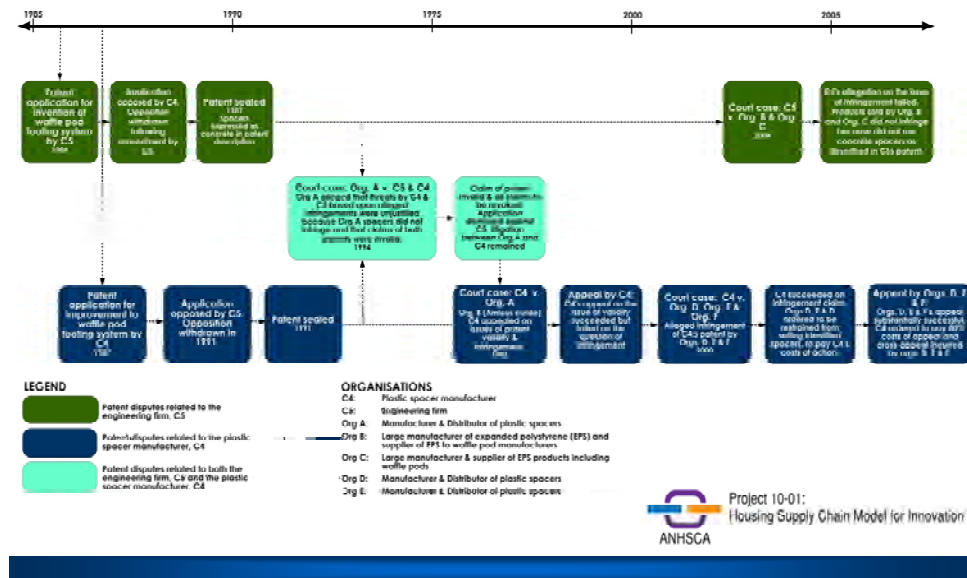


Project 10-01:
Housing Supply Chain Model for Innovation

History of waffle footing innovation



Intellectual capital, IP & patents



Barriers

Key themes	C1	C2	C3	C4	C5	C6	C7
Mindsets and perceptions		√	√	√		√	√
Difficulty/complexity			√			√	
Existing monopolies/relationships			√			√	
Misuse of system		√	√				
Formalisation of intellectual capital		√	√	√	√		√
Professional jealousies		√	√		√	√	√
Absence of supply chain player					√		√

“It was overcoming the hurdles and the mentality. It’s a huge jump. The product might be terrific but sometimes it’s very, very hard to change mindsets no matter what industry, no matter what you’re doing”

(Sales representative, Building Materials supplier - C3)



Mindsets



Project 10-01:
Housing Supply Chain Model for Innovation

“It was chequered with litigation...we were caught in the middle of some of that really...Very very messy. And in fact the litigation probably harmed the product as such. It slowed its introduction and people’s greed got in the way”

Sales representative, EPS supplier - C7)




AUSTRALIAN NATIONAL
HOUSING SUPPLY CHAIN
ALLIANCE (ANHSCA)

IP litigation

Enablers							
Social capital	C1	C2	C3	C4	C5	C6	C7
Mutual understanding and trust based on business motivation	√	√			√		
Development of alliances/relationships to access required resources	√		√		√	√	√
Cultural capital	C1	C2	C3	C4	C5	C6	C7
Acquisition of recognisable artefacts in developing reputation	√				√	√	√
Accessing credentials and authority through association	√				√	√	√
Intellectual capital	C1	C2	C3	C4	C5	C6	C7
Identification and integration of knowledge domains	√	√		√	√	√	√
Formalisation of intellectual capital	√	√		√	√	√	√

“...to work in with the waffle
 system I think C5
 [engineering firm] thought of
 it, C1 [housing developer]
 took it, I produced it and it
 was just a happy meeting and
 we were all happy to work
 with each other”

(Managing director, Footing
 contractor - C2)

Conceive, create,
 develop, adapt

“...this is what you have a strategic alliance partners to do. I was just the poor old builder. I realised all I was there for was just to control the building flow...We knew we had to get research-based information to support this development...I realised we had to go through a series of significant changes in getting regulations altered ...and I couldn't do that...So we used our engineers for doing this” (State building manager, Housing developer - C1)

Social, cultural & intellectual capital



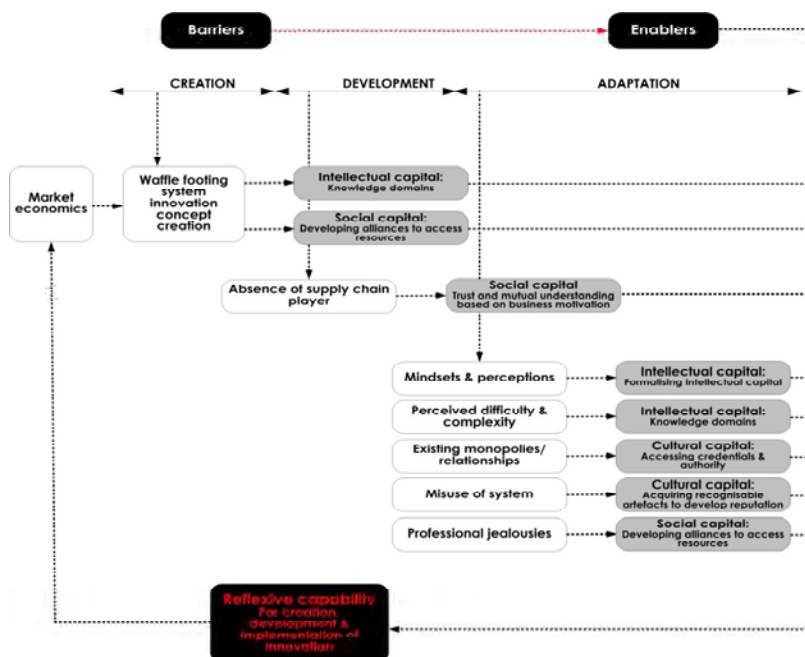
Stages		Case studies						
	Key themes	C1	C2	C3	C4	C5	C6	C7
Agenda-setting	Opportunistic surveillance	√	√	√	√	√	√	√
	Performance gap	√				√	√	√
Matching	Establishing fit: problem & innovation	√	√	√	√	√	√	√
Redefining	Changes to organisation/innovation	√	√	√	√	√		√
	Developing alliances to integrate resources	√	√	√	√	√	√	√
Clarifying	Role of champions	√	√	√		√	√	√
	Reducing uncertainty	√	√	√		√	√	√
Routinising	Widespread diffusion	√	√	√	√	√	√	√
	Adaptations		√	√	√	√		√




X Organisational Capital

MEMBER	ORGANISATION TYPE/ROLE	CREATION			DEVELOPMENT			ADAPTATION		
		SC	CC	IC	SC	CC	IC	SC	CC	IC
C1	Housing Developer	✓		✓	✓	✓	✓		✓	
C5	Engineering firm	✓		✓		✓	✓		✓	
C2	Footing contractor				✓		✓			
C3	Building materials supplier							✓		✓
C4	Plastic spacer manufacturer									✓
C6	Industry association							✓	✓	✓
C7	EPS supplier									✓

 AUSTRALIAN NATIONAL HOUSING SUPPLY CHAIN ALLIANCE (ANHSCA)



Process

 Project 10-01: Housing Supply Chain Model for Innovation
ANHSCA



INTELLECTUAL PROPERTY

Background Intellectual Property

Professor Kerry London has Intellectual Property (IP) on supply chain management and innovation diffusion. These are documented in her books and publications. She has completed national studies on supply chain management and on developing pathways for diffusion of innovative information technology.

FMG employees have technical IP on the engineering design of the waffle slab footing and these are documented in technical papers.

Project Intellectual Property

The IP arising from this project will include a description of a methodological process pathway to adoption and diffusion model for an integrated housing construction supply chain for developing an innovative product for organizations involved in the Australian construction industry context. This is documented in the research report.

This IP is shared between FMG and Professor London.

London has the right to publish in international academic journals and conferences at any time. Usual academic research protocols of anonymity of participants will be observed. Acknowledgement of industry partner FMG is required on each publication arising from the project outcomes for a period of 2 years after project completion [nominally April 2011]. London shall notify FMG of other public presentations other than ones conducted with FMG for a period of 12 months after project completion.

FMG has the right to implement the process with their supply chain participants. Neither party has the right to implement the process in another organization unless with permission from the other party.

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Acknowledgements

This work has had significant support from some key people.

Rob Anderson has provided invaluable insight as a research participant based upon his experiences in the innovation under study but also on his many work experiences. He has also provided comment on the research report. We are indebted for his support and visions about how to make this industry and organisation better. Rob is Chair of the Alliance that this work falls under.

Peter Bayetto is to be thanked for providing the funds to support this work and having the faith in the research team. His insights as a research participant were invaluable and the access to various historical documents were important to the research team. His dedication to innovation in engineering and his foresight to understand that engineering excellence is sometimes not alone enough to drive innovations is important. It is important for the improvement of many Australian companies to seek to take up challenges and need guidance on the business and organisational matters to support their leading edge practice.

1. INTRODUCTION

1.1 Australian Housing Supply Challenge

The housing sector has always been seen as an important part of the economy and is considered a key indicator of the health of the Australian economy. The construction industry typically represents between 6-12% of the GDP of an economy. In Australia in 2009 the residential sector accounted for approximately \$70b and from 2000-2009 the average was 47% of the total spend in the construction industry.

With anticipated population growth the significance of housing infrastructure provision is expected to increase in the next two decades. The Australian National Housing Supply Council estimates that around 3.2 million additional dwellings will be required in the next 20 years to accommodate a population growth from 2008 to 2028. Moreover, it also forecasts that the current demand-supply gap of 178,400 dwellings will increase to approximately 640,000 by 2028. According to the Australian Bureau of Statistics (ABS, 2010), the country currently needs to be building 17,400 homes every month. Housing supply, however, has oscillated between 10,000 to 16,000 dwellings per month since 1990. Based on the average number of approvals over the first three months of 2010, the current supply is around 14,500 dwellings per month. Put simply, the current supply of housing is unable to keep pace with the demand for housing across Australia (Liu and London, 2011). The shortfall means we are faced with a crisis in our capacity to plan, design and construct to meet our nations needs unless we act immediately to improve our capacity for a more efficient, effective and innovative supply system.

Housing affordability is always a concern in Australia. The housing sector supply crisis is not just associated with housing affordability it is much deeper and widespread than one segment of the market sector. The residential supply sector has little capacity to respond to all markets and achieve value for money for all categories of the housing market. There is an ongoing concern about the capacity of the housing sector in being able to provide quality value for money and sustainable housing with the current structural and behavioural characteristics. These underlying characteristics are seriously impeding the performance in terms of productivity and innovation, which is required to achieve the high volume of infrastructure required and at the rate anticipated over the next two decades.

2.2 Alliance members need to promulgate construction supply research to key policy and decision makers as well as our own stakeholders.

1.2 Housing Sector Concerns

It is proposed that the problems of the housing sector include:

- low profit margins for builders and subcontractors,
- high risk,
- fragmented supply,
- adversarial relationships between firms,
- wasted resources (time, cost and materials),
- low innovation,
- poor communication flows,
- low productivity and
- poor project management skills.

According to the Productivity Commission Inquiry Report (2004) "First Home Ownership", there are concerns about the competitiveness of some sections of the commercial sector involved in medium density residential construction. The cost of construction across several countries ranked Australia in the middle in terms of performance. The pace of innovation in

the building industry in Australia has been below that of other countries such as the United Kingdom and the United States. Productivity growth in the building industry is below average for the market sector of the economy.

Past research has clearly linked the housing supply problem to land supply and housing demand through mortgage interest rates (McTaggart et al, 2003; Elbourne, 2008; Edelstein and Sau, 2004). There has been some more recent work that linked completion times to development approval processes [Holmes, London and Sheehan, 2008]. The focus of attention has been on the earliest stages of the process including housing demand, then land supply and then housing development approvals. Very little attention has been on the industry and its performance in relation to achieving the capacity desired.

1.2.1 Supply chain workflow

The work of Ehsan et al (2010) indicates that the industry's capacity to supply is of serious concern. This work discussed two approaches to exploring the problem; the workflow approach and the activity-based approach. A first order and simplistic solution to the problem is that the housing supply system is constrained by capacity to deliver and thus the problem can be solved by increasing the capacity ie increasing the number of resources. Unexpectedly Ehsan et al's work (2010) clearly indicates that the problem may be much more complex than anticipated. In summary increased resources as exemplified by increasing the number of employees at a sectoral level did not have any impact upon completion times over a specific time period. The problem of the housing sector and its ability to supply is explained by a workflow approach. Workflow is linked to:

- flow in the supply chain;
- flow of materials to site, subcontractor management and work being ready to be completed;
- subcontractor firm management of multiple sites;
- information flow in relation to ordering and site readiness;
- over stating site readiness and then subsequent break down in communications and trust between contractor, subcontractors and suppliers when sites are not ready; and
- management of inter firm relationships along the chain of supply etc.

Effectively workflow is an issue related to supply chain coordination, planning and integration at a site and project level and also at the firm and multi site and overall supply chain network organisational levels. Such matters require appropriate attention to achieve improved productivity and successful introduction of an innovation into a system – whether a product innovation or a process innovation or a combination of product and process innovation.

1.2.2 Cultural change

It is speculated that the industry is resistant to change, participants tend to not have a holistic view of the industry and perhaps feel powerless to effect change (London and Siva, 2011). There are significant large national companies who are the market leaders in the residential sector who have some capacity to effect change, however in reality it is suspected that this group struggles to do so in a whole-scale concerted manner. The underlying structural and behavioural characteristics create an overwhelming inertia that resists change. If the large volume house builder is often frustrated by their ability to effect change then the smaller organisations who have less market share and thus power almost certainly can not ever hope to address systemic, cultural and process change individually. However that is not to say that collectively they are not more able to begin to be involved in behavioural and structural change. The next tier of the housing sector is highly competitive and fragmented too and involves numerous small to medium sized companies acting as subcontractors and typically operates in an uncoordinated and uncooperative environment. Then the third tier of the chain typically involves the major multinational materials and product suppliers. This is a

simplistic representation of what tends to happen and there are of course unique and individual differences in behaviour, culture and inter firm relationships.

The industry participants as a whole tend to be focused on short-term survival rather than overall industry improvements for the medium or long term. As a result the industry presents us with a set of interdependent problems. There is low performance and low margins of profit caused by:

- incorrect pricing,
- inadequate strategic plans,
- inaccurate bill of quantities,
- guess estimates,
- uncoordinated practices,
- poor communication and documentation and
- poor supervision and quality control.

These challenges impact contractors and most importantly subcontractors and suppliers as well as the eventual home-owner. Adversarial relationships and uncoordinated relationships between companies results in constant delays on site and time over runs on projects. It is also a highly regulated industry subject to changing market conditions where purchasing on a project by project basis with short term perspectives is the core method of operating that links the various firms in the chain of supply. Customers, planners, designers, contractors, subcontractors, suppliers and government agencies are interconnected but lack cohesive and coordinated action. Therefore, this is not a simply demand-supply balance equation. The sector's level of productivity, performance, competitiveness and innovation is linked to developing more sophisticated and focused integrated supply delivery solutions that improve coordination involving the various actors and stakeholders and which is aimed at reducing risk and costs.

1.3 Summary

This section has highlighted that there are significant problems in the supply of housing in Australia. Yet very little attention has been paid to the concept of integrated solutions and the research on supply chain management in housing construction. To date the housing supply debate has been largely focussed on housing demand, affordability and land supply. One of the key causal factors of poor housing supply is the poor coordination and integration between supply chain actors. A more cohesive supply chain would prove beneficial to all housing sector stakeholders because:

- it would provide the industry with more certainty in pricing, enable higher quality and lower priced housing achieved through more sophisticated, better planned and designed stock through innovative solutions and more rapid construction,
- it promotes more predictable margins and minimises financial risk to all participants, reducing conflict and enabling effective and efficient relationships and alliances between firms throughout the entire supply chain in cooperative and competitive action, and
- it would create high quality strategic purchasing environments between contractors, subcontractors and suppliers that would improve coordination which would lead to improved flow of information and products/services.

The development of integrated supply delivery solutions have not been extensively recognised in the Australian residential sector. Ad hoc examples and applications by some major building companies have seen some limited success. However, this has not been diffused throughout the sector and thus has had little real impact on overall sector performance and individual company competitiveness. Whole-scale industry improvement requires a concerted effort to undertake a stepwise change. A key to the solution is to

investigate successful examples of integrated supply chains which have resulted in productivity and/or innovation performance improvements.

Recommendation 1.1

Alliance members need to promulgate construction supply research to key policy and decision makers as well as our own stakeholders. The Alliance needs to develop a Dissemination Strategy to promulgate findings.

2. THEORETICAL BACKGROUND

The present research project is a first step in addressing the problems of the residential construction market using the “supply chain lens”. The project aim is to explore an example of an innovation which was successfully delivered to the housing construction industry which required an integrated construction supply chain model.

The theory that underpins this study is a combination of innovation diffusion theory and construction supply chain theory.

2.1 Construction supply chain theory

One of the greatest concerns of the construction industry is the lack of cohesion and coordination between firms along their supply chains during project contracts. The low productivity and poor performance of the industry has long been associated with the lack of integration between firms. The supply chain management concept has gained the interest of the construction research community and policymakers through its successful implementation by manufacturing sectors to resolve firm performance problems.

2.1.1 Development of supply chain theory and practice

The supply chain concept is very much concerned with firm behaviour within markets. The supply chain is the upstream and downstream contractual relationships between firms who deliver a commodity (product and/or service) related to the core business of a construction project. Subsequently the supply chain once formed creates a flow of commodities, cash and information. The creation of the supply chain is impacted by the location of the individual firm within its competitive market. These markets have unique structural and behavioural economic characteristics. The upstream and downstream linkages are affected by the characteristics of these markets and in particular the ensuring power relationships which arise between tiers (London, 2005).

A central idea of supply chain theory is that holistic supply chain integration relies upon each firm at each tier in the supply chain knowing and aiming for a common objective. The common objective may be an innovation or it simply may be concerned with efficiency and effectiveness across the whole supply chain. One of the most significant problems is that once a supply chain becomes fragmented at each tier in the chain there is an outcome from a firm and that firm passes their product and/or service to the next firm at the next tier in the chain and a silo effect may begin to take place. Each firm has unique objectives and ‘pushes’ on to the next tier the outcome they assume the next tier can ‘bear’. The outcome is generally the most efficient for the firm but may not necessarily completely satisfy the next tier’s objectives [i.e. the customer’s objectives]. It is almost certain that the firm would not be considering the objective of the whole chain nor any other levels in the chain at all.

The general approach to supply chain management to improve industry performance by the research community has been through either of the following two types (London, 2005):

- normative models: based on the assumption of a homogenous industry, but one which is fragmented and composed of numerous small to medium sized firms and therefore supply chain integration. The construction industry is considered to be highly fragmented with low levels of vertical integration. Coupled with this is the assumption of the added difficulty that each new project typically starts afresh with the formation of a completely new set of arrangements between suppliers along the chain. In 2008 (London, 2008) this myth was largely dispelled with extensive empirical evidence indicating that even though at tier 1 there may be new design consultants and major contractors in differing arrangements – often as you move down the chain there are predictable patterns and industrial arrangements but perhaps diverse channel arrangements for the supply of commodities.

- positive models: accepts that the industry is specialised and heterogeneous with varied structural and behavioural characteristics across individual markets but with predictability and reliability in supply chain organisation. The positive model has only recently been explored in detail (London, 2008).

The fragmented nature of the supply chain is central to concept of supply chain management where the concept of 'pull' vs. 'push' explores a different way of thinking about holistic supply chain performance outcomes alongside the individual outcomes at each tier. The final 'customer's objectives and desired outcome effectively 'pulls' through the products and/or services provided by each tier in the chain. Until quite recently there has been little empirical evidence on the channel organisation and the decision-making actions in relation to procurement at each level of various tiers in the supply chain (London, 2008). Therefore it has been difficult to see any real examples of where this concept has had any major impact or where improvements have been made.

To achieve supply chain integration the organisations need to have the right strategic environment to support innovations. The 'right' strategic environment is affected by the underlying economic and business environment. Organisations may have the will and the desire to 'integrate' or 'coordinate' or 'innovate' however underlying structural conditions may be a barrier to such aspirations. The underlying economic market structure that an organisation is located within affects their behaviours with their clients and then also with their suppliers. The supply chain becomes a series of inter-connected markets whereby the power to influence the upstream and downstream relationship is impacted by the power that they can exert which is affected by the power relationship that they have within their market. The structure-conduct-performance SCP theory is well known and one of the cornerstones of the theory of industrial organisation economics. It has been systematically explored and extended to the construction supply chain. The theory holds true for the construction industry supply chain. SCP is a static perspective whereas the construction industry is more dynamic with short term changing market conditions on every different project but there are also more pervasive longer term market conditions that each unique project relationship is embedded within. This is described in much more detail in London's book Construction Supply Chain Economics. For this study it is important to understand this background theory to contextualise the business context of the relationship between actors involved in the innovation case study.

2.1.2 Summary

Much rhetoric states that supply chain management will solve problems, however, we know little beyond this. There are a range of tools and techniques that can be applied from other sectors that are 'tried and true' to achieve more cohesive supply chains. However, it is critical that an understanding of the sector specific challenges associated with the unique housing sector supply chain problems are addressed as well.

One would anticipate that to create, develop and diffuse an innovation in a fragmented industry such as the residential sector would require collaborative efforts between firms along supply chains. It would also require a champion or group of champions who have enough resources and 'pull' to enable the development of the innovation. Beyond these propositions we do not know any more detail of the characteristics of the innovation process or methodology which would integrate the supply chain and achieve innovation creation and/or diffusion.

Recommendation 2.1

This study may contribute additional insights to construction supply chain economics theory and where this occurs the research team should publish the findings.

2.2 Innovation Diffusion theory

There is theory already established in relation to adoption and diffusion of innovations and this theory provides a starting point to interpreting and exploring the particular innovation that

shall be studied in this project. Rogers' theory of Innovation Diffusion (1962; 1995) provides an initial framework through which examination of the diffusion of an innovation can be examined. Rogers (1995) defines the diffusion of innovations as the process by which knowledge of an innovation is transmitted through communication channels, over time, among the members of a social system.

2.2.1 Elements of Diffusion

The four key elements comprising Rogers' diffusion theory are defined as;

- The innovation: an idea, practice or object that is perceived as new;
- Communication channel: can be mass media and/or interpersonal networks and is the means by which messages about the innovation gets from one individual to another;
- Time: comprising a) the innovation-decision process, b) relative time which an innovation is adopted by an individual or group – an innovation's rate of adoption
- The social system; a set of interrelated units that are engaged in joint problem solving to accomplish a goal.

2.2.2 Diffusion process

Rogers (2003) also outlined the innovation process as consisting of a sequence of five stages including:

- Agenda-setting: the initiation stage when a broad organisational problem is identified which generates a need for an innovation. Within this stage there are two key processes; firstly an identification and prioritisation of problems and requirements and secondly a search within the organisation to find innovations to resolve or manage the identified problems. It is in this stage that the initial motivation is created which drives the later stages in the innovation process.
- Matching: the stage where the problem from the organisation's agenda is conceptually matched with the innovation to determine how well they align. The feasibility of the innovation in resolving the organisational problem is also considered at this stage. This stage is critical to determining if a new idea is sustained in an organisation over time as key decisions are made which may lead to the termination of the innovation process even before its implementation. If it is perceived that the organisation's agenda fits with the innovation then the match is planned and designed.
- Redefining/restructuring: the stage when the innovation is adapted based upon the organisation's needs and structure or vice versa. It is anticipated that a degree of change occurs in the innovation and the organisation during this stage. The ease within which organisations experience the innovation process is influenced by the origin of the innovation (ie whether the innovation comes from within or external to the organisation) as well as the degree of change the innovation creates (radical vs incremental).
- Clarifying: the stage where the innovation has been spread more widely in an organisation. A high degree of uncertainty surrounds its members as an innovation is implemented in an organisation. As a result, individuals go about seeking answers to reduce uncertainty at this stage and construct their meaning of the innovation over time. Innovation champions can play a critical role in the innovation process during this clarifying stage.

- Routinizing: the stage when an innovation has become synonymous with the regular activities of an organisation, which completes the innovation process.

The identification of the different stages in the innovation process has been particularly useful for understanding how to effectively introduce new ideas in organisations because through this we are able to gain insights into the main sequence of decisions, activities and events in the innovation process.

2.2.3 Adopter categories and diffusion phases

Within this framework diffusion is largely measured through the degree of adoption within a system. Adopters are categorised by Rogers' as innovators, early adopters, early majority or laggards. These adopter categorisations are differentiated primarily in relation to diffusion as temporal process whereby diffusion happens in time, whilst the other key elements of innovation; communication channels and social/business systems exert influence upon the temporal diffusion process depending on their specific qualities (London et al, 2007). According to Rogers for example, communication channels vary in importance according to the type of adopter; mass media and expert knowledge has more influence on innovators, whereas personal networks are more important for late adopters (Rogers, 1995 as cited in London et al, 2007).

Further to this there are two key phases in relation to the diffusion of an innovation:

- First is the creation of the innovation and that process by the 'innovators'
- Second the adoption by others in the industry and the process of diffusion of the innovation.

The adopter categorisation by Rogers is particularly applicable to the second phase of the innovation diffusion process whereby adopters can largely be grouped into one of the four categories of innovators, early adopters, early majority or laggards. This simplistic classification by Rogers, however, places all participants involved with the creation of an innovation into the broad "innovator" group which does not capture the specific characteristics of the different participants within this group and the process undertaken by the different participants to create the innovation. The research described in this report seeks to extend the work of Rogers to examine more specifically the characteristics of the different participants within the innovator group and the process undertaken to create an innovation in the housing construction industry.

2.2.4 Pathways to adoption

London et al (2007) eventually challenged Rogers' simplistic binary approach to categorisation of adopters. However, according to this categorisation London et al (2007) explored late adopters and laggards of technology to develop an e-business technology adoption profile of the majority of the industry players. The work by London et al (2007) on e-business innovation diffusion in the construction industry was unique in that this piece of work identified pathways of adoption by the later majority adopters and laggards. That study challenged the basic premise to Rogers' work in that adoption was considered as a binary proposition, ie to adopt or not to adopt. This conceptualisation was tested. There were different rates of adoption and these were related to the way in which the players involved underwent transformations in their perceptions about the particular innovations. These patterns can be seen in three identifiable pathways which were termed: Perceptions Pathway, Compatibility Pathway and Communication Pathway.

2.2.5 Past innovation diffusion research

Over the years there has been a significant amount of research conducted in relation to the theory of innovation diffusion in various fields including anthropology, education, health, geography, information technology and construction. This long history of diffusion research has resulted in diverse types of diffusion analysis and Table 2.1, sourced from Rogers (2003) presents a summary of eight of these different types of diffusion analysis.

Table 2.1 Eight types of diffusion research (Source: Rogers, 2003, pp. 96-98)

Type	Main dependent variable	Independent variable	Units of analysis	Approximate percentage of generalisations of this type in available diffusion publications	Representative diffusion research study
1	Earliness of knowing about an innovation by members of a social system	Characteristics of members (eg cosmopolitaness, communication channel behaviour)	Members of social system (usually individuals)	5%	Greenberg (1964)
2	Rate of adoption of different innovations in a social system	Attributes of innovations (eg complexity, compatibility, etc as perceived by members of a system)	Innovations	1%	Fliegel and Kivlin (1966)
3	Innovativeness of members of a social system (the members may be individuals or organisations)	Characteristics of members (eg cosmopolitaness, communication channel behaviour, resources, social status, contact with change agents); system-level variables	Members of a social system (individuals or organisations)	58%	Deutschmann and Fals Borda (1962); Mohr (1969)
4	Opinion leadership in diffusing innovations	Characteristics of members (eg cosmopolitaness); system norms and other system variables; communication channel behaviour	Members of a social system (usually individuals)	3%	Kelly et al (1991, 1997)
5	Diffusion networks	Patterns in the network links between two or more members of a system	Dyadic network links connecting pairs of individuals (or organisations) in a system	Less than 1%	Coleman et al (1966)
6	Rate of adoption of innovations in different social systems	System norms; characteristics of the social system (eg concentration of opinion leadership); change agent variables (eg their strategies of change); types of innovation-decisions	Social systems	2%	Rogers and Kinkaid (1981)
7	Communication channel use (eg whether mass media or interpersonal)	Innovativeness and other characteristics of members of a social system (eg cosmopolitaness); system norms; attributes of innovations	Members of systems (or the innovation-decisions)	7%	Ryan and Gross (1943)
8	Consequences of an innovation	Characteristics of members, the nature of the social system; the nature and use of the innovation	Members or social systems or innovations	0.2%	Sharp (1952)

Table 2.1 presents an overview of the eight different types of diffusion analysis and the approximate amount of research attention paid to each type of analysis. As shown in the table the most popular type of analysis has been one centred on an investigation of the variables related to the innovativeness of the members of a social system (Type 3 in Table 2.1). Such analyses seek to identify the characteristics of those considered to be innovators. For example, Mohr's (1969) study on the innovativeness of directors of county departments of public health in Canada identified that the most innovative health departments were characterised by greater financial resources, a director who was more highly committed to innovation and larger size.

Furthermore each academic discipline has typically sought to concentrate on investigating one main type of innovation. For example, rural sociologists have typically specialised in farm innovations whilst medical sociologists specialised in public health innovations. Significantly the work of the construction management research community has not been included in Rogers' (2003) overview of diffusion research.

Some past work in diffusion analysis has been conducted in relation to the construction industry and it is important to briefly discuss these. London et al (2007) and Walker et al (2005) explored e-business and information technology adoption in the Australian construction sector using concepts from Roger's innovation diffusion theory. The unit of analysis in both studies comprised the members of the social system. Specifically London et al (2007) explored late adopters and laggards of technology whilst Walker et al (2005) explored early adopters of technology in the construction industry.

Manley and McFallan (2006; 2008) also conducted research on the members of the social system, ie high vs low innovators in the construction industry with a focus on the commercial building and civil engineering sectors which excludes the residential sector. Their particular contribution was an identification of the business strategies used for effective implementation of innovations within organisations. Through a survey with over 3000 key Australian construction firms Manley and McFallan (2008) identified the relative importance of five key types of business strategies related to employees, marketing, technology, knowledge and relationships. The strategies which had the greatest impact included investment in research and development, participating in partnering and alliances on projects, ensuring transferral of project learning into business processes, monitoring of international best practice and recruitment of new graduates. This piece of work however did not explicitly map the process pathway for innovation creation, development, adaptation and diffusion by an innovator group. Even though the term used to describe the case studies was "innovators", the study was focussed on the factors affecting adoption and implementation of innovations within organisations. The study investigated how new ideas were introduced successfully within organisations rather than innovation creation and development across organisations.

Consistent with Rogers' overview of diffusion research the past work in diffusion analysis related to the construction industry has also been concentrated on investigations of the innovativeness of the members of a social system (Type 3 in Table 2.1). The actual process undertaken by an innovator group in the creation of innovations has received little attention in the construction research community.

The present research extends the work of past research by addressing the two research gaps. Firstly the unit of analysis explored in this study is the *process* undertaken by the innovator group to deliver an innovation to the housing construction industry. The main dependent variable of this study is the pathway for supply chain integration for effective delivery of innovations. The independent variable includes the characteristics of the process of integration of the construction supply chain towards successful delivery of an innovation.

Secondly this research examines the first phase of the innovation diffusion process which is the creation of the innovation and that process undertaken by the 'innovators'. The innovator group is differentiated from the other adopter groups in that participants are actively engaged in the creation and development of the innovation. Innovator group participants are not simply adopting an innovation which has already been designed, tested, evaluated and implemented. The present research is focussed on the creation phase and the decisions and

actions relating to the innovator group. This research examines any unique characteristics in relation to pathways for innovation creation, development and diffusion. The participants in the “innovator group” explored in this study include those players who were actively engaged with the creation, development and adaptation of the waffle footing system innovation process.

2.2.6 Summary

The emphasis in past diffusion research has been on investigating:

- the members of the social system as the unit of analysis, and
- the second phase of the diffusion process which is the adoption by others in the industry following initial creation by an innovator group.

Consequently this has resulted in two key gaps in research understanding of:

- the *process* undertaken by members of the social system as the unit of analysis
- the first phase of the innovation process which is the initial creation of an innovation by an innovator group

The challenge for future research is to expand the work of past research and identify different objectives and research questions in directions that the theory suggests. Examine an example of the process undertaken by an innovator group to deliver an innovation to the housing construction industry and identify the barriers and enablers related to the innovation process. An identification of barriers and enablers allows a critique of the unique characteristics of the innovator group pathway to deliver an innovation.

Recommendation 2.2

The methodology of innovator group pathway to delivering an innovative system can now be described and further case studies can enhance validation of the findings

3. METHODOLOGY

The empirical study is organized in three phases:

- exploratory description of case study,
- critique of process, and
- development of integrated supply chain methodology.

The description of the data collection and analysis process is now presented.

3.1 Data collection

A total of seven organisations were involved in this study with one interview conducted per organisation with the exception of the engineering firm, C5. Two interviews were conducted with the engineering firm, C5. Therefore eight in-depth interviews were conducted for this study. Table 3.1 presents details relating to the interview participants. The duration of the interviews was between 60-180 minutes. The interview participants were asked questions relating to four key areas from their perspectives;

- their role in their organisation and their role in relation to the waffle pod footing system innovation
- key events or milestones in the innovation process
- barriers and enablers which hindered or drove the innovation process
- key players in the innovation process

Table 3.1 Summary of Case Studies: Organisation type, position, role and location

Case study	Organisation type	Participants position in organisation at time of innovation	Role in relation to waffle footing system innovation	Size of organisation	Location
C1	Large housing developer	State manager	Supply experimental/ prototype sites Coordinate inter firm supply chain relationships to create and develop the system	>450 employees	Australia-wide
C2	Footings contractor	Managing director	Construct footing system for experimental/ prototype sites	>50	South Australia
C3	Building materials supplier	Sales representative	Manufacture, promote and distribute the system	>2500 employees	Australia-wide and internationally the United States, New Zealand, the Phillippines and Chile
C4	Plastic spacer manufacturer	Managing director Managing director	Manufacture a key component of the system, ie plastic spacer	<10 employees	South Australia
C5	Engineering consultant firm	Managing director Managing director	Provide engineering design for the system Monitor and test experimental sites Obtain approvals/ accreditations for the system	>100 employees	South Australia, Victoria
C6	Polystyrene supplier	Managing Director Sales representative	Distribute the system in Victoria	>1000	Victoria
C7	Industry Association	Regional manager	Promote the system in Queensland	Members represent >80% of the industries' output	Queensland

3.2 Data analysis

A data analysis technique referred to as the narrative inquiry approach was used in this study. Narrative inquiry is well suited to uncover stories to highlight the organisational, communication and economic factors impacting on the creation, development and adaptation of the innovation. The key actions and events which influenced decisions made were systematically identified to connect and map the consequences of those events over time against the creation, development and adaptation of the innovation (Riessman, 1993).

The specific technique of story analysis was used for data analysis. Story analysis offered a way of connecting different stories from key protagonists to understand the innovation process and in particular changes that took place over time (Bell, 1993).

The unit of analysis is the cluster of organisations that are involved in the innovation and the collection of stories that describe the various experiences of the participants. The interviews were recorded, transcribed and subjected to four stages of analysis including:

- Description of the stories from each participant in isolation in relation to their experiences during the creation of the innovation process
- Collecting and connecting the stories and then matching to the five stages of the innovation process from all participants
- Description of barriers and enablers to the innovation process
- A description of the pathway for the creation, development, adaptation and diffusion of this particular innovation.

3.2.1 Narrative analysis technique

The first part of analysis involved an analysis of each participants experiences to identify links between stories particular to each participant. Stories were identified and coded into the five stages of the innovation process including agenda-setting, matching, restructuring/redefining, clarifying and routinising. The following steps were undertaken at this phase of analysis:

- Each interview was transcribed into “rough drafts” to develop narrative segments (refer to Figure 3.1). A framework developed by Labov (1972) was used to identify the boundaries of narrative segments. According to Labov (1972) all well-formed stories are made from a common set of elements and each clause has a function, which includes:
 - Abstract: what was this about?
 - Orientation: who, when, what, where?
 - Complicating action: then what happened?
 - Evaluation: so what?
 - Result or resolution: what finally happened?

The abstract serves to provide an overview or summary to the narrative by stating what the narrative is about and why it is told (Labov, 1972). The orientation offers a recognisable beginning, which is signalled by the narrator and listener (Bell, 1993). The evaluative comments which may occur in various forms throughout a narrative serve to answer the fundamental question of why the story is told in the first place and is particularly important as it indicates how the narrator makes meaning of the events. The coda serves to acknowledge the story's ending. The coda is however found less frequently than any other element of the narrative (Labov, 1972).

In order for a narrator to communicate a story, the narrator needs to narrate in a form that is compatible with the expectations of the listener (Bell, 1993). In the case of this study, all the interviewees told their stories in a way that was easily understood by the researcher. The interviewees' stories tended to have a "recognisable, patterned structure" (Bell, 1983) where most of the stories were composed of the elements described by Labov's (1982) "well formed" narrative. Even though not all narratives were composed of the full set of elements most of the stories included the basic elements which could be recognised.

- The narrative segments were then interpreted to identify the meaning of each individual story. In each story a particular feature was identified to demonstrate a certain element of a particular stage of the innovation process. Based on the participant's decisions, activities or events described within the stories, each story was then classified into categories according to the primary characteristics of the five stages of the innovation process (refer to Figure 3.2).
- The next stage involved linking the different stories into chronological order. The stories coded into the five stages of the innovation process were then "pasted together" to form a "metastory" to demonstrate the participant's experiences related to the waffle pod footing innovation over time (refer to Figure 3.3)

Figure 3.1 Stage 1: Development of rough drafts

and we had at that point significant land holdings south of Adelaide, an estate called Trott Park and an adjacent one called Redwood Park which was quite soft undulations in the landscape and they were selling reasonably well but not as well as we wanted to get revenue up. And even in those early days I realised about making money and the margins in housing are quite low, they're terrible because of the inefficient way we did things but it reminded me of the landscapes around Durban where I'd been working over there. So in one of my thinking modes when I realised I was being paid to think I thought why cant we cut and fill and slab as we did over there. So I started exploring that.

Figure 3.2 Stage 2: Identification of narrative segments and coding into five stages of innovation process

Story 2: “*they were selling reasonably well but not as well as we wanted to get revenue up*”
Stage: Agenda-setting

Orientation

105: and we had at that point significant land holdings south of Adelaide, an estate called Trott Park and an adjacent one called Redwood Park which was quite soft undulations in the landscape

106: ***and they were selling reasonably well***

107: ***but not as well as we wanted to get revenue up.***

Complicating actions

108: And even in those early days I realised about making money

109: ***and the margins in housing are quite low,***

110: ***they're terrible because of the inefficient way we did things***

111: but it reminded me of the landscapes around Durban where I'd been working over there.

112: So in one of my thinking modes when I realised I was being paid to think

113: I thought why cant we cut and fill and slab as we did over there.

Resolution

118: So I started exploring that.

Figure 3.3 Stage 3: Pasting together of a “metastory”

AGENDA SETTING					MATCHING		REDEFINING	ROUTINISING	
STORY 1 Overseas experiences “It reminded me of the landscapes around Durban...I thought why cant we cut & fill as we did over there”	STORY 2 Paid to think about things “had a break one day...I’m paid to think about things”	STORY 3 Dealing with unknowns – traditional footing “when you hit rock, you called the customers & said “you’re going to have to pay more money...so you’re offside”	STORY 4 Multistorey carparks & waffle pods “cant we do that same stuff over here?”	STORY 5 Inefficiencies & revenues “they were selling reasonably well but not as well as we wanted to get revenues up...the margins in housing are terrible because of the inefficient way we did things”	STORY 6 Developing value propositions “in discussion with my marketing people I said “if you could put a price on the market fixed, no extras would that be a value proposition? They said. god for it!”	STORY 7 The diary demonstration “I want that; I can measure it, I can see it, I can do it quickly”	STORY 8 Developing alliances “I was cost controlling...I was just the poor old builder...this was where we had that alliance”	STORY 9 Pushing through “I took the concrete gangs to [the engineers] offices...ran seminars on how to put a box together...I was determined & you have to champion that”	STORY 10 Innovation integrated with systems “that was the actual first system built...from that point it became accepted & we were pricing our land & house packages with it...we could give a fixed price”

3.3 Summary

An underlying assumption of this study is that there is a structured methodology which can be developed to describe a pathway for supply chain integration. Furthermore it is proposed that the process pathway for supply chain integration will enable effective delivery of innovations. The innovation can be either incremental or monumental, product or process that will improve the performance of the industry.

The narrative inquiry approach provides an opportunity to uncover stories to highlight the organisational, communication and economic factors impacting on the process undertaken by the innovator group to deliver an innovation to the housing construction industry. The technique of story analysis is proposed for use as it offers a way of connecting different stories from key protagonists to understand the innovation process and in particular changes that took place over time. The various experiences of the participants from the cluster of organisations which were involved in the successful delivery of the waffle footing innovation need to be captured. The specific characteristics of the innovator group process for integrated supply chain innovation also need to be captured.

Recommendation 3.1

The Alliance team should explore the marketing potential of the narrative 'story' approach in an industry brochure and also public presentations. The academic team should publish as this methodology will contribute to research methodologies in the academic community.

4. RESULTS

4.1 History of the waffle footing innovation

It is important to provide a brief summary of the key events and developments surrounding the waffle footing system so that the detail of the stories can be understood within their context. The key events are also presented graphically in Figure 4.1 in relation to the creation, development and adaptation phases.

The waffle pod footing system story begins in the early 1980s in Adelaide, South Australia. The state manager of a large national housing developer (C1) was exploring ways to increase revenues through developing efficient on-site materials management. The commonly found clay soil of medium to high reactivity in Adelaide, which undergoes shrinkage and swelling movements present a particular problem for footing systems and as a result, building construction. This soil reactivity has a more significant effect on housing in Adelaide compared to other parts of Australia as a result of the combination of reactive clays and the arid climate (APO, 2011). The problem was the variability between the concrete volume specified in design and concrete volume used in actual site construction. The variability arose because of soil conditions and subcontractor construction skills.

The waffle slab had been used in high-rise multi-storey buildings and car parks and so the idea was to translate that system to the residential footing system. The waffle footing system was seen as an economical solution to the problem of differential movements of reactive clay soils by reducing variability in concrete design specification versus onsite construction. The waffle slab is a system to replace the traditional concrete raft slab. It involves a series of hollowed-out box-like members separated by spacers and positioned together by reinforcing rods and mesh with concrete poured over the hollow members.

The housing developer was also trading with an engineering consulting firm (C5) at that time which had just embarked on a program of research and development on footing design. The late 1970s and early 1980s saw major developments in Australian building codes in terms of how footings were specified and designed and the waffle footing system was a part of the different streams of research the engineering firm was engaged with during that time.

The housing developer (C1) and engineering firm (C5) were central in the initial creation stage of the waffle footing innovation. A number of other key players also contributed to the creation, development and adaptation of the waffle footing system including a building materials supplier (C3), a footings contractor (C2), a plastic spacer manufacturer (C4), an industry association (C6) and a polystyrene supplier (C7). The footing system originated in South Australia and some 18 months after the first installation in 1985 had spread to the other states of Queensland, New South Wales and Victoria.

Over the following 10-15 years, the waffle footing system gained increasing popularity and there were various business ventures and alliances developed to promote and distribute the system. Some of these alliances were 'spin offs' from the original business in Adelaide whilst others were competitors to the original business. Significantly, in 1987 the waffle pod footing system began to be formally promoted and distributed nationally by a building materials supplier, C3. The building materials supplier was involved with the manufacturing and distribution of fibre cement building products and associated resale items within Australia. The engineering firm committed to a 3-year licensed distribution agreement with the building materials supplier. The agreement enabled the building materials supplier to have exclusive rights to distribute throughout Australia products manufactured in accordance with the engineering firm's patent. In return the engineering firm was paid royalties based upon the products sold by the supplier.

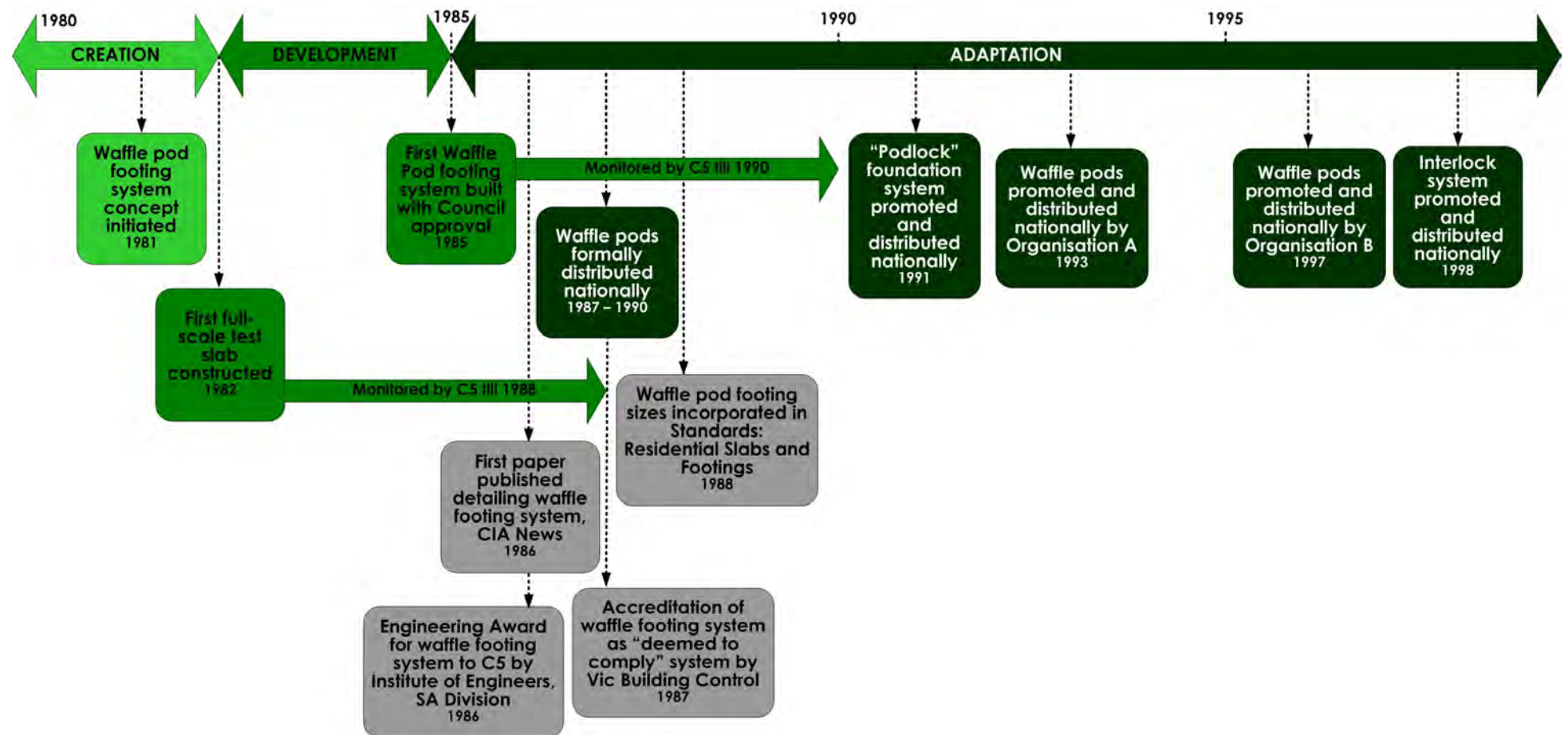
In 1991 the engineering firm and a plastic spacer manufacturer, C4 registered the business name "Podlock Distributors" to distribute and sell the Podlock foundation formwork system in South Australia. This was an alternative solution to the original waffle footing system which involved a collaboration between the inventor of the waffle footing system and the inventor of the plastic spacer component of the system. The business venture ceased not long after and

both the engineering firm and plastic spacer manufacturer continued to develop alliances with other players in relation to the distribution of waffle footing system products. In particular the engineering firm became involved with a number of manufacturers in Queensland, Victoria and New South Wales through joint ventures and partnerships, which helped promote the waffle footing system even further.

A number of key milestones or events contributed to the credibility and thus widespread diffusion of the waffle footing system during this time. For example, the Victorian Building Control Branch granted accreditation of the Waffle Pod Footing system as a “deemed to comply” footing system. In 1986 the engineering firm was presented the Engineering award for the waffle pod footings system by the Institute of Engineering, South Australian Division. Significantly, the waffle footing system was incorporated into the Australian Standards for Residential Slabs and Footings in 1988. Various publications, awards, standards and accreditations facilitated the dissemination of the system to relevant parties and adopters by providing credibility and reputation to the waffle footing innovation.

Figure 4.1 maps the key events into the three phases of creation, development and adaptation. Figure 4.1 shows that at different times throughout the creation, development and adaptation of the innovation various key players moved in and out of the cluster. Alliances and business ventures were constantly formed and reformed in response to the needs of the specific phase of the innovation process. Furthermore challenges surrounding the formalisation and ownership of intellectual property during the adaptation phase evolved as a very important series of events and this will be discussed in the following *Section: Intellectual capital, intellectual property and patents*.

Figure 4.1 Chronological history of the waffle footing system innovation



4.2 Intellectual capital, intellectual property and patents

The formalisation and ownership of intellectual capital through patents emerged in the story of the waffle footing system as a very important series of events as we proceeded into the data collection phase of the project. Intellectual capital refers to the knowledge base of the group of firms in terms of expertise, skills, experiences and competences in the creation, development and adaptation of the waffle footing system innovation. Firms often have informal intellectual capital – that is ‘this is the way we do things here’, however, with such a commitment to developing a new product and process associated with the waffle system there developed a need to formalise the intellectual capital. The motivation behind formalising the intellectual capital embedded in an innovative product or process is to protect the parties’ stake and thus define ownership of intellectual property.

Figure 4.2 provides a summary of the patent disputes and court cases which resulted from various participants seeking to formalise and take ownership of intellectual capital relating to the waffle footing innovation. Confirmation was sought from other data sources in order to verify specific details relating to the patent disputes and court cases. Specifically Federal Court transcripts and Patent Application documents were identified through public databases. Following this a document analysis of the various court transcripts and patent applications was undertaken.

There were interesting developments from 1986 onwards when the engineering firm (C5) sought protection to own the exclusive right to commercially exploit the waffle footing system by applying for a patent in 1986. The patent was entitled “Building Foundation Form Work Arrangement” which involved:

“levelling the ground on which the foundation is to be located, positioning a plurality of box-like hollow members in rows on the levelled ground, separating the hollow members by spacers, positioning lower reinforcing rods on the spacers and between the hollow members, positioning a reinforcing mesh over the hollow members and pouring concrete into channels between the hollow members and over the hollow members so as to envelope said reinforcing rods, mesh and hollow members and thereby form the foundation with a plurality of intersecting reinforced beams and an overlaying reinforced floor slab” (Australian Patent Office, 2011).

Not long after in 1987, the plastic spacer manufacturer (C4) sought to apply for a patent entitled “Improvements relating to building foundation form work”. The invention the spacer manufacturer (C4) was seeking to protect involved an improvement on the use of concrete blocks, which was proposed by the engineering firm (C5) as spacers. The plastic spacer manufacturer’s spacer is:

“in essence, a framework which holds in place pairs of vertical plates set at right angles to each other” (Federal Court Australia, 2011).

The plate fits over the corners of the hollow boxes and holds them in place relative to each other.

Both the plastic spacer manufacturer (C4) and engineering firm (C5) opposed each other’s patent applications. The spacer manufacturer’s opposition to the engineering firm’s application was withdrawn following an application for amendment was made by the engineering firm. The amendment involved specifying the specific use of spacers made out of concrete, which was different from the plastic spacer manufacturer’s plastic spacers. The engineering firm’s opposition to the spacer manufacturer’s patent application was then withdrawn and both patents proceeded to sealing. The specification of spacers made out of concrete in the engineering firm’s patent would become a highly significant feature in a series of litigations which eventuated as a result of patent disputes between the engineering firm (C5) and two key players, RMAX and Foamex (Sydney) in Figure 4.2. RMAX is a large manufacturer of expanded polystyrene products (EPS) and expanded Polypropylene (EPP) which supplied EPS to manufacturers of the waffle pods. Foamex (Sydney) is a large

manufacturer and supplier of EPS products including waffle pods to the commercial construction and home building industry.

From the mid-1990s onwards the plastic spacer manufacturer, C4 and engineering firm, C5 claimed that they experienced a number of infringements on their patents. It is not the intention of this report to discuss in detail the series of litigations which occurred as a result of the patent disputes. However it is useful to briefly summarise a number of the court cases which took place and the key outcomes to provide some contextual background to the challenges in the formalisation of intellectual capital in relation to the innovation. In summary there were two main streams of litigations; highlighted in green are litigations related to the engineering firm C5 and highlighted in blue are those related to the plastic spacer manufacturer C4 (refer to Figure 4.2).

The first stream of litigations, highlighted in green in Figure 4.2, involved one main court case between the engineering firm C5 and RMAX and Foamex. The engineering firm C5 sued RMAX and Foamex in two separate proceedings for infringement on C5's patent. Following this, in 2004 the Federal Court ordered that the proceedings against both RMAX and Foamex by the engineering firm C5 be heard together. Therefore even though the engineering firm C5 was involved with litigations with two key players there was only one court case hearing.

The court case took place in 2004 between the engineering firm C5 and RMAX and Foamex. RMAX and Foamex raised the defence that there was no infringement on the engineering firm, C5's patent. The argument provided was that the spacers used in the products they had been manufacturing and supplying to their customers were made of plastic and not concrete as referred to in the engineering firm, C5's patent. The judge's decision was in favour of RMAX and Foamex. Specifically, the judge decided that the engineering firm, C5

"had left open in formulating the claim that which the infringer has done, namely the use of plastic spacers" (Federal Court Australia, 2011).

As a result the engineering firm (C5) was ordered to pay the costs incurred by RMAX and Foamex.

The second stream of litigations, highlighted in blue in Figure 4.2, involved two court cases between the plastic spacer manufacturer C4 and several organisations as follows:

- Court case 1: Sartas vs the Plastic spacer manufacturer C4 and Engineering firm C5 in 1994 and then plastic spacer manufacturer C4 vs Sartas in 1996
- Court case 2: Plastic spacer manufacturer vs Theta Developments, The Reinforcement Bar Spacer (RBS) and Podfix

The first court case took place in 1994 involving Sartas, which was a company distributing and selling spacers, instituting a proceeding against both the engineering firm (C5) and plastic spacer manufacturer (C4). Sartas alleged that threats by the plastic spacer manufacturer, C4 and engineering firm, C5 based upon alleged infringements were unjustified. Sartas alleged that the Sartas spacers did not infringe and that claims of both the plastic spacer manufacturer, C4 and engineering firm, C5's patents were invalid. The judge's decision was in favour of Sartas that the claim of patent by the plastic spacer manufacturer, C4 and engineering firm, C5 were invalid. The judge ordered that all claims were to be revoked. The claim by Sartas seeking revocations of the claims of the patent was allowed. Following this, Sartas's application against the engineering firm C5 was dismissed, however, litigation between Sartas and the plastic spacer manufacturer C4 remained.

In 1996, the plastic spacer manufacturer C4 appealed on issues of patent validity and infringement. There was also an application to be involved with the plastic spacer manufacturer C4's appeal by RMAX to be heard as amicus curiae in relation to issues of validity of the patent. An amicus curiae is a "friend of the court" – someone who is not a party to the litigation, but who believes that the court's decision may affect its interest" (Rehnquist, 2011). RMAX which is a large manufacturer and supplier of EPS and EPP to manufacturers of the waffle pods is the same organisation which was involved with litigations with the

engineering firm C5 – as highlighted previously in the first stream of litigations. The outcome of the appeal was that the plastic spacer manufacturer C4 succeeded on the issue of validity but failed on the question of infringement. The judge found that the Sartas spacer did not infringe the claims of the plastic spacer manufacturer, C4's patent because it was found to be lacking a key feature of C4's patent description of the spacer. The key feature outlined in the plastic spacer manufacturer, C4's patent was that C4's spacer enabled concrete flow between members of the waffle pods. The judge stated that the plastic spacer manufacturer (C4)'s patent description included:

“an essential integer of the relevant claim that the lower most surface of the components of the framework, holding the vertical plates or engaging surfaces, be so substantially above the engaging surface of the spacer as to enable concrete to flow continuously below the frame members. This feature was lacking in the Sartas spacer” (Federal Court Australia, 2011).

The second court case was between the plastic spacer manufacturer (C4) and three other organisations, Theta Developments, The Reinforcing Bar Spacer Co (RBS) and Podfix (refer to Figure 4.2). Theta Developments, RBS and Podfix were manufacturing and distributing spacers. The three organisations are connected to each other in that the director of RBS is also the director of Podfix and the director of Theta Developments is also the director of RBS. The two directors control the day-to-day operations of Theta Developments and Podfix (Federal Court Australia, 2011).

In the proceeding the plastic spacer manufacturer (C4) accused Theta Developments, RBS and Podfix of selling spacers which contain the essential features C4's spacer as outlined in C4's patent. The case was tried in 2001 which resulted in a declaration that Theta Developments, RBS and Podfix had infringed on C4's patent. An order was made for Theta Developments, RBS and Podfix to be restrained from manufacturing or selling or offering, keeping or advertising for sale building foundation formwork spacers which infringed C4's patent. An order was also made that Theta Developments, RBS and Podfix to pay for C4's costs of action and that C4's application for damages for infringement on the patent to be adjourned to a date to be fixed.

Following this, in 2002, Theta Developments, RBS and Podfix launched an appeal against the orders made in the 2001 proceeding. The appeal was substantially successful. The plastic spacer manufacturer, C4 was ordered to pay 80% of the combined costs of the appeal and cross-appeal incurred by Theta Developments, RBS and Podfix.

4.2.1 Summary

In summary the discussion in this section about the patent disputes highlights that innovative products and the creators of an innovations will require protection of intellectual property. The intellectual property forms an important part of the intellectual capital of an organisation.

The formalisation and ownership of intellectual capital through patents emerged in the story of the waffle footing system as a very important series of events as we proceeded into the data collection phase of the project. Intellectual capital refers to the knowledge base of the group of firms in terms of expertise, skills, experiences and competences in the creation, development and adaptation of the waffle footing system innovation. Firms often have informal intellectual capital – that is ‘this is the way we do things here’, however, with such a commitment to developing a new product and process associated with the waffle system there developed a need to formalise the intellectual capital. The motivation behind formalising the intellectual capital embedded in an innovative product or process is to protect the parties' stake and thus define ownership of intellectual property.

The lack of protection of intellectual property offered by the existing system of patents in Australia does not appear to be a conducive environment for innovative behaviour. Furthermore there does not seem to be any incentive which rewards innovative behaviour at an industry level. The creation of innovative products rely upon the efforts of a select few organisations

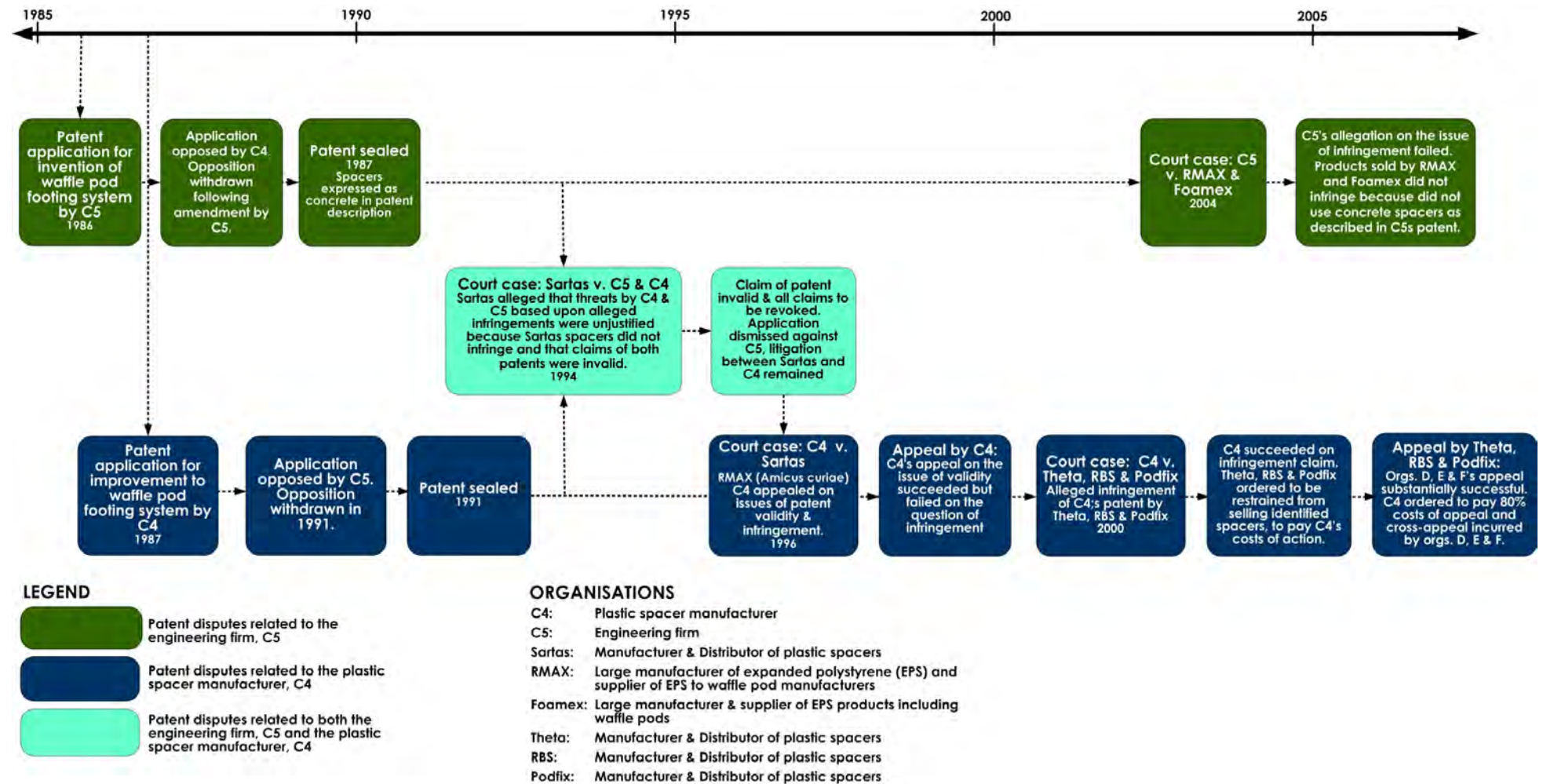
Recommendation 4.1

The Alliance should ensure that these barriers and enablers are published in the industry brochure.

Recommendation 4.2

The protection of intellectual property for the creators of innovative products and/or services is a significant issue which needs to be considered particularly in an industry where the pace of innovation is low. More investigation into the patent system is needed.

Figure 4.2 Challenges in formalisation of innovation intellectual capital: patent disputes and court cases



4.3 Description of case study participant organisations

The within-case analyses of each of the seven organisations is now presented in terms of:

- stages in the innovation process:
 - agenda-setting: the initiation stage when a broad organisational problem is identified which generates a search for innovations.
 - matching: the stage where the problem from the organisation's agenda is conceptually matched with the innovation to determine how well they align.
 - redefining: the stage when the innovation is adapted based upon the organisation's needs and structure or vice versa.
 - clarifying: the stage where the innovation has been spread more widely in an organisation involving individuals seeking answers to reduce uncertainty and construct their meaning of the innovation
 - routinising: the stage when an innovation has become synonymous with the regular activities of an organisation, which completes the innovation process.
- "meta-story": stories told by participants which have been "pasted together" chronologically. The meta-stories highlight the organisational, communication and economic factors impacting on the creation, development and adaptation of the innovation
- timeframe
- key players in the innovation process:
 - inter functional supply chain relationships
 - inter organizational supply chain relationships
- expertise: resources highlighted as significant to the innovation process in terms of specific knowledge domains, skills and experiences
- credibility: resources highlighted as significant to the innovation process to provide the innovation with reputation/credibility such as key milestones, events in the form of accreditations, publications, awards and credential backgrounds

Summarised diagrams showing the stages in the innovation process, "meta-stories", timeframe, key players, expertise and credibility of the seven organisations are presented in Figures 6.5, 6.6, 6.7, 6.8, 6.9, 6.10 and 6.11 alongside brief summaries of each case in this section. It should be noted that the summaries have been developed based on the stories participants told at the interviews. Some elements (for example key players, relationships, etc) may not be included in the summaries but that does not indicate that the events, decisions or relationships did not occur. Non-inclusion simply means that stories relating to these decisions, events, actions or relationships were not told at the interviews and were not significant enough to that research participant and their memory, recollection and retelling of the story.

4.3.1 Participant Organisation 1: Housing Developer

Participant organisation 1 is a large national residential property development and home building company which was founded in 1932. It was the largest housing developer in Australia throughout the 1970s, 1980s and 1990s. By the end of the 1990s the housing developer had built over 150,000 homes throughout the country. The organisation underwent a change in ownership in 1995, however, continued to build and sell houses throughout New South Wales (NSW), Victoria (Vic), Queensland (Qld) and South Australia (SA).

A 3-hour interview was conducted with the South Australia State Building manager of the housing developer during the time that the waffle footing system innovation took place. The

housing developer had set up in Adelaide (capital of South Australia) in the early 1970s and was constructing approximately 600-700 houses a year by the 1980s.

Meta-story and stages in innovation process

There were 11 stories identified from the interview with the state building manager including:

- Story 1 Overseas experiences
- Story 2 Innovation competition
- Story 3 Paid to think about things: Agenda-setting
- Story 4 Dealing with unknowns: Agenda-setting
- Story 5 Multistory car parks and waffle pods: Agenda-setting
- Story 6 Inefficiencies and revenues: Agenda-setting
- Story 7 Developing value propositions: Matching
- Story 8 The diary demonstration: Matching
- Story 9 Developing alliances: Redefining
- Story 10 Championing it through: Clarifying
- Story 11 Innovation integrated with systems: Routinising

In Story 1 the state building manager explained that prior to working with the housing developer, he had worked as a project manager overseas in the United Kingdom and South Africa on numerous large and complex projects. In particular, one project he was managing in South Africa involved building and completing five houses each day. His exposure to site materials and process management during his earlier experiences “stuck with him” and was one of the inspirations he drew upon in the agenda-setting phase for the creation of the waffle footing system innovation when he returned to Australia.

Title: Overseas experiences

STORY 1: “it reminded me of the landscapes around Durban...I thought why cant we cut and fill as we did over there”

Orientation:

- 4: At the time this innovation took place
- 5: I was a State Building Manager in Adelaide, South Australia
- 6: and we were doing something like 6-7 hundred houses a year.

Complicating action

- 10: I went overseas to England in my early twenties
- 11: and worked as a project manager over there on some pretty good stuff over there.
- 15: and then I went over to South Africa
- 16: and I worked there as a project manager over there.
- 20: and the project I ended up running was building houses for the apartheid.
- 21: and we were building and finishing 5 houses a day.
- 111: but it reminded me of the landscapes around Durban where I'd been working over there.
- 113: I thought why cant we cut and fill and slab as we did over there.

Evaluation

- 22: I learnt so much
- 23: basically it was all about people above anything else
- 24: it was all about how you organised and controlled people.
- 25: So I then realised at that point that later on in how we were building those houses.
- 26: I mean they were quite roughly finished
- 27: and there was lots of corruption
- 28: but essentially the process of building them was row housing and cutting and filling the sides and putting concrete slabs on those and then throwing up these brick dwellings on site that we used to do all that stuff.

Resolution:

- 29: So that stuck with me

Upon returning to Australia, the state building manager worked with a number of building companies in Adelaide prior to joining the housing developer organisation C1. He explained that he “clicked” particularly well with the culture of innovation within the housing developer company C1. He started working with the housing developer C1 from early 1980s onwards.

The organisation encouraged innovation competition between divisions. Towards this they provided awards to top building teams as a way to promote innovative behaviour and cross-pollenisation of ideas across state divisions. According to the state building manager, the housing developer C1 pioneered the use of subcontracting systems to achieve increased efficiency in time, cost and quality.

Title: Innovation competition

STORY 2: "We started to realise that there was a more cost-effective way of building housing...eventually that infiltrated into the system..."

Abstract

- 55: And I fell out with the leaders of that company I was with and left
- 56: and went round and did some work with a few building companies around the city.
- 57: First one that I clicked with straight away was AV Jennings.

Orientation

- 37: And that was the old paradigm of how you made houses in the 70s I guess.
- 38: And at that point AV Jennings had set up in Adelaide, they'd arrived in Adelaide.

Complicating Action

- 39: And during that time it was the old custom of building houses
- 40: of small units of builders building a few houses.
- 41: There was no mass-produced dwellings.
- 42: Until Jennings got out there of course.
- 44: and of course we would never use any of the Jennings trades coming to us
- 45: so it was a disgusting way of building houses you know
- 46: throwing up these frames and these subcontractor systems coming in
- 47: and so there was a real antagonism towards that process.
- 48: In fact they were quite successful because they were cutting everyone's prices
- 50: and I guess it happened in the rest of Australia where Jennings set up
- 51: and you know the story of Jennings and their innovations with subcontracting.

Evaluation

- 52: We started to realise that there was a bit more cost-effective way of building housing
- 53: paying somebody a lump sum to do a roof frame or a wall frame

Resolution

- 54: so eventually that infiltrated into the system as well these subcontractor systems creeping in

The waffle footing system, championed by the State building manager, was seen as "a little bit of portion of innovation" that took place within the organisation at the time. In 1987 the state building manager was presented with the "Innovation Award" for "outstanding enterprise and innovation in promoting and assisting the application of the waffle pod footing system to private house construction in South Australia". Even though there wasn't a dedicated innovation team within the housing developer organisation, the state building manager did not experience any detractors in driving the innovation through and was provided support from the CEO, finance, legal and marketing departments within the organisation.

Title: Innovation award

Story 2a: "we had a couple of like-minds...it's very nice when your financial and legal people give you support"

Abstract

- 413: no interference.
- 414: And to the point when we got the thing through

Orientation

- 415: and I remember in 1987

Complicating action

- 416: they presented me with this innovation award
- 432: And when I came up with these suggestions and I had a very good financial control of it
- 433: and I'd run into this new staff in Dubai
- 434: he came over to Jennings here
- 435: he and I clicked more than ever
- 436: and that was my driver
- 437: and I think it was about return on investment and stakeholder satisfaction stuff
- 438: and AAA the other guy – the financial fellow he was in that load as well

439: so whilst there wasn't an organised branch of people we had a couple of like-minds
Evaluation
440: it's very nice when your financial and legal people give you support.
441: I never really had to justify the schemes.
442: And I'm sure they were watching from afar

In Story 3, the state building manager explained that he was aware of the need to be innovative to "keep ahead of the pack". He experienced an epiphany when he realised he was "being paid to think about things" and became highly conscious about being a team leader and thus the need to continually explore ways to achieve performance improvements for the organisation.

Title: The epiphany

Story 3 AGENDA-SETTING: "had a break one day...I'm paid to think about things"

Abstract

60: so I joined them as a supervisor and got in to the system
64: And then they introduced me to their systems of subcontractor control and quality assurance and time-based
65: it's all about time, cost and quality control.
66: Really appealed to me.

Orientation

71: had a break when I realised
72: one day sitting in the office
74: It was a huge breakthrough.
75: I'm paid to think about things.
76: And by that time I'd been imbued by the time, cost and quality controls

Complicating action

77: and then I looked at this
78: that C1 had introduced and realised that oh that's not such a silly way of building houses at all
79: and realised there was a complete set of values which really clicked with my intellect
81: as the building manager I was very much involved with the price setting and the marketing linkages
82: and it was a very good company as far as communicating, marketing and sales and production
83: and all of this was completely new to me
84: cos I was very blinkered in how I thought
363: And I remember the epiphany
364: I was just sitting and things were going really well
365: and I was getting really worried because it's all going really well
366: what happened in those days was they appointed me as Building Manager of State operations
367: and I was given this office with all these books and computers
368: and nobody said a word.
369: And I was running on my wits
370: and I was very conscious of being a team leader
373: and I can remember the day I was sitting there thinking there's something going wrong somewhere
374: and I gotta go and kick somebody
375: and I worked out my KPIs and I didn't even know they were called KPIs at that time.
376: I thought ahead of time, I did my budgets, had a lovely quality product and had my customers not complaining – that they're happy with it.
377: So I started thinking – I mean I did a lot of self-education
378: and one of the things I can remember doing
379: I spoke to the CEO at that time and wanted to get together
380: so we had sorta this state review
381: and I just said "Has anybody actually done supply chain management training?"
382: And they went "What do you mean?"
383: And then he said "Purchasing?"
384: I said "no, supply Chain managing like the car business"
385: and "I'm gonna do it"

Evaluation

386: so I was a bit pushy – still
388: and I guess that guy, cos BBB was the CEO at that time and he sort of smiled

389: and I don't know what you do with people like me.
Resolution

390: He said "well you go and do it"

In stories 4, 5 and 6, the state building manager explained that the desire to create an innovation was generated during one of his "thinking modes" following the epiphany.

Title: Dealing with unknowns

STORY 4 AGENDA-SETTING: "when you hit rock, you called the customers and said "you're gong to have to pay more money...so you're offside""

Abstract

87: when I realised I was paid to think about things

88: and what I was paid to think about was how to reduce the cost without destroying the quality.

89: In fact improve the quality so then time, cost, quality became an imbued thing with me from that point I guess.

Complicating action

90: I'd been driven by time control because these are the projects that and – these were really the lifeblood I saw it.

91: I saw the sense in them.

92: So that got us to that point so I was in charge of a whole room of people building 6 or 700 houses and helping generate sales

93: and realising about service and quality and finishing on time and all those things

Orientation

94: so what happened perhaps to take us back

95: the traditional way of getting to the floor line was by doing strip footing as following the contours of the ground and then doing a brick build-up and doing timber piers and joists to the timber floor. And then you do the super structure

96: and brick veneer was another breakthrough I guess.

97: Timber frame and then clad that with brick.

98: That was a C1 way of doing things throughout the country

99: and so that being the traditional was a brick build-up, followed the contours, timber joists

Evaluation

100: and what that meant was you had unknown rock excavation on the strip footings

101: so when you sold the house to a client or a customer when you hit rock, you called the customers up and said you're going to have to pay us some more money

102: so straight away you're off-side, business disputes

103: a highly emotional thing buying a house and getting a house built.

104: So with the cross-functioning realising I was marketing and selling as well as building and service application had to apply

Title: Multi-storey carpark and waffle pods

STORY 5 AGENDA-SETTING: "cant we do that same stuff here?"

Orientation

167: All of this was happening around 1980, all of this stuff.

Complicating action

170: As I remember it, we knew we had to get research-based information to support this development

171: so we engaged the CSIRO

172: and through C5 [managing director from the engineering firm]'s direction – he got a passion for it

173: and as I remember it we did an all concrete slab on a very reactive site

174: and that was measured to move and those sorts of things cos I didn't – that's where they took it

Evaluation

175: so I realised we had to go through a series of significant changes

176: in getting regulations altered and all sorts of things like that

177: and I couldn't do that

178: and that was what our partners here in innovation could do

Resolution

179: so we used our engineers for doing this.

180: And it does set it out clearly here where they said we started checking out soil movements and all sorts of things

181: but from my point of view I remember that solid slab we put down,
 183: and the point I noticed when this all went in –
 184: its just a massive concrete between the ribbing steel
 185: so in my naïve way so went along the lines of paraphrasing Peter Bayetta “Why do we need all that concrete in the ribbing steel?”
 186: Cos you know where’s the strength? Oh the strength is in the steel...
 187: what about that massive concrete that costs me a lot of money in the spaces?
 188: Can't we substitute that with something? Cant we substitute that with something and pour over it?
 189: And the other thing that hit me was in multi-storey car parks I'd seen
 190: where these waffle pods had been used – and they were doing it in multi-storey buildings
 191: and I just said, cant we do that same stuff here?
 192: So we went along that track.

In story 6, he explained how he realised that revenues could be raised through increased efficiencies in how processes and/or products were managed on traditional footing systems.

Title: Inefficiencies and revenues

STORY 6 AGENDA-SETTING: “they were selling reasonably well but not as well as we wanted to get revenues up...the margins in housing are terrible because of the inefficient way we did things”

Abstract

105: and we had at that point significant land holdings south of Adelaide, an estate called Trott Park and an adjacent one called Redwood Park which was quite soft undulations in the landscape

Evaluation

106: and they were selling reasonably well
 107: but not as well as we wanted to get revenue up.

Complicating actions

108: And even in those early days I realised about making money
 109: and the margins in housing are quite low,
 110: They're terrible because of the inefficient way we did things

Resolution

118: So I started exploring that.

In Story 7, he described how he was developing value propositions with the marketing unit to match the objectives of the organisation. The matching phase involved an evaluation of how well the waffle footing system innovation aligned with the organisation's agenda. The organisation was driven by the need to lower and reduce variability in building costs in order to provide “fixed-prices” to customers, which would set the organisation apart from competitors who were offering “provisional footing costs”.

Title: Developing value propositions

STORY 7 MATCHING: “in discussion with my marketing people I said “if you could put a price on the market; fixed, no extras. Would that be a value proposition? They said, “go for it!””

Abstract

119: So my drivers were to lower the build cost so that we could actually fix the customer's price and charge no extras for them
 120: which was the appealing thing in that market where every builder charged you a price subject to professional costs for below the ground obstructions and things like that
 121: so in discussion with my marketing people that time,

Complicating action

122: I said, “What do you really want, like if you could really put the price on the market fixed, no extras would that be a value proposition?”
 123: They went “oh boy, would that be!” They said, “go for it!”
 124: So then that was the driver
 125: just to get more sales, to lower the building costs but improve the quality of the construction.
 126: So what I wanted to do was I needed a slab that wouldn't crack or break – very technical engineering terms!
 127: I wanted to be able to control the actual costs
 128: and I wanted to reduce time.
 129: I want to speed up construction.

130: I want to improve streetscape from these monoliths and the brick buildup and the house high in the sky you know what I mean,
131: So the streetscape was shocking
132: I mean there were steep climb-ups of stairs everywhere which all added costs.
133: So I wanted a soft streetscape

Evaluation

134: because I'd learned that what also a good proposition to selling house
135: was to have a decent gingerbread, a really good streetscape, that's my house, that's my dream, I love it.

Resolution

136: So we worked on that streetscape
137: so it really appealed to me that I could actually get in there and cut those sides out, cut and fill and compact and the whole street
138: so that was in my mind
139: and with that happening we'd have a more attractive place to live
140: it'd looked great
141: and we'd won awards eventually for those divisions being really a lovely place to live and all that
142: so it was integrating all those building thoughts with lifestyle, appeal and selling more houses through that way.

The housing developer C1 was trading with an engineering firm, C5 during that time and in Story 8 the state building manager highlighted the significance of a "diary test" which he conducted with the managing director of the engineering firm. The idea of the waffle footing system innovation was borne as a result of the diary test through discussion between the state building manager and the managing director of the engineering firm. An alliance was formed between the housing developer organisation and the engineering firm in the initial stage to create the waffle footing system innovation which eventually resulted in further development and adaptation of the waffle footing system in Adelaide initially and in other states later on.

Title: The diary demonstration

STORY 8 MATCHING: "I want that – I can measure it, I can see it, I can do it quickly"

Abstract

143: We were trading at that point with a company called C5 [engineering firm]
145: and this was the diary test that I did with them.

Complicating action

146: I said PP [managing director 1], and PP said it was easy, what I want you guys to do – your engineers
147: I want you to give me a slab that I can put my house on it
148: and I don't want it to bend or break
149: and I want to be able to measure how much is in it so know what my costs are
150: I can then organise my subcontractor concreters
151: I know how long it'll take me to build.
152: I won't do all this build-up stuff. I'll get a tractor in there to cut this up and fill this up a lot cheaper than with the brick build-ups and putting steps.
153: So that was it
154: and probably KK [managing director 2] sort of bought into that I think essentially because we had a fair bit of work and he thought he'd better pay a bit of attention
155: so we were using our volume to capture the lead in, that he would come with me
156: and he handed basically the whole thing over to PP who was an engineer at that time...

Evaluation

157: so the diary demonstration was significant in my memory
158: It really was a diary
159: it hit me- that's what I want.
160: I want to be able to put that anywhere.
161: That's it. How do I do that?
162: And I can remember saying I don't care if the whole thing tilts as long as it doesn't break.
163: Because the traditional system of the brick build-up had timber floors on the strip footing was a hell of a problem for return maintenance and fix-ups
164: so that destroys your credibility.
165: cos that was really you know I want that
166: I can measure it, I can see it, I can do it quickly.

Resolution

167: So we kicked on from there.

Contributions from the housing developer organisation in the form of land allotments as experimental and prototype sites was central to the development of the waffle footing system innovation. The land contributions by C1 enabled experiments and tests to be conducted to progress the development of the innovation. Not only did C1 contribute in terms of land contributions, the state building manager played a significant role in “controlling the building flow” in bringing together various key players which had different contributions in relation to the creation, development and adaptation of the innovation.

Title: Developing alliances

STORY 9 REDEFINING: “I was cost controlling...I was just the poor old builder...this was where we had that alliance”

Abstract

193: And I can remember driving around at this state

194: trying to find plastic tubs or bails or hay or something –

196: but it didn't matter what we stuck in there

199: and I was cost controlling

200: and so you basically got tangled up with visyboard I remember with making cardboard boxes.

201: When they did the external boarding and then the rebate boards for the outside for the bricks for the outside of the brick veneer

202: and then they rigged it all out and put these boxes in between and put all the boxes on the controlled levels flat cut and filled platform, just place the boxes in there, lay the steel in there

Complicating action

203: it led to a lot of other innovations.

204: Visyboard were there for a while.

205: People got involved in spacers to hold the reinforcing in position

206: So lots of bits and pieces that I wasn't too bothered at all there.

207: I just wanted to drive this innovation through

208: and then I remember we did on a site which is tabled in here somewhere

209: the first full scale test slab we did in July 1982

Evaluation

210: and this is what you have a strategic alliance partners to do

211: I was just the poor old builder

212: I realised all I was there for was just to control the building flow

Resolution

213: so this was where we had that alliance.

Following the creation of waffle footing system during the initial stages of the innovation process, the clarifying stage was characterised by a high level of uncertainty. In story 10, the state building manager explained the efforts he undertook in championing the innovation by conducting seminars and demonstrations to convince others about the benefits of the innovation.

Title: Championing the innovation

Story 10 ROUTINISING: “I took the concrete gangs to the engineers offices...ran seminars on how to put a box together...I was determined and you have to champion that”

Abstract

227: Well the first waffle test slab

228: I think we utilised some traditional footing contractors to do it.

229: At that stage of the game we were supplying and as most builders were, we were supplying the steel and the material, paying for that when you had the labour only contractors

Complicating action

238: I took the concrete gangs to FMG's offices at Adelaide at that stage

239: and sat them down and ran seminars on how to put a box together. And then you go to sites and you stick it in here

240: and then the engineers, Peter talked to them about the different methods of high resistance

Evaluation

241: cos I was determined – and you have to champion that
 242: so you've got to just push that through like most things in innovation
 243: people either get it or they don't get it.
 244: A couple of the gangs got it.
 245: We took them on and they actually go paid a lot more money to put boxes in rather than digging holes and pouring concrete in...
 246: So we didn't really have any other players other than driving it ourselves.

The background credentials of the housing developer in terms of its reputation and volume attraction also played a significant role in capturing and maintaining the interest of the key players during the earlier stages of the innovation process. Of particular importance was the successful completion of the first waffle footing system for a real customer in 1985 which had been approved by the regulatory authorities through prior experimental work performed by the engineering firm. From that point on, the waffle footing system became integrated into the housing developer organisation's systems in the manner in which land and house packages were priced. The organisation was then able to provide "fixed-prices" to their customers which according to the state building manager, "upset most of the building industry" who were still offering provisional costing at that stage. The housing developer thus achieved a distinct advantage in its ability to attract a higher volume of customers as a result of the implementation of the waffle footing system innovation.

Title: Innovation integrated with systems

Story 11 ROUTINIZING: "that was the actual first system built...from that point it became accepted and we were pricing our land and house packages with it...we could give it a fixed price"

Abstract

247: We took it through to from that initial solid concrete slab testing and all that to the first waffle pod for a client which had been fully council approved
 248: so the engineering group had been through all the process of getting the regulations accepted and the design accepted and the testing done
 249: and so somehow or other we moved on to putting one of this propositions in.
 250: We did a lot of other testings on allotments
 251: and we picked out one lot to build the first waffle pod system for an actual house for a customer.

Complicating action

252: And I can remember talking to that customer, explaining what we were doing
 253: and they got quite excited about it as well.
 254: And we did some marketing as well.
 255: So that was the actual first system built

Orientation

256: and that one was August 1985.

Complicating action

257: We sat with the marketing guys and explained that we wanted to do a prototype are you happy to do it
 263: Prototype 1 – we got approval for it from the council
 264: so the significance of it was that it was approved by the authority that had to approve footing systems
 265: and it was a breakthrough.
 266: We called the thing – here we are on the 25th October 1985 still there, it hasn't broken.
 267: So from that point it became accepted
 268: and we were pricing our land and house packages with it
 269: or when people came to us we could definitely give a fixed price.
 270: It upset most of the building industry over there where they were still on the provisional costing thing.

Evaluation

271: So we had a distinct advantage there.
 272: And I knew that we could not hold that system to ourselves alone
 273: but we'd made a breakthrough

Resolution

274: and then it started to be picked up by other builders.

Following the waffle footing innovation, the state building manager explained that the organisation experienced a number of "battles" in terms of strategic direction whereby the organisation "went into areas they shouldn't have gone". The organisation experienced

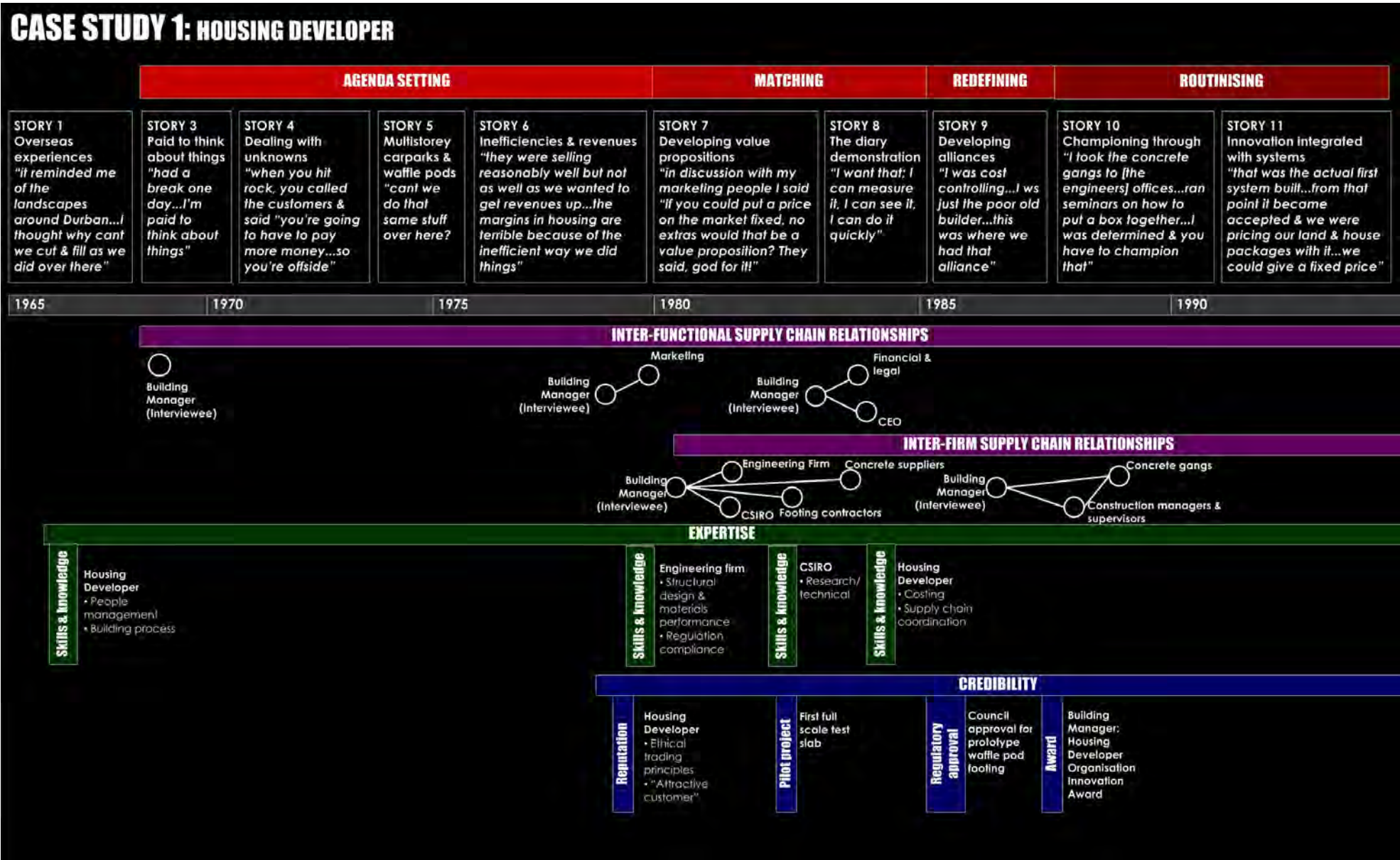
significant losses in its decision to diversify its business into non-core areas. Consequently the state building manager indicated that a large part of his role was then focussed on ensuring the organisation's survival and maximising returns rather than creating, developing or adapting innovations.

Summary

The discussion in this section has demonstrated that the housing developer experienced the five stages of the innovation process in the creation, development and adaptation of the waffle footing system innovation. In summary a number of key factors were raised by the state building manager as critical to the successful delivery of the waffle footing system including:

- Identification and integration of the knowledge domains, expertise or resources of various participants within the innovator group (stories 3, 4, 5, 8, 9)
- Development of alliances or relationships to access required resources for the creation, development and adaptation of the innovation (stories 3, 4, 5, 8, 9)
- Mutual understanding, compatibility and trust between participants in the innovator group based on business motivation (stories 3, 4, 5, 8, 9)
- Acquisition and utilization of recognizable artefacts in developing reputation for eg. obtaining council approval for a pilot project using the waffle footing system (stories 8, 11)

Figure 4.3 Summary Description Case 1: Housing Developer



4.3.2 Case 2: Footings contractor

Participant organisation 2 is a large footings contractor in Adelaide, South Australia. The company is predominantly involved with residential work and deals with approximately 20% of all residential foundation work in Adelaide of which 10-15% comprises waffle pod footings. The company employs approximately 50 staff members. A 1-hour interview was conducted with the managing director of the footings contractor.

Meta-story and stages in innovation process

There were 9 stories identified from the interview with the sales representative including:

- Story 1 Testing the waters: Agenda-setting
- Story 2 In love with the waffle: Matching
- Story 3 A clear fit: Matching
- Story 4 Minimal fuss: Redefining
- Story 5 Greatest thing ever invented: Redefining
- Story 6 Convincing workers on the ground: Clarifying
- Story 7 Professional jealousy: Routinising
- Story 8 Championing the innovation: Routinising
- Story 9 A bitch fight: Routinising

The nine stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

In the first story, the footings contractor explained that he was originally from Adelaide but was working as a concreter in Port Lincoln in the early 1980s. He first heard about the waffle pod footing system when he was in Port Lincoln. He decided to send a number of his workers to Adelaide to “test the waters” to consider the benefits of the waffle footing innovation. He said that he “sent a mob of his guys over to try and pour the job”. He explained that there were issues associated with how the system worked at that stage and suggested the use of a concrete pump to overcome the identified problem.

In the second and third stories, the footings contractor explained how he established a clear fit between the innovation and his organisational objectives. He moved back to Adelaide in the mid 1980s and started working with the housing developer C1. He was contacted by the housing developer to be involved with the construction of the first full scale test slab in 1982 which marked C2’s initial involvement with the waffle footing system innovation process. The footing contractor indicated that he was involved with the waffle footing system innovation process “right from the word go”. He indicated that the first waffle footing system, which he witnessed and was involved with, was an “eye opener” for him. He said that the waffle footing system offered improved work practices and that he “straightaway...went into gear” and decided that the innovation was “the easiest way to do it”. The simplicity and savings offered by the waffle footing system was felt to be unique and the footings contractor “fell in love with it” at that early stage. Another key reason why the footings contractor was interested in being involved with the waffle footing system was the ability to work with the housing developer through the “supply and fix” method, that is, the emerging subcontracting environment.

In the fourth and fifth stories the footings contractor explained that the implementation of the waffle footing system within his company took place “overnight” due to its simplicity. It involved the investment in a number of staple guns which were used to hold the waffle pods in place. He was able to learn the method of construction the waffle footing system on his own relatively quickly.

The involvement of the state building manager of the housing developer (C1) was recognised in providing the footings contractor the confidence at that early stage to be involved for three reasons. Firstly the footings contractor trusted that given the housing developer’s reputation as a credible large construction company, C1 would pay appropriately upon work completion. Secondly the ethical trading principles practiced by the housing developer, C1 was valued by the footings contractor in that fair treatment would be received. Finally and perhaps an unspoken motivation related to the fact that the housing developer undertakes a significant

amount of projects and by being involved with them the footings contractor can potentially be offered a share of the work.

In story 6, the footings contractor indicated that following the decision to adopt the waffle footing innovation its implementation within the organisation was an easy and straightforward process. He did not face any resistance from his workers and the system was well received by his workers who “loved it” and didn’t require any convincing.

Despite this the footings contractor admitted that it was a “very brave move” on his part at the time to implement the waffle footing innovation given its newness and the associated risks involved with implementing anything new. In stories 7 and 8, he explained that there were a number of barriers to the wider diffusion of the waffle footing system. The key barriers highlighted included professional jealousies and perceptions and attitudes.

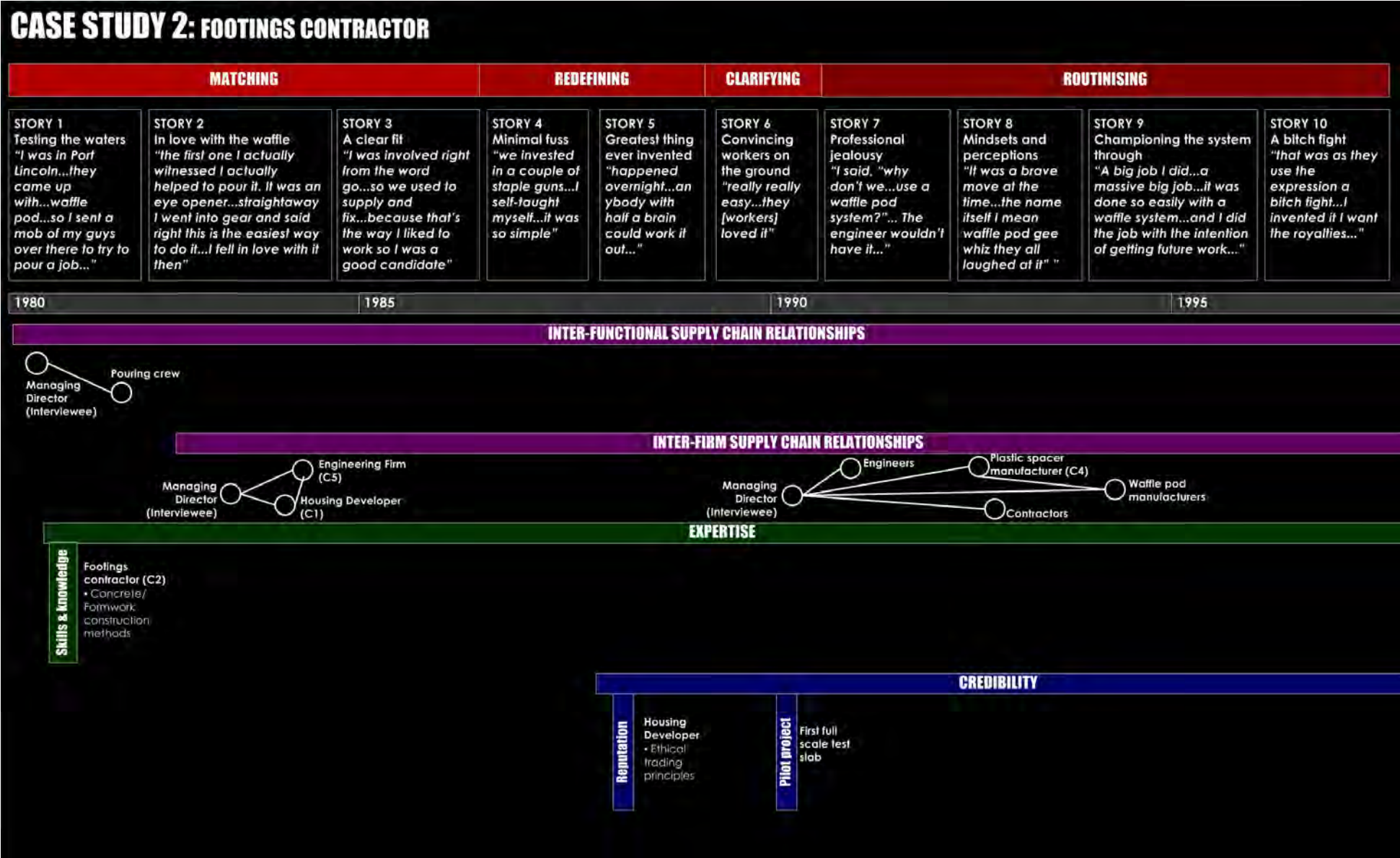
In the final story he talked about the challenges associated with the series of patent disputes which took place. He was of the perception that the patent disputes was “a wasted expense”.

Summary

In summary a number of key factors were raised by the footings contractor as critical to the successful delivery of the waffle footing innovation including:

- The mutual trust and understanding between various key participants which was driven by business motivations (stories 4, 5)
- The reputation of the housing developer (C1) in being 1. a large housing developer, 2. in practicing ethical trading principles and 3. in the significant amount of projects undertaken which helped to build the credibility associated with the footings contractor’s involvement with the innovation (stories 4, 5)

Figure 4.4 Summary description Case 2: Footings contractor



4.3.3 Participant organisation 3: Building materials supplier

Participant organisation 3 (C3) is a leading international building materials company in the supply of building products such as roofing, cladding, flooring and decorative products. The building materials supplier (C3) is a publicly owned company which was listed on the Australian Stock Exchange in 1951. Following this the company built up a diverse portfolio of building and industrial product businesses. In the mid 1980s, the building materials supplier C3 pioneered the development of fibre cement technology and started to design and manufacture a wide range of fibre cement building products. Based on the company's net sales it is believed to be the largest manufacturer of fibre cement products and systems for internal and external building construction applications in the United States, Australia, New Zealand and the Philippines. It is currently a purely fibre-cement business employing over 2500 staff members with operations in the US, Australia, New Zealand, the Philippines and Chile.

A 3-hour interview was conducted with the sales representative of the building materials supplier (C3) during the time of the waffle footing innovation.

Meta-story and stages in innovation process

There were 9 stories identified from the interview with the sales representative including:

- Story 1 Revolutionary: Agenda-setting
- Story 2 A fit: Matching
- Story 3 Job creation: Redefining
- Story 4 Professional jealousy: Routinising
- Story 5 Rogue contractors: Routinising
- Story 6 Perceptions: Routinising
- Story 7 Familiarity and complexity: Routinising
- Story 8 Diplomacy and politics: Routinising
- Story 9 Peddles and the bike: Routinising

The nine stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

In story 1, the sales representative explained that during the time of the waffle footing system innovation the building materials supplier (C3) was exploring ways to diversify their range of products on offer. He explained that the building material supplier's decision to distribute waffle pods was a "revolutionary" move given that the waffle footing system was a "very very new thing". Furthermore the waffle footing system was also not a core component of the company's business.

In the second story, the sales representative acknowledged the initial work conducted by the housing developer (C1) and engineering firm (C5) in the creation, development and adaptation of the waffle footing system. The actual use of the system by the engineering firm (C5) on pilot projects and the organisation of promotional events and activities by the housing developer (C1) were seen as crucial in the wider diffusion of the innovation. According to the sales representative, a distinct advantage of the engineering firm was that they were a "major structural engineering force" with "lots of clients and a number of major builders under their wing". The building materials supplier on the other hand brought to the alliance a set of networks and contacts within the building industry which was necessary in the successful delivery of the system to the industry. As highlighted by the sales representative, "the network was there so that's why it suited both parties". This marked the matching period whereby it was determined that the organisation's agenda and capacity aligned well with the other participants of the innovator group network.

As a result, in 1987 the building materials supplier (C3) committed to a three-year distribution agreement with the engineering firm (C5). Through the agreement, the building materials supplier was granted exclusive rights to distribute the waffle footing system nationally and paid the engineering firm royalties accordingly. In story 3, the sales representative highlighted that the building materials supplier (C3) underwent a redefining stage whereby

specific roles within the organisation were created to support its decision to distribute the waffle footing system. Accordingly the sales representative's position was created to promote and sell the waffle footing system throughout different states nationally.

Following this, the sales representative explained that the waffle footing system innovation "took a long time to get picked up" by builders, engineers and foundation contractors. In stories 4 to 9 the sales representative highlighted that there was a high degree of uncertainty surrounding the builders, engineers and foundation contractors as he sought to promote the use of the system to these participants. He explained that he played a critical role during this clarifying stage to reduce the uncertainty of various participants. However, there were still a number of barriers which hindered the effective implementation of the waffle footing innovation including:

- professional jealousies (story 4)
- inappropriate use of the system (story 5)
- mindsets/perceptions (story 6)
- difficulty/complexity (story 7)
- politics (story 8)
- challenges in formalisation of intellectual capital (story 9)

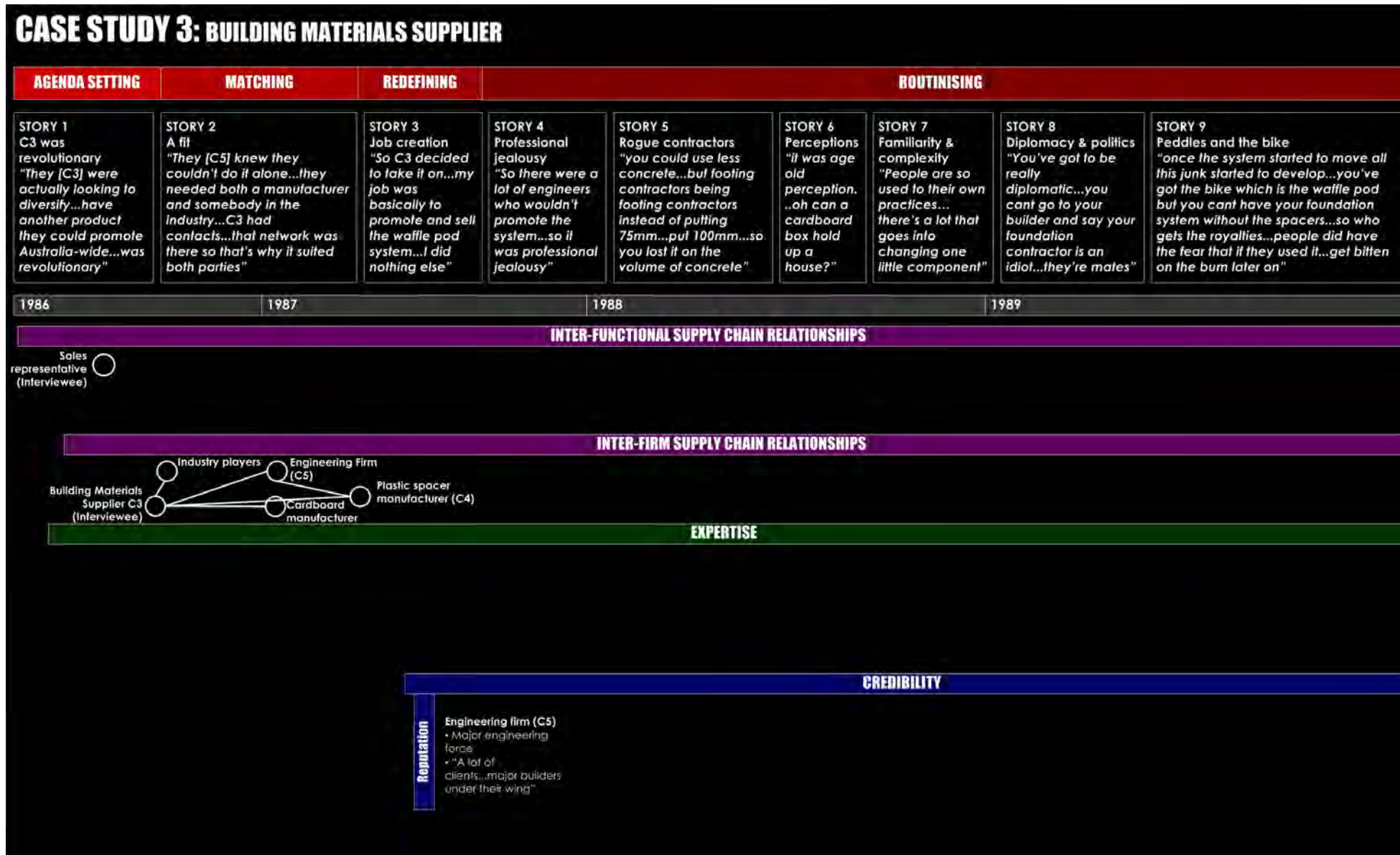
These barriers are discussed further in *Section 4.5 Barriers*. The building material supplier's involvement with the waffle footing system innovation and innovator group ended when the 3-year distribution agreement ceased in 1990.

Summary

In summary the sales representative highlighted that the following were crucial to the successful implementation of the waffle footing system:

- a high degree of risk undertaken by the building materials supplier (C3) in the decision to distribute the waffle footing system (story 1)
- identification, alignment and integration of capacities between participants in the innovator group; ie mutual understanding and trust based on business motivation (story 2)
- recognition of credibility of participants in innovator group in developing reputation (story 2)

Figure 4.5 Summary Description Case 3: Building materials supplier



4.3.4 Case 4: Plastic spacer manufacturer

Participant organisation 4 (C4) is a plastic spacer manufacturing company in Adelaide, South Australia. The company employs 5-6 staff members. It manufactures and sells approximately 100,000 spacers each month both locally and interstate.

A 1-hour interview was conducted with the managing director and co-owner of the plastic spacer manufacturer. The managing director and co-owner are a husband-and-wife team running the company at both the strategic and operational levels.

Meta-story and stages in innovation process

There were 8 stories identified from the interview with the sales representative including:

- Story 1 How it all started: Agenda-setting
- Story 2 Establishing fit: Matching
- Story 3 Forming alliances: Redefining
- Story 4 Reforming alliances: Redefining
- Story 5 Overcoming professional jealousy: Routinising
- Story 6 Court cases and patent disputes: Routinising
- Story 7 The lawyer stuff: Routinising
- Story 8 Adaptations: Routinising

The eight stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

In the first story the managing director of the plastic spacer manufacturing company, C4 explained that he was a footings contractor when he first heard about the waffle footing system. During that time his wife, the co-owner of the current business was a nurse. He came to know about the innovation through one of his sub-contractors who also worked with the housing developer C1 whom at that time had started to implement the waffle footing system on projects.

In the second story, the managing director explained that when he heard about the waffle footing system he “didn’t like the way it was put together”. He “wanted to improve it by making a better spacer to hold it together”. He reflected upon his past experiences in relation to the formalisation of innovation intellectual capital through patenting an earlier invention in the automotive industry. He realised that he was able to capitalise on this expertise by applying for a patent in relation to the waffle footing system innovation. A fit was thus established between the innovation and the organisation’s capacity.

As previously outlined, the engineering firm had previously applied for a patent in 1986 for the invention of a “Building Foundation Form Work Arrangement” involving levelling the supporting ground and placing a plurality of hollow boxes in rows in order to form a grid of intersecting channels between the boxes (Australian Patent Office, 1987). The boxes were initially made of cardboard with internal baffles for strength. The use of cardboard boxes became less popular with the introduction of polystyrene boxes during the late 1980s. The use of polystyrene boxes was made popular by RMAX, a large manufacturer of expanded polystyrene products (EPS) and expanded Polypropylene (EPP) which supplied EPS to manufacturers of the waffle pods. The discussion *Section 4.2 Intellectual property, intellectual capital and patent disputes* highlighted that RMAX was involved in patent disputes with the plastic spacer manufacturer and the engineering firm (C5).

The engineering firm (C5)’s patent expressed the use of concrete blocks to be placed at the intervals between boxes in order to maintain their separation into rows. The plastic spacer manufacturer, C4’s invention involved an improvement on the use of concrete blocks as spacers between the boxes. The spacer is a framework which holds in place pairs of vertical plates set at right angles to each other. Essentially the framework holds the boxes in place relative to each other, which is said to provide “substantive resistance to distortional

pressures” (Australian Patent Office, 1987). A key feature of the improvement as outlined in the patent description was that it enabled concrete flow below the main body of the spacer:

“This is achieved by providing that each spacer, which having a substantially large outermost engaging surface to bear against the side of a box, nonetheless has frame members which have a lowermost edge which are substantially above a lowermost edge of such outermost engaging surface and as such above any supporting ground level surface. In this way much concrete is allowed to flow and set below such frame members thereby maintaining as much as possible the structural integrity of the concrete” (Australian Patent Office, 1987).

In the third story the managing director explained that his company supplied the spacer component of the waffle footing system which was being distributed by the building materials supplier, C3 between 1987 and 1990. The spacer manufacturer explained that he was not keen with the involvement of the building materials supplier C3 in the promotion of the innovation. He felt that the price of the waffle footing system was inflated due to the costs incurred by the building materials supplier, C3. He claimed that the high costs were a key reason that the innovation “never took off” during that time. He also claimed that many engineers did not adopt the waffle footing system because they were in competition with the engineering firm C5, who was receiving royalties from the system.

Consequently in 1991, the spacer manufacturer C4 and the engineering firm C5 entered into an alliance to distribute and sell the waffle footing system by re-patenting the system as Podlock foundation formwork system. In story 4, the spacer manufacturer, explained that the new alliance between his company and the engineering firm trading as Podlock foundation system resulted in the doubling of sales of the system.

In the sixth and seventh stories the spacer manufacturer explained that they were experiencing a number of infringements on his patent and that the “patent whittled down” as a result of patent disputes. The plastic spacer manufacturer highlighted that the litigations and in particular the financing of the litigations proved to be the main challenge they experienced in their attempt to formalise and protect intellectual capital related to the waffle footing innovation. The series of court cases which occurred during that time has been discussed in *Section 4.1.1 Challenges in formalisation of innovation intellectual capital: intellectual property and patents*.

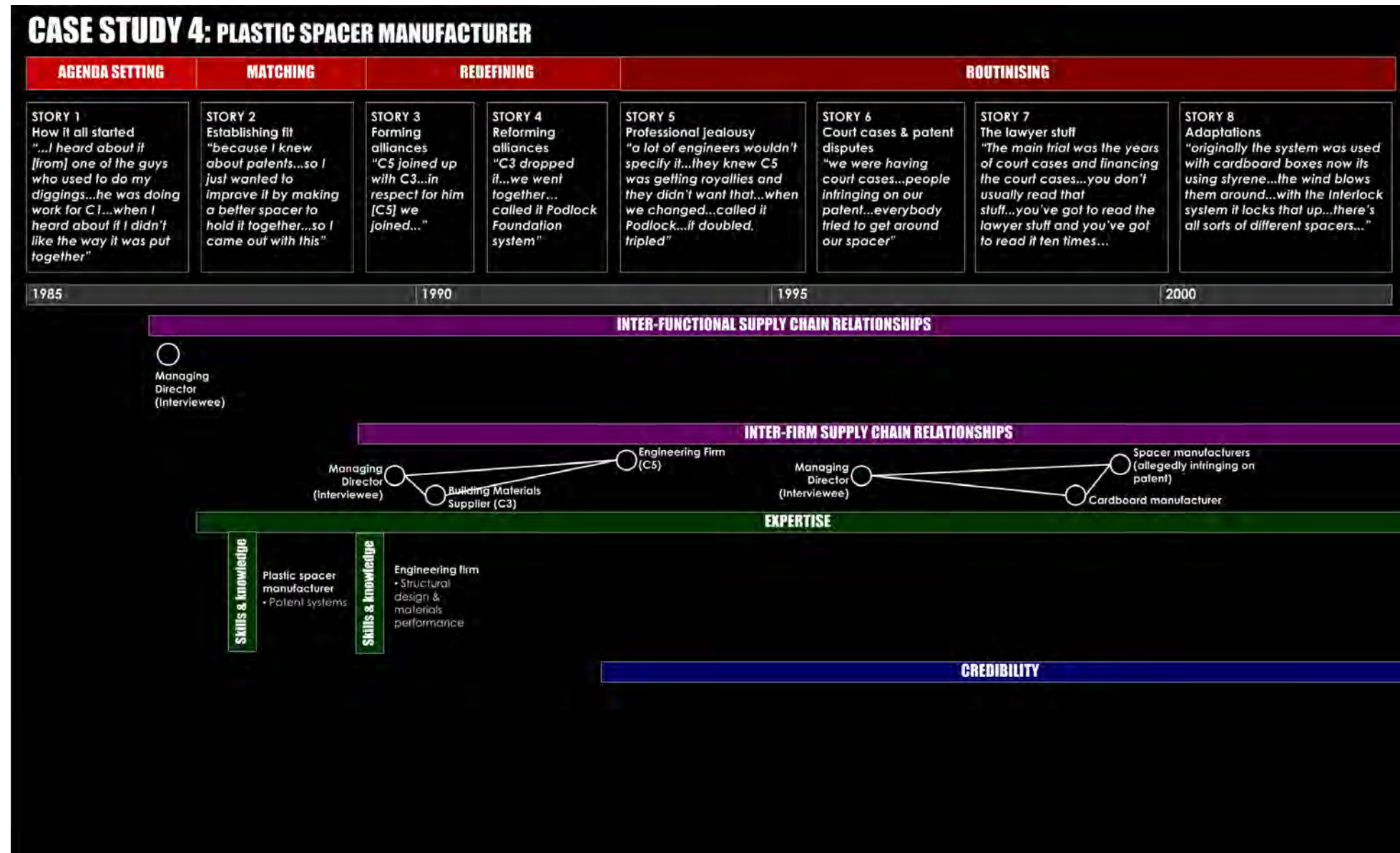
Summary

The key barriers highlighted by the plastic spacer manufacturer include:

- High costs incurred by the distributor of the waffle footing system which in turn resulted in inflated prices of the system (story 3)
- Professional jealousy whereby engineers chose not to adopt the system as they were in competition with the inventor of the system (stories 4 and 5)
- Patent disputes and litigations (stories 6 and 7)

In summary the discussion in this section has highlighted that there were various elements or components to the innovation process. There were different competitors related to the various parts of the innovation. Despite the various patent disputes resulting from the plastic manufacturer, C4's actions, C4 was instrumental in creating a national market for the waffle footing system. The plastic spacer manufacturer, C4 was key in the adaptation of the innovation by being the first to adapt the waffle footing system through the introduction of the plastic spacers instead of concrete blocks.

Figure 4.6 Summary Description Case 4: Plastic spacer manufacturer



4.3.5 Case 5: Engineering firm

Participant organisation 5 (C5) is an engineering firm which was founded in Adelaide in the 1970s. The engineering firm has offices in South Australia and Victoria and services markets in South Australia, Victoria and Queensland. It has over 100 employees. The engineering firm prides itself on the high quality of work it produces in the strive for excellence. The firm is differentiated as one which specialises in complex projects requiring high-level expertise and specialisations and have been involved with a majority of the prominent, high-profile and large-scale complex projects in South Australia.

Two interviews were conducted with the current managing director and retired managing director of the engineering firm. The first interview with the current managing director lasted 2.5 hours and the second one with the retired managing director lasted 1 hour.

Meta-story and stages in innovation process

There were 8 stories identified from the interviews with the two managing directors including:

- Story 1 Researching footing systems: Agenda-setting
- Story 2 The seed: Agenda-setting
- Story 3 Striving for excellence: Matching
- Story 4 The first test slab: Redefining
- Story 5 Forming alliances for commercialisation: Routinising
- Story 6 Reforming alliances: Routinising
- Story 7 Restructuring: Routinising
- Story 8 Threats and court cases: Routinising

The eight stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

In the first story the managing director explained that the waffle footing system was one of a series of Research and Development (R&D) projects that they were involved with in the early 1980s. The R&D program was led by the current managing director. The engineering firm was much smaller during that time and did not have dedicated research teams.

In the second story the retired managing director explained how he appropriated the waffle concept which was used previously elsewhere to overcome the problems they were having with differential ground movements in residential footing systems. The managing director had designed waffle slabs for first floors of buildings and figured that the waffle concept could be applied to footing systems.

The managing director highlighted that the “kudos” and credibility achieved by the firm through making improvements to existing engineering services and design methods in the industry is what drives the firm to continuously engage in R&D programs and activities. In story 3, the managing director explained that he wrote a letter in the early 1980s clearly stating the objectives they wished to achieve in terms of the creation of a footing system. The main objectives were to achieve reduced variability in actual vs predicted costs. According to the managing director the company was a vehicle for them to achieve excellence and to “be the best”. The design and development of an innovative product such as the waffle footing system during that time therefore matched the engineering firm’s organisational objectives.

The fourth story is about the first test slab which was conducted in 1982. The managing director explained that they approached the housing developer (C1) to make a specific site available for the construction of a test slab. The test slab was monitored by the engineering firm (C5) till 1988. The housing developer, C1 had an interest in the creation and development of the waffle footing system as it offered them an opportunity to differentiate themselves from competitors by the ability to provide “fixed-costing”. The housing developer provided the engineering firm access to the block of land for the construction and monitoring of the first full-scale test slab. This was seen by the managing director as a “visionary” approach undertaken by the housing developer.

Alongside their involvement with the waffle footing system innovation, the engineering firm was conducting a comparative study of the various rational methods available in the design of footing systems. The firm then embarked on the development of a computer software program called CORD. CORD is used for designing residential footings and was developed based upon the findings of the comparative study which identified the most rational method of modelling footing systems. The software started being used widely by engineers in Adelaide by the end of 1985. Publications were also produced which detailed the findings related to the tests and experiments done by the firm in the area of footing systems.

Significantly, in 1985, a prototype waffle pod raft house footing was poured with the support of the housing developer. The engineering firm obtained regulatory approval from the local authorities for the prototype waffle pod footing. The engineering firm received strong support from the housing developer C1 with respect to the work they were conducting in the development of the waffle footing system which the managing director indicated “gave it good long-term credibility”. It was believed that the tests and experiments relating to the prototype footing provided crucial information and data which gave the firm a high degree of credibility to successfully deliver the innovation by being able to convince others to adopt the system. As the managing director pointed out “it was sort of if we said that was going to work then everyone believed us”.

Following this, the engineering firm continued their effort to promote the wider diffusion of the waffle footing system through a number of activities. The firm managed to obtain accreditation of the Waffle Pod Footing system as a “deemed to comply” footing system by the Victorian Building Control Branch. The waffle footing system was published in the Australian Standards for Residential Slabs and Footings in 1988. They also managed to obtain accreditation for the computer design software CORD for use in residential designs from Victoria Building Control Branch in 1987.

Story 5 tells of how the engineering firm developed alliances with others with an aim to commercialise the waffle footing innovation. In 1987 the building materials supplier C3 was granted the exclusive rights to distribute the waffle footing system as they entered into a distribution agreement with the engineering firm. The agreement lasted three years. During that time the engineering firm developed a simple but comprehensive “how-to” guide which explained site preparation, soil classification and construction methods for the waffle footing system. The guide was distributed nationally by the building materials supplier, C3 from 1987 onwards.

As the firm moved on to the next phase to commercialise the waffle footing system, they lodged a patent application for the innovation. The retired managing director pointed out that his patent application marked the start of the problem relating to a series of patent disputes. The series of patent disputes was discussed in *Section 4.2 Intellectual property, intellectual capital and patent disputes*. Both the managing directors highlighted that the patent disputes led to many problems for the engineering firm.

In story 6, the managing director explained that when their agreement with the building materials supplier C3 ended in 1990 they developed numerous business ventures to set up waffle pod factories in Queensland, New South Wales and Victoria. The business ventures were an attempt by the engineering firm to recoup losses resulting from the patent disputes as well as the costs incurred from the creation and development of the innovation. The managing director explained that even though they were the inventors of the system “we[they] were not getting any money out of royalties”. The business ventures were thus seen an alternative approach to achieve financial returns out of the waffle footing system innovation.

Setting up and managing factories, however, was not a part of the engineering firm’s core expertise. In the seventh story, the managing director discussed how the business ventures ended up “draining” the engineering firm instead of facilitating its goal to achieve financial returns. The engineering firm then underwent a significant restructure in 2000 with the aim of moving the focus of the organisation “back to core business” where their expertise and competencies were.

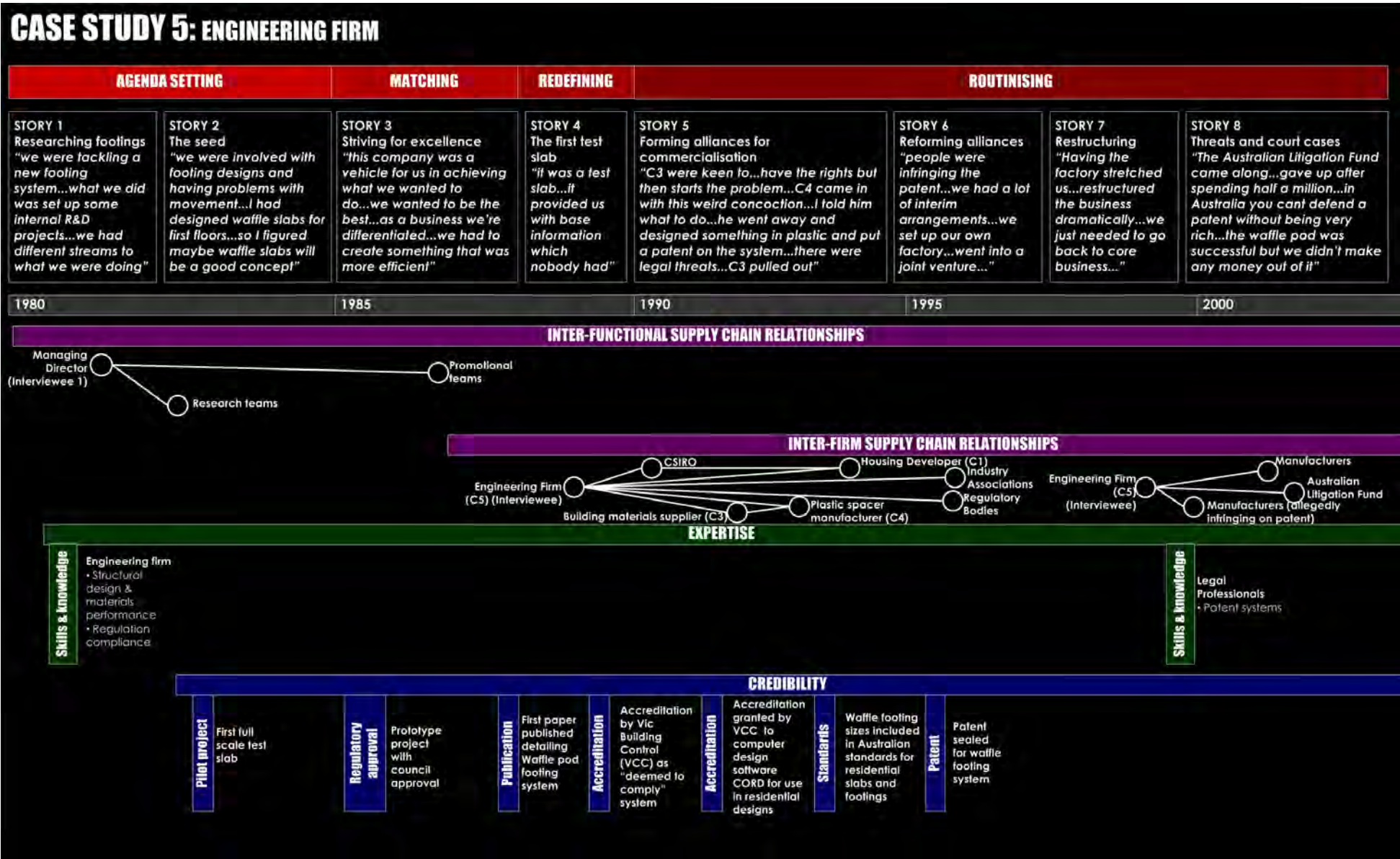
In the final story the managing director discussed their experiences related to patent infringements and litigations they were involved with. The engineering firm was funded by the Australian Litigation Fund in 2000 to sue two organisations which had infringed on their patent. This was discussed in *Section 4.2 Intellectual property, intellectual capital and patent disputes*. The outcome of the court case which took place in 2004 was unfavourable for the engineering firm. The managing director did however also have a positive interpretation of the patent disputes. He was of the perception that the patent infringements increased the market reach of the innovation. Even though the infringements and patent disputes may have proven to be a key challenge for the affected parties, it was perhaps something that worked in favour of the widespread diffusion of the waffle footing innovation.

Summary

In summary a number of key factors were raised as critical to the successful delivery of the waffle footing innovation including:

- Mutual understanding and trust based on business motivation whereby there was strong support between participants as each was motivated by altruistic and economic motivations (stories 3 and 4)
- Acquisition of recognizable artefacts in developing reputation whereby it was clearly understood that the achievement of accreditations and approvals and production of publications was critical towards wider diffusion of the innovation (stories 1, 2, 3, 4 and 5)

Figure 4.7 Summary Description Case 5: Engineering firm



4.3.6 Case 6: Industry association

Participant organisation 6 (C6) is an industry association, which is the Cement and Concrete Association of Australia. The Cement and Concrete Association is the peak national body representing the interests of Australia's heavy construction materials industry. Members of the industry association include the country's leading cement, concrete and aggregate suppliers, accounting for over 80% of the industries output. A 1-hour interview was conducted with the Queensland regional manager of the industry association.

Meta-story and stages in innovation process

There were 6 stories identified from the interview with the regional manager of the Cement and Concrete Association:

- Story 1 Initial interest: Agenda-setting
- Story 2 Promoting concrete use: Matching
- Story 3 How the waffle pods came about: Matching
- Story 4 Forming alliances: Redefining
- Story 5 Well developed system: Routinising
- Story 6 Incorporating system into regulations: Routinising

The six stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

The first story tells of the regional manager's initial interest in the waffle footing system. His initial interest stemmed from having worked in South Australia in the early 1970s prior to moving to Queensland. In South Australia he had been actively scanning for footing systems that would work in the problematic soil conditions in South Australia. Upon moving to Queensland he uncovered that there were numerous areas with equally bad conditions as in South Australia hence his continued interest in new types of footing systems which would overcome those problems.

In the second story, the regional manager explained that he started working at the industry association, C6 in the early 1970s. He indicated that during that time "there was virtually no concrete floors in Queensland for housing". Therefore a major part of his role was to promote the use of concrete whereby he provided technical advisory assistance to industry players including builders, engineers and architects in the innovative use of concrete. He also was involved with running educational events to develop the confidence of industry players in using concrete. Apart from his role as regional manager with the Cement and Concrete Association, he was also the secretary of the Concrete Institute of Australia, which enabled the waffle footing system to be included into the local technical agenda with seminars organised on the use of concrete floors for houses.

In the third story, the regional manager explained that he first heard about the waffle footing innovation in the 1980s. It was through his relationship with a previous colleague in South Australia that he came to know of the creation of the waffle footing system by the engineering firm, C5. In discussions with the engineering firm, the regional manager realised that there was potential for the waffle footing system to be used in Queensland.

In story 4, the regional manager highlighted how he recognised that the easiest and most efficient way to promote the use of concrete was through the involvement of local authorities and other industry associations because of the influence and authority associated with these bodies. It was not the role of these bodies/organisations including the Queensland Housing Commission, Master Builders and Housing Industry Association to promote the use of concrete floors. However, the organisations were in a position to facilitate the dissemination of information that would be valuable to their members through various functions such as seminars and courses. The regional manager was able to provide information sessions to members of these groups on the benefits and construction methods associated with the waffle footing system. The regional manager had the support of these bodies. The authority and influence of these bodies was critical in the development of credibility for the waffle footing system innovation.

In the fifth story he explained that by the time he had heard about the waffle footing system there was a considerable amount of data and practical examples of actual waffle footing systems built in various conditions. The technical data and completion of pilot projects were critical in demonstrating that the waffle footing innovation was a well-developed system which could be used easily and immediately. It was not difficult to capture the interest of industry players in the use of a new product. However, there was also the need to provide the necessary technical data and actual examples of how the system had worked effectively elsewhere.

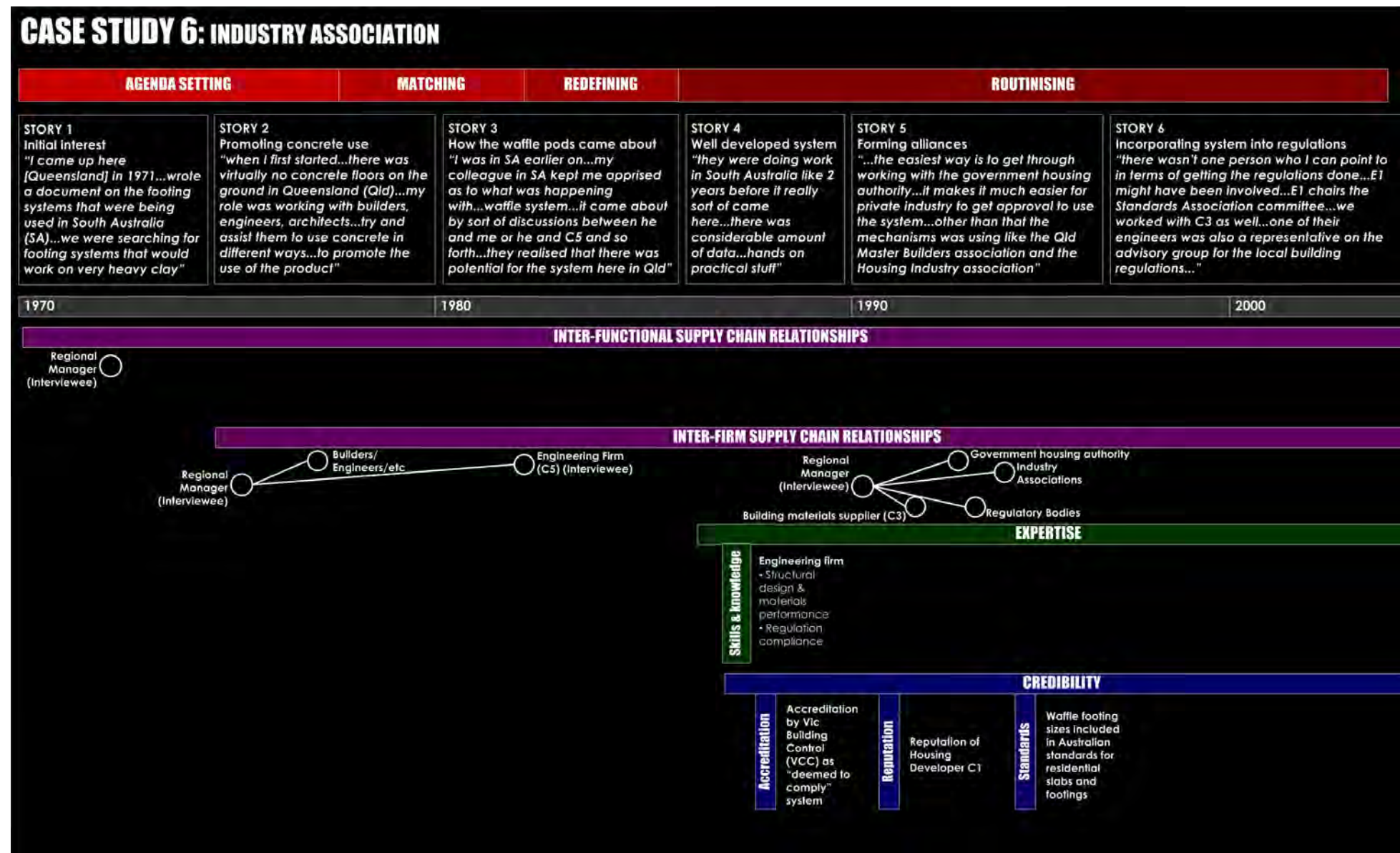
In the last story the regional manager indicated that they worked closely with the advisory committees for local building regulations to ensure that systems such as the waffle footing system would be approved by local authorities. He worked with the department of local government who had control over the building regulations to ensure the waffle footing system conformed with the local building act. Approval by the local authorities was seen as “a huge enabler” in successfully diffusing the system at the wider industry level. Industry players were always permitted to use the waffle footing system prior to it being included in the local building regulations as a “deemed to comply” system. However there was still general reluctance to use the system because it was easier to use existing standard systems which were clearly recognised as “deemed to comply” systems. The use of existing ‘deemed to comply’ systems would not require additional work on the part of the industry players in the provision of technical information or justifications. Therefore the inclusion of the waffle footing system as part of the local building regulation’s standard “deemed to comply” systems was seen as a particularly significant milestone in the diffusion of the innovation in the industry. He highlighted the importance of a number of key players in getting the waffle footing system accepted in the local building regulations including the Chair of the Standards Association Committee as well as a number of local engineers.

Summary

In summary, there was a crucial mix of various key elements which contributed to the successful diffusion of the waffle footing system in Queensland including:

- the authority and influence associated with industry associations whose support for the waffle footing system offered its members the confidence to adopt the system (stories 4 and 6)
- the acceptance of the waffle footing system as a “deemed to comply” footing system by local regulatory bodies (story 6)
- the credibility of the technical data developed by the engineering firm, C5 (stories 3 and 5)

Figure 4.8 Summary Description Case 6: Industry association



4.3.7 Case 7: Expanded Polystyrene (EPS) Supplier

Participant organisation 7 (C7) is a company supplying expanded polystyrene (EPS) products with branches in NSW, Victoria, Queensland and South Australia since 1982. The company is nationally recognised as a leader in polystyrene production. It has over X employees.

One interview was conducted with the managing director and sales representative of the EPS supplier (C7) of the Victorian branch. According to the sales representative the Victorian branch is “the biggest supplier of [waffle] pods for any single site in Australia”. The interview lasted 1.5 hours.

Meta-story and stages in innovation process

There were 8 stories identified from the interviews with the two managing directors including:

- Story 1 Problem identification: Agenda-setting
- Story 2 Forming alliances: Redefining
- Story 3 Promoting the system: Routinising
- Story 4 Breaking down barriers: Routinising
- Story 5 Patent disputes: Routinising
- Story 6 A different world: Routinising
- Story 7 Taking scrap collection to the next stage: Routinising

The six stories are outlined in detail in *Section 8: appendices*. An overview is now provided.

As previously highlighted the waffle footing system was first introduced with the use of hollow cardboard boxes which then became less popular with the introduction of polystyrene boxes. As an aside the sales representative told the story of how polystyrene boxes were introduced in Adelaide. In the late 1980s a block moulder in Sydney had an excess of polystyrene to the point where it was becoming a fire hazard and he was under duress from the local authorities to remove the material from the premises. As a result the block moulder sold the excess material in the form of recycled solid polystyrene and transported these to Adelaide at below-cost. This captured the attention of a large company who was also supplying EPS products at the time, Organisation A. Organisation A then established a mould to manufacture waffle pods out of EPS, which became universally accepted as “the way to go” from then on.

In the first story the managing director explained that they were having problems with the products in which they were supplying in that they were not achieving good returns. He indicated that they “saw a market opportunity” to be involved with the waffle footing system innovation process through the supply of EPS products.

In the second story the managing director highlighted that they first got involved with the waffle footing system innovation in the early 1990s. They were approached by the managing director from the engineering firm, C5. The EPS supplier, C7 entered into a 50-50 joint venture with the engineering firm, C5 through the set-up of the “Waffle Pod Footing Systems” company in Victoria in 1994 with C7 as the manufacturer of the product.

In the third story, the managing director explained that in the early days when they first started supplying waffle pods they promoted the system by various means. One of these included the organisation of trade night with various industry players such as builders, engineers and reinforcing suppliers to promote the use of product.

In story 4, the managing director acknowledged that the work which was done by the engineering firm, C5 “made it easy for the thing [waffle footing system] to grow rapidly”. He asserted that the inclusion of the waffle footing system as a “deemed to comply” system in the Australian standards and the computerised system were key drivers of the adoption of the system. Apart from that the managing director also indicated that the support and “enthusiasm” from the housing developer, C1 was critical to adoption by other companies.

In the fifth story, the managing director explained that the joint venture with the engineering firm, C5 ended after approximately 2-3 years following numerous patent disputes. The managing director highlighted that the disputes “definitely competed with the development of the product”. During that time, the engineering firm, C5 were in an agreement with Organisation A, a footings contractor in Queensland. Organisation A had been granted a patent for the “Interlocking platform elements” which essentially locked the waffle pods together. The managing director of Organisation A then signed over the patent to the plastic spacer manufacturer, C4. It is unclear why the managing director of Organisation A did that nor what the agreement was between the managing director and the plastic spacer manufacturer, C4, if any. Following this there was a period of uncertainty in regards to ownership rights of the patent and associated intellectual property. As a result the partnership between the engineering firm, C5 and the EPS supplier, C7 “imploded”.

In the sixth story the managing director highlighted the challenges associated with the patent dispute. They found themselves in a different world when forced to defend themselves against allegations of patent infringements. He explained that they “were pretty much caught off guard” but have since “moved forward and taken on from there”.

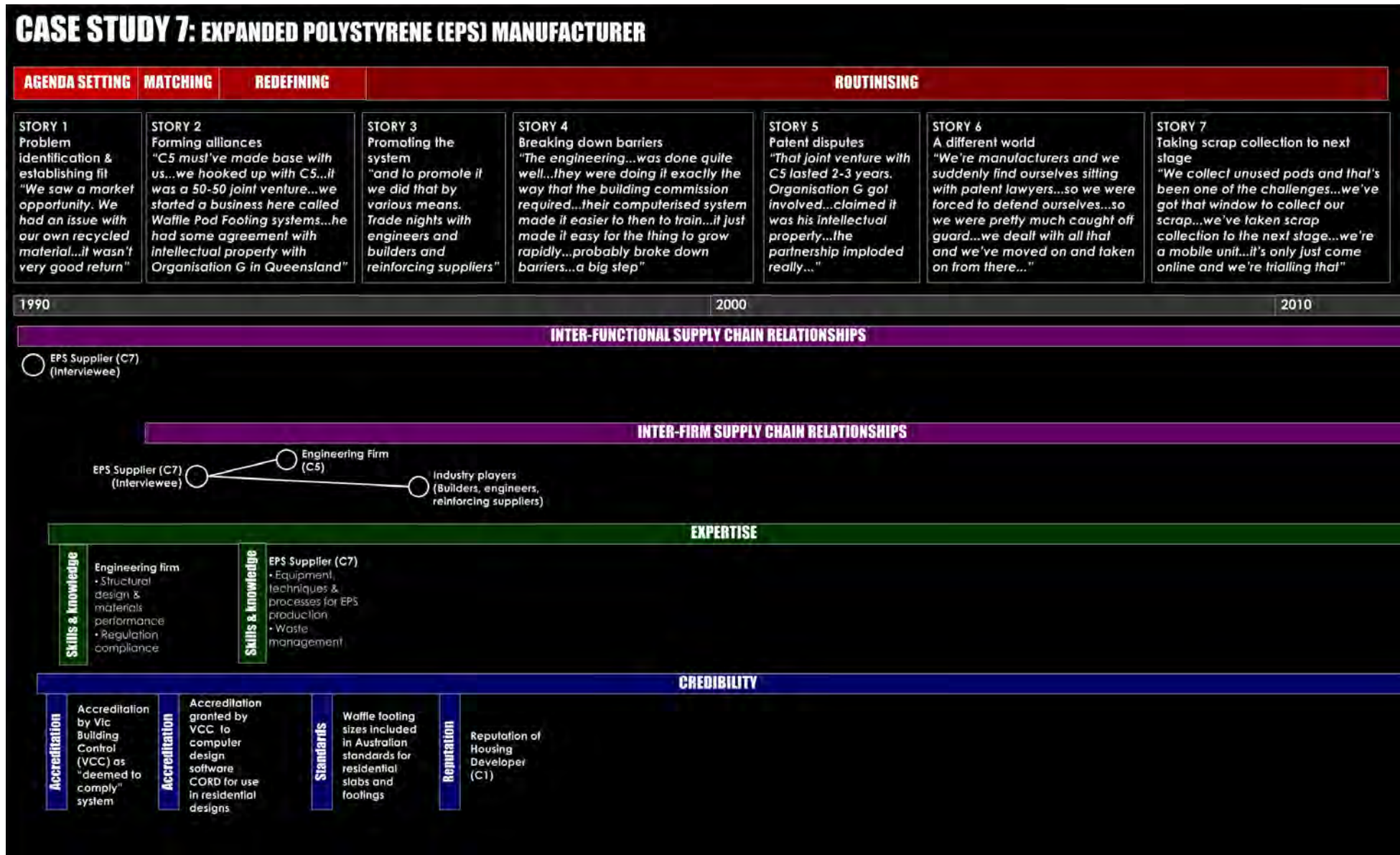
The EPS supplier, C7 prides itself as the “best foam makers in the country and the quickest most efficient” which has “taken scrap collection to the next stage”. In the final story, the sales representative explained that the success of the company can be attributed to effective logistics management and the actual product which is supplied becomes almost secondary. The bulkiness of polystyrene makes it a very expensive product to collect which contributes a large percentage of construction materials waste generated by the industry. The EPS supplier, C7, has been very much involved with exploring innovative ways in the collection and transportation of EPS waste products, which is part of the service agreement they have with major companies they supply products to. Towards reducing on-site waste the EPS supplier, C7 pioneered the system of tracking and tying down EPS products. The company has also developed their own intellectual property in terms of equipment and unique processes and techniques used. The EPS supplier, C7 is able to produce EPS products 2-2.5 times faster than conventional systems. The EPS supplier is also able to include up to 20% recycled material in their products without affecting their quality. The EPS supplier is currently trialling an innovative method for transporting EPS waste products through the use of mobile units.

Summary

In summary the EPS supplier highlighted a number of key enablers to the successful diffusion of the waffle footing innovation including

- Collaborative efforts between key players to promote the innovation such as the EPS supplier’s efforts in the organisation of trade nights to work together with various potential adopters of the system (story 3)
- The credibility of the system achieved through its classification as a “deemed to comply” system in the Australian standards and the computerised program which accompanied the use of the system
- The enthusiasm and support provided by the housing developer (C1) in championing the innovation.

Figure 4.9 Summary Description Case 7: EPS supplier



4.3.8 Summary

This section has described the stories from each participant organisation in isolation in relation to their experiences of the waffle footing innovation process. The stories from each participant were collected and connected and then matched to the five stages of the innovation process including agenda-setting, matching, redefining, clarifying and routinising.

A number of barriers to the innovation process were highlighted by the participants individually including:

- Professional jealousy whereby engineers chose not to adopt the system as they were in competition with the inventor of the system (C2, C3, C4, C5, C6)
- Overcoming perceptions and attitudes
- High costs incurred by the distributor of the waffle footing system which in turn resulted in inflated prices of the system (C4)
- Patent disputes and litigations (C2, C3, C4, C5, C6, C7)

Further to this a number of enablers to the innovation process were also raised including:

- Mutual understanding and trust based on business motivation whereby there was strong support between participants as each was motivated by altruistic and economic motivations (C1, C2, C5)
- a high degree of risk undertaken by key participants in the decision to be involved with the innovation process, which was driven by numerous reasons including economic rewards (C3), trust in the credibility of other players (C1, C2, C6, C7), the authority and influence associated with specific participants whose support for the waffle footing system offered its members the confidence to adopt the system (C1, C2, C3, C5, C6, C7)
- appropriate identification, alignment and integration of capacities between participants in the innovator group (C1, C2, C3, C5, C6)
- development of alliances or relationships and collaborative efforts between participants to access required expertise and capacity for the innovation process (C1, C3, C5, C6, C7)
- Acquisition and use of recognizable artefacts in developing reputation whereby it was clearly understood that the achievement of accreditations and approvals and production of publications was critical towards wider diffusion of the innovation (C1, C4, C5, C6, C7)

In summary the discussion in this section has highlighted that there were various elements or components to the innovation process. The individual metastories from each participant related to their experiences of the innovation process has been a useful starting point for identifying some barriers and enablers. However, the different experiences between participants need to be cross-compared to identify any common themes or irregularities.

Further to this there is a need to analyse in detail the inter-organisational process undertaken by the innovator group participants in the creation, development, adaptation and diffusion of the waffle footing system.

Finally a critique of the barriers and enablers will enable the development of a methodology process pathway for the creation, development, adaptation and diffusion of the waffle footing innovation across organisations.

5. DISCUSSION

5.1 Innovator organisational process

Numerous similarities between the participants' experiences on the waffle footing innovation and the five stages of the innovation process became apparent during the interviews. It was evident through the analysis that the participants' experiences in the creation, development and adaptation of the waffle footing innovation can be mapped to the five stages of the innovation process.

The first stage of the analysis involved categorising the participants from the seven organisations' stories into the five stages of the innovation process; namely, agenda-setting, matching, redefining, clarifying and routinising. The results of this stage of analysis were presented in *Section 4: Results*.

Following this a comparative analysis between the seven organisations in how they experienced the five stages of the innovation process was conducted to ascertain common themes. Nine key themes were identified across the organisations including (refer to Table 5.2):

- Opportunistic surveillance
- Performance gap
- Establishing fit between problem and innovation
- Changes to organisation/innovation
- Developing alliances to integrate resources
- Diffusion within organisations
- Enablers for diffusion across organisations
- Barriers to diffusion across organisations
- Adaptations

Table 5.1 provides a summary of the themes arising from the cross-coding of the participants' stories into the five stages of the innovation process. A detailed discussion of the themes identified within each stage is then provided in this section.

Table 5.1 Cross case comparison: key themes in relation to five stages of innovation process

Stages of innovation process		Case studies						
	Key themes	C1	C2	C3	C4	C5	C6	C7
Agenda-setting	Opportunistic surveillance	√	√	√	√	√	√	√
	Performance gap	√				√	√	√
Matching	Establishing fit between problem and innovation	√	√	√	√	√	√	√
Redefining	Changes to organisation/innovation	√	√	√	√	√		√
	Developing alliances to integrate resources	√	√	√	√	√	√	√
Clarifying	Convincing diffusion within organisation		√					
Routinising	Enablers to diffusion across organisations	√	√	√	√	√	√	√
	Barriers to diffusion across organisations		√	√	√	√	√	√
	Adaptations/re-inventions		√	√	√	√		√

5.1.1 Agenda-setting

In diffusion theory (Rogers, 2003) the agenda-setting stage initiates the innovation process and is when an organisational problem is identified thus generating the need for an innovation. Analysis of the interviews revealed that the agenda-setting stage was critical. In the agenda setting stage organisations identify the initial motivation to resolve an identified problem and this then drives the latter stages of innovation.

A total of eleven stories identified from the interviews were coded into the agenda-setting stage (refer to Table 5.3). Two themes were identified as part of this stage including:

- performance gap, and
- opportunistic surveillance.

The first theme of performance gap is about inconsistencies between how individuals within an organisation perceived the organisation's performance and how they expected to perform. Participants from the housing developer, C1 and the engineering firm, C5 identified a perceived performance gap between how traditional footing systems were designed, specified and built. The performance gap was a trigger to search for an innovation.

“the traditional [footing system] was a brick build-up...and what that meant was you had unknown rock excavation on the strip footings...when you hit rock, you called the customers up and said you're going to have to pay us some more money so straight away you're off-side...So my drivers were...that we could actually fix the customer's price and charge no extras for them... I wanted to be able to control the actual costs” (State Building Manager, Housing Developer - C1)

“the idea was to get a footing system that was as near as possible to a factory-produced...and above-ground...cause once you start digging you lose control of what you’re building, you get over-runs, your trenches collapse” (Managing Director, Engineering Firm - C5)

For these participants the need for an innovation was borne out of the inefficient manner in which traditional in-ground strip footing systems performed. The traditional system involved excavated trenches with foundation walls built up to the required floor level from the footing. This method was considered to be labour-intensive and not particularly cost-effective. The problem with the traditional footing system was uncertainty in footing depths due to variability in in-ground movement. The uncertainty led to a difficulty to accurately control the volume of concrete used. Both the housing developer, C1 and engineering firm, C5 highlighted a disadvantage of the traditional system which was its inability to control quantities and costs. The desire to develop an above the ground footing system which was *“as near as possible to a factory-produced product”* was thus seen as a way to achieve fixed or accurate concrete use and thus cost predictions.

Table 5.2 Stories coded into the agenda-setting stage

Agenda-setting						
C1	C2	C3	C4	C5	C6	C7
<p>Opportunistic surveillance: <i>Story 3: "had a break when I realised one day sitting in the office...I'm paid to think about things"</i></p> <p><i>Story 5: "the other thing that hit me was in multi-storey car parks I'd seen where these waffle pods had been used...I just said, cant we do that same stuff here?"</i></p>	<p>Opportunistic surveillance: <i>Story 1: "I was in Port Lincoln 30 years ago and they came up with a crusher bull waffle pod...So I sent a mob of my guys over there to try and pour a job"</i></p>	<p>Opportunistic surveillance: <i>Story 1: "C3 is basically a building materials supplier...they were actually looking to diversify and try something else and have another product that they could promote Australia-wide"</i></p>		<p>Opportunistic surveillance: <i>Story 1: "So what we did was set up some internal R&D projects...so we had different streams to what we were doing"</i></p> <p><i>Story 2: "because we were involved with footing designs and having problems with movement. As a structural engineer I had designed waffle slabs for first floors...So I figured we got nowhere for support in soils or footings in soil and maybe a waffle will be a good concept"</i></p>	<p>Opportunistic surveillance: <i>Story 1: "and we were searching for footing systems that would work on very heavy clay in South Australia"</i></p>	<p>Opportunistic surveillance: <i>Story 1: "I guess we saw a market opportunity"</i></p>
<p>Performance gap: <i>Story 4: "the traditional [footing system] was a brick build-up...and what that meant was you had unknown rock excavation on the strip footings...when you hit rock, you called the customers up and said you're going to have to pay us some more money so straight away you're off-side"</i></p> <p><i>Story 6: "the margins in housing are quite low, they're terrible because of the inefficient way we did things"</i></p>				<p>Performance gap: <i>Story 3: "the idea was to get a footing system that was as near as possible to a factory-produced...and above-ground...cause once you start digging you lose control of what you're building, you get over-runs, your trenches collapse"</i></p>		<p>Performance gap: <i>Story 1: "we had an issue with our own recycle material – extruded etc to re-sell it...it wasn't very good return"</i></p>

The second theme revolved around the participants being engaged in opportunistic surveillance (Rogers, 2003) by continuously being on the look out for new ideas which might be beneficial to the organisation. Past work into the innovation process has highlighted that organisations are often driven more by solutions compared to problems (March, 1981). Given the high number of problems typically faced by organisations, the chances of identifying an appropriate innovation to deal with a specific problem is relatively low. The possibility of matching an innovation to a problem faced by an organisation can, however, be higher if organisations begin with a wanted solution or innovation. As a result numerous organisations tend to be involved in opportunistic surveillance to identify promising innovations, which may be relevant for dealing with existing problems in the organisation. Indeed this was the case for the engineering firm, C5 and the housing developer, C1 who were actively scanning the environment for new ideas at the time of the waffle footing innovation process:

“So what we did was set up some internal R&D projects...so we had different streams to what we were doing” (Managing Director, Engineering firm - C5)

“had a break when I realised one day sitting in the office...I’m paid to think about things” (State Manager, Housing developer - C1)

In the case of the building materials supplier, C3, knowledge of an innovation launched the innovation process in the organisation. The organisation took on an opportunistic approach whereby knowledge of the waffle footing system created a need for the innovation process. Prior to the organisation discovering the product there was no specific plans for its use except that the organisation was looking to diversify its product-line. Therefore even though the innovation process is often initiated by a perceived need to address a particular problem it can also be triggered by knowledge of an innovation, as in the case of the building materials supplier (C3).

“C3 is basically a building materials supplier...they were actually looking to diversify and try something else and have another product that they could promote Australia-wide” (Sales representative, Building materials supplier - C3)

A sub-theme of opportunistic surveillance related to how participants actively scanned for ideas in the creation, development and adaptation of the innovation. For the managing director from the engineering firm, C5, the idea of the waffle footing innovation was developed through his prior experiences of designing waffle slabs for first floors in buildings.

“because we were involved with footing designs and having problems with movement. As a structural engineer I had designed waffle slabs for first floors...So I figured we got nowhere for support in soils or footings in soil and maybe a waffle will be a good concept” (Managing Director – retired, Engineering firm - C5)

The experiential problem solving method was thus employed by the engineering firm, C5 in the creation of the innovation whereby the managing director drew upon prior experiences to create a more efficient product in response to “problems with movement”.

On the other hand the state building manager from the housing developer, C1 recalled upon his observations of the waffle system being used elsewhere.

“...the other thing that hit me was in multi-storey car parks I’d seen where these waffle pods had been used...I just said, cant we do that same stuff here?” (State Manager, Housing Developer - C1)

Based upon his observations, the state building manager from the housing developer, C1 was able to appropriate an existing solution which has been used elsewhere. The waffle footing system can thus be seen as an adaptation of an existing construction method used in a different sector.

5.1.2 Matching

A total of nine stories were coded into the matching stage. Table 5.3 presents a summary of the stories coded into the matching stage.

Table 5.3 Stories coded into the matching stage

Matching						
C1	C2	C3	C4	C5	C6	C7
<p>Establishing fit:</p> <p>Story 7: "so in discussion with my marketing people at that time, I said, "What do you really want? Like if you could really put the price on the market; fixed, no extras – would that be a value proposition?" They went "oh boy, would that be!" They said, "go for it!"</p> <p>Story 8: "so the diary demonstration was significant in my memory...it hit me- that's what I want... I can measure it, I can see it, I can do it quickly"</p>	<p>Establishing fit:</p> <p>Story 2: "the first one [waffle footing system] I actually witnessed...it was an eye opener for me... Straight away I went into gear and said right, this is the easiest way to do it"</p> <p>Story 3: "So we used to supply and fix. So he started the ball rolling on that and I would never have worked any other way because that's the way I liked to work so I was a good candidate"</p>	<p>Establishing fit:</p> <p>Story 2: "cos basically everybody no matter what industry you're in especially in the building industry you're forever looking to save costs wherever you can. And this was a cost saving exercise"</p>	<p>Establishing fit:</p> <p>Story 2: "I was a foundation contractor and when I heard about it I didn't like the way it was put together ... and because I knew about patents ... So I just wanted to improve it by making a better spacer to hold it together. So I came out with this</p>	<p>Establishing fit:</p> <p>Story 3: "Well we wanna be the best and this company was a vehicle for us in achieving what we wanted to do As engineers we were doing it pure engineering for I guess our own egos and business but then we were also going down the road of the footings system for the reasons which I've just said which is the client base's need...We had to create something that was more efficient and more factory-lined.</p>	<p>Establishing fit:</p> <p>Story 2: "and when I first started that role in the early 70s and cos there was virtually no concrete floors on the ground in Queensland for housing...I guess in the cement industry's point of view to promote the use of the product.</p> <p>Story 3: and the sort of soils we had up here and the problems we had up here so then they realised that there was a potential for the system here in Queensland</p>	

A common theme that the participants experienced during the matching stage was the establishment of the fit between problem and innovation. At this stage, participants determined how well the innovation aligned with the identified organisational problem:

“so in discussion with my marketing people at that time, I said, “What do you really want? Like if you could really put the price on the market; fixed, no extras – would that be a value proposition?” They went “oh boy, would that be!” They said, “go for it!”” (State Building manager, Housing developer - C1)

“the first one [waffle footing system] I actually witnessed...it was an eye opener for me... Straight away I went into gear and said right, this is the easiest way to do it...if you dig a foundation right in the ground you really cant form it up...that’ll cost money and time whereas just the simple process, form up the perimeter of your house foundation...lay some pods in there” (Managing Director, Footings contractor - C2)

“So we used to supply and fix. So he started the ball rolling on that and I would never have worked any other way because that’s the way I liked to work so I was a good candidate” (Managing director, Footings contractor - C2)

“cos basically everybody no matter what industry you’re in especially in the building industry you’re forever looking to save costs wherever you can. And this was a cost saving exercise” (Sales representative, Building Materials Supplier - C3)

“I was a foundation contractor and when I heard about it I didn’t like the way it was put together ... and because I knew about patents ... So I just wanted to improve it by making a better spacer to hold it together. So I came out with this” (Managing Director, Plastic spacer manufacturer - C4)

These quotes highlight that the matching stage was a critical stage in the innovation process for the participants. It marked the decision to proceed with the creation, development and adaptation of the waffle footing system innovation within their organisations. The specific benefits of the waffle footing system were anticipated in different ways including:

- fixed pricing (C1),
- ease of construction (C2),
- appropriate work method of supply-and-fix (C2)
- cost savings (C3), and
- organisational capacity which supported the innovation (C4).

The waffle footing innovation found a home in the respective organisations due to the high degree of fit between the innovation and organisational needs or problems.

The matching stage can also be influenced by organisational capacity or specific expertise/experiences related to the innovation process as demonstrated by the plastic spacer manufacturer, C4. For spacer manufacturer, the decision to adapt the waffle footing system innovation was largely a result of having prior understanding of dealing with an innovation in a different industry and in particular with patents. The waffle footing system innovation was established as one which fit with the organisation’s specific expertise and capacity and thus a decision was made to be involved with the adaptation of the innovation.

5.1.3 Redefining/restructuring

Eleven stories were coded into the stage of redefining/restructuring (refer to Table 5.4). There were two themes identified:

- Changes to organisation or innovation
- Development of alliances or cluster/network of visionaries

Table 5.4 Stories coded into the redefining stage

Redefining						
C1	C2	C3	C4	C5	C6	C7
<p>Shaping the innovation:</p> <p><i>Story 9: "I can remember...trying to find plastic tubs or bails or hay or something – but it didn't matter what we stuck in there and I was cost controlling..."</i></p>	<p>Organisational changes arising from innovation - incremental:</p> <p><i>Story 4: "We invested in a couple of staple guns and stapled them together. So it was so simple...and I self taught myself"</i></p>	<p>Organisational changes arising from innovation - radical:</p> <p><i>Story 2: "The only thing that I did was waffle pods...I was employed to drive that...They had people that were already promoting C3 products and this was an add on for them to promote"</i></p>				
<p>Cluster/network of visionaries gravitating:</p> <p><i>Story 9: "I remember when we did the test slabs...I got all the materials and things from suppliers...I was communicating with our direct suppliers and I said you're going to be a part of this... I was just the poor old builder...I realised all I was there for was just to control the building flow so this was where we had that alliance."</i></p>	<p>Cluster/network of visionaries gravitating:</p> <p><i>Story 5: to work in with the waffle system I think C5 thought of it, C1 took it, I produced it and it was just a happy meeting and we were all happy to work with each other...no major dramas"</i></p>		<p>Forming & reforming alliances in response to requirements arising from innovation refinements:</p> <p><i>Story 3: What we did was we joined up with C3 [building materials supplier] in a 3 year contract</i></p> <p><i>Story 4: C3 [building materials supplier] had dropped it anyway. And then we went together and we took the name of waffle pod...so we called it Podlock foundation system</i></p>	<p>Cluster/network of visionaries gravitating:</p> <p><i>"C1 [housing developer] gave us this block of land and that footings was built for free. ...So there was quite a bit of visionary in doing that. A long commitment type of thing"</i></p> <p>Forming alliances in response to requirements arising from innovation refinements:</p> <p><i>"So C3 [building materials supplier] were keen to be behind us and have the rights and we had some sort of a contract with them"</i></p>	<p>Forming alliances in response to requirements arising from innovation refinements:</p> <p><i>Story 4: we thought well the easiest way is to get through working with the government housing authority ...the work then started with Queensland Housing Commission on concrete slab, and we were partnered with them ... and using organizations like the Queensland Master Builders association, Housing industry association and other organizations to try and get some things going.</i></p>	<p>Forming alliances in response to requirements arising from innovation refinements:</p> <p><i>Story 2: And then we hooked up with Peter. So we started the business here called Waffle Pod Footing systems with C5 and it was a 50-50 joint venture in those days with C5 and us the manufacturer.</i></p>

The first theme of the redefining stage involves changes which occurred to the organisations or innovation during the innovation process. The innovation process resulted in a degree of change for the participants in terms of work practices and organisational structure. For the footings contractor, C2, the waffle footing system can be classified as an incremental innovation as it did not require a high degree of technical expertise to implement the innovation.

"We invested in a couple of staple guns and stapled them together. So it was so simple...and I self taught myself" (Managing director, Footings contractor - C2)

Therefore the footings contractors, C2 implemented the waffle footing innovation relatively easily and as indicated by C2, "it was so simple...I self taught myself". For the building materials supplier, C3 however, the innovation process was a little more radical. The organisations's decision to promote and distribute the waffle footing innovation lead to the creation of the interview participant's role, which was specifically to promote the waffle footing system. It also affected the "whole spectrum" of the organisation's marketable products by expanding its market share to supply products for the construction of an entire house.

"The only thing that I did was waffle pods...I was employed to drive that...They had people that were already promoting C3 products and this was an add on for them to promote...And that's the other thing its changing the whole spectrum ...they could then turn around and use it as an advertising thing and say C3 can build a house for you" (Sales representative, Building materials supplier - C3)

According to Rogers (2003) the redefining/restructuring stage is when the innovation imported from outside an organisation loses its foreign character. This is the stage when the innovation is adapted to suit the organisation's needs or structure and vice versa. Even though the innovation process did result in changes, there was a slight difference in the way the redefining stage was experienced by the innovator group analysed on this project. Given that the innovator group were responsible for creating, developing and adapting the innovation, they were presented the opportunity to shape the innovation to suit their organisational needs. Unlike other adopter groups, participants in the innovator group do not need to change the innovation to suit the organisation at a later stage, as highlighted by C1:

"I can remember...trying to find plastic tubs or bails or hay or something – but it didn't matter what we stuck in there and I was cost controlling" (State building manager, Housing developer - C1)

For the housing developer, C1, a primary objective of the organisation centred on an ability to control costs. Therefore during the redefining stage of the innovation process the housing developer was found to be developing the waffle footing system to achieve the organisation's objective of cost efficiencies. Being involved at the start of the innovation process, the organisation was able to create an innovation which was particularly aligned to the objectives of the organisation.

The second theme was associated with the formation and reformation of alliances between various participants in response to the needs of the innovation process. The development, refinement and promotion of the waffle footing innovation at various stages required increased expertise and capacity from a range of different participants. The requirement for increased capacity led to the creation of informal alliances with collaborative efforts between participants in the innovator group in the creation, development and adaptation of the waffle footing system innovation. The innovator group functioned as a cluster or network of visionaries whereby participants were driven by both altruistic and economic motivations as highlighted in the following quotes:

"I remember when we did the test slabs...I got all the materials and things from suppliers...I was communicating with our direct suppliers and I said you're going to be a part of this... I was just the poor old builder...I realised all I was there for was just to control the building flow so this was where we had that alliance." (State Manager, Housing developer - C1)

“...to work in with the waffle system I think C5 thought of it, C1 took it, I produced it and it was just a happy meeting and we were all happy to work with each other. And C1 [housing developer] always paid me on time so no major dramas” (Managing Director, Footings contractor - C2)

“C1 [housing developer] gave us this block of land and that footings was built for free. All the suppliers and contractors contributed to it so people were happy to put in as an industry but to give us access to that block of land for that period of time was just something that they did. So there was quite a bit of visionary in doing that. A long commitment type of thing...we did that work very thoroughly very diligently and that provided base information that I think nobody had ever had to give credibility to the design methods we were using” (Managing Director, Engineering firm - C5)

“So C3 [building materials supplier] were keen to be behind us and have the rights and we had some sort of a contract with them” (Managing Director – retired, Engineering firm - C5)

Even after the decision was made to create the innovation, a considerable amount of time was spent in the development and adaptation of the waffle footing system. This was particularly important because unlike other adopter groups the participants were not simply importing an innovation to be implemented within their organisations. Instead they were delivering an innovation which required initial creation, designing, planning and then diffusion. There is an added layer of complexity which the innovator group has to undergo, which many organisations adopting prior developed innovations do not have to encounter. Therefore the participants were committing to a high degree of risk and uncertainty in the decision to create, develop and adapt the waffle footing innovation and as raised by C3, perhaps a “highly revolutionary” move. The quotes demonstrate the different roles each participant within the innovator group played in the successful delivery of the waffle footing system to the residential construction industry.

5.1.4 Clarifying

The clarifying stage occurs when an innovation has been implemented in a more widespread manner in an organisation (Rogers, 2003). The management of the clarifying stage during the innovation process tends to be characterised by a high level of uncertainty. As a result, the clarifying stage typically involves key participants or champions undertaking various activities aimed at reducing uncertainty of those staff members within their organisations.

Interestingly, this was not the case for the organisations in the implementation of the waffle footing system innovation within the individual organisations. Only the following story told by the footings contractor was coded into the clarifying stage.

Title: Convincing workers on the ground

Story 6 CLARIFYING: “really really easy...They [the workers] loved it”

Abstract

Interviewer 441: Was it difficult in the early days to convince the guys that worked for you?

Interviewee: 442: They loved it.

Complicating action

443: They didn't have to carry cages.

444: Four top rods, four bottom rods.

445: We used to make them outside the trenches and carry them in.

446: that was a nightmare.

447: Here they just pick up 6 rods and they drop them in 1, 2, 3, 4, 5, 6 and away they go.

Evaluation

448: Really really easy.

449: They loved it.

450: Well you look at it with form up, steel and pod a job is finished in 4 hours.

451: And the next day you pour it, in the afternoon you go and prepare another one.

In this story, the footings contractor, C2 explained how easy it was for him to implement the waffle footing system innovation within his organisation. The fact that the waffle footing system improved the work practices of his staff members was critical. In his comparison

between the waffle footing system and the traditional footing system, he explained how the traditional system was “a nightmare” and that the waffle footing system was “really, really easy”. There was no resistance experienced in the footings contractor’s implementation of the waffle footing system in the organisation.

This is of course not to say that the group of organisations did not experience any difficulties when spreading and promoting the wider diffusion of the innovation to different tiers of players in the construction supply chain. However, it is to say that participants did not tell any stories which indicated that they experienced resistance when implementing the innovation within their organisations. Therefore the barriers to innovation occurred when the participants sought to promote the innovation across organisations rather than within organisations. The barriers which participants experienced in the wider diffusion of the waffle footing innovation across different tiers of the supply chain are discussed further in *Section 6: Critique of barriers and enablers*.

5.1.5 Routinising

The routinising stage occurs when an innovation has become synonymous with the regular activities of an organisation, which completes the innovation process (Rogers, 2003). This was the stage when the waffle footing system became incorporated into the regular activities of the organisations and had lost its separate identity.

“So that was the actual first system built... So from that point it became accepted and we were pricing our land and house packages with it or when people came to us we could definitely give a fixed price... and then it started to be picked up by other builders” (State building manager, Housing developer - C1)

According to the housing developer, C1, the completion of the first project built with the waffle footing system was a significant event because that was when the innovation “became accepted” as a whole in the organisation. The organisation was then able to integrate the waffle footing system into the land and house packages on offer to their customers. This was also when the innovation began to spread out of the organisation and started to be “picked up by other builders”. Even though the routinising stage marked the completion of the innovation process within the organisation it also was the start of when the innovation began to be diffused more widely across organisations in different tiers of the supply chain.

Twenty-five stories were identified from the interviews which were coded into the routinising stage (refer to Table 5.5). The stories participants told about the routinising stage were largely centred around their experiences dealing with others outside of their own organisations in the promotion of the innovation. Three key themes were identified in this stage:

- Enablers to diffusion across organisations
- Barriers to diffusion across organisations
- Adaptations or re-inventions

Table 5.5 Stories coded into the routinising stage

Routinising						
C1	C2	C3	C4	C5	C6	C7
<p>Enablers – role of champions:</p> <p><i>Story 10: I took the concrete gangs to C5 [engineering firm]'s offices... sat them down and ran seminars... I was determined – and you have to champion that so you've got to just push that through like most things in innovation</i></p>	<p>Enablers – role of champions:</p> <p><i>Story 11: "and that was a massive big job...and it was done so easily with a waffle system...and I did the job with the intention of getting future work"</i></p>		<p>Adaptations/re-inventions:</p> <p><i>Story 8: "Originally the system was used with cardboard boxes. Now its styrene. The wind blows them around...with the Interlock system it locks that up...there's all sorts of different spacers"</i></p>	<p>Enablers– credibility of system:</p> <p><i>Story 5: "I presented at a 1987 MBA conference in Qld and out of that came a whole string of contacts. Then I presented in 1987 at a local government conference in Perth and out of that building surveyors who check and approve building applications all came to learn about it"</i></p>	<p>Enablers – role of champions:</p> <p><i>Story 6: "there wasn't one person who I can point to in terms of getting the regulations done"</i></p> <p>Enablers– credibility of system:</p> <p><i>Story 5: "they were doing work in South Australia like 2 years before it really sort of came here...there was considerable amount of data...hands on practical stuff"</i></p>	<p>Enablers – role of champions:</p> <p><i>Story 3: "and to promote it we did that by various means...Trade nights with engineers and builders and reinforcing suppliers"</i></p> <p>Enablers– credibility of system:</p> <p><i>Story 4: "The engineering was done quite well...it just made it easy for the thing to grow rapidly... broke down barriers"</i></p> <p>Adaptations/re-inventions:</p> <p><i>Story 7: "we've taken scrap collection to the next stage...we're a mobile unit...its only just come online and we're trialling that"</i></p>

Table 5.6 (continued) Stories coded into the routinising stage

Routinising						
C1	C2	C3	C4	C5	C6	C7
	<p>Barriers to diffusion of innovation across organisations – professional jealousies:</p> <p><i>Story 7: “why not we turn around and use a waffle pod system?... The engineer wouldn’t have it”</i></p> <p>Barriers to diffusion of innovation across organisations – perceptions:</p> <p><i>Story 9: “it was a brave move at the time... The name itself I mean waffle job gee whiz, they all laughed at it you know”</i></p> <p>Barriers to diffusion of innovation across organisations – patent disputes:</p> <p><i>Story 12: “that was as they use the expression a ‘bitch-fight”</i></p>	<p>Barriers to diffusion of innovation across organisations – professional jealousy:</p> <p><i>Story 8: “a lot of the engineers wouldn’t promote the system...it was professional jealousy”</i></p> <p>Barriers– misuse of system:</p> <p><i>Story 9: footing contractors being footing contractors instead of putting 75mm...put 100mm...so you lost it on the volume of concrete”</i></p> <p>Barriers– perceptions:</p> <p><i>Story 10: “it was age old perception...oh can a cardboard hold up a house?”</i></p> <p>Barriers– politics:</p> <p><i>Story 11: “You’ve got to be really diplomatic... you cant then go back to the builder and say oh your foundation contractor is an idiot... they’re mates</i></p>	<p>Barriers to diffusion of innovation across organisations – professional jealousy:</p> <p><i>Story 5: “see what was happening is that a lot of engineers wouldn’t specify it ...they knew C5 was getting royalties and they didn’t want that”</i></p> <p>Barriers to diffusion of innovation across organisations – patent disputes</p> <p><i>Story 6: “we were having court cases...and this is people infringing on our patent...everybody tried to get around our spacer”</i></p> <p>Barriers to diffusion of innovation across organisations – mismatched inter-organisational capacity</p> <p><i>Story 7: “The main trial was the years of court cases...and financing the court cases...you don’t usually read the lawyer stuff and you’ve got to read it ten times”</i></p>	<p>Barriers to diffusion of innovation across organisations – patent disputes</p> <p><i>Story 6: “people were infringing the patent</i></p> <p><i>Story 8: “The Australian Litigation Fund came along...gave up after spending half a million...in Australia you cant defend a patent without being very rich</i></p> <p>Barriers to diffusion of innovation across organisations – mismatched inter-organisational capacity</p> <p><i>Story 7: “having the factory stretched us...restructured the business dramatically...we just needed to go back to core business”</i></p>		<p>Barriers to diffusion of innovation across organisations – patent disputes</p> <p><i>Story 5: “That joint venture with C5 lasted 2-3 years...Organisation G got involved... claimed it was his intellectual property...the partnership imploded really”</i></p> <p>Barriers to diffusion of innovation across organisations – mismatched inter-organisational capacity</p> <p><i>Story 6: “We’re manufacturers and we suddenly find ourselves sitting with patent lawyers...so we were forced to defend ourselves”</i></p>

The first theme related to the enablers to wider diffusion of the waffle footing innovation across organisations. The participants highlighted two key enablers which contributed to the widespread adoption of the waffle footing system innovation including the role of champions and artefacts.

The role of champions in the innovation process was raised as an important enabler. An innovation champion may be viewed as “a charismatic individual who throws his or her weight behind an innovation, thus overcoming indifference or resistance that the new idea may provoke an organisation” (Rogers, 2003, p. 414). In the case of the waffle footing innovation its wider diffusion was reliant upon not just an individual champion but also a group of champions working together across organisations.

“I took the concrete gangs to C5 (engineering firm)’s offices ... and ran seminars on how to put a box together...cos I was determined and you have to champion that so you’ve got to just push that through like most things in innovation” (State building manager, Housing developer - C1)

“there wasn’t one person who I can point to in terms of getting the regulations done...E1 might have been involved...E1 chairs the Standards Association Committee...we worked with C3 (building materials supplier) as well...one of their engineers was also a representative on the advisory group for the local building regulations” (Industry Association – C6)

“and to promote it we did that by various means...Trade nights with engineers and builders and reinforcing suppliers” (EPS supplier – C7)

Given the newness of the waffle footing system in the residential industry, its diffusion was surrounded by a high degree of uncertainty requiring significant input from numerous organisations to dispel fear and increase the confidence of potential adopters. The example quotes demonstrate the collaborative efforts between numerous organisations in championing the waffle footing innovation for wider diffusion. The housing developer, C1 explained that he worked with the engineering firm, C5 in the promotion of the innovation to “concrete gangs” through the conduct of seminars and demonstrations. The EPS supplier, C7’s strategy to promote the system was through the organisation of trade nights with engineers, builders and suppliers.

The regional manager from the industry association, C6 attributed the widespread diffusion of the waffle footing system to its acceptance by relevant accrediting and approval authorities into local building standards and regulations. Further to this, he indicated that he was not able to identify one key person in ensuring that the waffle footing system was incorporated into the local standards and regulations. Instead he highlighted various key participants including the chair of the Standards committee, the building materials supplier and a representative on the advisory group for local building regulations, whom each contributed through their individual roles to the wider diffusion of the innovation.

Another important enabler related to various artefacts such as publications, awards, regulatory approvals, accreditations and prototype projects and the impact that the artefacts have on how the innovation was perceived favourably which in turn facilitated wider diffusion.

“so the significance of it was that it was approved by the authority that had to approve footing systems and it was a breakthrough” (State Building Manager, Housing Developer – C1)

“I presented at a 1987 MBA [Master Builders Association] conference in Queensland and out of that came a whole string of contacts. Then I presented...at a local government conference in Perth and out of that building surveyors who check and approve building applications all came to learn about it... The key thing was doing it at different levels” (Managing director, Engineering firm - C5)

“The engineering was done quite well...it just made it easy for the thing to grow rapidly... broke down barriers (EPS supplier – C7)

“they were doing work in South Australia like 2 years before it really sort of came here...there was considerable amount of data...hands on practical stuff” (Regional manager, Industry association – C6)

The various artefacts helped to develop credibility and provide confidence to potential adopters of the innovation. The housing developer, C1 explained how approval provided by the authority which deemed the waffle footing system as one which complied with the required codes as a “breakthrough”. The regulatory approval was significant in that it demonstrated the credibility of the innovation to the industry and more importantly it provided the assurance for others to be confident in their use of the waffle footing system. Similarly, the “considerable amount of data” and “hands on practical stuff” relating to the innovation as well as publications, presentations and engineering credentials associated with the system were critical in building its credibility.

Alongside the enablers to wider diffusion the participants also experienced a number of barriers in their efforts to promote the innovation. The second theme was the barriers participants experienced in the wider diffusion of the innovation to other organisations. Six key barriers were raised including:

- Perceptions and attitudes
- Resistance to change because of perception of difficult and complex innovation
- Existing monopolies or relationships
- Misuse of system
- Formalisation of intellectual capital
- Professional jealousies

Perceptions and attitudes: One of the key barriers raised involved overcoming existing perceptions and attitudes in the industry. According to the interview participants, difficulties surrounding wider diffusion had little to do with technicality. Instead difficulties were caused by “people issues” surrounding conservative behaviour and mentality of industry players who resisted the introduction of any new product or process:

“It was overcoming the hurdles and the mentality. It’s a huge jump. The product might be terrific but sometimes it’s very, very hard to change mindsets no matter what industry, no matter what you’re doing” (Sales representative, Building Materials supplier - C3)

“The name itself I mean waffle job gee whiz, they all laughed at it you know...Well the white ones now, the cardboard boxes they all used to laugh at that” (Managing director, Footings contractor - C2)

“And difficulties in getting that going at times were they’re not technicality but they’re just people because some of people that worked in those areas in the department of local government were ultra conservative would’ve been too forward for them I think. They were really hard to convince to adopt new things” (Regional Manager, Industry association - C6)

“Well changing people’s... builders was the biggest hurdle because that’s how they were doing it. Their mindset was – now that they’re using the system to change them back will be impossible” (Managing director – retired, Engineering firm - C5)

“I built a house 10 years ago. The builder said no, no, no we’ll use a conventional slab. I said I’ll give you the pods for free, I’ll help, I’ll do whatever. He went no. So there’s resistance from old guys who don’t want to change” (Sales representative, EPS supplier - C7)

Ultimately the perceptions and attitudes were underpinned by the thinking that the innovation will not offer any benefits, is too difficult or that it simply will not work.

Resistance to change because of perception of difficult and complex innovation: Adopting any new product such as the waffle footing innovation was perceived to equate to a

degree of difficulty in having to change their existing practices and systems. For these contractors/builders/local government agents, the waffle footing system was out of their comfort zone and seen as simply “too hard” to adopt even though it may be a “terrific” product. The problem lies in the familiarity with existing work practices and methods/systems whereby the adoption of a new product or process would entail change and perhaps additional work which is often seen as unnecessary and a hassle.

“Because people are so used to their own practices, systems and whatever and it works there’s a lot that goes into changing one little component” (Sales representative, Building materials supplier - C3)

“part of that resistance was because the builders were set up to do something else. And they had to change their systems to do this. And they were never keen to do that” (Regional Manager, Industry association - C6)

As the regional manager from the industry association, C6, explained, anything which required extra effort to adopt was seen as a barrier:

“Initially the difficulties were –it wasn’t a deemed to comply system. The local building act had different systems in it, types of footings and floors and so forth. And if you used one of those there was no questions asked because it was deemed to comply with the building regulations...but you know what I mean that it [waffle footing system] wasn’t deemed to comply with the regulations and everyone had to be individually handled...and that was a barrier” (Regional Manager, Industry association - C6)

As explained previously, the incorporation of the waffle footing system into the local regulations as a “deemed to comply” system was critical in its wider diffusion. However, prior to this occurring, it did pose as a barrier. Adoption and use of the system on projects meant that participants needed to take additional steps to prove or demonstrate to the authorities its compliance which was felt to be a difficulty and hence the resistance by many to change.

Existing monopolies: The introduction of a new product or system was also perceived as a threat on existing industry players or groups’ monopoly or control over the supply of material/products. The use of the waffle footing system was viewed by concrete suppliers as a product that would potentially decrease the use of concrete in footing systems which would in turn result in a decrease in demand for concrete.

“There was some opposition from the likes of concrete producers in the initial sense. The use of the waffle slab didn’t necessarily increase the amount of concrete that went into the house slab. And we worked almost internally with those sort of groups to try and show you know, “look fellas, ok that’s quite true but you stand a chance of getting you know 1000 houses rather than getting 10 houses. So on a multiplication you’re still far better off”. But they were always reluctant when they saw something with narrow beams” (Regional Manager, Industry association - C6)

Even though the adoption of the waffle footing system would likely increase the use of concrete in general, the concrete suppliers were unable to realise the nature of the competition. Adoption of the waffle footing system would lead to an increase in the use of concrete in general because it would eliminate the use of timber raised floors. Therefore instead of only supplying concrete for the production of ten houses the suppliers could potentially be supplying for one hundred houses. The suppliers however demonstrated reluctance in the adoption of the waffle footing system because it was associated with narrow beams which gave the immediate impression of less volume of concrete used. This again goes back to the underlying issue of overcoming existing narrowly defined mindsets and perceptions.

Misuse of system: The benefits offered by the waffle footing system was lost due to the misuse of the system by certain groups. This is particularly problematic given that the adoption of new products or systems is largely driven by perceptions of advantages offered by the product or system in question.

"So we promoted that you could use less concrete but footing contractors being footing contractors, instead of putting 75 mm cover over the top of your slab the traditional method is 100mm and they always put 100mm. So you lost it on the volume of your concrete. So this is what I said before it has to be policed really really spot on and people didn't do that. Because the whole thing was so new you really needed someone on the ground. I mean that never happens" (Sales representative, Building materials supplier - C3)

Therefore even though the system may have offered clear benefits it was also heavily reliant upon the skills and behaviour of those meant to implement the system "on the ground". The footing contractor, C2 also explained whilst the accurate installation of the waffle system may offer benefits its incorrect installation may spell disaster.

"it was a disaster...With the waffle system too, unless you're a contractor who's really on the ball, when you're pumping it, with these foam boxes or cardboard sometimes you might get movement. In other words one of your spacers move so it is important that your contractor is alert. So you know its not faultless its not a faultless system but its only up to your contractor how thorough he wants to be, how precise he wants to be and if he's got any pride in his work" (Managing director, Footings contractor - C2)

A number of barriers which were particularly unique to the innovator group were also identified including:

Formalisation of intellectual capital: One of the key barriers raised consistently by all participants except the housing developer, C1 and the industry association, C6 included the complications associated with protection and formalisation of their intellectual capital related to the innovation. This is perhaps something that is unique to the experiences of the innovator group since innovation adopters would not have issues concerning protection of intellectual property given the lack of intellectual investment that they make.

As the system began to gain acceptance, the engineering firm, C5, which designed the waffle footing system sought to protect their intellectual property by developing a patent on the system. The process was fraught with difficulty and was considered "a major stuff up" which was characterised by litigation. As the sales representative from the building materials supplier C3 explained, a key player within the innovator group, C4, who developed a plastic spacer attempted to patent the "improved waffle footing system" and claimed the whole system as his own.

"And once the system started to move then all this other junk started to develop...the people that had the spacers were saying that the royalties should come to them from the waffle pods. And the people who had the waffle pods were saying that the royalties should come to them...it was a major stuff up" (Sales representative, Building materials supplier - C3)

At the same time, as the waffle footing system was gaining increased widespread uptake in the industry, more and more companies started to re-invent the innovation to market as their own product. C4 and C5 explained how these companies were infringing on their patents. The managing director of the engineering firm, C5 indicated that the manner in which the firm dealt with the infringements was by developing interim arrangements with the companies as a way of making them acknowledge the existence of the patent:

"we were having court cases and this is people infringing on our patent...everybody tried to get around our spacer" (C4)

"We had a lot of interim arrangements where we tried to do a deal with someone to bring them onboard so that at least they acknowledged the patent existed even if they half broke it and did whatever they wanted to without paying us royalties...but it helped promote the system... And there's a whole range of people who came in and promoted what they thought was their pot of gold and went broke. And each time they did that they increased the market reach of the system a bit more." (Managing director, Engineering firm - C5)

The participants' opinions were mixed in relation to the effects of the infringements and patent disputes on the implementation of the waffle footing system. Even though the managing director from the engineering firm, C5 seemed to think that the infringements helped to promote the waffle footing system, the EPS supplier, C7 and building materials supplier, C3 were of the perception that the patent disputes hindered the promotion and diffusion of the system:

"It was chequered with litigation...we were caught in the middle of some of that really...Very very messy. And in fact the litigation probably harmed the product as such. It slowed its introduction and people's greed got in the way" (Sales representative, EPS supplier - C7)

"with this in the background people were a little bit loathed to go with the system because they had the fear that they might get involved somehow in the litigations in some shape or form" (Sales representative, Building materials supplier - C3)

According to the building materials supplier, C3 and the EPS supplier, C7, this background chequered with litigation instilled a degree of fear in the minds of those potentially seeking to adopt the innovation. Indeed this may have been the case for the building materials supplier, C3 who did not proceed to renew its licensed distribution agreement with C5 to promote the distribute the waffle footing system due to its "messy" background. Despite the mixed opinions of participants in terms of the impact that the litigations had on the adoption of the system, the participants were in agreement that they found it difficult to deal with the "language" and system of patents and litigations arising from it:

"and you don't usually read that stuff and you've got to read the lawyer stuff and you've got to read it ten times because I don't know how many pages they use to say one thing. So our main trial would've been court cases and infringements and the way patents work...it was a challenge... I was a nurse and he was a concreter" (Co-owner, plastic spacer manufacturer, C4)

"You're involved in another world and even though you're ignorant of infringing, that's it. They just count backwards and add zeros. So we were forced to defend ourselves. We're manufacturers and we suddenly find ourselves sitting with patent lawyers and the clock's running, very expensive" (A, EPS supplier, C7)

"and just going up against that sort of stuff [infringements and litigations] became half the course" (Managing director, Engineering firm - C5)

The participants (plastic spacer manufacturer, C4, EPS supplier, C7 and engineering firm, C5) unexpectedly found themselves "in another world" faced with the challenge of dealing with areas beyond their expertise. Despite the lack of appropriate skills and experiences, they were forced to deal issues which seemed foreign to them. One of the key challenges in dealing with issues beyond their capacity involved having to employ the services of other professionals and more specifically the high costs associated with the legal fees.

While it is unclear whether the patent disputes and litigations may have hindered the successful diffusion of the waffle footing system it does raise another important issue in relation to the protection of intellectual property for those who were central to its creation as highlighted by C5:

"If anything Australia needs to do is change the system of patents because its not fair to someone like me who's started off something that's so popular that gets nothing out of it because of some crook" (Managing director – retired, Engineering firm - C5)

The lack of protection of intellectual property offered by the existing system of patents in Australia does not appear to be a conducive environment for innovative behaviour. There does not seem to be any incentive which rewards innovative behaviour. This is perhaps quite a significant issue which needs to be considered particularly in an industry where the pace of innovation is low.

Professional jealousies: The issue of professional jealousies was observed by various participants as another key barrier in the implementation of the innovation.

“so the civil engineer wanted a raft footing system. So I said that's ridiculous why not we turn around and use a waffle pod system? The engineer wouldn't have it...Because a lot of engineers they go, “C5 invented that so why should we go with it?”...Well they sit around and say you know why should I use C5's why don't I use my own?” (Managing director, Footings contractor - C2)

“And there were a lot of the other key engineers wouldn't promote the system and they had nothing to do with the fact that of the litigation at all. So it was professional jealousy ... they [engineers] wouldn't use it for a long time. So innovation may be there but it's the human thing. It's about ownership and it's about money, greed” (Sales representative, Building materials supplier - C3)

“see what was happening is that a lot of engineers wouldn't specify it...because they knew that C5 was getting \$1 per waffle for royalty. They didn't want that he was their competitor that's business” (Managing director, Plastic spacer manufacturer - C4)

“One of the impediments we had because we were consulting engineers other engineers were jealous about us making money sort of thing so they didn't take it on they didn't specify it” (Managing director – retired, Engineering firm - C5)

“...because this was a system that was coming out of another consulting engineer company and so that was allied to them, there was sort of engineers around that were doing footings and some of them were structural based or geotech based but some of them were very nervous about it because they could see it sort of just taking work away from them and they'd lose quite a bit of livelihood. So certainly that did occur” (Regional Manager, Industry association - C6)

These participants explained that they experienced a high degree of resistance and “head banging” in efforts to promote the waffle footing system to engineers. The resistance to adopt the waffle footing system by engineers was not related to technical issues but rather to do with “human nature”, “ownership” and “greed” and the fact that another engineering firm, which was in competition to them would benefit from the successful implementation of the system. Furthermore these engineers saw nothing to be gained out of being in favour of the innovation. This was a particularly significant barrier because the specification and design of footing systems are highly reliant upon the engineer's discretion.

The third theme in the routinising stage is concerned with re-inventions or adaptations made to the waffle footing system. Consistent with the literature related to the innovation process which indicates that innovations tend to undergo adaptations and are continuously re-invented to suit changing organisational and environmental needs, the waffle footing system experienced a number of iterations. Of significance was the introduction of polystyrene boxes for a component of the waffle footing system to replace an earlier cardboard box. As with many developments, the use of polystyrene was seen as beneficial in a number of instances when compared to the cardboard boxes however was also disadvantaged due to its bulky nature and the difficulties associated with transporting the product.

5.1.6 Summary

It was evident through the analysis that the participants' experiences in relation to the waffle footing innovation can be mapped to the five stages of the innovation process. Each of the seven organisations experienced the five stages of the innovation process individually. A summary is provided in how the participants experienced each of the five stages:

- Agenda-setting: the agenda-setting stage was critical in initiating the innovation process within organisations. The decision to create, develop and adapt the waffle footing innovation by the participants was the result of the participants' perceived performance gaps and engagement in opportunistic surveillance. The experiential problem solving method was used to appropriate an existing solution previously used elsewhere. The waffle footing

system was an adaptation of an existing construction method used in a different sector.

- Matching: the matching stage involved participants establishing the fit between problem and innovation. The decision to create, develop or adapt the innovation was largely driven by the potential to achieve improved work practices and economic rewards.
- Redefining: The development, refinement and promotion of the waffle footing innovation required increased expertise and capacity from a range of different participants. The requirement for increased capacity led to the creation of informal alliances and collaborative efforts between participants in the innovator group. The redefining stage involved the innovator group functioning as a cluster of visionaries driven by both altruistic and economic motivations.
- Clarifying: Only one story was coded into the clarifying stage. There was no resistance experienced in the footings contractor's implementation of the waffle footing system in the organisation because it improved the work practices of his staff members.
- Routinising: The routinising stage marked the completion of the innovation process within the organisations. It also was the start of when the innovation began to be diffused more widely across organisations in different tiers of the supply chain. Participants experienced a number of enablers and barriers in the diffusion of the innovation across organisations. A critique of the barriers and enablers is provided in *Section 6 Critique of barriers and enablers*.

The waffle footing innovation resulted from participants capitalising on a prior innovation whereby the waffle concept was adapted for use in the residential sector. Following on from initial creation the development, refinement and promotion of the innovation required increased capacity from a range of different participants. The analysis has demonstrated that there are various components to the innovation process. Various participants play different roles and contribute in response to the changing requirements throughout the process. This section was primarily focussed on the efforts of individual firms in the innovation process. The following section considers the collaborative efforts between firms in relation to the innovation process.

5.2 Innovator group inter-organisational process

As outlined previously, adopters are categorised by Rogers' (2003) as innovators, early adopters, early majority or laggards. Further to this there are two key phases in relation to the diffusion of an innovation:

- First is the creation of the innovation and that process by an 'innovator group'
- Second the adoption by others in the industry and the process of diffusion of the innovation.

The adopter categorisation by Rogers is applicable to the second phase of the innovation diffusion process but less useful for understanding the first phase involving the creation of an innovation and that process undertaken by the innovator group. Rogers' simplistic classification does not capture the characteristics of the different participants within the innovator group and the process undertaken by the different participants to create and deliver an innovation. Furthermore past research examined the factors affecting adoption and implementation of innovations *within* organisations by various adopter categories including early adopters (Walker, 2005; Manley and McFallen, 2006; 2008) and late adopters and laggards (London et al, 2007). The process undertaken by the innovator group *across* numerous organisations to create and deliver an innovation has been largely unexplored.

The present study has extended the work of past research (Rogers, 2003; Walker, 2005; Manley and McFallen, 2006; 2008; London et al, 2007) to examine the characteristics of the innovator group and the process undertaken to create and deliver an innovation in the residential construction industry. The analysis revealed two key findings, which are that:

- The innovation process undertaken by innovators to create an innovation involved inter-organisational collaboration across numerous firms
- The firms has various roles to play throughout the inter-organisational innovation process and can be categorized into four key types including innovator-creator, innovator-developer, innovator-adaptor and innovator-diffuser.

5.2.1 Inter-organisational collaboration

Analysis of the interviews validated findings of past research related to the five stages of the innovation process (Rogers, 2003). Each of the seven participant organisations interviewed experienced the five stages of the innovation process. The within-case analyses of each of the seven organisations related to the five stages of the innovation process were presented in *Section 4.3 Description of case study results*. Within each firm, the decision to create, develop and/or adapt the waffle footing innovation resulted in firms experiencing the five stages of the innovation process; namely, agenda-setting, matching, redefining, clarifying and routinising stages. The initial decision undertaken by each firm to create, develop or adapt an innovation was an *organisational* process.

Following this the actual process of creating, developing, adapting and ultimately delivering the waffle footing innovation was an *inter-organisational* process which required collaborative efforts between various firms. The analysis demonstrated that the successful delivery of the waffle footing system innovation to the residential construction industry required significant input from numerous firms. Because each firm did not have enough resources and 'pull' to create, develop and adapt the waffle footing innovation, effective delivery of the innovation relied upon a group of firms involved in various phases of the innovation process.

Therefore the firms within the innovator group were concurrently participating in two different processes (refer to Figure 4.10):

- an organizational process whereby each firm individually experienced the five stages of the innovation process including agenda-setting, matching, redefining, clarifying and routinising

- a broader *inter-organisational process* whereby numerous firms entered and left the process in response to the specific requirements of the different phases of innovation creation, development, adaptation and diffusion.

A key point to note is that not all the firms were involved throughout all phases of the creation, development, adaptation and diffusion of the waffle footing innovation. Each firm was involved in either the creation, development, adaptation or diffusion or combinations of the different phases in the inter-organisational innovation process. This is significant because it indicates that each firm had a different role to play within the inter-organisational innovation process.

5.2.2 Innovator group categorisation and roles

One of the key findings of this research is a more refined categorisation of firms within the innovator group. The discussion in the previous section demonstrated that the firms within the innovator group had various roles to play at different phases of the innovation process in the successful delivery of the waffle footing system. There is an accepted broad classification of “innovators” (Rogers, 2003) and yet this probably does not capture the specific characteristics of the different types of innovators. We propose the following definitions:

- Innovator-creator: those who are responsible for initiating and creating the innovation.
- Innovator-developer: those who contribute towards the design and development of the innovation
- Innovator-adapter: those who contribute to the innovation by modifying/adapting the innovation
- Innovator-diffuser: those who enter at latter phases and contribute to the innovation by promoting or diffusing the innovation

5.2.3 Summary

In summary the discussion in this section has highlighted the following:

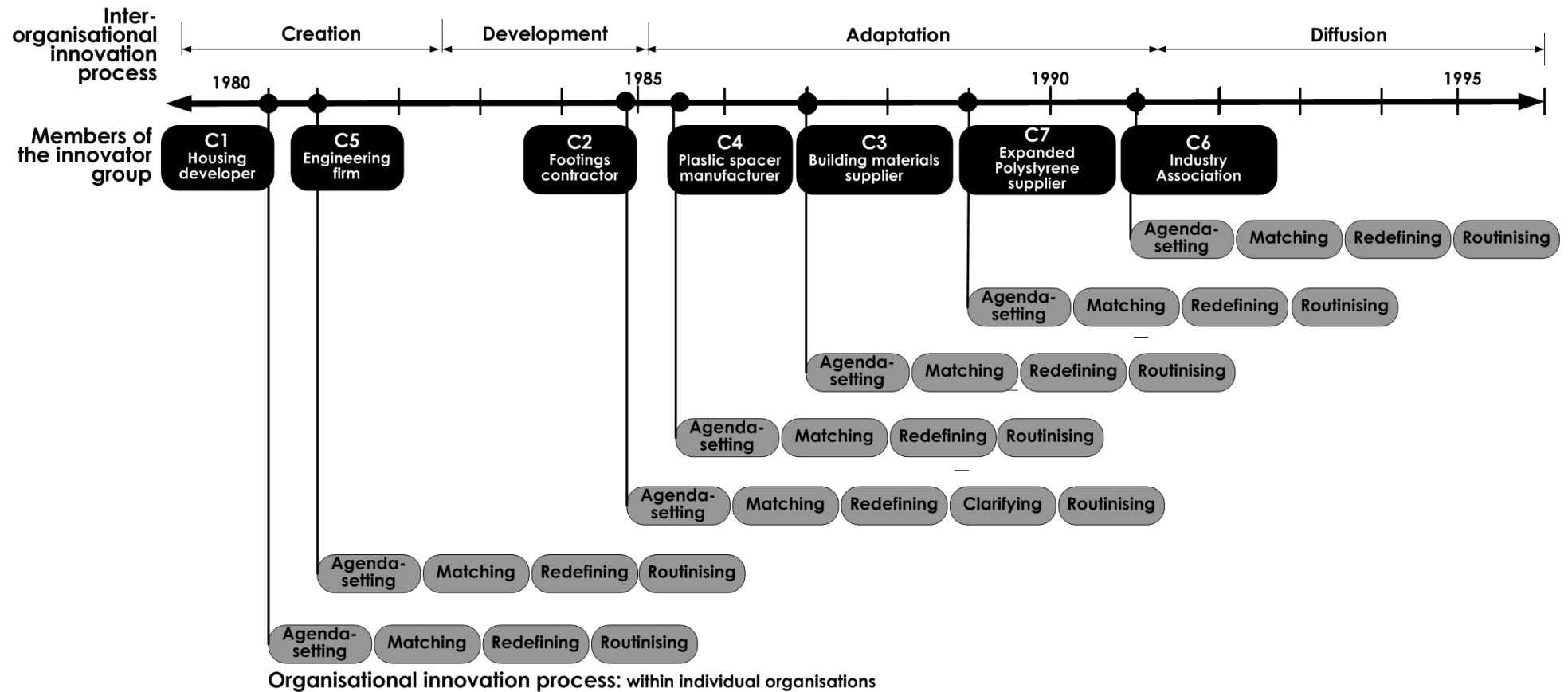
- Inter-organisational and organisational innovation process: The firms participated in two innovation processes; ie within individual firms (agenda-setting, matching, redefining, clarifying and routinising) and across numerous firms (creation, development, adaptation and diffusion).
- Innovator group typology: The firms within the innovator group can be categorized into four key types including innovator-creator, innovator-developer, innovator-adapter and innovator-diffuser based upon the contributions they made to the innovation process.

Whilst firms were required to undergo each stage of the organizational innovation process, the inter-organisational innovation process involved firms moving in and out of the cluster in response to circumstantial needs. The firms had different roles to play and contribute to different stages of the innovation process. There is a need to identify the contributions which various firms make in relation to the waffle footing innovation process.

Recommendation 5.1

Publish the description of the innovation process pathway as a generic construct more widely to industry in a brochure and/or presentations/forums. The findings of the study should be presented to the organisations within the Alliance. The findings should be presented to the academic community.

Figure 5.1 Inter-organisational and organisational innovation process of the waffle footing system



5.3 Critique of barriers and enablers

5.3.1 Barriers

Barriers were experienced by the seven participant organisations at each stage of the innovation process including creation, development, adaptation and diffusion. Many of the barriers are consistent with those identified previously in the literature. However this research moved beyond simply identifying the barriers to:

- clarify in detail how the barriers were overcome, and
- understand the characteristics of an innovator group who were successful in the delivery of an innovation to the residential housing industry.

In the beginning of the project it was suspected that there would be a high degree of variability in how firms responded to problems given the changing situational needs of the different stages of the innovation process. Indeed the analysis demonstrated that at each stage the firms experienced different problems resulting in the need for appropriate strategies to suit the changing requirements of the innovation process. Perhaps the only consistent feature was that change occurred throughout all stages of the innovation process. This does not come as a surprise given that innovations are about change – whether major or minor – the innovation process brings about change to all those participants involved. The creation, development, adaptation and diffusion of innovations necessitate changes to organisational structures, work practices and processes and personal and business relationships.

Therefore the innovation process is dynamic. A critique of the barriers to innovation identified in this research highlighted that rather than dealing and coping with change in a reductionist manner the challenge of successfully delivering an innovation is to embrace its dynamic nature. An important finding of this research is the clarity and detail achieved about how barriers were overcome by the innovator group and the classification of a typology of four distinct categories of innovators. The four categories of innovators were described in *Section 5.2 Innovator group: innovation process and typology*.

At each stage of creating, developing, adapting and diffusing the innovation, when experiencing barriers at different stages there appeared to be a common way in how barriers were overcome. The way that the innovator group overcame barriers related to how they responded effectively as a group to changes throughout the innovation process. Specifically it was the clear awareness of the inter-changeability of roles and relationships across the group of firms throughout the innovation process and the capacity to respond and adapt strategies to suit the changing requirements of the innovation process.

The following section considers reflexivity theory as it provides a method to critique the characteristics of the innovator group in how they successfully delivered the waffle footing innovation to the residential housing industry.

5.3.2 Reflexive capability

Reflexivity has its derivation in sociological research (Giddens, 1991) and is a useful concept to borrow. Reflexivity is based on a positive interpretation of change and a continual responsiveness to change by participants in the system. A reflexive capability approach to the innovation process is needed, as it is highly appropriate to the dynamic and complex environment of the innovation environment. Reflexive capability is thus a characteristic of the innovator group which successfully delivered the waffle footing innovation to the housing construction industry.

To be reflexive means a continual responsiveness to change by members of the innovator group. Members need to have some self-awareness about what is required to solve the problems experienced at each stage of the innovation process and be conscious of that constantly changing environment. Members also need the skills and mechanisms to allow for change. In summary there are three key dimensions to reflexivity:

- Awareness: Members of the innovator group need self-awareness about what is required to solve the problem in terms of the expertise, knowledge, social networks, etc required at different stages of the innovation process
- Responsiveness: Members need to consciously identify where the expertise, knowledge, social networks, etc reside, identify ways to access the expertise and knowledge and draw upon the collective contributions of the group to suit different circumstances of the innovation process
- Adaptability: Members, individually and collectively need to have openness to inter-changeability in the group's practices, procedures and relationships to align with the requirements of the creation, development, adaptation and diffusion of the innovation. The individual firm business culture also needs to be supportive of change.

A reflexive capability approach views that any given position in the innovation process requires a specific set of resources in terms of expertise, knowledge, social networks, etc. Based upon this understanding innovators need to have detailed awareness of the specific resources required at all times and an understanding of where they resided. Furthermore it involves understanding the ways to access the resources in response to the creation, development, adaptation and diffusion of the innovation. As we proceeded to the next stage of analysis these various forms of resources can be categorised into three types of non-economic capital including social, cultural and intellectual capital. The innovator group's strategic management of social, intellectual and cultural capital to develop the three key dimensions to reflexivity was the primary means through which barriers to the creation, development, adaptation and diffusion of the waffle footing system innovation were overcome.

5.3.3 Strategic management of social, cultural and intellectual capital to develop reflexive capability

A number of themes arose in relation to enablers which facilitated the creation, development, adaptation and diffusion of the innovation. Enablers tended to be discussed in the interviews in the form of trust, relationships, credible artefacts, credentials, knowledge and intellectual property which resided in the different firms within the supply chain at different phases of the innovation process (refer to Table 4.3). These various enablers can be grouped into social, cultural and intellectual capital.

Table 5.7 Enablers for the creation, development and adaptation of the waffle footing system innovation: Social, cultural and intellectual capital

Enablers							
Social capital	C1	C2	C3	C4	C5	C6	C7
Mutual understanding and trust based on business motivation	√	√			√		
Development of alliances/relationships to access required resources	√		√		√	√	√
Cultural capital	C1	C2	C3	C4	C5	C6	C7
Acquisition of recognisable artefacts in developing reputation	√				√	√	√
Accessing credentials and authority through association	√				√	√	√
Intellectual capital	C1	C2	C3	C4	C5	C6	C7
Identification and integration of knowledge domains	√	√		√	√	√	√
Intellectual property	√	√		√	√	√	√

Social capital

Social capital arises from the creation of personal relationships and business networks based on trust built over time. According to Cohen and Prusak (2001, p.4), “social capital consists of the stock of active connections among people: the trust, mutual understanding and shared values and behaviours that bind the members of human networks and communities and make cooperative action possible”. Two key themes identified in relation to the innovator group’s management of social capital include:

- Trust, mutual understanding and shared values based upon business motivation
- Development of alliances and relationships to access required resources

Social capital generates a set of rules and norms which subsequently shapes the behaviour of members in a network (Cova and Ghauri, 1996; Skaates et al, 2002). Members belonging to specific networks share tacit knowledge and an implicit social contract which establishes their ways of working and behaving within the network. Such an implicit social contract was critical in the development of the waffle footing system innovation whereby each participant recognised their specific role in relation to the innovation process which led to a “happy meeting” of like-minded professionals. As the footing contractor explained:

“...to work in with the waffle system I think C5 [engineering firm] thought of it, C1 [housing developer] took it, I produced it and it was just a happy meeting and we were all happy to work with each other” (Managing director, Footing contractor - C2)

Social capital in the form of trust, mutual understanding and shared values between the members of the innovator group was central in enabling cooperative behaviour to occur particularly during the development stage of the innovation process. Trust, mutual understanding and shared business values is exemplified in what the participants referred to as “ethical trading”.

“... they believed in it because I think we had a good...ethical trading. We always try to fulfil our part to pay you on time when we were sure the quality was fine. I mean you’ve got to look after these people” (State building manager, Housing developer - C1)

"And C1 always paid me on time so no major dramas. It's the most important thing for any contractor...and if I didn't do it successfully he would've found somebody else and at the right price. As much as I like the guy you know business is business. And because I was doing my job right I had no problems" (Managing director, Footings contractor - C2)

This quote by the footings contractor, C2 reveals the significance of receiving timely payments which was mutually understood by the housing developer, C1, who recognised that as the "client" there was a need to "fulfil our [their] part...and look after these people". Underpinning this though was the business motivation of the different parties to practice ethical trading principles. The housing developer trusted the expertise of the footings contractor in producing the quality which was required, "pay you on time when we were sure the quality was fine". This was mutually understood by the footings contractor who indicated that, "because I was doing my job right I had no problems"

Social capital appears to be a highly valued commodity by the innovator group. There trust and respect evident to initiate the pilot project:

"And C1 gave us this block of land and that footings was built for free. All the suppliers and contractors contributed to it so people were happy to put in as an industry...So there was quite a bit of visionary in doing that. A long commitment type of thing" (Managing director, Engineering firm - C5)

Given the infancy of the innovation there was an element of risk associated with its development. Resources invested by members of the group may not generate any significant profit for them. With little to guarantee return on investment there must be trust in the other players in the ability to develop and implement the innovation successfully. The cultural capital of specific players and in particular, the housing developer C1 played a large part in the development of trust and respect.

Cultural capital will be discussed in a later section, however, it is useful to provide a brief definition now. Cultural capital is the embedded "culture" of an individual, referring to the ensemble of resources including "verbal facility, general cultural awareness, aesthetic preferences and educational credentials" (Schwartz, 1997). Cultural capital takes shape in three ways, namely, embodied, objectified and institutionalised (Bourdieu, 1986). Embodied cultural capital is the form that is inherited through socialisation which cannot be transferred like a gift (Bourdieu and Passeron, 1990). Objectified cultural capital refers to the cultural goods an individual possesses such as works of art, dress and buildings. Institutionalised cultural capital refers to the academic credentials held by an individual which is clearly recognised and guarantees a certain institutional value.

Within the context of the innovation process, cultural capital are the recognisable artefacts such as patents, regulatory approvals and accreditations, publications and completed pilot projects and typically these artefacts manifest because of the other forms of capital. These artefacts build the reputation of the innovation. Cultural capital also refers to the professional credentials held by those associated with the innovation which guarantees a certain value recognised by other players. The cultural capital of the housing developer as being "an attractive customer" and having the "trading respect" was critical in the development of trust:

"I think probably the size of the organization in that state was good. It was small enough to be flexible and allow me to do this but not too small to not have a volume attraction so they're enablers if you like. You've got to get yourself to a point where you can actually have flexibility in your thinking and innovation but then big enough to be able to be an attractive customer. And I don't think this would've happened if we hadn't had that trading respect. I was certainly respected and certainly at the time the enthusiasm for this was quite strong from those guys" (State building manager, Housing developer, C1)

The importance of social networks for the innovator group was also recognised in the ability to access various forms of resources residing in different players in the supply chain. The group was able to build upon initial individual resources to develop a collaborative network to help spread risks and reduce developmental costs. Members in the group benefited through

being in a symbiotic relationship with each other as described by the building materials supplier, C3 with members contributing to different parts of the innovation process including provision of “plots of land” (housing developer, C1), conducting “a bit of promotion” (housing developer, C1 and engineering firm, C5), expertise of “a manufacturer” (building materials supplier, C3) and access to “contacts” (building materials supplier, C3):

“They [the engineering firm, C5] developed it, and they were doing work for the housing developer C1 at the time and so as such C1 gave them plots of land...and they would do a bit of promotion...They knew they couldn’t do it alone and they needed both a manufacturer...who was in the building industry. They [building materials supplier, C3] had contacts within the building industry...its predominantly through supplies so that network was there so that’s why it suited both parties” (Sales representative, Building materials supplier - C3)

There was clear recognition of the importance of developing and utilising social capital to overcome specific lack of resources within the group. As the sales representative from C3 explained, whilst the housing developer and engineering firm were able to develop the innovation up to a certain stage, there was still a need to promote and distribute the system and in order to achieve this the group established an alliance with the building materials supplier who was “both a manufacturer” and “had contacts within the building industry”.

Intellectual capital

The significance of the concept of intellectual capital in the story of the waffle footing system has been highlighted in *Section 4.2 Intellectual capital, intellectual property and patents*. However it is worthwhile to explain further the nature of the intellectual capital and in particular the extent of overlapping knowledge domains and shared intellectual capital. As defined in *Section 4.2 Intellectual capital, intellectual property and patents* intellectual capital refers to the knowledge base of the group of firms in terms of expertise, skills, experiences and competences in the creation, development and implementation of the waffle footing system innovation. The management of intellectual capital for the greater benefit of the innovator group and ultimately the innovation was a critical aspect of the successful implementation of the innovation. Two key themes were identified in relation to the innovator group’s management of intellectual capital:

- Identification and integration of knowledge domains
- Formalisation of intellectual capital

Different skills and capacities attributed to the various players in the innovator group in the form of specific knowledge domains is a dominant reference to intellectual capital on this study. During the initial phase, the knowledge domains of engineering structural design and materials performance, costing, building flow and construction methodology were critical in the creation of the waffle footing innovation. The effective integration of the various knowledge domains in order to create the waffle footing system innovation was critical and C1 played the key coordinating role:

“...this is what you have a strategic alliance partners to do. I was just the poor old builder. I realised all I was there for was just to control the building flow...We knew we had to get research-based information to support this development...I realised we had to go through a series of significant changes in getting regulations altered ...and I couldn’t do that...So we used our engineers for doing this” (State building manager, Housing developer - C1)

The management of inter-firm supply chain relationships in terms of knowledge domains was central. There was a need to identify the specific processes required to develop the innovation, to identify where the knowledge domains resided and to match players with the appropriate skills and capacity to tasks accordingly. Given the novelty of the system, C1 explained that not only was there a need to acquire “research-based” information to support its development, but it was also important to obtain the necessary regulatory approvals to which C1 relied upon the expertise and competences of C5. It was this clear awareness of

the specific requirements for development of the innovation and identification of the knowledge domains of supply chain players and an understanding of how to gain access to that intellectual capital through the use of social capital which facilitated the creation and development of the waffle footing system innovation. It is important to note that although the state building manager refers to himself as “just the poor old builder” there is a significant element of intellectual capital involved in “controlling the building flow” and also in creating the environment for the innovation to flourish. He explained how his understanding of people management was something he achieved through prior experiences of working internationally in the United Kingdom and South Africa:

“I learnt so much...basically it was all about people above anything else...it was all about how you organised and controlled people” (State building manager, Housing developer - C1)

C1’s accumulation of intellectual capital through experiential knowledge was thus a key contribution to the creation and development of the waffle footing innovation. Specifically he was able to undertake leadership in the development of strategies for accumulating the required resources upon identification and played a central role in the accumulation of social capital in exchange for other forms of capital, “this is what you have a strategic alliance partners to do”.

As the innovation became more established and refined the intellectual capital created by the innovation became increasingly apparent through a number of measurable indicators such as patents and publications. A measurable indicator of the intellectual capital of the system was the patents which were granted to a number of key players including the plastic spacer manufacturer, C4 and the engineering firm, C5 for various components associated with the waffle footing system. As highlighted previously, the history of the waffle footing system was chequered with litigations and patent disputes with participants seeking to own exclusive rights of the innovation’s intellectual capital.

“So that [litigations] was a major stuff up because people did have the fear that if they used it would they get bitten on the bum later on. And that sort of stymied the whole thing in the early stages and it didn’t need that” (Sales representative, Building materials supplier – C3)

“Each one of those patent decisions really led to... the manufacturers hesitated...and then there was another patent dispute and it hesitated” (EPS supplier – C7)

Achieving formal recognition of the intellectual capital created by the innovation through patenting was seen by the innovator group as something which would help with its commercialisation. It is important to note though that the dynamics of ownership and control over that intellectual capital resulted in a largely adversarial environment, which was felt to be not particularly conducive for the implementation of the innovation:

Cultural capital

Finally it is important to consider another type of capital which we refer to as cultural capital. As defined previously, cultural capital are the recognisable artefacts such as patents, regulatory approvals and accreditations, publications and completed pilot projects and typically these artefacts manifest because of the other forms of capital. These artefacts build the reputation of the innovation. Two key themes were identified in relation to the innovator group’s management of cultural capital:

- Acquisition of recognizable artefacts for developing reputation and credibility
- Accessing credentials and authority by association

The ability of the innovator group to effectively acquire certain significant artefacts such as publications and awards, regulatory approvals, accreditations and complete prototype projects was critical. The impact that the accruing of the artefacts has on how the innovation is perceived is central to the accumulation of cultural capital. It is the accumulation and demonstration of the acquisition of an array of artefacts that is significant in developing the

reputation of the innovation and associated innovator group after initial introduction to the industry.

As the engineering firm, C5 and housing developer, C1 highlighted, achieving accreditation, gaining acceptance of the system into the Australian standards and completing a pilot project for a real client marked key milestones in the development of the waffle footing innovation:

“we got the system accredited...by Victoria Building Commission very early in the piece...so that gave engineers the confidence about how to use it and really that was what it was about” (Managing Director, Engineering firm - C5)

“We took it through...to the first waffle pod for a client which had been fully council approved so the engineering group had been through all the process of getting the regulations accepted...the testing done. So the significance of it was that it was approved by the authority that had to approve footing systems and it was a breakthrough. So from that point it became accepted” (State building manager, Housing developer - C1)

“But we also spent a lot of time proving to the standards the waffle was a serious system. And that’s really why we did all this to get the credibility” (Managing Director - retired, Engineering firm - C5)

Each of these milestones contributed towards developing a reputation that the waffle footing system was “a serious system” as evidenced through previous success (pilot project) and acceptance by regulatory authorities. Cultural capital is thus a representation of the innovation’s credibility. Whilst acknowledging the importance of the product itself in developing a reputation for the innovation, the innovator group also recognised that presenting at forums such as conferences and producing publications relating to the waffle footing system provided cultural capital. This is significant because reputation circulates through social networks at different places which inevitably helps to shape the perceptions of potential adopters towards the system.

“I presented at a 1987 MBA conference in Queensland and out of that came a whole string of contacts. Then I presented in 1987 at a local government conference in Perth and out of that building surveyors who check and approve building applications all came to learn about it” (Managing Director, Engineering firm - C5)

The innovator group was able to invest in intellectual capital (publications) and used social capital (social networks) to exchange cultural capital (credibility). The recognition of publications and presentations as a particularly valuable resource for the innovator group establishes its connection with intellectual capital. A measurable indicator of the intellectual capital within the innovation was publications as a way of explicitly formalising the contribution and uniqueness of the innovation and dispel fears.

Cultural capital also refers to the professional credentials and capability held by individuals associated with the innovation which is clearly recognised and guarantees a certain value recognized by other players within a specific field. For the innovator group, this form of cultural capital was recognised as an important resource in a number of ways:

“One advantage was the Koukourous were a major structural engineering force. They were big, they had a lot of clients. They had a number of major builders under their wing so that really kicked it along quite well. It did help – it most certainly did help” (Sales representative, Building materials supplier - C3)

“C6 [industry association] promoted it. They had credibility so when they said that’s a good thing everybody believed it” (Managing Director, Engineering firm - C5)

These participants clearly acknowledged the reputation, authority and influence in professional status and expertise and economic capital of other players in the creation of cultural capital in the innovation process. The significance of social networks to develop cultural capital was also clearly recognised by the participants. Through this recognition they were then able to develop relationships and associate themselves with those who had specific backgrounds or characteristics and develop cultural capital. The association

provided access to the others' cultural capital such as the "credibility" of the industry association, C6 (C5) and the engineering firm being a "major structural engineering force" (C3) which provided the innovation increased recognition and reputation. The innovator group was thus able to accumulate cultural capital through both existing and newly acquired social capital.

5.3.4 Human capital transformation

The relationships between social, cultural and intellectual capital are complex (Bourdieu, 1992). The primary relationships between the various forms of capital are guided by an understanding of three key concepts; investment, exchange and accumulation of capital. The investment of a specific type of capital can be aimed at the accumulation of another form of capital. Alternatively the accumulation of a particular type of capital may be so that an exchange of another type of capital can take place.

Management of social, cultural and intellectual capital involves understanding the inter-relationships between forms of capital to leverage one form of capital to gain another. It also involves understanding the dynamics of the innovation process to identify the requirements of any given point in the creation, development, adaptation and diffusion stages and responding accordingly. The capacity to identify and access the appropriate social, cultural and intellectual capital is the primary enabler to the innovation process.

Some observations were made and discussed in the previous sections in relation to the strategies undertaken in the firms' practice of capital investment, accumulation and exchange in the innovation process. These observations are now explicitly outlined in Table 5.9 through a description of the capital transformation process matched to example quotes.

Table 5.8 Human capital transformation

Capital transformation	Description and example quotes
<p>1. Accumulation of social capital through cultural capital</p>	<p>There is an element of risk associated with the creation of any new product or process. The waffle footing system was no exception. Initial resources invested by firms may not have generated an equal amount of profit for them.</p> <p><i>“it was a brave move at the time...” (Managing director, Footings contractor, C2)</i> <i>“it was a very, very new thing. C3 (building materials supplier) was revolutionary” (Sales representative, Building Materials Supplier – C3).</i></p> <p>The footings contractor and the building materials supplier indicated that their firms’ involvement with the waffle footing innovation was “a brave move” and “revolutionary” given “it was a very, very new thing”. With little to guarantee return on investment the firms took a “leap of faith” in the decision to be involved with the creation, development, adaptation and/or diffusion of the innovation. There was trust in the other firms to successfully develop and diffuse the innovation. In this sense the credibility of the housing developer and the engineering firm was critical in the development of trust by other parties.</p> <p><i>“I think probably the size of the organization in that state was good...big enough to be able to be an attractive customer. And I don’t think this would’ve happened if we hadn’t had that trading respect...We always try to fulfil our part to pay you on time when we were sure the quality was fine” (State building manager, Housing developer, C1)</i></p> <p><i>“C1 (housing developer) always paid me on time...because I was doing my job right I had no problems” (Managing director, Footings contractor, C2)</i></p> <p><i>“Because what C5 (engineering firm) did...it was a very wise move, they started to use this and they started to develop it...and they were doing work for C1 (housing developer) at the time...C1 gave them plots of land to do one or two houses ...they would do a bit of promotion like photographs and that sort of business... Things that showed people” (Sales representative, Building materials supplier – C3)</i></p> <p>The reputation and credentials held by the housing developer and engineering firm as well as the innovation itself were recognised by the other players as being critical in the development of trust. Because the housing developer was “an attractive customer” with a significant volume of work and had the “trading respect” the other firms were assured that they would 1. gain access to potential future work, and 2. receive fair and timely payment. The reputation of the innovation which was developed by both the engineering firm and housing developer through completion of pilot projects and “promotion” was also important. Each of these artefacts contributed to the development of a reputation and “showed people” that the waffle footing system was credible.</p> <p>Cultural capital in the form of the key participants’ credentials and the reputation of the innovation were thus critical elements in the development of trust (social capital) by the other players. In this case social capital was accumulated through cultural capital.</p>

Table 5.9 (continued) Human capital transformation

Capital transformation	Description and example quotes
<p>2. Investment in social capital to accumulate intellectual and cultural capital</p>	<p>The importance of social networks was recognised in the ability to access other forms of capital residing in different players in the supply chain. Through social capital, firms were able to build a collaborative network to not only help spread risks and but also overcome lack of resources.</p> <p><i>“This is what you have a strategic alliance partners to do. I was just the poor old builder. I realised all I was there was just to control the building flow...We knew we has to get research-based information to support this development...go through a series of significant changes in getting regulations altered...I couldn’t do that...we used our engineers for doing this” (State building manager, Housing developer – C1)</i></p> <p><i>“They knew they couldn’t do it alone and they needed both a manufacturer...who was in the industry. C3 (building materials supplier) had contacts within the building industry...that network was there” (Sales representative, Building materials supplier – C3)</i></p> <p>The firms were clearly aware of the need to invest and utilise social capital to accumulate intellectual and cultural capital. The housing developer identified the need to access “research-based information” and obtain regulatory approvals which was where the “strategic alliance” was critical. There was also the need to gain access to the expertise of a “manufacturer” as well as “contacts within the building industry” for the commercialisation of the system. By investing in social capital through the development of the strategic alliance members were able to access a pool of collective resources residing in various players. In this case participants were able to accumulate intellectual and cultural capital through initial investment in social capital.</p>
<p>3. Investment in intellectual capital to exchange cultural capital through the use of social capital</p>	<p>The acquisition of certain artefacts such as publications and presentations impact upon how an innovation is perceived which in turn is central to the accumulation of cultural capital. Presenting at forums such as conferences and producing publications relating to the waffle footing system provided reputation for the innovation. This is significant because reputation circulates through social networks which helps to shape the perceptions of potential adopters.</p> <p><i>“I presented at a 1987 MBA conference in Queensland and out of that came a whole string of contacts. Then I presented in 1987 at a local government conference in Perth and out of that building surveyors who check and approve building applications all came to learn about it” (Managing Director, Engineering firm - C5)</i></p> <p>The recognition of publications and presentations as a valuable resource for the innovation establishes its connection with intellectual capital. The production of publications is a way of formalising the contributions and uniqueness of the innovation and helps to dispel fear and reduce uncertainty. These publications and presentations are a measurable indicator of the intellectual capital within the innovation. Within this context the engineering firm invested in intellectual capital (publications/presentations) and used social capital (social networks) to exchange cultural capital (credibility).</p>

Table 5.10 (continued) Human capital transformation

Capital transformation	Description and example quotes
4. Accumulation of cultural capital through social capital	<p>The significance of social capital to accumulate cultural capital was recognised. Participants were clearly aware of the significance in the professional credentials and capability held by key players which guaranteed a certain value recognised by other players.</p> <p><i>“One advantage was the C5 (engineering firm) were a major structural engineering force. They were big. They had a lot of clients. They had a number of major builders under their wing so that really kicked it along quite well. It did help – it most certainly did help” (Sales representative, Building materials supplier - C3)</i></p> <p><i>“C6 [industry association] promoted it. They had credibility so when they said that’s a good thing everybody believed it” (Managing Director, Engineering firm - C5)</i></p> <p>Participants acknowledged the reputation, authority and influence in professional status and expertise of other players in the creation of cultural capital. The engineering firm’s reputation and professional influence was critical in the sense that they were “big”, “had lots of clients” and “had a number of major builders under their wing”. The credibility of the industry association was also felt to be important given the level of influence and reach it had through its professional membership base.</p> <p>The use of social capital in the form of social networks was seen as a way to gain access into the reputation, authority and influence of other players. Through this understanding participants developed relationships and associated themselves with those with specific professional status and credentials to develop cultural capital. Through the association participants were provided access to the others’ cultural capital such as their reputation of being “a major structural engineering force” and “credibility”.</p>

Scarce resources means one firm may not supply all the necessary expertise and knowledge required to respond to all stages of the innovation process. However the dynamics of capital accumulation, investment and exchange enables firms to build upon initial resources to rapidly respond to the changing requirements of the innovation process through an integrated supply chain approach. The various examples outlined in this section has demonstrated the benefits and value of the inter-relationships between various forms of capital for integrated supply chain innovation.

5.3.5 Reflexive capability pathway for integrated supply chain innovation

A critique of the barriers and enablers allowed the development of a structured methodology of 'best practice' for innovations requiring an integrated supply chain approach. The study focused on the organizational, communication and economic contextual factors as they relate to the technological innovation rather than the technical factors of the innovation.

Figure 5.2 Reflexive capability pathway for integrated supply chain innovation

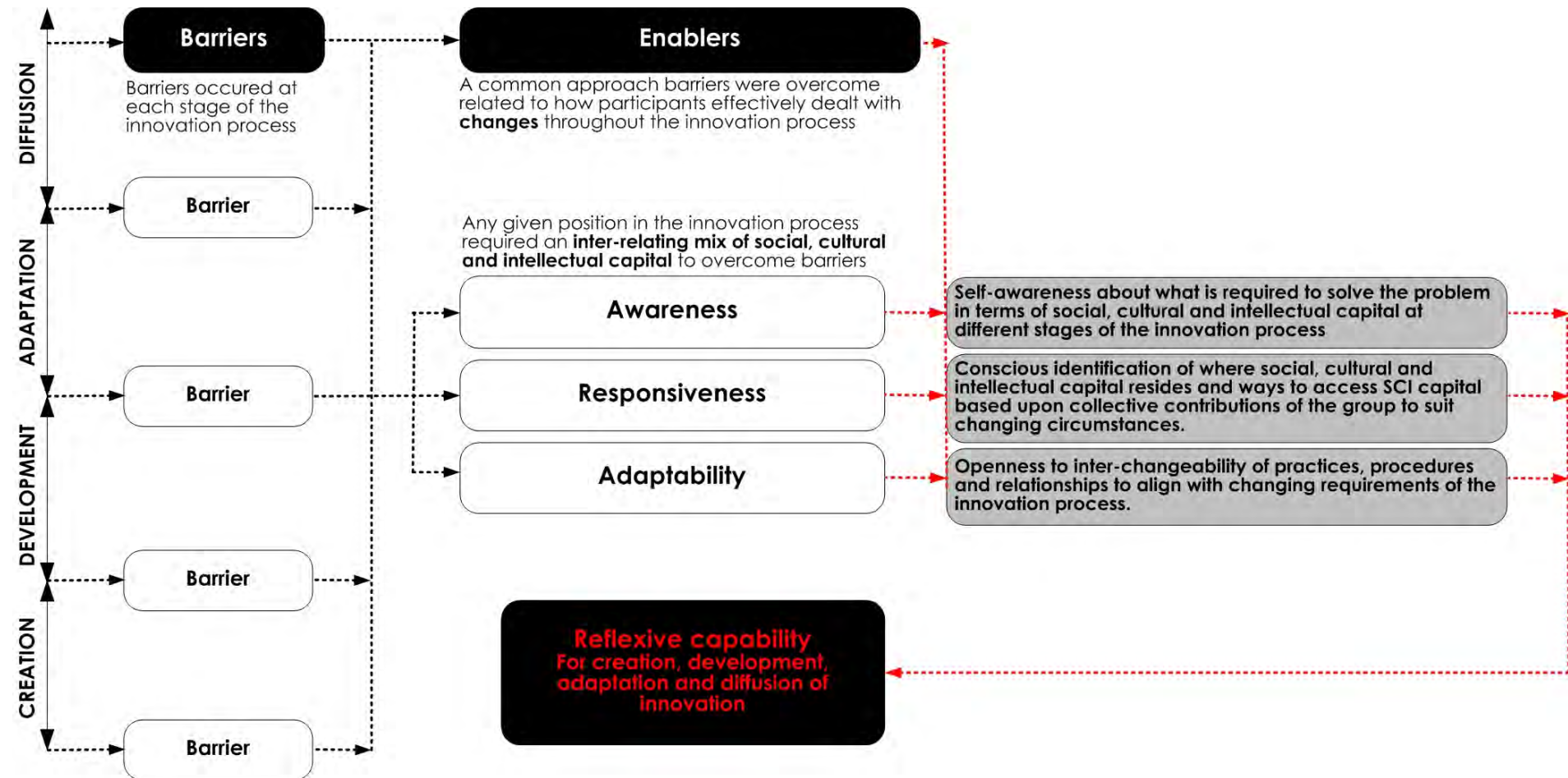


Figure 5.2 presents a reflexive capability pathway from barriers to enablers through an integrated supply chain approach. As previously outlined, at each stage of the innovation process the firms experienced different barriers. As a result the firms needed to constantly respond and adapt strategies to suit the changing requirements of the innovation process. Innovations are thus about change and a key challenge in the effective delivery of innovations is the capacity to deal with change in an appropriate manner.

Even though the innovation environment was characterised by constant change there is a common underlying theme in what is required to overcome barriers. The underlying theme is that any given position in the innovation process requires an inter-relating mix of social, cultural and intellectual capital to overcome barriers.

Therefore a common approach in how firms can deal with barriers and respond to change revolve around the strategic management of social, cultural and intellectual capital. Through an understanding of the inter-relationships between capital, firms can invest, accumulate and exchange social, cultural and intellectual capital to rapidly respond to changing situational needs of the innovation process.

Three important observations are made in how the innovator group effectively overcame barriers related to the innovation process:

- Firstly the group of firms was clearly aware of the social, cultural and intellectual capital required to solve the problems at each phase of innovation creation, development, adaptation and diffusion (awareness)
- Secondly the group responded to the identified problems through identification of where the social, cultural and intellectual capital resided and drew upon the collective contributions of firms to suit different circumstances (responsiveness)
- Thirdly the roles and responsibilities of firms within the group were constantly adapted and re-strategised to align with the changing requirements of the different phases (adaptability)

These are the three dimensions to reflexivity. Findings of the group of firms discussed in this project identifies that barriers are primarily the result of a low degree of reflexive capability. Enablers demonstrated by the innovator group are the product of increasing reflexive capability. The successful creation, development, adaptation and diffusion of the waffle footing system thus resulted from the high level of reflexivity of the firms in the innovator group.

5.3.6 Summary

The analysis demonstrated that at each stage the firms experienced different problems resulting in the need for appropriate strategies to suit the changing requirements of the innovation process. Instead of simply identifying the specific barriers which occurred at each stage of the innovation process, a more useful approach undertaken in this research has been to identify common themes in how those barriers were overcome. The way that the innovator group overcame barriers related to the clear awareness of the inter-changeability of roles and relationships across the group of firms throughout the innovation process. It also relied upon the firms' capacity to respond and adapt strategies to suit the changing requirements of the innovation process.

Reflexivity theory provided a method to critique the characteristics of the innovator group in how they successfully delivered the waffle footing innovation to the residential housing industry. A reflexive capability approach views that any given position in the innovation process requires a specific set of resources in terms of social, cultural and intellectual capital. Innovators need to have detailed awareness of the specific capital required at all times and an understanding of where they reside. Furthermore it involves understanding the ways to access the various forms of capital in response to the creation, development, adaptation and diffusion of the innovation.

The analysis has demonstrated that the successful delivery an innovation across a project-based and fragmented industry such as the housing construction sector is based upon a group of firms' strategic integration of the collective social, cultural and intellectual capital. In summary the three types of capital were critical because:

- Social capital in the form of business trust, mutual understanding and shared values enabled cooperative behaviour to occur. The importance of social networks was also recognized in the ability to access other forms of capital residing in different players in the supply chain.
- The role of cultural capital was instrumental in building the reputation and credibility of the innovation.
- The effective identification and integration of knowledge domains facilitated the creation, development and adaptation of the innovation. Achieving formal recognition of the intellectual capital of the innovation helped in its commercialization.

A general theme running through the analysis is the fluid nature of the different forms of capital and their interconnectivity. The analysis has shown that the various forms of capital can be easily transformed into or leveraged into other forms of capital. The interrelationships between the three types of capital were demonstrated to be critical towards overcoming barriers at different stages of the innovation process.

Management of social, cultural and intellectual capital thus involves understanding the interrelationships between forms of capital. In doing so firms are able to utilise and leverage one form of capital to gain another. It also involves understanding the dynamics of the innovation process to identify the requirements of any given point in the innovation process. Furthermore firms need to have the capacity and flexibility to integrate the various forms of capital to respond to the requirements. The group's capacity to overcome problems through the management of social, cultural and intellectual capital indicates their degree of reflexive capability.

The analysis demonstrates that barriers are primarily the result of a low degree of reflexive capability. Enablers demonstrated by the innovator group are the product of increasing reflexive capability. The successful delivery of innovations is reliant upon the innovator group's high level of reflexivity. Therefore there is a need to develop appropriate measures to assess firms' (individually and collectively) levels of reflexivity in relation to the delivery of innovations.

Recommendation 5.2

After further studies to validate these findings a much more useful and detailed innovation assessment tool/decision framework could be developed.

Recommendation 5.3

Develop communication plan adapted for different audiences

6. IMPLICATIONS FOR PRACTICE

6.1 Conclusions

This project sought to undertake a case study analysis of the successful delivery of an innovation to the Australian housing construction industry by an “innovator group” which required an integrated construction supply chain model. An underlying assumption of this study was that there is a structured methodology which can be developed to describe a pathway for supply chain integration to enable effective delivery of innovations. The innovation can be either incremental or monumental, product or process that will improve the performance of the industry.

6.1.1 Theory

The theory that provided the framework for this study was a combination of diffusion theory and construction supply chain theory. Although there has been a long history of diffusion research there has been very little attention paid to the creation of the innovation and that process undertaken by the ‘innovators’. This research has therefore been exploratory. It examined the collaborative efforts between firms along supply chains in the creation, development, adaptation and diffusion of an innovation in a fragmented industry such as the housing sector.

The general research question addressed was: “What is the pathway for creation, development and adaptation of an innovation by the innovator group?”

6.1.2 Method

Towards this end research was conducted on the experiences of the innovator group to create, develop and adapt the waffle footing system innovation. Eight in-depth interviews with participants from seven organisations were conducted for this study. This investigation described the chronological history of the creation, development and adaptation of the waffle footing system innovation including key players, events, drivers and decisions. It also identified the barriers and enablers to the creation, development and adaptation of the innovation. The characteristics of the process of integration of the construction supply chain towards the creation, development and adaptation of an innovation were identified and a methodological process pathway to innovation creation, development and adaptation for an integrated housing construction supply chain developed.

6.2 Innovator group innovation process and typology

The present study has extended the work of past research to examine the characteristics of the innovator group and the process undertaken to create and deliver an innovation in the residential construction industry. The analysis revealed two key findings, which are that:

- The innovation process undertaken by innovators to create an innovation involved inter-organisational collaboration across numerous firms
- The firms have various roles to play throughout the inter-organisational innovation process and can be categorized into four key types including innovator-creator, innovator-developer, innovator-adaptor and innovator-diffuser.

6.2.1 Inter-organisational collaboration

Analysis of the interviews validated findings of past research related to the five stages of the innovation process. Within each firm, the decision to create, develop and/or adapt the waffle footing innovation resulted in firms experiencing the five stages of the innovation process; namely, agenda-setting, matching, redefining, clarifying and routinising stages. The initial decision undertaken by each firm to create, develop or adapt an innovation was an *organisational* process.

Following this the actual process of creating, developing, adapting and ultimately delivering the waffle footing innovation was an *inter-organisational* process which required collaborative efforts between various firms.

Therefore the firms within the innovator group were concurrently participating in two different processes (refer to Figure 4.10):

- an organizational process whereby each firm individually experienced the five stages of the innovation process including agenda-setting, matching, redefining, clarifying and routinising
- a broader *inter-organisational process* whereby numerous firms entered and left the process in response to the specific requirements of the different phases of innovation creation, development, adaptation and diffusion.

A key point to note is that not all the firms were involved throughout all phases of the creation, development, adaptation and diffusion of the waffle footing innovation. Each firm was involved in either the creation, development, adaptation or diffusion or combinations of the different phases in the inter-organisational innovation process. This is significant because it indicates that each firm had a different role to play within the inter-organisational innovation process.

6.2.2 Innovator typology and roles

One of the key findings of this research is a more refined categorisation of firms within the innovator group. The discussion in the previous section demonstrated that the firms within the innovator group had various roles to play at different phases of the innovation process in the successful delivery of the waffle footing system. There is an accepted broad classification of “innovators” (Rogers, 2003) and yet this probably does not capture the specific characteristics of the different types of innovators. We propose the following definitions:

- Innovator-creator: those who are responsible for initiating and creating the innovation.
- Innovator-developer: those who contribute towards the design and development of the innovation
- Innovator-adapter: those who contribute to the innovation by modifying/adapting the innovation
- Innovator-diffuser: those who enter at latter phases and contribute to the innovation by promoting or diffusing the innovation

6.3 Critique of barriers and enablers

The identification of barriers and enablers achieved through this study is significant in that it allowed a critique of the unique characteristics relating to the pathway undertaken by the innovator group to create, develop, adapt and diffuse the waffle footing system innovation. This required appropriate management of functional relationships within organisations and also more importantly the inter-firm relationships in the supply chain.

Barriers to the innovation process were generally considered as resulting from the lack of awareness of the resources and access to specific resources relevant to particular stages of the innovation process. Enablers were identified as the appropriate management and integration of the various resources in the form of social, cultural and intellectual capital which resided in the different firms within the supply chain at different phases of the innovation process.

The innovation process is dynamic. A critique of the barriers to innovation identified in this research highlighted that rather than dealing and coping with change in a reductionist manner the challenge of successfully delivering an innovation is to embrace its dynamic nature. The way that the innovator group overcame barriers related to the clear awareness of the inter-changeability of roles and relationships across the group of firms throughout the innovation process and the capacity to respond and adapt strategies to suit the changing requirements of the innovation process.

6.3.1 Reflexive capability

Reflexivity theory provided a method to critique the characteristics of the innovator group in how they successfully delivered the waffle footing innovation to the residential housing industry. A reflexive capability approach views that any given position in the innovation process requires a specific set of resources in terms of social, cultural and intellectual capital. Innovators need to have detailed awareness of the specific resources required at all times and an understanding of where they reside. Furthermore it involves understanding the ways to access the resources in response to the creation, development, adaptation and diffusion of the innovation.

Findings of the case studies identified that barriers were primarily the result of a low degree of reflexive capability, and that enablers demonstrated by the innovator group were the product of increasing reflexive capability. The group's capacity to overcome problems through the management of social, cultural and intellectual capital indicated their degree of reflexive capability. This capability consisted of a detailed awareness of the specific resources required and where they resided within the supply chain and further to that an understanding of ways to access the resources in response to the creation, development and adaptation of the innovation through an integrated supply chain approach. The innovator group's strategic management of social, intellectual and cultural capital to develop the three key dimensions to reflexivity was the primary means through which barriers to the innovation process were overcome.

6.3.2 Inter-capability analysis: social, cultural and intellectual capital

The results indicate that the successful creation, development and adaptation of the waffle footing innovation relied upon the effective management of social, cultural and intellectual capital across firms in the innovator group. Whilst one firm may not have all the necessary resources for the various stages of the innovation process, the collaborative efforts between firms and integration of social, cultural and intellectual capital enabled the innovator group to pull together resources in response to the specific requirements of the different phases of the innovation process. Furthermore these three forms of capital can be highly fluid and interchangeable, transforming into or being leveraged to create another form of capital.

Effective delivery of an innovation thus results from the strategic ways in which capital is invested, accumulated and exchanged to enable members to rapidly respond to changing stages of the innovation process and situational needs. At different times throughout the innovation process various key players of the innovator group moved in and out of the cluster. Relationships between firms in the waffle footing innovation process were constantly formed and reformed in response to the needs of the specific phase of the innovation process. The collaborative relationships between supply chain players were not permanent and indeed both dynamic and transient. Furthermore the upstream and downstream linkages between firms influenced the innovation process in both enabling and inhibiting ways.

In either case, an explicit mapping of each firm's role and contributions is important to enable supply chain integration for effective delivery of an innovation. Members within the innovator group were found to be placed along a continuum in terms of the levels and types of capital each firm had. Table 6.3 maps the type of capital each firm contributed in the creation, development, adaptation and diffusion of the waffle footing system innovation. It should be noted that the table was developed based upon an interpretation of the participants' descriptions and discussions of their/other participants' roles and contributions.

Table 6.1 Inter-firm capability analysis: Social, cultural and intellectual capital contributions


MEMBER	ORGANISATION TYPE/ROLE	CREATION			DEVELOPMENT			ADAPTATION		
		Social capital	Cultural capital	Intellectual capital	Social capital	Cultural capital	Intellectual capital	Social capital	Cultural capital	Intellectual capital
C1	Housing Developer	√		√	√	√	√		√	
C5	Engineering firm	√		√		√	√		√	
C2	Footing contractor				√		√			
C3	Building materials supplier							√		√
C4	Plastic spacer manufacturer									√
C6	Industry association							√	√	√
C7	EPS supplier									√

6.3.3 Reflexive capability measures for integrated supply chain innovation

Table 6.1 outlines the three key dimensions to reflexivity which influence the integration of supply chain for innovation creation, development and adaptation. The matrix has been developed to allow innovators the means to gain a more detailed understanding of some generic activities relating to the innovation process requiring an integrated supply chain approach through reflexive capability. It is intended that the matrix would be customised to suit and sit within the framework of existing supply chain management systems and strategies for innovation.

This matrix provides a guide and starting point in terms of the key issues to consider for integrated supply chain innovation. The matrix both encourages the objective rationalisation of the innovative group's resources both individually and collectively and the evaluation of when specific resources are required for the appropriate development of integrated supply chain strategies in response to the evaluation. Through this it is more likely that under-performing aspects or lacking resources within the group can be identified. It is then possible to measure how far away from "best practice" a particular innovator group seeking to create, develop or adapt an innovation is and further to that set in motion strategies that will facilitate achieving increased firm reflexive capability for integrated supply chain innovation.

Table 6.2 Reflexive capability assessment for integrated supply chain innovation

Reflexive capability measures for integrated supply chain innovation 					
AWARENESS					
Awareness of the need to create, use and maintain SCI for the innovation process					
No recognition of the need for SCI capital for the innovation process					Comprehensive understanding of unique SCI capital needs to create, develop and adapt the innovation
AWARENESS					
Awareness of key strategies needed to create, use and maintain SCI for the innovation process through supply chain integration					
No awareness of supply chain integration strategies to create, use and maintain SCI capital for innovation					Clear understanding of strategies to create, use and maintain SCI through supply chain integration in relation to the innovation process
RESPONSIVENESS					
Responsiveness to changing approach to creating, using and maintaining SCI capital at different stages of the innovation process					
Uncritical acceptance and adherence to rigid processes and isolated efforts by supply chain players in the innovation process					Fully integrated networks developed between supply chain players through alignment of SCI capital in response to changing needs of the innovation process
ADAPTABILITY					
Innovator group systems in place which define what is adaptable in the innovation process in response to market economics					
Strategies for creating, developing or adapting innovation poorly defined or not effectively communicated resulting in barriers to innovation					Fully effective communication on how to re-strategise and adapt the innovation based upon clear and well defined supply chain roles and relationships

7. REFERENCES

8. APPENDIX

8.1 Resource Management

8.1.1 Plan

Activity	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Phase 1							
Ethics Application							
Data Collection							
Transcriptions							
Analysis							
Draft report							
Phase 2							
Re-analysis							
Draft Report							
Phase 3							
Description of Model							
Presentation							

8.2 Budget

Item	Amount
Research Fellow 1.5 days per week @ \$300/day [inc 18.68 on costs] for 20 weeks	\$9,000
Travel to Adelaide [4 days accommodation and 2X air flights] X2	\$1,700
Transcription 15 hrs interviews @ \$100 per hr [x2.5]	\$3,800
Production of report [limited copies-20]	\$1,500
2 X Conference travel [1 international & 1 local]- partial funding	\$2,000
Production of Brochure [limited copies – 250]	\$2,000
Total	\$20,000

8.3 Interview stories

8.3.1 Participant organisation 2

Title: Testing the waters

Story 1 Agenda-setting: "I was in Port Lincoln...they came up with...waffle pod...so I sent a mob of my guys over there to try to pour a job"

Orientation

T: 16: I was in Port Lincoln 30 years ago

17: and they came up with a crusher bull waffle pod.

Complicating action

18: It's a cardboard box.

19: So I sent a mob of my guys over there to try and pour a job

20: and they had no idea.

21: So as soon as you put a wheelbarrow and a crusher and a box you know it's only meant to take the weight of the concrete

22: cos they're reinforced, they've got their spacers and everything

23: and I think they used bricks those days to try to keep the pods apart and then they put the rod on.

24: Anyway it was all up and down and I wasn't really enthused by them because they didn't do it properly.

25: So I suggested that we form it up with higher formwork.

26: So out came my formwork

27: cos I was a concreter over in Lincoln and I also had a concrete pump

28: so I suggested we pump it in.

29: First job we ever done with Rob and now I gotta live with it and of course I understood the concept of the waffle pod.

30: Very very good in the economy and saving concrete.

31: Obviously its been engineered so it withstands anything.

Evaluation

32: I prefer a waffle pod because as I said the simple reason you don't have blowouts in things like concrete.

33: So if you only do one job a year and it goes over 2 cubic metres it doesn't matter.

Title: In love with the waffle

Story 2 MATCHING: "the first one I actually witnessed I actually helped to pour it. It was an eye opener...straight away I went into gear and said "right this is the easiest way to do it"...I fell in love with it then"

Orientation

T: 276: Well like I said the first one I actually witnessed I actually helped to pour it

277: and it was an eye opener for me there and then at that moment.

Complicating action

278: Straight away I went into gear and said right, this is the easiest way to do it.

279: These guys came over to do it they had no idea.

280: So you know with a concrete pump and forming it up and then putting your pods in

281: it was unique so straightforward you know.

282: Because if you dig a foundation right in the ground you really cant form it up

283: unless you've got offset formwork

284: and that'll cost money and time

285: whereas just the simple process, form up the perimeter of your house foundation your slab and then lay some pods in there,

286: that was unique.

287: And the steel it was 4 top, 4 bottom it was just one rod every 1200 centres,

288: that was fantastic.

Evaluation

289: So the waffles were a unique system

53: But the process is so quick and so unique you know

54: I fell in love with it then, 30 years ago

Title: A clear fit

Story 3 MATCHING: "I was involved right from the word go...so we used to supply and fix...because that's the way I liked to work so I was a good candidate"

Abstract

220: I was involved with right from the word go I was involved with work there.

221: Cos Rob Anderson was chief boy down there right,

222: and when they were going over 30-40 cubic metres a month or a week or whatever on ... from dug footings.

Complicating action

223: He thought well why don't we turn around and get somebody to supply and fix

224: so in other words side cut the job, dig the job and pour it.

225: So we used to supply and fix.
226: So he started the ball rolling on that
227: and I would never have worked any other way
Evaluation
228: because that's the way I liked to work so I was a good candidate.

Title: Minimal fuss

Story 4 REDEFINING: "we invested in a couple of staple guns...I self-taught myself...it was just a simple system"

Abstract

58: it was just a simple system
59: and we used those cardboard boxes those years right.
60: We invested in a couple of staple guns and stapled them together.
61: So it was so simple what can I say.

Complicating action

62: Yeah I'm not educated
63: but I learnt the system of how to put them together, put the spacers in between
64: so I used to form out on the outside
65: they came up with crosses and everything you know they had 110 external rib
66: so if you've got a 2-storey house now they can widen the rib
67: and I self taught myself because there was no one else out there to teach us.
68: It was so simple.
69: I only needed to read the engineers drawings
70: and of course with the pipes and the underfloor plumbing we used to have a hole in the cardboard box
71: we used to have to measure and consequently put a hole there
72: and so that not too much concrete went down we used to have a sleeve over the top.

Title: Greatest thing ever invented

Story 5 REDEFINING: "it happened overnight...anybody with half a brain could work it out"

Abstract

R: 200: and it took you I don't know, months to get it all sorted?
T: 201: Heavens no, overnight.
202: Couldn't afford to – too much money you know.
203: It was just so efficient you know.
204: It was just such a simple process.

Complicating action

205: And I'm not educated but the thing is anybody with half a brain can work it out its so simple.
206: You read a plan both architect's and engineers and you cant go wrong.
207: The engineer tells you to start at this corner and your pods just move it along progressively.
208: How can you go wrong.
209: So you become more efficient.
210: Whereas digging the foundation you know 6-1200 deep all that takes time,
211: the deeper the longer it takes.
212: It was a straight simple procedure the waffle pods
231: So the fact that the waffle pod doing that- it was the greatest thing that was ever invented because of its efficiency.
232: So we could do 2-3 jobs a day compared to opposite system would only ever do 1 every 3 days or something you know.

Evaluation

233: to work in with the waffle system I think C5 thought of it, C1 took it, I produced it
234: and it was just a happy meeting
235: and we were all happy to work with each other.
236: And C1 [housing developer] always paid me on time
237: so no major dramas"

Title: Convincing workers on the ground

Story 6 CLARIFYING: "really really easy...They [the workers] loved it"

Abstract

R: 441: Was it difficult in the early days to convince like guys that worked for you?

T: 442: They loved it.

Complicating action

443: They didn't have to carry cages.

444: Four top rods, four bottom rods.

445: We used to make them outside the trenches and carry them in.

446: that was nightmare.

447: Here they just pick up 6 rods and they drop them in 1, 2, 3, 4, 5, 6 and away they go.

448: Really really easy.

Evaluation

449: They loved it.

450: Well you look at it with form up, steel and pod a job is finished in 4 hours.

451: And the next day you pour it, in the afternoon you go and prepare another one.

Title: Professional jealousy

Story 7 ROUTINISING: "why not we turn around and use a waffle pod system?...The engineer wouldn't have it"

Abstract

154: Yeah I was involved with this job up at Wallaroo which is out of town two hours

155: and just sand dunes

Complicating action

156: so the civil engineer wanted a raft footing system.

157: So I said that's ridiculous why not we turn around and use a waffle pod system?

158: And I just thought what a great idea.

159: I thought how good you know just prepare my base, end of story.

160: The engineer wouldn't have it.

161: So I literally I was – it was impossible to stand the sand up because we had to walk on it put steel, put the mesh on it

162: so all that was going to happen and its going to cave in because the trenches were 750 wide by the way and 750 deep, it was ridiculous.

163: So I thought to myself the only way I can do that is – I didn't even know – I just got it to trench level and made up my base out of corrugated iron

Resolution

164: so I charged them for it.

165: Cost them extra 5-10 grand.

166: Labour-intensive.

Evaluation

167: But that waffle system would've been over and done within half a day.

Title: Mindsets and perceptions

Story 8 ROUTINISING: "it was a brave move at the time...The name itself I mean waffle job gee whiz, they all laughed at it you know"

Abstract

391: I came over from Lincoln

392: and the guys knew of it here that I was into waffles

Complicating action

393: and a couple of contractors came up and asked me what's involved.

394: And I thought well what have I got to lose, I'll show them [competitors].

395: I mean you cant do every job, its impossible.

396: I was working 7 days a week until 10 years ago.

397: And that's enough.

398: Now my son runs the business and I go fishing and

Evaluation

399: It was [a brave move] at the time I think very brave you know.

400: The name itself I mean waffle job gee whiz, they all laughed at it you know.

401: Many years later its amazing how the public didn't get with it

402: either because there were instances like you know different jobs that we were next door to another house or something and gee whats this you know, strange –

403: I said its been out for 15 years, you haven't seen it?

404: So its something people overlook at times.

405: You don't realise what it is.

406: Well the white ones now, the cardboard boxes they all used to laugh at that.

Title: Championing the innovation

Story 9 ROUTINISING: “and that was a massive big job...and it was done so easily with a waffle system...and I did the job with the intention of getting future work”

Abstract

295: Once again you look at the fact that –
296: I mean a big job I did a big foundation we did a whole floor in one pour
297: it was for a school for another builder
298: and that was a massive big job

Complicating action

299: and it was done so easily with a waffle system.
300: That was a real blessing to have a big job like that and pour so many square metres.
301: That was just so good.

Orientation

302: Yeah that was quite early on,
303: It was up at Andrews Farm the builder was Hickam Botham?
304: And they did a school up there in their sub-division
305: and that was quite a unique job.
306: I was promised more work but you know what they're like.
307: And it was sweet talk because they knew I could handle the waffle pod system in South Australia I suppose.
308: And I did the job with the intention of getting future work
309: but that fell by the wayside.

Evaluation

310: That was a unique job, very very unique, very proud of that.
311: Poured it well, finished well so all was good.

Title: A bitch fight

Story 12 ROUTINISING: “that was as they use the expression a ‘bitch-fight’”

Abstract

120: And then this guy, long story, he claimed he invented the spacers.
121: His name is Nick Leonardis, for the record, nice guy.

Complicating action

122: So anyway he claimed he invented the crossers and spacers
123: and Rmax invited me to go over to Sydney at a court, supreme court to give them my opinion
124: so being a concreter like I said you didn't need a brain to do anything
125: and I used bricks.
126: Well anyway that was as they use the expression a 'bitch-fight'
127: amongst Rmax, Nick Leonardis and etc etc
128: because of the simple fact of you know, I invented it, I want royalties.
129: I wasn't involved so it was between Rmax, Podfix and Nick Leonardis
130: and I just stayed right out of it.
133: Podfix was the people who used to make the spacers.
134: So Rmax used to supply the foam, Podfix was the manufacturers for these spacers
135: and Podfix was getting sued by Nick Leonardis
136: and Podfix had the backup of Rmax.
137: I used to use their products and I was the meat in the sandwich
138: but other than that I've tried to support Nick over the past
139: but since that thing was sold I'm not sure what he's done since
140: but Bianco's have taken over some way or other and I don't get involved with it.
141: All we do is we buy from the same people whether its Biancos or Podfix and we buy our spacers from there and life goes on.

Evaluation

142: It was a wasted expense.
143: I don't know how the guy finished up.
144: He must've lost a lot of money out of it.
145: Obviously a nervous wreck as well but he just got on with his job and life
146: I feel sorry for him and no good.
147: I go to bed in the night time and think if I win the lottery
148: but I wake up the next morning and I haven't won the lottery
149: so I think the poor bugger just chased something that didn't pay off for him.
150: Oh this was ongoing for years.
151: Nick Leonardis had backup in Visyboard
152: and of course Visyboard were cardboard boxes.

Resolution

153: So they're cardboard...so what happens – they've now come up with a foam box so Visyboard dropped him.

8.3.2 Participant organisation 3

Title: C3 was revolutionary

Story 1 AGENDA-SETTING: “they [C3] were actually looking to diversify...have another product they could promote Australia-wide...was revolutionary”

Abstract

85: James Hardie is basically a building materials supplier
86: and they supply things like roofing and they were big in asbestos and they did a hell of a lot cladding whatever
87: and they were actually looking to diversify and try something else and have another product that they could promote Australia-wide.

Evaluation

88: [it was] very very [new thing].
89: James Hardie was revolutionary
90: because that was never their core business or anything like that

Complicating action

91: but because they wanted to do something and the timing was right.
92: Koukourou came up with this concept who then spoke to James Hardie who then spoke to Visy who made the boards etc.
93: We never supply and fixed – it was supply only.

Title: A fit

Story 4 MATCHING: “they [C5] knew they couldn't do it alone and they needed both a manufacturer and somebody in the industry...so that network was there so that's why it suited both parties”

Abstract

114: *cos basically everybody no matter what industry you're in especially in the building industry you're forever looking to save costs wherever you can. And this was a cost saving exercise*
115: Because what koukourous did it was a very wise move is they started to use this and they started to develop it.

Complicating action

116: Its great on paper but you still have to develop it no matter what it is.
117: And developed it, and they were doing work for Jennings at the time
118: and so as such Jennings gave them plots of land to do one or two houses or whatever
119: and they would do a bit of promotion like photographs and that sort of business you know.
120: Things that showed people you know.
121: They knew they couldn't do it alone and they needed both a manufacturer and somebody who was in the building industry.
122: They had contacts within the building industry
123: and James Hardie has got a huge building place and its predominantly through supplies

Evaluation

124: so that network was there so that's why it suited both parties.

Title: Job creation

Story 2 Redefining: “So C3 decided to take it on...my job was basically to promote and sell the waffle pod system..i did nothing else”

Abstract

12: Koukourou came up with the concept which wasn't new
13: but they came up with the concept of doing the waffle pod footing system in houses.
14: In the past they've only been used in multi-storey floors and what have you.

Complicating action

15: **So James Hardie decided to take it on**
16: and I came from a building/concrete pre-mix industry.
17: So I knew the builders and I knew the foundation contractors etc etc.
18: and my job was basically to promote and sell the waffle pod system.
19: And it was done through most states of Australia
20: so that's what I did.
165: The only thing that I did was waffle pods.
166: I was the only specialist in Australia that did that.

167: I did nothing else.
168: I was employed to do drive that and that's it.
21: So I used to call up builders
22: cos basically everybody no matter what industry you're in especially in the building industry you're forever looking to save costs wherever you can. And this was a cost saving exercise.
Evaluation
23: It was highly revolutionary.

Title: Professional jealousy

Story 8 ROUTINISING: "there were a lot of the other engineers who wouldn't promote the system...it was professional jealousy"

Abstract

146: And there were a lot of the other key engineers wouldnt promote the system
147: and they had nothing to do with the fact that of the litigation at all.
148: It had to do with the fact that they were –

Complicating action

149: and in theory in hindsight they should perhaps look after their client base and ensure that their client base can do a better foundation system cheaper.
150: But it doesn't work that way
151: and it was the majors.
152: And the smaller engineers were a lot more amenable to the system
153: but it was the bigger boys.

Evaluation

154: So it was professional jealousy absolutely
155: and they wouldn't use it for a long time.
156: And that's what it was, very much so.
157: And I say that its South Australia
158: but its not unique, its pretty much across the board.
159: whats in it for me you know. I didn't develop it so why should I bother?

Title: Rogue contractors

Story 9 ROUTINISING: "you could use less concrete...but footing contractors being footing contractors instead of putting 75mm...put 100mm...so you lost it on the volume of concrete"

Abstract

189: And that's the other thing so we promoted that you could use less concrete

Complicating action

190: but footing contractors being footing contractors, instead of putting 75 mm cover over the top of your slab the traditional method is 100mm and they always put 100mm.
191: so you lost it on the volume of your concrete.
192: So this is what I said before it has to be policed really really spot on
193: and people didn't do that.
194: So what I used to do is sit down and do the costings for the house you know what the foundations would cost
195: and I would cost it all out, show it to the builders
196: and it'd look good on paper as things often do.
197: And when it came down to the crunch it always cost more.
198: And it wasn't my position to say to the contractor to say your floor's too thick.
199: Its not my business I cant do that.
200: It has to come from them and it has to come from the building supervisor and the engineering supervisor – it had to come from them.
201: I could promote it and I could show them the cost savings
202: but they have to make that happen.
203: Because the whole thing was so new you really needed someone on the ground
204: I mean that never happens.
205: You've got to be politically correct
206: but there's nothing wrong with the system.
207: The system is gorgeous.

Evaluation

208: That's when the control comes in.
209: It's like any system, if you can control it
210: even when they do the traditional foundations the depth and width of the trenches if they did them too deep or too wide they would use more concrete,
211: their costs will escalate.

212: That doesn't change.

Title: Perceptions

Story 10 ROUTINISING: "it was age old perception...oh can a cardboard hold up a house?"

Abstract

229: and another thing is was perception old age perception I think I just mentioned a while ago of oh, I don't know it doesn't look right to me son.

Complicating action

230: Its cardboard.

231: And it wasn't only and it was the foundation contractors

232: and it was some of the engineers although they did the calculations and they know the system, its not new.

233: But what was new was that it was put on the ground it wasn't suspended.

234: And that wasn't all that new – it had been done before.

235: So the engineers could do the calculations and they could see how it worked

236: but then again its human nature

237: and they find it hard because they're so different,

238: oh can cardboard hold up a house?

239: And you go well actually the cardboard breaks down.

Evaluation

240: And when you're looking for excuses its very easy, I can come up with 100 and you can come up with another 100.

Title: Familiarity and complexity

Story 11 ROUTINISING: "People are so used to their own practices...there's a lot that goes into changing one little component"

Abstract

334: The product might be terrific but sometimes its very very hard to change mindsets no matter what industry, no matter what you're doing.

Complicating action

335: Because people are so used to their own practices, systems and whatever and it works.

336: If you can show savings but they have to be controlled, its like everything else.

337: You could around and say well if you're making cars if you're making a certain component

338: and you said look if you make it this way not only will it be cheaper it'll work better or whatever.

339: But then to get them to change that component they'd have to change their machines, change the dyes,

Evaluation

340: there's a lot that goes into changing one little component.

Title: Politics and Diplomacy

Story 12 ROUTINISING: "You've got to be really diplomatic... you cant then go back to the builder and say oh your foundation contractor is an idiot...because he's been doing his work for eight years, they're mates, they're friends."

Abstract

343: You could change because of greed because you're the base, you're the foundation contractor, you can make it work.

344: You're at the base of this whole situation, a lot depends on you

345: because you're actually laying the pods, pouring the concrete, employing the labour to get this finished.

346: So therefore you cant go up to them and say look you've stuffed up, its supposed to be 75mm slab you've put down 100mm.

347: Good luck!

Resolution

348: So you've got to be really diplomatic.

Evaluation

349: And the thing is you cant then go back to the builder and say oh your foundation contractor is an idiot

350: because he's been doing his work for eight years, they're mates, they're friends.

Title: Peddles and the bike

Story 13 ROUTINISING: “once the system started to move all this junk started to develop...you’ve got the bike which is the waffle pod but you cant have your foundation system without the spacers...so who gets the royalties...people did have the fear that if they used it....get bitten on the bum later on”

Orientation

125: The court case came later I cant remember specifically how much later but maybe 12-15 months or so.

126: It took a while but the thing is that it never went away.

Complicating action

127: And once the system started to move then all this other junk started to develop

128: because people all thought hey this is alright we could make some money here.

129: And one of the people put it to me that it was you cant have a bike without peddles.

130: What that basically means is that you've got the bike which is the waffle pod but you cant have your foundation system without the spacers

131: so who gets the money, who gets the royalties etc.

132: It was absolutely ludicrous

Evaluation

133: and it could've been too and it always after the case that you can see that its very easy to solve – it could've been too.

132: It's a good analogy.

133: So that was a major stuff up

134: because people did have the fear that if they used it would they get bitten on the bum later on.

135: And that sort of stymied the whole thing in the early stages

136: and it didn't need that

137: but that's the way it is and you cant do much about that.

8.3.3 Participant organisation 4

Title: How it all started

Story 1: “I heard about it from one of the guys who used to do my diggings...he was doing work for the housing developer (C1)...when I heard about it I didn't like the way it was put together”

Abstract

119: I was a foundation contractor

120: and when I heard about it I didn't like the way it was put together.

Complicating action

121: One of the guys who used to do my diggings, he was doing a job for Jennings

122: and he says look you better get rid of your machines because we don't want to be digging trenches anymore.

123: So I said what are you talking about.

124: So he said they're using this new system and you don't have to dig trenches

125: and I said oh yeah

126: so he told me about it.

137: So anyhow, how I heard about all that and

Title: Establishing fit

Story 2 Matching: “because I knew about patents...So I just wanted to improve it by making a better spacer to hold it together....so I came out with this”

Abstract

138: because I knew about patents

139: because I've had the suspensions you know for the racing cars and we developed one

140: and we had one out.

141: So I just wanted to improve it by making a better spacer to hold it together.

Resolution

142: So I came out with this.

143: It holds the pods at one corner, the reinforcement comes up here you don't have to tie the steel

144: and what it does is that locks it up so it doesn't move anyway.

Complicating action

145: K used a brick they used to brick them in half and they stick it in between the beams.

147: and that and for a start the brick they were using, when you use house bricks you're not in contention you're only in compression cos you're holding.
 148: Different story when you're in the ground.
 149: The ground moves and all that.
 150: So what we did was we did a test with the Institute of Technology
 151: I did two foundations
 152: and I had another engineer come out there to check
 153: and I had people monitoring it to make sure that at the Institute of Technology the levels to make sure they were reading the calculations properly.
 154: So we crack tested it – both systems, the K and my system
 155: and ours showed up to about 40% increase in strength.
 156: Its all there in documents its all there.
 157: Whereas the K one failed because when it cracked it cracked straight up from the block like that.
 158: Then we flipped them over the foundation
 159: and we cracked it to see how much it would take and ours still had 40% increase strength wise.
 160: And I said to Peter I said look you need to get something on yours to hold it together
 161: otherwise we're not going to pass these jobs anymore
 162: and that's when PK and I said to them look I don't want the system
 163: I'll go out and I'll train the concretors because I'm a concretor
 164: you can make the royalties on the foundation system.
 165: I just make my spacers and I make my money on the spacers.
 166: I'll go out there put my rubber boots on because that's my job and I'll go out there.
 167: You've got your engineering background, you go do all your engineering talk and all that
 Resolution
 168: and that's what we did.

Title: Forming alliances

Story 3 REDEFINING: "C5 joined up with C3...in respect for him we joined"

Abstract

169: What we did was he joined up with James Hardie in a 3 year contract

Complicating action

170: and I didn't want to join
 171: but he'd joined up with them
 172: I didn't want to not upset him how do I put it – what was the word Beth when we joined with James Hardie ?
 173: I didn't want to – in respect for him we joined.
 174: Anyway JH isn't going to do anything
 175: because what they did was they lifted the price on it because they had a rep on the road and this and that

Evaluation

176: and it was just too dear
 177: and the foundation just never took off.

Title: Reforming alliances

Story 4 REDEFINING: "C3 dropped it...we went together...called it Podlock Foundation system"

Orientation

178: When the 3-year contract was finished with them

Complicating action

179: I said to Peter, look I'm not joining with them anymore,
 180: if you want to you can do that.
 181: You go do your system
 182: I go do my system with someone else.
 183: I'll employ engineers or whatever because its just too dear.
 184: And JH had dropped it anyway.
 185: And then we went together and we took the name of waffle pod
 186: because there was a lot of people didn't like PK.
 187: The others John Goldfridge and I got on really well –
 188: he's one of the directors with PK –

Resolution

189: so we called it Podlock foundation system

Title: Professional jealousy

Story 5 ROUTINISING: “see what was happening is that a lot of engineers wouldn't specify it ...they knew C5 was getting royalties and they didn't want that...when we changed...called it Podlock...it doubled...tripled”

Abstract

190: see what was happening is that a lot of engineers wouldn't specify it

Complicating action

191: and they wouldn't specify it because that would make it too expensive

192: because they knew that K was getting \$1 per waffle for royalty.

193: They didn't want that

194: he was their competitor that's business.

195: When we changed and we called it Podlock –

196: when they [engineers] found out that PK were silent partners,

197: we were splitting it so they were getting 50 cents per pod

Resolution

8: and it doubled up, it tripled up, especially interstate.

Title: Court cases and patent disputes

Story 6 ROUTINISING: “we were having court cases...and this is people infringing on our patent...everybody tried to get around our spacer”

Abstract

34: But while that happened –

35: we were having court cases

36: and this is people infringing on our patent you know the story about that?

Complicating action

38: everybody tried to get around our spacer

39: and it was that much inferior stuff out there it doesn't even comply with the codes

40: and it was that many houses which are going to be a disaster one day because the way they've been put together.

199: And then of course people started to try to get around us.

200: And went to court

201: so the patent whittled down

202: so when the patent they challenged it

203: we had to remove it

204: so now anything that they use without concrete flow they brought this down.

205: But it didn't infringe on our patent.

Evaluation

206: But engineering that's no good.

207: You take out a chunk of concrete.

208: They didn't care.

209: The builders didn't care because it was cheaper and who suffers?

210: The homeowners.

211: So Metricon does 5000 homes a year

212: you multiply that by \$50 a house its money to them

213: but they put the poor person at risk.

214: They don't care about that.

215: Jennings had a 25 years structural guarantee they didn't care.

Title: The lawyer stuff

Story 7 ROUTINISING: “The main trial was the years of court cases...and financing the court cases...you don't usually read the lawyer stuff and you've got to read it ten times”

Abstract

B: 257: The main trial was the years of court cases

258: and financing the court cases.

Complicating action

259: And getting in your head if you get a lawyer

260: and you don't usually read that stuff

261: and you've got to read the lawyer stuff and you've got to read it ten times because I don't know how many pages they use to say one thing.

262: So our main trial would've been court cases

263: and infringements

264: and the way patents work is that if you've had a patent and you say you're pinching our stuff so stop it
 265: if they're smart they'll go straight away in cos they know you're coming after them
 266: and they'll put a challenge on your patent
 267: so therefore your patent's been challenged
 268: so all the other guys out there can start doing it too
 269: because while you're under challenge you cant stop anybody.
 N: 270: But they're worried too because if we won the patent
 271: but the way the law the law just sticks because you see
 272: and by making them aware and then they're only \$2 companies that wind themselves up.
 273: You can actually go the whole haul and spend thousands
 274: which we did and did the last thing where its accessing costs- they were liquidated yesterday.
 275: And because these things take so long, you can start something but you might not get into court in 2 years
 276: while all the stuff you told your lawyer then he's charging you for that 14 days you have to pay
 277: and by the time you get to your 2 years
 278: he wants to talk to you again because he's dealt with another 500 people in the meantime and he's got notes scattered all over the place
 279: so you have another big meeting and get charged by the hour
 280: and you've got to drag out what you said as well.
 281: And its really really difficult,

Evaluation

282: it's a challenge.

Title: Adaptations

Story 9 ROUTINISING: "Originally the system was used with cardboard boxes. Now its styrene. The wind blows them around...with the Interlock system it locks that up...there's all sorts of different spacers"

Abstract

96: See originally the system was used with cardboard boxes.

97: Now its using styrene

Complicating action

98: and the styrene boxes are very light compared to cardboard

99: and when the wind blows them around you know.

100: So with the interlock system it locks that up so the pods don't move around before you put the reinforcement in you see.

101: Using that system there might make it different sort of \$40-50 a house more

102: builders don't want to do that.

103: But that \$40-50 if you're getting a house built you could save if that was put together properly.

104: 99% of the time when there's a concrete pour the engineer's not there anyway

105: so when they pour it the pods move all over the place

106: and they cant get them back into place because you got mesh and you got concrete in between there

107: so the beam instead of being that wide they're that wide.

108: Because when they start moving you've got concrete on there

109: so it's getting to be pretty bad the way it is.

110: There's all sorts of different spacers

111: and there was one particular spacer – you could squash it with your fingers.

112: So when you're putting a vibrating shaft between the beams how much are you pushing it

113: and once it pushes, it pushes the next one and the next one becomes less gap.

114: And the engineers are aware but they don't care.

Evaluation

115: It was really done properly before the patent got broken when Koukourou we joined together

116: because that's what they used and that's it.

117: But then when they tried to get around it

Resolution

118: they tried all different things and they made all this inferior stuff.

8.3.4 Participant organisation 5

Title: Researching footing systems

Story 1 AGENDA-SETTING: “we were tackling a new footing system...what we did was set up some internal R&D projects...so we had different streams to what we were doing”

Orientation

109: When we really started the project back in actually in about 82

110: we were tackling a new footing system

111: we were engineers producing soil reports.

Complicating action

123: So what we did was set up some internal R&D projects

124: We paid David Payne to research the different rational methods that were around that you had a choice of using.

125: John Holland in Melbourne had thought out his slabs around 76

126: and the Mitchell method was endorsed by the Institute of Engineers in the early 80s

127: and that was a way of doing it.

128: John Holland had put out to CSIRO the Walsh method of analysis

129: and we assessed them

130: and we came up with we decided that the Walsh method was the most rational method of modelling it

131: and gave us the most opportunity to model how footings perform sensibly within things that we understood.

Resolution

132: And then we embarked on an R&D program with Paul Walsh to develop a program called CORD

133: so we had different streams to what we were doing.

Title: The seed

Story 2 AGENDA-SETTING: “we were involved with footing designs and having problems with movement...I had designed waffle slabs for first floors...so I figured maybe waffle slabs will be a good concept”

Orientation

7: My memory fades but I think we started this process in 1981

Abstract

8: and it was just a concept I had

9: because we were involved with footing designs and having problems with movement.

Complicating Action

10: As a structural engineer I had designed waffle slabs for first floors.

11: When we did that it was because support structures were further apart with longer spans.

12: So I figured we got nowhere for support in soils or footings in soil

Resolution

13: and maybe a waffle will be a good concept.

Evaluation

14: So that was the seed

Title: Striving for excellence

Story 3 MATCHING: “this company was a vehicle for us in achieving what we wanted to do...we wanted be the best ...as a business we’re differentiated...we had to create something that was more efficient”

Abstract

592: Well we wanna be the best

593: and this company was a vehicle for us in achieving what we wanted to do

594: and we wanted to be the best

595: and excellence

596: and this business was a vehicle for excellence

Complicating action

597: and as a business we're differentiated

598: and we target stuff that needs a higher level skill much higher level of expertise in different fields

599: we've got the best people in the country working for us

600: and in a way its partly because we all enjoy that some of the challenging things our ...

601: people here are doing are just the opportunities we get to do interesting things are just...

602: if you go around Adelaide you cant pick a major thing that we haven't had some hand in it

603: so there's nothing major we're not an international company

604: so we don't do that giant line

605: but Olympic Games we did all the geotech
606: we did the pipeline to the Great xxx?
607: I had the argument I predicted the xx stands would leak
608: so through this excellence we get the opportunity to participate in the hard bits on everything
609: like the xx it's a great building built on – on time on budget all precast and you had all the –
610: if you look at the podium level and you look at the and we designed that
611: because it was the hard bit
612: and just about everything you see around we've done the hard bit
613: or when anything's gone wrong we've fixed it up
614: In South Australia our competitors can charge up to 50% less than we do

Resolution

615: and they're willing to pay that huge differential because of the quality of what we can do.
616: How much easier it is to build all the stuff they've been hearing that we can bring to the table because we've raised it beyond being ordinary
134: We were doing pure engineering and then out of that came –
135: it led to a lot of things here
136: and the new technology was flying through for introducing stability index and calculation of γ value that sort of thing
137: which people knew how to do but only in a research sense.
138: CSIRO had done it
139: but nobody was doing it generally
140: so we started working with University of SA to develop testing methods for measuring soil sections and stability index in laboratory, regular and repeatable way

Orientation

141: and that R&D work started whenever it was here well the late 80s early 90s
142: those laboratory methods were developed.

Complicating action

143: First we got a NATO accredited
144: and then the Australian standard AS121.
145: As engineers we were doing it pure engineering for I guess our own egos and business
146: but then we were also going down the road of the footings system for the reasons which I've just said
147: which is the client base's need
148: and we've just come out of what we're doing.

Resolution

149: We had to create something that was more efficient and more factory-lined.

Title: The first test slab

Story 4 Redefining: "it was a test slab...it provided us with base information which nobody had"

Abstract

150: We had good support from Jennings with respect to doing R&D in a way that gave it really good long-term credibility
151: because we poured that slab in Trott Park god knows when

Orientation

152: it was a test slab and we poured that in 1982
153: and we were able to monitor that for four years till the end of 1988.

Complicating action

154: And we did some other R&D with CSIRO through Jennings with the timber pile
155: except that it went nowhere.
156: But that slab provided – we did that work very thoroughly very diligently
157: and that provided base information that I think nobody had ever had
158: to give credibility to the design methods we were using
159: and in fact all the rational design methods that are in the standard

Evaluation

160: but it also gave us that credibility when we started to move to saying well we've got a new footing system.
161: By the time we got to that point we were actually we had the credibility to drive that through.
162: And people like the Cement and concrete association and MBA, standards, NATO even with the test methods you know
163: it was sort of if we said that was going to work then everyone believed us.
164: So the system was developed with real R&D

165: because we had those test slabs first, we had the design methods, soil testing methods
Resolution

166: and then we moved into the commercialisation of the waffle pod.

Title: Forming alliances for commercialisation

Story 5 REDEFINING: "C3 were keen to...have rights but then starts the problem...C4 came in with this weird concoction...I told him what to do...he went away and designed something in plastic and put a patent on the system...there were legal threats...C3 pulled out"

Abstract

93: So James Hardie were keen to be behind us and have the rights

94: and we had some sort of a contract with them

95: but then starts the problem

Complicating action

96: a guy called Nick Leonardis who was a footing contractor came up

97: because our first the way it was started we just used concrete bricks to space the pods apart and also supports for the bottom reinforcement.

98: So this guy came into my office one day

99: and said oh I got a good idea we can invent this cruciform thing and put in the middle and separate them.

100: And he came in with a weird contraction of metal and wire cross block in the path of the concrete

101: and I said you cant do that, this is what you need to do

102: I showed him what to do

103: and he went away and designed something in plastic and then put a patent on the system.

104: Not just the spacer but the system.

105: So that's when we started having problems

106: and there were legal threats made from him

107: and James Hardie just didn't want to be involved so they pulled out.

Evaluation

108: But again I blame myself for not arranging the patent strong enough to

109: and to help this guy do something with his

Resolution

110: and then that led to other destructions later on

111: because we found a financial backer to take it to court to suppliers of the system.

112: And we lost on technicality

118: and there were some disasters there.

Title: Promoting through different tiers of players

Story 5 ROUTINISING: "I presented at a 1987 MBA conference in Qld and out of that came a whole string of contacts. Then I presented in 1987 at a local government conference in Perth and out of that building surveyors who check and approve building applications all came to learn about it"

Abstract

22: Through the industry there were lots of different tiers of people who got involved

23: they range from councils, builders, local government type people, cement concrete association who promoted it

Complicating action

25: and they saw this as a way to actually expand the concrete market.

26: And they were an independent authority in the building industry.

27: They had credibility so when they said that's a good thing everybody believed it.

28: And then we had the individual builders

29: the MBA, they were very supportive.

30: The state manager over in MBA helped us promote it in Vic

31: and I presented at a 1987 MBA conference in Qld

32: and out of that came a whole string of contacts.

33: Then I presented in 1987 at a local government conference in Perth

34: and out of that building surveyors who check and approve building applications all came to learn about it.

35: The next thing you know – and this is the list of things that I did and the list of people that I contacted by the end of 1987.

Evaluation

36: The key thing was doing it at different levels

Title: Reforming alliances

Story 6 ROUTINISING: "people were infringing the patent...we had a lot of interim arrangements...we set up our own factory...went into a joint venture"

Abstract

380: One of the things we've had in this business is the luxury of not going broke.

381: If the waffle pod footing system didn't make it, it was only a sideline.

382: So we were never driven to the point of bankruptcy by it.

383: Although I've got to say we've got pushed into it at one stage.

Orientation

384: So after James Hardie we recollected stuff and royalties on the system

385: and even back in the 80s people were infringing the patent and not paying royalties

386: but at that time James Hardie would go out and do all this for us.

Complicating action

387: We had a lot of interim arrangements where we tried to do a deal with someone to bring them onboard

388: so that at least they acknowledged the patent existed

389: even if they half broke it and did whatever they wanted to without paying us royalties

390: and what it led us to do which wasn't a good move in the end

391: but it helped promote the system

392: well we teamed up with Ian Troughgood in SE Qld who had developed a different way of linking pods together and wanted to patent that

393: We teamed up with him and actually did the patent joint venture type of thing

394: but he's started out as a footing contractor

395: he ended up as a polystyrene box manufacturer

396: so he had a factory in SEQ.

397: We set up our own factory manufacturing polystyrene boxes in Sydney

398: and we went into a joint venture with Foamex in Victoria who manufactures polystyrene boxes

399: and we did that out of desperation because we were getting no money out of royalties.

400: Maybe we were getting money out of selling the boxes kind of thing

401: and there was a lot of drama in that type of industry

402: competition the cut-throat nature of it

403: a lot of legal action going back and forth

404: and it was full of lawyers letter and that sort of thing

Evaluation

405: and just going up against that sort of stuff became half the course.

Title: Restructuring

Story 7 ROUTINISING: "having the factory stretched us...restructured the business dramatically...we just needed to go back to core business"

Abstract

406: Having the factory stretched us

Orientation

407: and I in fact restructured the business dramatically in about 2000

408: because we just needed to go back to core business.

Complicating action

409: So we sold the factory in Qld for a nominal sum

410: it still ended up costing us \$15000 about 2 years later

412: actually we were coming into partnership

413: because we were desperate for money there was this guy who came out from Taiwan on a business immigration thing

414: so he put his money into our waffle pod factory

415: but he was a bit of a rogue and it wasn't run very well

416: and we sold out to him

417: and I think he went broke about a year or two later

418: and everybody knew it was virtually going bankrupt

419: and we gave the lawyer \$15k to go away.

420: NSW I went into a joint venture with Nixons concrete

421: they had a waffle pod factory and they were big industry suppliers

422: Nixons was like a hardware same like Biancos here or Smorgons and that sort of thing supplying reinforcements

423: and they had concrete supply

424: so they supplied all the big footing contractor gangs

425: so we merged our factory with theirs
 426: and then we had a bank overdraft and it was probably a \$25k bank overdraft
 427: and another \$25k tied up in bank guarantee for the rental
 428: we were losing money
 429: and during all that it got burnt down twice
 430: and by the end of it anyway the joint venture was successful
 431: and we sold our half to Nixons
 431: and we did out of that was pay the bank off.
 432: We got no money out of it
 433: and Foamex eventually didn't renew our contract with them
 434: there was sour grapes there as well.

Resolution

435: So if you want drama – that was real drama.
 436: All of that – just restructuring getting out of that
 437: because it wasn't making any money it was draining us
 438: but it helped the system but it wasn't doing anything for us.

Title: Threats and court cases

Story 8 ROUTINISING: "The Australian Litigation Fund came along...gave up after spending half a million...in Australia you cant defend a patent without being very rich...the waffle pod was successful but we didn't make any money out of it"

Abstract

439: It was like threats and court cases

Orientation

440: and the Australian Litigation Fund came along around 2000

Complicating action

441: they said they'll fund the court case
 442: and they said they'll fund the court case
 443: and we'll sign 75% over to them if we won it
 444: which is what we did.
 445: And then they gave up after spending half a million.
 446: And Freehills
 447: Which was on the other side which was Australia's best and Kerry Packer and John Huntsmen
 448: who was in the US chemical economy was the equivalent of Kerry Packer over here
 449: so there was plenty of money to throw around.
 450: So we got kudos but
 451: Huntsmen Chemicals were big and breaches of the patent and Kerry Packer was tied up in that as well.
 452: So there's polystyrene manufacturers who just breached the patent –
 453: Rmax and Visyboard
 454: Now I remember Visy I rang up the state manager one day oh I got him on the golf course
 455: and he said well I'm just a box manufacturer I don't know what these people use these boxes for.
 456: I mean there's that sour grapes there
 457: well in Australia you can't defend a patent you cant enforce a patent without being very rich
 458: because you've got to be able to go through with the legal stuff to defend it against the people who're breaching it in small ways or even large ways.

Evaluation

459: And when you think about it then one of the reasons the waffle pods could take off was that it had something that didn't need well we promoted it
 460: and different people in the industry promoted it all along
 461: because for us it was business life or death
 462: but the waffle pod was successful
 463: but we didn't make money out of the waffle pod
 464: we made money out of our core business.
 465: And there's a whole range of people who came in and promoted what they thought was their pot of gold and went broke.
 466: And each time they did that they increased the market reach of the system a bit more.

8.3.5 Participant organisation 6

Title: Initial interest

Story 1 AGENDA-SETTING: “I came up here in 1971...wrote a document on the footing systems that were being used in South Australia...we were searching for footing systems that would work on very heavy clay”

Orientation

105: I came up here in 1972

Complicating action

106: and I remember it clearly because before I came up here in 1971 I actually wrote a document on the footing systems that were being used in South Australia

107: and that was pre-waffle

108: and we were searching for footing systems that would work on very heavy clay in South Australia.

109: And then of course when I came up here I found out that we had numerous areas that were bad clay here in Queensland

Resolution

110: hence the interest.

Title: Promoting concrete use

Story 2 MATCHING: “when I first started...there was virtually no concrete floors on the ground in Queensland...my role was working with builders, engineers, architects...try and assist them to use concrete in different ways...to promote the use of the product”

Orientation

12: and when I first started that role in the early 70s

Complicating action

13: and cos there was virtually no concrete floors on the ground in Queensland for housing

2: And a major part of that role was working with builders, engineers, architects and so forth

3: to try and assist them to use concrete in different ways, to use it better, to use it in more innovative ways.

4: The role involved technical advisory work.

5: It also involved educational work of running events and so forth.

6: I guess in the cement industry's point of view to promote the use of the product.

7: As an association we didn't actually run promotional things in a direct sense not like sales promotions.

8: We ran events that were technical

9: and taught people how to do things working on the premise that if they were confident enough to use you know had the knowledge they would be confident enough to use them

10: and then if they wanted to put them into practice we can go and talk to them.

11: So that was the key role that I was playing at the time with the CCIA

Title: How the waffle pods came about

Story 3 MATCHING: “I was in SA earlier on...my colleagues in SA kept me apprised as to what was happening with...waffle system...it came about by sort of discussions between he and me or he and C5 and so forth...they realised that there was potential for the system here in Qld”

Abstract

89: The initial interest was because I was in South Australia earlier on

90: I knew the conditions there

Complicating action

91: and while I didn't work with the waffle pod I worked quite a bit with a fellow by the name of Phil Farger –

92: an engineer who had a system called the Griulage raft

93: and it wasn't the same as the waffle pod

94: but it actually had the same philosophy behind it

95: and that was making the raft so stiff that it wouldn't move up and down and float without distorting

96: and that was the first thing in South Australia that started to work on the heavy clays

97: whereas we had pier and beams and cut off wall systems

98: and that none of which really worked

99: so I had good knowledge of that

100: and my colleague in South Australia kept me apprised as to what was happening with this waffle system

101: because he was involved with it there.

102: And I think it came about by sort of discussions between he and me or he and Koukourous and so forth

103: and the sort of soils we had up here and the problems we had up here
Resolution
104: and so then they realised that there was a potential for the system here in Queensland.

Title: Forming alliances

Story 4 REDEFINING: "the easiest way is to get through working with the government housing authority...it makes it much easier for private industry to get approval to use the system...other than that the mechanisms was using like the Qld Master Builders Association and then Housing Industry association"

Abstract

23: The other part of my role was I also had a role with the concrete institute of Australia
24: which I was the secretary of over here

Complicating action

25: and that also enabled us to get topics such as those we are talking about onto the technical agenda locally by running technical seminars on them
26: and we used the concrete or we were able to use to the concrete institute to run technical seminars on concrete floors for houses.
27: And other than that the mechanisms was using like the Queensland Master Builders association and housing industry association
28: who also ran their own courses and also ran different functions
29: and we were able to work with those
30: and in fact I spent quite a lot of time with those on the subject in all the regional areas right through Queensland through the different events that they would get their members to come into.
14: and we started work with what was then called the Queensland Housing Commission which was the government housing authority that used to build houses in their own right those days.
15: Not anymore but they used to.

Evaluation

16: So we thought well the easiest way is to get through working with the government housing authority initially
17: to get things implemented with them
18: then it makes it much easier to get private industry to get approval to use the system.
19: So the work then started with Queensland Housing Commission on concrete slab,
20: it was on ground
21: and we were partnered with them before we started to get involved with sort of private industry
22: and using organizations like the Queensland Master Builders association, Housing industry association and other organizations to try and get some things going.

Title: Well developed system

Story 5 ROUTINISING: "they were doing work in South Australia like 2 years before it really sort of came here...there was considerable amount of data...hands on practical stuff"

Orientation

74: I do know that they were doing work in South Australia like 2 years before it really sort of came here

Complicating action

75: because there was a considerable amount of data and examples of things
76: that we were able to get our hands on and use.
77: it wasn't just like a theoretical exercise
78: it was sort of hands on practical stuff that have occurred in South Australia.
79: Look I don't know that I can actually put a date on that or a year on that.
80: When Peter started – early 80s –
81: I remember – it would've been mid 80s to late 80s
82: but I'm guessing my memory was that there was quite a bit of things that they had done in South Australia
83: because when they first got here
84: they were able to actually show examples of things being done, things being built in different conditions.

Evaluation

85: So my memory of that was that it was one or two years after they had been building stuff in South Australia.
86: Which might have been prior to us getting that actual approval
87: because it takes quite a long time to get approval and state regs
88: and then of course to get approval in the standards Australia too.

Title: Getting the system accepted into regulations

Story 6 ROUTINISING: “there wasn’t one person who I can point to in terms of getting the regulations done...E1 might have been involved...E1 chairs the Standards Association Committee...we worked with C3 as well...one of their engineers was also a representative on the advisory group for the local building regulations”

Abstract

144: There wasn't one person who I can point to in terms of getting the regulations done....

Complicating action

145: i can think ...there was some engineers locally Morgan Fox and Stanley

146: I think Eric Fox might have been involved with that

147: he's still around actually

148: I think he still chairs the standards Association committee

149: I think Eric was probably involved in that as well.

150: I don't know if you can sort of point to anybody in particular

151: because its on of these things that it starts and you think look we've got to consider this because this is a system that has worked

152: and then it gets slowly evolved from there...

153: and as more information has entered more people get on side.

154: I don't know that you'll be able to pin point one person.

155: The technical data on the system, the engineering data and that sort of thing had to come from them [Koukourous]

156: because that was really the only data that was available.

157: And that came from them

158: and anything that was considered that it needed back up technically came from them.

159: We didn't actually write anything definitively in an engineering sense.

160: We had documents which were written on clause for housing and so forth

161: in which the system was included to explain what it was, what the key elements of it were

162: like the grid of beams, the reinforcement tying into the slab and conditions under which it was advantaged.

163: It was some of the builders that started to talk to Master Builders about the fact that they wanted to use it

Evaluation

164: because not only because of technical content but it was economical to do so.

237: And of course in the initial stage

238: James Hardie were involved with it

239: in the promotion of it you know

240: and we worked in with them as well.

241: They were the producers of the waffle

8.3.6 Participant organisation 7

Title: Problem identification

Story 1 AGENDA-SETTING: “We saw a market opportunity. We had an issue with our own recycled material...it wasn't very good return”

Abstract

19: But I guess we saw a market opportunity

20: we had an issue with our own recycle material –

21: extruded etc re-sell it...it wasn't very good return.

Orientation

22: And in the early days

Complicating action

23: we were introducing our scrap if you like,

24: recycled material into void forms for bridge construction where they do T-beams and the like and the waffle pod market developed and that's where we put all of our 'livestreams' into the pod.

25: It would've been in the 90s

26: and it was with Peter Koukourou.

27: We had a joint-venture if you like.

28: It was in Victoria

29: we set up a joint company in Victoria to do the pods.

30: And he also had some ... with the intellectual property of –

31: because there was a chap called Ian Thorogood in Queensland

32: yes he was the chap with the original Interlock
33: he signed it over to another guy –
34: it gets pretty murky
35: yeah I can check the dates but its early 90s.

Title: Forming alliances

Story 2 REDEFINING: “C5 must’ve made base with us...we hooked up with C5...it was a 50-50 joint venture...we started a business here called Waffle Pod Footing systems...he had some agreement with intellectual property with Organisation G in Queensland”

Abstract

48: Peter Koukourou approached – must’ve made base with us.
49: In the early days when I first heard Ian Thorogood did this

Complicating action

50: because he actually sent a round robin letter for license agreements
51: when he was running his own entity in Queensland.
52: Everyone was looking at it at that point.
53: And then we hooked up with Peter.
54: So we started the business here called Waffle Pod Footing systems with Peter Koukourou
55: and it was a 50-50 joint venture in those days with Koukourou and Partners and us the manufacturer.
56: He had some agreement with intellectual property with Ian Thorogood in Queensland

Orientation

57: It would’ve been around or before 94.

Title: Promoting the system

Story 3 ROUTINISING: “and to promote it we did that by various means...Trade nights with engineers and builders and reinforcing suppliers”

Abstract

331: Look it was basically just it was in its infancy
332: and to promote it

Complicating action

333: and we did that by various means
334: trade nights with engineers and builders and reinforcing suppliers
335: and just pushing the product really.
336: We did quite a bit of that.

Title: Breaking down barriers

Story 4 ROUTINISING “The engineering...was done quite well...they were doing it exactly the way the building commission required...their computerised system made it easier then to train...it just made it easy for the thing to grow rapidly...probably broke down barriers...a big step”

Abstract

339: And the engineering – it was done quite well.
340: And the fact that they were an engineering business meant that they were doing it exactly the way that the building commission required
341: and then their computerised system made it easier then to train

Complicating action

342: and it just made it easy for the thing to grow rapidly.
343: That probably broke down the barriers to competing engineers.
344: A big step.
345: There was still the ones who’d want to put their own stamp on it.
346: But if they could pay a few hundred dollars get the software and design slabs
347: I cant remember when it first went into the Australian standard for slabs and footings
348: but it was a deemed to satisfy solution –
349: I think you’ve got the date for that.
350: Its not a big part of the slabs and footings now
351: but its in there –
352: its just normal now.
353: But initially when it went in

Evaluation

354: it would’ve been a big deal.

Title: Patent disputes

Story 5 ROUTINISING: "That joint venture with C5 lasted 2-3 years...Organisation G got involved...claimed it was his intellectual property...the partnership imploded really"

Abstract

187: That joint venture with the Koukourous ran for about 2-3 years.
188: Then Ian Thorogood became involved in the equation
189: and claimed that it was his intellectual property
190: and so the partnership imploded really I guess

Complicating action

191: it was uncertain there.
192: They were telling me that they had it
193: and Ian had signed it over to Leonardis
194: and that was later again.
199: You're probably aware that there were patent disputes going on everywhere.
200: They definitely competed with the development of the product.
201: But even recently even with Peter,
202: after he left Koukourous
203: he signed up for what you call ambulance chasers, yeah
204: There was litigation against anyone using the waffle pod system.
205: There was an attempt to draw right back to the original
207: No, he focused on Foamex Sydney
208: as a test case
209: and they lost that comprehensively
210: and they folded.
211: Not Foamex
212: but the ambulance chasers did leave.
213: But Peter went from friend to foe
214: because he saw a dollar in it
215: and he had his own partnership issues within Koukourou

Resolution

216: and you know so that's how it unfolded.

Evaluation

217: Oh, messy.

Title: A different world

Story 6 ROUTINISING: "We're manufacturers and we suddenly find ourselves sitting with patent lawyers...so we were forced to defend ourselves...so we were pretty much caught off guard..we dealt with all that and we've moved on from there"

Evaluation

218: We're manufacturers
219: and we suddenly find ourselves sitting with patent lawyers
220: and the clock's running,
221: very expensive.

Abstract

368: You're involved in another world

Complicating action

369: and even though you're ignorant of infringing,
370: that's it.
371: They just count backwards and add zeros.
372: So we were forced to defend ourselves.
195: So we were pretty much caught off guard if you like.

Resolution

196: And we dealt with all that,
197: that's behind us now
198: and we've moved forward and taken on from there.

Title: Taking scrap collection to the next stage

Story 7 ROUTINISING: "We collect unused pods and that's been one of the challenges...we've got that window to collect out scrap...we've taken scrap collection to the next stage...we're a mobile unit...its only just come online and we're trialling that"

Abstract

1: We play a big part in contributing to the waste.

Complicating action

2: We collect unused pods and that's been one of the challenges...

3: We get a lot of pressure from councils to pick it up in a certain timeframe

4: and we keep a regular track of jobs

5: and if there's any late reports we notify them

6: and we've had a pretty good record really

7: and part of the service agreement we have with some of the majors like One Steel of Smorgons

8: we adhere to that

9: and cos they get fined

10: and there's all sorts of issues

11: we've sort of got that window if you like to pick up our scrap.

we've taken scrap collection to the next stage

37: and we're a mobile unit

38: and its only just come online

39: and we're trailing that

40: and effectively what that means styrene is 98% air when its moulded its 2% plastic

41: so its very expensive to collect, its bulky.

42: And you cant get a lot into a vehicle.

43: So this is a trial

44: and if its successful roll it out.

Evaluation

45: And I do the vehicle mathematically anyway it should fit maybe 4 or 5 times, one vehicle should do 4-5 vehicles.

46: And the way that its granulated on condensed on site

47: it comes back here, gets processed, and then we ... the product.