Sustained Product Innovation in Small Companies through the Lens of Absorptive Capacity

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

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Preamble

The purpose of this PhD is to investigate how a significant part of the Australian economy, namely small manufacturing companies, acquire and use knowledge, and succeed in product innovation (PI). Using Absorptive Capacity (ACAP) as the primary lens, it explores the actions, capabilities and processes used to recognise, acquire, assimilate, transform and exploit new knowledge for commercialisation of new products; and the factors which impact on successful and sustained PI. It aims to provide an improved understanding of how ACAP manifests in small companies particularly during the front-end of the PI process, and how it and the key moderating factors impact on this process. The study provides suggestions on how the success and sustainability of product innovation in small companies might be improved and the role ACAP can play in this process.

The research will follow the “thesis structured by papers” model, where chapters will be in the form of four papers that are in the process of being prepared for publication (being formatted, publication ready, submitted, accepted or published). The university does not require these chapters (papers) to have been submitted for publication nor accepted prior to the submission of the thesis.

The thesis document is built around three studies which provide the data for these chapters (papers), with an introduction outlining the context of the work and introducing the overarching research questions. The final chapter draws together the four chapters (papers), discusses the contributions, limitations and implications of the work and offers final conclusions and recommendations.
## Contents

Abstract 1

Chapter 1 – Introduction 3
  * Introduction, Context and Research Questions 3
  * Philosophical Considerations 8
  * Data Collection and Analysis 10
  * Thesis Structure 12
  * Executive Summaries, Chapters 2-5 12-16

Chapter 2 – The Front End of Sustained Product Innovation in Small Companies using ACAP as Lens: An Exploratory Study 17
  * Abstract 17
  * Introduction 18
  * Theoretical Background 21
  * Methodology, Sampling, Data Collection and Analysis 27
  * Results 30
  * Discussion 41
  * Conclusions 42
  * Limitations, Potential Implications, and Recommendations for Future Research 43

Chapter 3 – How Alternative Innovation Approaches impact on the Front-End to achieve Sustained Product Innovation in Small Companies 47
  * Abstract 47
  * Theoretical Background 48
  * Methodology, Sampling, Data Collection and Analysis 59
  * Results 62
  * Discussion 68
  * Conclusions, Implications and Recommendations 71

Chapter 4 – How small companies conduct relationships with others to overcome resource deficiencies, develop their ACAP capability and improve product innovation 74
  * Abstract 74
  * Introduction 75
  * Theoretical Background 78
  * Methodology, Sampling, Data Collection and Analysis 88
  * Results 92
  * Discussion 99
  * Conclusions, Implications and Recommendations 104
Chapter 5 – ACAP, FEI and Sustained Product Innovation – a quantitative study of small food manufacturing companies

- Abstract
- Introduction
- Theoretical Background and Hypotheses Development
- Methodology
- Results
- Discussion
- Conclusions, Implications and Recommendations

108

108

112

121

122

127

132

Chapter 6 – Summary, Conclusions and Future Research

- Introduction
- Conclusion
- Contributions to Research (Theory)
- Contributions to Practice
- Limitations
- Future Research
- Final Comments

135

135

143

146

148

149

151

APPENDIX 1 ETHICS NOTICES OF APPROVAL

153

APPENDIX 2 COMPANY INTERVIEW GUIDE

155

APPENDIX 3 EXTERNAL SOURCE INTERVIEW GUIDE

159

APPENDIX 4 QUANTITATIVE SURVEY QUESTIONNAIRE

161

APPENDIX 5 FACTOR LOADINGS

170

REFERENCES

178
List of tables

Table 2.1 – Summary of Companies Interviewed
Table 2.2 – Summary of Company Interview Findings
Table 3.1 – PI in Small Companies and the role of ‘closed’ IAs
Table 3.2 – Summary of Companies Interviewed
Table 3.3 – Knowledge processes, resources, and alternative IAs to FEI in participating small companies
Table 3.4 – Examples of alternative IAs taken by participants
Table 4.1 – Key Literature on Engagement, Collaboration and Open Innovation, and FEI in small companies
Table 4.2 – Summary of Companies Interviewed
Table 4.3 – Summary of External Sources Interviewed
Table 4.4 – Stakeholder Engagement
Table 4.5 – Knowledge processes, resources, collaboration and open innovation in FEI
Table 4.6 – Examples of Collaboration and OI projects by participating companies
Table 5.1 – Reliabilities and Validities of Composite Factors
Table 5.2 – Correlation Matrix
Table 5.3 – Independent t-tests (95% confidence level)
Table 5.4 – Linear Regression Analysis

List of figures

Figure 1.1 – Thesis Structure
Figure 2.1 – Framework to Study ACAP and FEI
Figure 3.1 – Overview of FEI and SPI and the role of IAs
Figure 4.1 – Conceptual model of Collaboration in FEI and SPI
Figure 5.1 – Conceptual Model of FEI/SPI Factors
Figure 5.2 – Results - Relationships between Composite Factors
Abstract

Innovation is universally accepted as critical to economic growth, and small companies are recognised as key sources of innovation. Despite the plethora of government programmes to encourage innovation, Australia chronically ranks at the bottom of OECD countries with respect to commercialising innovation, particularly by small companies. Small companies provide the livelihood of many families, and are at the core of many communities and industries, so it is critical to understand how small companies function, and how they can improve performance. They are characteristically resource deficient, so how do some overcome this shortcoming to sustain product innovation and grow? This study conducts qualitative and quantitative research into the ability of small companies to acquire and exploit new knowledge (absorptive capacity) and how this capability together with organisational processes, resources, capabilities and characteristics influence the front-end of the product innovation process; and how this in turn impacts on successful and sustained product innovation, in the context of small food manufacturing companies in Australia. The food industry currently adds value of A$26 billion to the Australian economy each year, and together with agriculture the food sector has been selected for strategic national development in Australia. The findings suggest that absorptive capacity (ACAP) plays a central role in influencing activities at the front end of innovation (FEI), and both directly and indirectly in successfully achieving sustained product innovation (SPI). The research also finds that the individual ACAP, entrepreneurial passion and innovation leadership of the owner-manager of a small company play major roles in the success of FEI, together with the organisation’s culture. The results indicate that small companies, while being active seekers of new knowledge typically utilise a limited scope of sources and use primarily ‘closed’ approaches, particularly bricolage, in product innovation. Similarly, the research indicated that small companies have a limited scope of engagement with external stakeholders, and they rarely participate in collaborative innovation. This lack of engagement and collaboration is most evident between small companies and technical
institutions and potentially contributes to lower levels of novelty of product innovations by these companies. It is argued that building understanding, confidence and trust between small companies and technical institutions will require structural and attitude changes to enable higher levels of success through collaborative innovation. The findings of this research have implications for academics. These include further research into the role of ACAP in small companies within other sectors, into how ACAP can influence FEI over time as the size of a company grows, into how to improve the scope and depth of external engagement by small companies, and into how the issues impeding small company-university collaboration on product innovation can be overcome. From a practitioner’s perspective, the findings provide insight into the importance of developing ACAP within a small company; into the complex inter-relationships of the organisation’s characteristics and capabilities particularly in the front-end of the innovation process, and the need for owner-managers to develop and manage these as a necessary part of growing the company successfully and sustainably. For policy makers the findings can provide guidance on appropriate platforms and programmes to encourage and support greater product innovation in small companies in Australia.
Chapter 1 – Introduction

Introduction, Context and Research Questions

The main objective of this research is to examine how small companies acquire and use new knowledge in the front-end of innovation (FEI) to successfully achieve Sustained Product Innovation (SPI). The research uses Absorptive Capacity (ACAP) as a primary lens and considers its relationship with Dynamic Capabilities (DCs) within the paradigm of the Resourced Based View of the firm (RBV), in view of the resource deficiencies common in small companies. The research focusses on the front-end of the innovation process (FEI), and on small manufacturing companies, as seekers of information to enable product innovation, while also obtaining insight from external agencies in their capacity as potential knowledge providers to small companies. This focus on a discrete cohort, namely small companies in the Australian food manufacturing sector, addresses calls for better understanding of how sustained product innovation is achieved (Koryak et al., 2015), of how the small company sector innovates (Hutchinson and Quintas, 2008; Buenechea-Elberdin, 2017), and for more sector specific research (De Massis et al., 2018). The research follows a mixed method approach guided by a pragmatist paradigm to develop further understanding of product innovation applicable to small companies, and reflects this in a new model of SPI.

ACAP was established as a framework in which actions related to knowledge could be studied, and is defined as the ability of a firm to recognise the value of new external information (knowledge), assimilate it, and apply it to commercial ends (Cohen and Levinthal, 1990). Under RBV, competitive success is driven by the ability of firms to develop new knowledge-based capabilities that create core competencies (Pemberton and Stonehouse, 2000), and this is important in sustained innovation (Paradkar et al., 2015). Zahra & George (2002) defined a firm’s ACAP as one of a company’s dynamic capabilities and a critical resource. Research has concluded that
effectively managing the front-end of the product innovation process (FEI) is one of the most
important challenges facing companies (Kim and Wilemon, 2002). The front-end activities,
include market vision and strategy, and the communication of these; the identification and
assessment of opportunities; idea generation; product and project definition and planning (Khurana

Conducting investigation into small companies is important given that SMEs make up over
99.5% of all companies in most economies, and in particular US, UK and Australia. Despite over
70% of these being non-employing, i.e. single owner operated, SMEs make up between 48% (US)
and 60% (UK and Australia) of all private sector employment, and add 34% in US (US Small
Business Administration, 2016), 49.8% in UK (British Institute of Statistics, 2015) and 56.5% in
Australia (Statistics, 2016a) of economic value. While the literature on SMEs is extensive and
growing, this cohort is wide in its size range (up to 500 employees in some jurisdictions), and size
matters when it comes to the availability of resources (Morrison et al., 2003). Small and medium-
sized enterprises should not be considered as one homogeneous group of smaller businesses, and
it is important that their differences are acknowledged and considered (Wachsen and Blind, 2016).
This research focuses on small companies, defined here as having less than 50 full-time equivalent
employees, consistent with Recommendations of European Commission 2003/361/EC, and most
commonly used worldwide. This classification makes up a significant portion of all companies,
and of private sector employment; and it bridges the gap between start-ups and larger, better
resourced companies. So, it follows that it is important to understand how this cohort of companies
operates, and how they achieve success, particularly as a consequence of product innovation.
Because the literature on ACAP and PI solely dedicated to small companies is limited, in this thesis
literature on medium sized and larger companies, if it is considered applicable to small companies,
will be incorporated into the discussion.
Small businesses face a unique set of operational challenges, such as limited human and financial resources, and time constraints (Millward et al., 2006). While this has also been observed and reported in US (Ogbuehi and Longfellow, 1994), UK (Freel, 2000) and Australia (Statistics, 2013), there has been little work undertaken, particularly in Australia, in examining how these challenges affect the corporate decisions and performance of small businesses relative to those of larger firms (Australia, 2015). There is a high failure rate of companies which are smaller and in the first few years of operation (50% in US (USBA, 2011) and over 60% in Australia (Statistics, 2016a)). Furthermore, research from UK and Ireland indicate that even after operating for 10 years only 4% of companies are considered to have achieved high growth rates (O’Gorman, 1997).

Achieving a high rate of growth is important since a few rapidly growing firms generate a disproportionately large share of all new net jobs in Australia, compared with non-high-growth companies (Henrekson and Johansson, 2010; DIIS - Department of Industry, 2017).

There have been calls by researchers for the need to improve our understanding of innovation, and how greater economic growth in companies can be achieved (Koryak et al., 2015). To do so is important since research has shown, for example, that small manufacturing companies contribute positively to job creation (Neumark et al., 2011a; DIISR - Department of Industry, 2012), and that these companies implement innovation strategies to drive a nation’s employment growth (Triguero et al., 2014). Furthermore economic growth is maximised when an economy includes a balanced mix of family and non-family SMEs (Memili et al., 2015), both of which are common in the food sector, the context for this thesis.

This study focusses on product innovation in small established companies. It uses the OECD definition of product innovation (PI) as ‘a good or service that is new or significantly improved - this includes significant improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics’ (OECD, 2005). We also use (OECD, 2005) for the definition of radical innovation as that which results in fundamental
changes in the firm's products, while incremental innovation entails the refinement and reinforcement of existing products. The study defines sustained product innovation (SPI) as the generation of multiple new products (more than 4), as strategically necessary over time (3 years), with a reasonable rate of commercial success (sales growth rate greater than GDP) as used by (Dougherty and Hardy, 1996). In a survey of senior executives, Andrew (2013) found that 71% of companies regarded SPI in their top three strategic priorities.

It has been shown that the characteristics of, and the factors impacting on, innovation in small established companies are similar across sectors (Bessant et al., 2009), but that they are different from larger companies due to different technological and economic environments (Audretsch, 2001). To improve innovation performance, it is necessary to go beyond the measurement of the individual factors involved to understanding the reasons for the current performance level, how these key factors impact, and how they contribute directly and indirectly to success in the small company environment. This thesis will help address this need and also address the issue raised by (Hutchinson and Quintas, 2008; Buenechea-Elberdin, 2017) that most prior research into product innovation has been conducted on large companies. It will further aim to consider the multi-dimensional aspects of innovation and growth raised by these authors, in the context of small companies.

The overarching research question of the thesis is “How does ACAP manifest itself in small companies, and how does it together with other dynamic capabilities, influence the sustained success of product innovation in those companies?”

This overarching research question is addressed in a series of subsidiary research questions each of which are the primary question, respectively, for four papers which form the core of this thesis (Chapters 2-5):

1. How does ACAP manifest itself and impact on the front-end of the product innovation process (FEI) in resource deficient small companies? (Paper 1);
2. How do resource deficient small firms use alternative innovation approaches (IAs) to overcome ACAP (or knowledge-based) limitations in the FEI? Further, what other characteristics of the firm and its management enable these strategies to be implemented to overcome limitations? (Paper 2);

3. How do ACAP and organisational characteristics and capabilities influence the external relationships of small companies and the subsequent successfulness of the FEI? (Paper 3);

4. How do a small company's ACAP, culture and leadership influence each other, and how do they affect the success of the front-end and of sustained PI? (Paper 4).

Data was obtained from the representatives of small companies, and from external knowledge sources, during face-to-face interviews. As a result of gaining insights from individuals operating within the innovation process this research contributes to the literature on product innovation, and particularly the FEI, by providing new understanding of how ACAP manifests in practice during the critical front-end of sustained product innovation (SPI) in small companies; and how ACAP and other organisational resources and characteristics impact on the success of SPI. This knowledge was then used to develop and distribute a quantitative online survey of the food sector to obtain further knowledge on product innovation within this sector, and how ACAP and other activities, characteristics and capabilities relate to each other and impact on FEI.

The geographic context selected for this research is Australia, which has a chronically low ranking among OECD countries for collaboration on and commercialisation of innovation (Innovation and Science Australia, 2017; OECD, 2017). This research takes a sector specific view by investigating the food manufacturing industry. The food industry is a significant part of all economies, representing 7.6% of value added and 13% of employment (30% of which is in small companies) in UK (DEFRA, 2014), and 5.7% of GDP and 9.3% of employment in US (USDA, 2016). Despite this importance, food has not featured significantly in studies of ACAP, FEI or SPI.
Selecting the food industry in Australia as the context for this study is appropriate since it contributes in excess of $26.4 Billion in value add to the Australian economy, employs an estimated 245,000 people, and approximately 60% of its manufacturing companies fit the definition of small being used in this study (Statistics, 2016a). It is a dynamic and globally competitive industry, sometimes involving complex technologies, but often based as much on ‘art’ and ‘intuition’ as well as ‘prior knowledge’.

Although food has been included in some cross-sectorial studies in Australia (Liao et al., 2015; Terziovski, 2010), and in research into specific dynamic capabilities (Bhaskaran, 2006; Reid and Brady, 2012) there is an absence of research in this industry, and more specifically into ACAP, FEI and SPI in small companies. With a dynamic and growing market which is continuously subject to a variety of external pressures, domestic and international, the food manufacturing sector is appropriate to be the subject of a study into ACAP and PI. While it has significance worldwide, it is of particular importance in Australia since it is one of five sectors targeted by the Federal Government for strategic growth at a national level (Abbott, 2014).

**Philosophical Considerations**

The world of business is very real and requires pragmatism to survive and succeed. How the world is perceived can be defined by a set of assumptions and beliefs, a paradigm, that can provide a framework which can guide research (Jonker and Pennink, 2010). The first paradigm, ontology, perceives that the existence of reality can be viewed as external and independent of the social actors, or as dependent on these actors and their contribution to reality. The second paradigm, epistemology, considers how knowledge is generated, understood and used in the research. Axiology considers the ethics of how the researcher approaches the study, and methodology provides the process in which the study is conducted under the selected paradigm.
Two world views that are not entirely dissimilar are pragmatism and critical realism. Each of these uses a realist, tentative ontology and a subjective, critical epistemology. Their differences are that critical realists tend to put ontological considerations front and center and focus on the hidden, taken for granted structures from the real world; whereas pragmatists tend to have a lesser emphasis on ontological considerations in favor of epistemological and issues justified by experience (DeForge and Shaw, 2012). Drawing on the work by (Saunders et al., 2009; Lincoln et al., 2011; Hallebone and Priest, 2009), and discussed by (Wahyuni, 2012: 70) this work is conducted under the paradigm of Pragmatism (Tashakkori et al., 1998; Creswell and Creswell, 2017).

**Ontology:** the research drew on data from a variety of external sources, providing insights which are both dependent (interpretivist) and independent (positivist) of the participants, to build an overall view of product innovation in small companies.

**Epistemology:** Both in the interview and survey phases, knowledge was built from both observable and subjective facts as appropriate to each of the research questions being addressed.

**Axiology:** the research was informed and influenced by prior studies, theories and constructs which have been published, albeit in different contexts. The researcher had prior experience in the broad context area, small business, but not in the subject context of the Australian food sector – so the research was conducted objectively. The data collected during the survey phase of the research was provided anonymously and only used in an aggregated form.

**Methodology:** A mixed method approach was taken in the research, employing both qualitative and quantitative methods to obtain information.

In the first phase, representatives from small food manufacturing companies, and from a variety of external knowledge providers participate in one-on-one interviews. Qualitative interviews, which employ an interpretivist philosophy, were used to guide the conversation based on prior
knowledge, and in the process induce reflection and insight, which builds theory and provides management implications (Yin, 2013; Johnson and Harris, 2002). In the current study, it enabled discovery of specifics of how certain aspects of the innovation take place in practice, and what factors impact on the success of the process, thereby creating the reality of the participating cohort.

The insights gained from the qualitative research, combined with published empirical literature, provided a more nuanced understanding of product innovation and generated a framework to enable quantitative investigation via an on-line survey covering the food manufacturing sector, the second phase (third study) in this work. This study used a positivist philosophy. Under the paradigm of pragmatism, the data obtained from the survey responses was then used in conjunction with the qualitative data from phase 1 to address the overarching research questions, constrain our beliefs and reflect on how the different factors relate and impact on the front-end of the product innovation process and on SPI.

**Data Collection and Analysis**

This thesis is structured around three inter-connecting studies. As discussed above, under the paradigm of pragmatism the studies employ both qualitative and quantitative techniques to acquire and interpret information.

The first study used ACAP as the primary lens, guided by (Flatten et al., 2011a), to conduct semi-structured, face-to-face interviews with practitioners (Yin, 2013) in a cohort of small food manufacturers. This approach aimed to build on understanding from the literature, which has historically been mainly sourced from studies on larger companies, by gaining insight into how small companies recognise, acquire, use and exploit knowledge to achieve sustained and successful product innovation; and what influences their approach.

Then using similar face-to-face interviews a second qualitative study was conducted with external practitioners, as sources of new knowledge, into the relationship between small companies
and external agencies, such as universities, government and industry bodies. The aim of this second study was to understand the roles of these agencies in providing knowledge to small companies to assist them in product innovation, and how the parties engaged. In these first two studies the data was then content analysed for key themes to develop insight as to how the participants operate with regard to product innovation.

The third study drew on the insights and new knowledge gained from the qualitative interviews with company representatives to develop key themes to be used in the quantitative survey. It utilised scales from published literature which had been established to study these themes (Flatten et al., 2011a; Cardon et al., 2013; Koen et al., 2014b; Wu et al., 2017; Zeng et al., 2010; Reid and de Brentani, 2010; Freel, 2000; Markham, 2013) to conduct a nationwide quantitative survey of the food manufacturing sector.

This survey was tested with a small sample of companies drawn in part from those which participated in the qualitative interviews. It was then distributed on a Qualtrics platform to companies which had confirmed to the researcher that they were engaged in food manufacturing, and would accept an email inviting them to participate in the survey. This third study provided quantitative responses which enabled comparison with key themes discovered in the qualitative interviews (studies 1 and 2), and made it possible to explore the relationships between these factors in the subject context.

The responses were downloaded to SPSS v25 and subjected to a variety of statistical analyses to assess validity, reliability, and correlation; and to conduct bivariate linear regression. This analysis enabled findings from the first two studies to be supported or otherwise, and the relationships between key factors to be explored. From this, expanded understanding of ACAP, FEI and SPI was developed, implications for academics and practitioners were formulated and recommendations made on future directions for research. Unfortunately, the low response rate to the survey restricted the analysis that was possible, particularly with regard to structural equation
modelling, and prevented the original aim of developing a model to predict innovation outcomes based on capabilities and performance levels in front-end activities.

**Thesis Structure**

As shown in Figure 1.1, the core of the thesis is organised around two qualitative and one quantitative study, resulting in four inter-related chapters, each of which has been structured as papers for publication in relevant journals. Each of Chapters 2 to 5 discusses the theoretical background to the paper, the methodology undertaken, how data was collected and analysed, discussion of the findings, and finally conclusions, implications and recommendations. Consistent with the pragmatism paradigm, Chapter 6 draws together the qualitative and quantitative findings, consolidates the overall conclusions, presents the contributions made to theory and practice, discusses the limitations, and makes recommendations to practitioners and researchers for future action.

**Figure 1.1: Thesis Structure**

![Thesis Structure Diagram](image)

**Executive Summary – Chapter 2**
Innovation is universally accepted as critical to economic growth. Since small companies are a major part of the economy and are recognised as important sources of innovation, this paper investigates how some small companies overcome their inherent resource deficiencies, sustain product innovation and grow. This study investigates the published literature on Product Innovation, Absorptive Capacity, Resource Based View and Dynamic Capabilities as it relates to small companies in their pursuit of sustained product innovation. The study then explores the key themes from this literature in a series of semi-structured, face-to-face interviews with representatives of small food manufacturing companies (employing less than 50 employees) located in four states in Australia.

Using the theory of Absorptive Capacity (ACAP) as a primary lens, this qualitative study, which focusses at the critical front-end of product innovation (FEI), shows that continuous acquisition of new market, product and business knowledge, even if not necessarily achieved using a formalised process, is a feature of FEI and sustained success in product innovation in small companies. It finds that ACAP, prior knowledge, the owner-manager’s leadership, entrepreneurial passion, market vision, and close internal communication play major roles in the success of new product development in these resource deficient companies. It further finds that bricolage, using internal and readily available resources, is a common part of small company product innovation strategy, whereas external collaboration and open innovation, which are also influenced by ACAP, are not.

The study develops a new conceptualisation of product innovation and the role played by ACAP and dynamic capabilities. The study recognises that further research needs to be conducted into specific areas to improve understanding, particularly with regard to how small business owner-managers search for and recognise the new knowledge they need and with whom they engage to acquire this. More research is also required into team-level ACAP, bricolage and other ‘closed’ innovation approaches, entrepreneurial passion, as well as open innovation and collaboration. This
need for further research of these factors is explored in Chapter 3 and in the second series of interviews, with external agencies, in Chapter 4.

Executive Summary – Chapter 3

The research presented in Chapter 2 indicated that the resource deficiency of small companies impacts on their approach to innovating. How these small firms repurpose their resources, and access readily available resources, can impact on their success at developing new products. Chapter 3 explores this issue in more detail, using data from the interviews with the same personnel from 15 small companies involved in food manufacturing as in Chapter 2, and examines causation, effectuation, improvisation, and bricolage in small companies. The research agrees with the literature that knowledge, existing and new, is a key resource in these ‘closed’ innovation approaches (IAs). It further finds that when positively influenced by leadership with a clear market vision, entrepreneurial passion and absorptive capacity, new knowledge can drive successful product innovation over a prolonged period. Bricolage and improvisation can become key capabilities of the company and provide competitive advantage. However, this study also finds that it is possible that over-reliance by a small company on bricolage could limit its innovation to incremental improvements, by limiting consideration of more novel opportunities.

Executive Summary – Chapter 4

The findings from the qualitative interviews presented in Chapter 2 and 3, and supported by published literature, show that small companies are typically resource deficient - so how do they use their limited resources and capabilities to engage with others, and access new knowledge and expertise, to sustainably develop new products? Chapter 4 uses data from face-to-face interviews conducted with small companies involved in food manufacturing, as presented in Chapter 2 and 3, together with information gained from further one-on-one interviews with several external knowledge sources, to explore the use of collaborative and open innovation. This chapter takes a particular interest in industry-university linkages. The research found that, despite the potential
benefits published in the literature, external collaboration and open innovation are not typically used by small food manufacturing companies in Australia, and that university linkages aimed at developing new products by this sector are employed even less. It found that, when effective collaboration and open innovation does occur, an important antecedent is active engagement between the parties. The research found that collaborative and open innovation in small companies are strongly influenced by the owner-manager, and his/her ACAP and managerial capabilities and entrepreneurial passion. The study concluded that there are several barriers which need to be overcome in order to achieve successful small company-university linkages which can contribute to increased product innovation. Structural and attitudinal changes need to occur to encourage more, and sustained, engagement between the parties in order to develop the understanding and trust necessary for effective collaboration. Implications for policymakers and the management of both small companies and universities are considered, and recommendations for the future are presented.

**Executive Summary – Chapter 5**

Success in achieving SPI involves many dynamic capabilities, including ACAP, as well as resource factors, as shown in the results of the qualitative research conducted with the small companies in Chapters 2, 3, and 4. In Chapter 5, the key themes evolving from the qualitative interviews in Chapters 2-4 are used as the constructs to be studied in an on-line quantitative survey of Australian food manufacturers. Established scales, from the published literature, for each of these constructs are used to create an on-line survey, the data from which was then analysed using correlation analysis, bivariate regression and t-tests, to determine how these factors inter-relate and impact on FEI and SPI. The study found that multiple factors influence the approach taken to product innovation and the activities in the front-end of the innovation process, and that these factors influence each other. In particular, ACAP, organisational culture, and leadership by the owner-manager have significant influence throughout the FEI process. This study extended the
knowledge of FEI, based on the literature involving medium and larger companies, by showing that success in the front-end also had significant influence on sustained success in product innovation in small companies. The study found that within the specified size range of less than 50 employees, there was homogeneity with size not having any significant effect on results. The study presents a model of FEI which highlights the multiplicity of factors that the owner-managers of small companies need to appropriately address in order to achieve SPI successfully. However, improvement in product innovation performance cannot be achieved in isolation, and the study also has implications for academics and policy makers and these are discussed, with recommendations made for future research.
Chapter 2 -

The Front End of Sustained Product Innovation in Small Companies using ACAP as Lens: An Exploratory Study

Abstract

Innovation is universally accepted as critical to economic growth, and small companies are recognised as key sources of innovation. Small companies are characteristically resource deficient, so how do some firms overcome this to sustain successful product innovation and grow?

Using the theories of Resource Based View (RBV) and Absorptive Capacity (ACAP) as primary lenses, this qualitative study of small food manufacturing companies focuses at the critical front end of product innovation (FEI). The study shows that continuous acquisition of new market, product, and business knowledge, even though not necessarily a formalised process, is a feature of sustained success in product innovation (SPI) in small companies. It finds that ACAP, along with prior knowledge, managerial capabilities of the owner-manager, a clear market vision, and entrepreneurial passion, individually and collectively, all play significant roles in overcoming resource deficiencies, and influence sustained success of new product development. It further finds that while bricolage, utilising internal resources, is a common part of innovation strategy in the cohort of small companies, external collaboration and open innovation, which are also influenced by ACAP, are not.

The findings have implications for industry, funding agencies, and academia; and recommendations for future research to further our understanding are presented.

Key Words: absorptive capacity, product innovation, small companies, dynamic capabilities, FEI
Introduction

The main objective of this research is to examine Sustained Product Innovation (SPI) in the context of small manufacturing companies, using Absorptive Capacity (ACAP) as a lens and considering its relationship with the paradigm of the Resourced Based View of the firm (RBV) in view of the resource deficiencies common in small companies. This paper focuses on how the key knowledge capabilities (ACAP) and mechanisms manifest in the early stages (front-end) of the product innovation process (FEI) in small manufacturing companies; and how organisational characteristics and resources together with managerial capabilities impact on FEI. This study is based on information from a series of interviews with practitioners drawn from the Australian food industry. By focusing on a single sector and a specific range of company size, this study aims to overcome some of the issues recognised in studies of broader industry cohorts (De Massis et al., 2018; Fabrizio, 2009; Hervas-Oliver et al., 2011). This paper presents and discusses current literature on the importance of ACAP in product innovation, in particular in FEI, in the context of small enterprises and their success in sustained product innovation (SPI).

ACAP is the capability of recognising, acquiring, assimilating, transforming, and exploiting new knowledge (Zahra and George, 2002), and these are key elements of the early stages of product innovation. As a dynamic capability, ACAP forms part of the resources of a company (Zahra and George, 2002), and therefore research grounded in RBV is also reviewed. The literature highlights the importance of the front-end of the innovation process to the overall success of an organisation (Kim and Wilemon, 2002), but acknowledges that there are gaps in our knowledge of ACAP and FEI in the context of small companies.

Small and medium enterprises (SMEs) make up over 99.5 percent of all companies in most economies; and particularly in US, UK, and Australia make up over half of all the private sector employment. SMEs add up to 55 percent of the economic value in these countries (SBA, 2014; Statistics, 2016b; British Institute of Statistics, 2015). Research on SMEs has expanded
significantly over the last two decades. However, this cohort is wide in its size range (up to 500 employees in some jurisdictions), and size impacts on the availability of resources (Morrison et al., 2003; Gassmann et al., 2010; Petruzzielli et al., 2018). Since SMEs are not one homogeneous group, it is important that the differences between small and medium sized enterprises are acknowledged and taken into account in research (Wachsen and Blind, 2016). This research focuses on small companies, defined here as having less than 50 full-time equivalent employees, consistent with Recommendations of European Commission 2003/361/EC and most commonly used worldwide. This classification makes up a significant portion of all companies and bridges the interval between start-ups and larger, better resourced companies.

However, small businesses face a unique set of resource constraints and operational challenges, such as limited human capital (not only the number of staff but also the scope and depth of knowledge), financial resources (capital and cashflow) and time constraints (Millward et al., 2006). While this has been observed and reported previously in US (Ogbuehi 1994), UK (Freel 2000) and Australia (Statistics, 2013), there has been little work undertaken, in particular in Australia, in examining how these challenges affect the corporate decisions and performance of small businesses by contrast to larger firms (Australia, 2015). Small businesses which overcome these challenges and achieve high growth have been found to generate a disproportionately large share of new employment (Neumark et al., 2011b; DIISR - Department of Industry, 2012) and economic growth (Triguero et al., 2014), but this high growth only occurs in three to six percent of all small firms (Audretsch, 2012; DIIS - Department of Industry, 2017; Henrekson and Johansson, 2010; Daunfeldt et al., 2010).

Several researchers have highlighted the gaps in empirical knowledge of leadership and capabilities in relation to product innovation in small companies, and suggested that more research can be done to better understand these issues (Koryak et al., 2015; De Massis et al., 2015; Brunswicker and Vanhaverbeke, 2015). In this study, we focus on product innovation, and we use
the OECD definition of product innovation (PI) as a product or service that is new or significantly improved by changes to technical specifications, components and materials, software in the product, user-friendliness or other functional characteristics (OECD, 2005). We also use (OECD, 2005) for the definition of radical innovation as that which results in fundamental changes in the firm's products, while incremental innovation entails the refinement and reinforcement of existing products. The study defines sustained product innovation (SPI) as the generation of multiple new products (more than four), as strategically necessary over time (three years), with a reasonable rate of commercial success (sales growth rate greater than GDP), as used by (Dougherty and Hardy, 1996). SPI is regarded by companies as being in their top three priorities (Andrew et al., 2013).

To improve innovation performance, it is necessary to increase our understanding of practice in the small company environment. This paper will address this need and also address the issue raised by Hutchinson and Quintas (2008) and demonstrated in a recent literature review (Buenechea-Elberdin, 2017), that most prior research into product innovation has been conducted on medium and large companies. It will also aim to consider the multi-dimensional aspects of innovation and growth raised by these authors. While a company needs to be proficient in all phases of the PI process, managing the “upfront or fuzzy front–end” is one of the most important, and difficult challenges facing innovation managers (Kim and Wilemon, 2002). Since there is no time when the resource deficiency of small companies is more apparent than in these early stages of PI, the paper will have an emphasis on ACAP and dynamic capabilities in the front-end of the new product development process.

The overarching question to be addressed is “How does ACAP manifest itself in the front-end of the innovation process to foster sustained product innovation in resource deficient small companies?”. 
This will be answered via a series of Supplementary Research Questions (SRQs):

1. How do small firms develop new ideas, and how do they use prior knowledge in FEI?
2. How do small firms recognise and acquire new knowledge and use it in FEI?
3. How do they assimilate and transform this knowledge to be used throughout FEI?
4. What barriers and difficulties do small firms face implementing ACAP and building ACAP as a capability that fosters sustained success in FEI?
5. What are the organisational characteristics which influence on FEI and drive SPI in small companies?

By gaining insights from individuals operating within the innovation process, this research contributes to the literature by providing new understanding of how ACAP manifests itself particularly during the critical front-end of sustained product innovation in small companies, given their resource constraints.

**Theoretical Background**

The core value of a company is its competitive performance and its ability to exploit its resources (Wernerfelt, 1984; Barney, 1986; Barney, 1991; Peteraf, 1993; Penrose, 1995). This is known as the Resource Based View of the firm (RBV). SMEs have a number of resource disadvantages including limited financial resources, scarce personnel capacities, and limited time availability (Millward et al., 2006; Laforet and Tann, 2006; Teng, 2007). These resource deficiencies have been shown to adversely impact on the ability of SMEs to sustainably engage in product innovation and to grow (Darroch, 2005; Martineau and Pastoriza, 2016; Xie and Suh, 2014).

Under RBV, competitive success is driven, in part, by the ability of firms to develop new knowledge-based capabilities that create core competencies (Pemberton and Stonehouse, 2000), and this is important in sustained innovation (Ngo and O'Cass, 2009; Morgan et al., 2009; Paradkar
et al., 2015; Lin et al., 2013), inclusive of in small companies (Dibrell et al., 2008). This ability is particularly important in the early stages of development in these companies (Paradkar et al., 2015), and for companies to achieve and sustain high growth they need to continuously innovate (O’Gorman, 1997; Mazzucato and Parris, 2015).

**Product Innovation and Absorptive Capacity**

Cohen and Levinthal’s seminal work introduced the concept of Absorptive Capacity (ACAP) to construct a framework in which the actions related to knowledge could be studied. ACAP is defined as the ability of a firm to recognise the value of new external information (knowledge), assimilate it, and apply it to commercial ends, and this is critical to its innovative capabilities (Cohen and Levinthal, 1990). Extending Cohen and Levinthal’s work by taking a dynamic capabilities view of the firm, a distinction has been made between a firm’s potential and realised capacity, potential ACAP being the acquisition and assimilation of knowledge and realised ACAP being transformation and exploitation of this knowledge (Zahra and George, 2002). Zahra & George (2002) defined a firm’s capability to effectively create, manage, and exploit knowledge as one of a company’s dynamic capabilities (DCs) and a critical resource.

Developing this view further, Lane et al (2006) concluded that ACAP is a significant determinant of knowledge transfer and organisational learning and that it is also important at the front end of product innovation. This has led to a number of researchers viewing ACAP as a central capability in product innovation, because it describes the process by which knowledge creates and leads to the commercialisation of new products (Verona and Ravasi, 2003; Zhou and Wu, 2010; Sáenz et al., 2014; Ritala and HurmeLinn-Lauckkanen, 2013; Lin et al., 2012). Furthermore, Flatten et al (2011a) have contributed useful scales to measure ACAP, and these scales are applicable to studies of SMEs.

Prior knowledge has a significant impact on ACAP particularly at an individual level (Lowik et al., 2017). Berkhout et al (2010) have shown that a higher level of technological capability leads
to a higher receptivity to new external information, and to increased ACAP. Developing ACAP as a central capability in sustained product innovation cannot be achieved in isolation, and so how other capabilities impact on ACAP need to be considered. These capabilities include market visioning competence (Reid and deBrentani, 2012), planning (Salomo et al., 2007), leadership and commitment (Ambrosini et al., 2009), and entrepreneurial passion (Cardon et al., 2009; Drnovsek et al., 2016).

There is an absence of, and need to develop, knowledge which focusses on how ACAP influences FEI and SPI performance in small companies, particularly those in specific sectors such as manufacturing (Volberda et al., 2010; Van Wijk et al., 2011; De Massis et al., 2018). It is also true that extant research has focused on the outcomes of ACAP actions by relating the existence of these actions to proxies of innovation, such as R and D expenditure, patents, and sales growth (Romijn 2002; Coad 2008), rather than how ACAP is manifested, particularly in small companies.

SMEs which do not continually invest in innovation put themselves in greater risk of losing competitive advantage (Dibrell et al., 2008; Verhees and Meulenberg, 2004). Small firms need to acquire, transform, disseminate, and exploit customer and market information just as much as their larger counterparts but are limited by many resource related factors (Alegre and Chiva, 2008; Teng, 2007), and this can be particularly so in their early stages of their development (Paradkar et al., 2015). The limited amount of research that has been focused on small companies has shown that knowledge acquisition and how it is used (that is ACAP) are key drivers for innovation, productivity and growth (Roper et al., 2008; Hervas-Oliver et al., 2011; Parida et al., 2012; da Costa et al., 2018). Volberda et al. (2010) concluded that there is a need to revisit ACAP, with regard to the role of individuals, which in companies with smaller numbers of employees takes on a higher relative importance, particularly related to the role of the owner-manager.
Front End of Innovation

Cooper (1983) argued that product innovation (PI) has seven phases - idea generation, preliminary assessment, concept agreement, research and development, testing, trialling and launch. The Fuzzy Front End, or FFE, as it was termed by (Khurana and Rosenthal, 1998) included the first six of these phases up to the point of final detailed design, development and launch of the product. Kim & Wilemon (2002) defined FFE as the period from when an opportunity is first considered to when the idea is assessed as being ready for commercial development. While using this definition, this paper uses the term FEI, as used by (Koen et al., 2001), instead of FFE, and is more common in recent literature. Highly innovative companies were found to be more proficient in the front end of the process (Koen et al., 2001), and their later research found that opportunity identification and analysis, idea enrichment, and concept definition were the most critical elements (Koen et al., 2014b). Despite the acknowledged importance of these activities, there has been limited research published in this area (Kock et al., 2015).

Reid & De Brentani (2004) found that the environment, the individual and the organisation, are important to an understanding of the innovation process overall, and to FEI in particular. Kim & Wilemon (2002) found that a distinctive feature of FEI is ambiguity and uncertainty, and within this environment Reid & De Brentani (2012) on market vision, and Benassi et al. (2016) studying product vision, found that for success these need to be clear and concise, and aligned with the overall innovation strategy. Trust was found to have significant impact on FEI as it allowed business partners to act in a non-opportunistic way, reinforcing their credibility and their motivation to acquire and exploit external knowledge (Presutti et al., 2011).

Small Companies

Small companies characteristically have resource constraints. The challenges most frequently discussed in the literature are financial, time and human resources (Rosenzweig and Grinstein, 2016). Resource deficiencies may occur simultaneously, influence one another, and present
cumulative effects because challenges may interconnect, and as a result affect the overall intensity of the constraint and its impact. For example, lack of necessary financial resources can limit a company’s innovative performance by not being able to afford to develop multiple technologies, or to experiment with new ideas (Agarwal et al., 2004); and small firms with financial constraints are not able to hire the required employees, which can limit their creativity, innovativeness and viability (Voss et al., 2008; Eisenhardt and Schoonhoven, 1996). Vermeulen (2005) suggested that small firms incur problems in innovation related to resources, lack of strategic focus, and information technology. Wang & Ahmed (2007) found that entrepreneurs and owner-managers of small firms often fail to consider the broader market environment in which they operate and fail to take the long term into account when making strategic decisions. As a result, these small firms tend to be more reactive and to not optimally exploit their resources or innovations – this was later supported by Mazzarol et al. (2009). Bocken (2014) found that SMEs favor informal, systematic, and open innovation activities at the front-end, that their teams are multidisciplinary, and that creativity and prior knowledge is critical.

Capabilities

Investing in research and other capability building can improve a company’s ability to identify, value, assimilate and apply knowledge, that is its ACAP (Fabrizio, 2009; Caragliu and Nijkamp, 2012). The acquisition and transformation of external knowledge and the firm’s learning orientation has a positive impact on market orientation and entrepreneurial orientation as key dynamic capabilities and, in turn, on innovation success (Moilanen et al., 2014; Roxas et al., 2014; Rhee et al., 2010). Developing ACAP as a central capability in SPI cannot be achieved in isolation, and so how key dynamic capabilities impact on ACAP needs to be considered. These capabilities which along with ACAP form part of the resources of the company include market vision competence (Reid and deBrentani, 2012), planning and processes (Salomo et al., 2007), leadership
and commitment (Ambrosini et al., 2009), and entrepreneurial passion (Cardon et al., 2009; Drnovsek et al., 2016).

The literature on RBV demonstrates the role of ACAP and the other dynamic capabilities as resources which form part of the value of the company. The literature also indicates what factors typically impact on a company’s ACAP, and whether ACAP impacts on FEI and SPI. However, it does not provide much insight into how this happens in practice, how small companies use their limited resources, the capabilities they employ, and the actions they take to achieve FEI and SPI success. This research investigates these issues within the framework outlined in Figure 2.1.

**Figure 2.1 - Framework to Study ACAP and FEI**

The following section will discuss the methodology used to investigate how ACAP manifests throughout the FEI process, and how the company’s resources, organisational characteristics, and its managerial capabilities, shown in Figure 2.1, impact on ACAP, FEI and SPI success. It outlines how the data is collected via a series of face-to-face interviews and how this data is analysed. Following this the findings are then discussed, compared with published literature, implications for practitioners are outlined, and conclusions drawn.
Methodology, Sampling, Data Collection and Analysis

Most prior research on ACAP and PI has been conducted using cohorts of SMEs and larger companies. However, previous studies have shown that size has a clear impact on ACAP and product innovation (Alegre and Chiva, 2008; Hervas-Oliver et al., 2011). Since SMEs are a large group which is diverse in size, this study focuses on one of its major subsets, namely small companies with less than 50 full-time equivalent (FTE) employees.

This research is constrained to a single industry in order to better understand business processes without the potentially confounding effects of multiple industry contexts. Food manufacturing has not featured significantly in studies of small business, ACAP and PI. Selecting the food industry in Australia as the context for this study is appropriate since it contributes in excess of $26.4 Billion in value add to the Australian economy, employs over 240,000 people; and approximately 60 percent of its manufacturing companies fit the definition of small being used in this study (Statistics, 2016a). The food sector has been included in some cross-sectorial studies in Australia (Liao et al., 2015; Terziovski, 2010), and in research into specific dynamic capabilities (Bhaskaran, 2006; Reid and Brady, 2012) but there is an absence of research in this industry specifically focussed on ACAP, FEI and SPI in small companies. With dynamic and growing markets which are continuously subject to a variety of external pressures, domestic and international, the food manufacturing sector is appropriate to be the subject of a study into ACAP and its role in FEI and SPI.

Method

Since the topic of how ACAP manifests in resource deficient small companies has not been well covered in prior literature (Flatten et al., 2011b), this research is being undertaken via a series of qualitative interviews to induce comment and gain insight in order to build on theory and provide management implications (Yin, 2013; Johnson and Harris, 2002). By conducting interviews with informed participants who operate within the PI process of their companies it aims
to reveal the nature, source and mechanisms behind the capabilities used (Rouse and Daellenbach, 2002). This approach is similar to that used by (De Massis et al., 2015).

**Data Collection and Analysis**

The selection criteria for participants included:

1. Size - less than 50 employees,
2. Age - operating and demonstrating above GDP growth for three years or more,
3. Sustained PI - demonstrated by commercialising at least four new products each year.

The selection of ‘successful’ companies was taken because (1) it enabled focus on how sustained PI was achieved, that is what worked rather than what didn’t; and (2) difficulty to access unsuccessful companies to reveal the nature and source of their ‘failures’.

The pool of participants was generated using non-probability sampling through discussion with, and suggestions from two industry-representative organisations; and by independently searching the content of websites of companies in the food sector. Publicly available information for each company was assessed broadly against the selection criteria, in particular for the company’s innovativeness. Potential Participants were selected from family and non-family businesses, from metropolitan and rural areas covering four states and a geographic spread of over 2000 kms. They covered a range of different types of ingredients, food and beverages with little if any direct competition between them.

Having developed a list of Potential Participants, the owner-manager of the company was then contacted personally to confirm the company met the selection criteria of size, age and sustained PI; and the project scope and obligations were explained. If the owner-manager agreed, an Invitation to Participate was sent out, which explained the aim of the study, and discussed the obligations and rights of participants as well as full contact details for the researchers. This invitation was followed by a consent form to be completed and signed by each person to be interviewed.
The interviews were conducted around a series of open and semi-structured questions drawing on work from several studies (Cardon et al., 2013; Fabrizio, 2009; Flatten et al., 2011a; Statistics, 2013). Using an open interviewing approach, the questions were supplemented as appropriate to the individual conversations to draw out key themes and investigate how sustained PI occurs in the business, with a particular emphasis on the FEI. The scope of questions was broadly grouped into:

1. Confirmation of Selection Criteria and Business Description
2. Market and Product Innovation Climate
3. Absorptive Capacity and the Front End of Product Innovation
4. Resources
5. Dynamic Capabilities
6. Sustained Product Innovation

Details of the lead questions are shown in Appendix 2.

A total of 24 individuals in 15 companies were interviewed lasting between 45 minutes and two hours. The interviewees varied in age (30 to 80 years), approximately half had a university education, and a quarter had post-graduate qualifications. All companies had been operating for more than three years, and most more than 10 years.

All interviews were conducted by the principal investigator and voice recorded, with both companies and individuals being de-identified. In transcripts and published works the company is only referred to by a number (for example, Firm 6) and neither the name nor the title of the interviewee is mentioned in any published information. The recordings were transcribed, totalling 182 pages or approximately 109,000 words, and then the data was manually coded based on critical factors/key themes from the published literature. This data was then tabulated, by individual company, and these factors, themes and patterns were consolidated for the total cohort of companies. The data was then examined to search for further underlying patterns, and for any
divergence from extant literature. To minimise coder bias, and to detect any significant themes not detected by the principal coding approach, the transcriptions were then content analysed using Leximancer Release 4.5, which text analyses the content of textual documents and provides a display of the information visually and quantitatively. The results of this analysis were compared against the primary coding results.

Table 2.1 - Summary of Companies Interviewed

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Turnover ($million)</th>
<th>Employees</th>
<th>New Products Developed/yr.</th>
<th>Age of Company</th>
</tr>
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<tbody>
<tr>
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<td>&lt;1</td>
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<td>4</td>
<td>Non-Family</td>
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<td>2</td>
<td>Region</td>
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<td>7</td>
<td>50</td>
<td>Non-Family</td>
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<tr>
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<td>10</td>
<td>8</td>
<td>Non-Family</td>
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<tr>
<td>4</td>
<td>Region</td>
<td>3-4</td>
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<td>10</td>
<td>Non-Family</td>
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<tr>
<td>5</td>
<td>Region</td>
<td>5</td>
<td>20</td>
<td>10-20</td>
<td>Non-Family</td>
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<tr>
<td>6</td>
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<td>10</td>
<td>25</td>
<td>20-40</td>
<td>Non-Family</td>
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<tr>
<td>7</td>
<td>Region</td>
<td>10</td>
<td>25</td>
<td>7-10</td>
<td>Non-Family</td>
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<tr>
<td>8</td>
<td>Metro</td>
<td>20-30</td>
<td>20-30</td>
<td>300</td>
<td>Family</td>
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<tr>
<td>9</td>
<td>Metro</td>
<td>30-40</td>
<td>35</td>
<td>&gt;20</td>
<td>Family</td>
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<tr>
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<td>45</td>
<td>42</td>
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<tr>
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<td>50</td>
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<td>Family</td>
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<tr>
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<td>8</td>
<td>50</td>
<td>15-20</td>
<td>Non-Family</td>
</tr>
<tr>
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<td>3-4</td>
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</tr>
<tr>
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<td>Region</td>
<td>25-35</td>
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<td>15-20</td>
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Results

This study was conducted in the context of small manufacturing companies operating in the food sector in Australia. As is recognised globally and nationally, the need to innovate is well understood by these small companies - the development of “our IP is the reason we exist and that we will continue to exist” (Firm 8), and “if you don't have innovation you won't survive” (Firm 11). In relation to the market environment in which PI was conducted participants commented that product cycles were getting shorter which placed increasing demand on companies for product
innovation. The average product life was five to seven years which was consistent with the findings by (Morris et al., 2008). Product packaging and presentation was the most common area of PI. Incremental innovation focused at convenience, and the need to deliver time and/or labor savings dominated PI activity. Approximately one quarter of the participating companies actively engaged in development of products which were new to the company and the market (Firms 1, 8, 11, and 13) - this contrasted to a cross-sector study showing less than 1 in 6 participated in more novel innovation (Commbank, 2016), and supports the suggestion that success in incremental innovation can be an antecedent to radical innovation, by an organisation being ambidextrous or having the ability to engage in both explorative and exploitative activities (Bledow et al., 2009; Gibson, 2004). The resultant new products from innovation programs launched over the past year or so currently contributed around 10 percent of annual revenue for most participants, which was generally regarded by participants as below their long-term target, and was primarily due to slower uptake through the distribution chain.

Most commonly three to seven employees (15-20% of total staff) were involved in various stages of product innovation, with multifunctional representation and a major participation by the owner-manager. Particularly in the smaller companies, production/operations personnel were directly involved in innovation process at an early stage, because they did not have a separate R&D function and often conducted experimentation using production equipment.

There were no major differences in response between geographic locations of the businesses, corporate structures (family and non-family), nor segments of the food sector (for example food vs beverage). For family owned and managed companies the family’s culture and values, as well as trust and good communications, were paramount (Firms 8, 11, 12). Interestingly, all the non-family companies demonstrated many of the same characteristics, such as close interpersonal relationships, communication and trust. There were differences which became apparent when the cohort was divided into ‘smaller’ companies (less than 30 employees, being the average of the
sample) and those above this level. Participants, particularly in these ‘smaller’ companies, highlighted the issue of resource deficiency related to the impact of the knowledge resources available to the company, and this suggested that there may be a tipping point below which human and knowledge resources are perhaps the major constraint to product innovation.

**Supplementary Research Question 1 - How do small firms develop new ideas, and how do they use prior knowledge in FEI?**

**Prior Knowledge.** Generally, the companies have a very stable workforce and this stability, particularly of key staff, contributes to substantial prior knowledge of technology and markets being available to the product innovation process. This prior knowledge, or intellectual capital, is a key resource of these successful small companies. In smaller companies the owner-manager is the major source of prior knowledge particularly related to products, customers and markets, and as the company grows this knowledge base broadens to key staff. Almost all owner-managers have backgrounds in food (50% as chefs), or grew up in entrepreneurial families, and these backgrounds established a foundation of prior knowledge - this is consistent with (Sullivan and Marvel, 2011). Only two of the companies interviewed had an owner-manager with a tertiary technical education which contributed directly to the prior knowledge of the company. In both cases, however, the growth of the businesses was higher than most of the companies interviewed which is consistent with the findings of (Bolli et al., 2015; Gray, 2006). Smaller companies (less than 30 employees) in particular have a very high dependence on prior knowledge and intuition of the owner-manager, most notably Firms 1, 2, 6, 7, and 13.

**Opportunities and the need for new knowledge.** It was often explicitly stated by interviewees in all companies that there was a high level of entrepreneurial passion, principally regarding the products and the market, and this drove an interest in seeking new opportunities and in gaining new knowledge. New opportunities were identified from discussions with customers, by studying trends in the domestic markets, and by looking overseas at products which had not yet been
exploited in Australia. One-third of the participating companies actively looked for opportunities for their products overseas. Generally, a new opportunity generated a need for new knowledge. The most common type of new knowledge required related to packaging and secondly to ingredients – formulation and processing knowledge for these new products usually were satisfied by the prior knowledge of key people. Where the opportunity related to markets new to the company, particularly if export, new human resources with experience in the market were required – in one case this need was ultimately satisfied by establishing a facility in the overseas market and staffing locally.

**Supplementary Research Question 2 - How do small firms recognise and acquire new knowledge and use it in FEI?**

The food sector is very driven by trends, so the need to be constantly updating information is very important - “basically sucking knowledge from wherever I can” as expressed by one owner (Firm 2). The participating companies used a variety of sources to acquire new knowledge externally, as discussed below. The search for and acquisition of this knowledge largely was the responsibility of the owner-manager. The primary focus of this recognition and acquisition phase was maintain currency of knowledge of market and product trends and to look for new opportunities. Following recognition of a new idea/opportunity the company searched for the new knowledge required to evaluate the feasibility of the idea. This information together with any additional new knowledge, which generally related to new resources or technology that might be needed, was used to develop the concept to a level of definition to enable product development to proceed.

Internet, social media, magazines etc. The dynamic nature of social media and the technology it uses is a major challenge to small companies to keep up. However, all use internet (primarily Google) and social media (Facebook, Twitter, Instagram, blogs) as sources of knowledge,
particularly on market trends, and a few for consumer feedback. Platforms more focused at B2B, such as LinkedIn and Google+, are not commonly used.

**Market research reports.** With only two exceptions companies did not purchase supermarket scan data (due to cost), although some subscribe to other lower cost market publications - "it would be a great thing if government would buy that (scan data) and provide it to the small companies gratis" as one participant (Firm 14) wishfully stated it, as he believed affordable access to such information would lead to more competition and innovation.

**Local and overseas travel.** Travel is predominantly done by owner-managers, who can spend up to 50% of their time (Firm 11) acquiring new knowledge and ideas from the market, but more commonly 10-20% of their time is spent on this activity. International markets are major sources of new knowledge of new products, technology, and market trends. Given that time is the most commonly mentioned resource constraint, this demonstrates the importance small companies place on the acquisition of this new knowledge. Regions of travel reflect the focus of each business. "I had seen that in Brittany in France they do a lot of biscuit with salt and I thought it was a good idea. And my French chef friend said let’s do it" - Firm 6. As more human resources are available, larger companies also send key staff. Generally, but not always this travel is linked to international food industry expos. Some have participated in government-led trade delegations with some success in developing new export sales (for example Firms 1, 5, 6, 7, 9), albeit within their resource limitations.

**Hiring in new people and training of staff.** Within the last two years, the majority of companies have hired new personnel to bring in new knowledge (technical, marketing or business) to add to product innovation success. All companies recognised the need to ensure that new personnel coming into the company were compatible with the established company culture. This fit was critical in the smaller companies, where the impact of the ‘wrong’ person was considered to be greater. One company related the experience of hiring a new manager by having him work in the
business for six months “so if he could understand what (the company) was and we could identify with what he could do with the product and food, then we can see if we can work something out with him” (Firm 5). This type of approach was supported by (Firm 2) - “the new people coming in have to be passionate about it and be part of the team”. Participants recognised the need for training of staff as a means of acquiring new knowledge and skill. Owners recognised that they “probably don’t do enough (training) at senior management level” (Firm 10). For many of the smaller companies, participants commented that “the real battle for us is to get companies that can deliver stuff (knowledge) which is relevant to our industry” (Firm 7) and to have it “cost and time effective” (Firm 14).

Industry and supply chain sources. The use of industry expertise as a source of knowledge is primarily via personal contacts developed over the individual’s career or involving existing supply chain relationships rather than seeking out new sources - this has the potential to limit the depth and diversity of potential knowledge sources. Since packaging changes are the most common innovations, packaging suppliers are the most common source of new knowledge from within the supply chain - in particular Firms 5, 8, 12, and 13. Customers were also a source of new knowledge particularly related to end-user needs (Firms 1, 4, 6, 7).

Smaller companies in general did not participate in industry networks, clusters, associations etc. due to lack of time and accessibility (particularly regional companies). Exceptions to this are Firms 1 and 15 for which a local cluster of companies plays a critical role in product development.

Larger family companies in the study use collaborations with other companies as sources of knowledge, generally with other family companies where values play a strong role in the longevity of relationships - “it is shared values. The views that they have on their staff and community are very similar to ours, and we also get the decision quickly” (Firm 8) – this built a relationship of trust in which knowledge could be shared. Smaller companies collaborate very little with other companies. In virtually all cases collaborations, where they exist, are informal.
Institutional sources. In contrast to (Street and Cameron, 2007), only 25 percent of all participating companies, all of which were larger (that is more than 30 employees), sourced new knowledge or conducted any product innovation externally with a technical institute or university. “We have never had much success in using consultants etc. in product development” (Firm 6), and “the platforms they offer aren’t really right, so it’s better to go ahead and do it yourself” (Firm 14). When they did work with a technical institute it was a longer term, more novel innovation project which at least in part exceeded the company’s technical capability (Firms 6 and 9), and they were able to find the knowledge within an accessible institution. Many, particularly regional and smaller companies, had no relationships with technical institutes - accessibility, costs and culture were noted as significant factors for this (Firms 3, 4, 5, 7, 12, and 14). Most informants recognise it would be useful to have closer relationships, and that as food becomes more technical may be more necessary in future - “where we are headed with food now there will be a lot more involvement (with others) with developing the technology” (Firm 13). In the case of federal and state agencies, any relationship was mainly as a result of the company seeking funding and companies did not utilise the business or market expertise and knowledge available. The general perception was that these institutions and agencies were more relevant to and focused on larger companies.

Supplementary Research Question 3 - How do small firms assimilate and transform this knowledge to be used throughout FEI?

Assimilation of Knowledge. Since in most cases within small companies the identification of opportunities and the acquisition of new knowledge was done by the owner-manager, the assimilation of this into the company largely rested in him/her. Not surprisingly then, in almost all participants the owner-manager took a major role in the front-end of the innovation process guiding the process with a clear market vision (Reid and de Brentani, 2010). In very small
companies assimilating the opportunity into an idea which had the potential to be exploited by the company was conducted by the owner-manager and one or two others in a very informal process (Firms 1, 2, 3, 4, 5, 6, and 13). As the companies grew, this informal process became a more systematic ideation involving four to seven people from multiple functions - Firms 8, 9, 11, 12 and 15. A feature through this early phase of the innovation process was not only the passion of the owner-manager for developing new products, but also of the development team (Drnovsek et al., 2009). As one owner succinctly stated, “the people who weren’t passionate are the people who aren’t here anymore” (Firm 10). New knowledge acquired as part of this process is generally transferred to team members verbally or by sharing information which is publicly available via the internet or company literature.

Transformation of new knowledge and ideas. Having selected the idea/s to be developed the team works on transforming the idea and any associated new knowledge to a concept which is realistically achievable for their company. How this happens in smaller companies (Firms 1, 2, 3, 4, and 5) is impacted more by having to ‘make do’ with limited existing resources than the larger companies studied, although this practice was apparent in all companies. As Firm 2 expressed it, “I have always been in business on the basis of doing what you can afford, taking baby steps, and so we own everything you see here, we own the lot. When I could afford it, I would buy it”. These companies often do initial trialling on a product made in small batch production equipment - “a lot of the development tends to be virtually on the floor rather than within an R and D kitchen” - Firm 13. This places a high emphasis on getting it right early, but inevitably for all participants, the transformation tends to be an iterative process forming the core of their R and D activities consistent with (Todorova and Durisin, 2007). It was apparent that during this phase all companies followed a systematic, if not well-documented process. However, for the larger participating companies the process also became more formalised, and better documented, involving more detailed market research, price/cost considerations, and lab-scale sample development.
Typically, both in the assimilation and transformation phases regular communications were critical, which for the smaller companies were frequent, often ad hoc, verbal, ‘shop floor’ discussions. As the company size, and the size of the development team grew, these communications were more systematised by email and fortnightly meetings, resulting in more thorough documentation particularly towards the latter phases of the innovation process. With one exception the documentation in the early stages of the development process is not highly disciplined - “in the initial stages I prefer to not have any boundaries and let them come up with something” (Firm 14).

**Exploitation and commercialisation of knowledge.** Exploitation of new knowledge occurs throughout the front-end of innovation and on to the commercialisation of the new products developed. This study focusses on the front-end, and so new knowledge related to marketing, launch and distribution are not covered. However, a key to successful exploitation of new knowledge is the ability of employees to apply this knowledge (Flatten et al., 2011a), and in all participating companies, there was a high awareness of the need to have the right people in the organisation with the ability to effectively apply knowledge.

**Supplementary Research Question 4 - What barriers and difficulties do small firms face implementing and building ACAP as a capability that fosters sustained success in the front-end of PI?**

**Barriers.** Barriers to successful product innovation that participants most commonly mentioned are resource based:

(i) access to skilled resources and upskilling of existing personnel, particularly for regional and smaller companies (Firms 2, 4, 5) – this constrains the ability of a company to acquire new knowledge and to build ACAP;
(ii) access to appropriate funding for market research and product R&D (Firms 1, 2, 4, 13) – this constrains the ability to gain market and technical knowledge particularly that which can be validated, to assimilate and transform it through R&D activities, and to build ACAP;

(iii) time (Firms 1, 2, 4, 5, 10, 12) – this is the most common and most significant constraint – it relates to the deficiency of appropriate human resources and organisational systems to enable a small company to efficiently acquire and use new knowledge and develop new products.

Supplementary Research Question 5 - What are the organisational characteristics which influence on FEI and drive sustained success in PI in small companies?

Organisational Culture. Participating companies maintained stable employee, supplier, and customer bases – this provided prior knowledge and sources of new knowledge. A feature of all the companies was good internal communication and close interpersonal relationships which were important in maintaining the trust and commitment in order to retain staff; and to encourage a risk-taking culture in FEI.

Organisational Resources. Most participants, particularly the smaller ones, commented that time was a major resource limitation in developing ACAP, and to being more prolific and successful at PI. Time could be considered as a reflection of deficiencies in human and financial resources, both in terms of the quality and quantity of the resource. This suggests that an important role of the owner-manager is to continuously re-evaluate deployment of resources to best effect (Sapienza et al., 2006).

Managerial Capabilities. A company’s leadership, and in particular the entrepreneurial and innovativeness characteristics of the leader, are critical to sustained PI (Verhees and Meulenberg, 2004). A very strong theme which evolved from the participating companies was the presence of entrepreneurial passion in the leaders, particularly the owner-manager, and the ability of these leaders to engender this in employees consistent with the work of (Adomako et al., 2016; Drnovsek
et al., 2009). This passion and commitment contributed to overcoming difficulties when crises had occurred in some of the businesses - Firms 1, 11, and 13. To succeed at FEI on a sustained basis all three types of entrepreneurial passion (inventing, founding and developing (Cardon et al., 2009)) are required, and several participants had acted to overcome individual deficiencies by bringing in new capabilities either full or part-time - Firms 1, 10, 11, 12, and 13.

A clear, concise market vision (Reid and deBrentani, 2012), and a strategic plan (Salomo et al., 2007) are important antecedents for ACAP and SPI. All participants had a clear market vision. Strategic planning by very small companies was generally not formally documented, but particularly with Firms 1 and 2 was very clear.

All participants had a strong learning orientation particularly focused at market knowledge, although this was often restricted by access to information, as highlighted by Firms 2, 4, 5, 6, and 7. All participants had a very strong customer orientation, and most PI was initiated in response to customer feedback (Firms 3, 4, 5, 8, and 13). All firms spent significant time on watching and assessing market trends, particularly overseas. Only the larger companies actively considered broader strategic marketing issues such as more sophisticated promotion and distribution systems (Firms 8, 9, 10, and 12).

Table 2.2 presents a summary of the findings for each research question.

Table 2.2 - Summary of Company Interview Findings

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<th>RQ</th>
<th>Research Question</th>
<th>Small, successful innovative Companies</th>
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| 1  | How do small firms develop new ideas, and how do they use prior knowledge in the FEI? | (a) Have passionate and entrepreneurial leaders  
(b) Have a clear market vision  
(c) Proactive travel to and observation of overseas market trends  
(d) Depend heavily on prior knowledge of the owner-manager to initiate and develop ideas |
| 2  | How do small firms recognise and acquire new knowledge and use it in FEI?         | (a) Make substantial use of the internet and social media  
(b) Proactive travel to and observation of overseas markets and trends  
(c) Use close interface with their supplier and customer base for knowledge and ideas rather than external technical or business organisations  
(d) Hire in new employees/skills, within resource constraints |
| 3  | How do they assimilate and transform this                                         | (a) Be agile and adapt the development of products in response to information received from their customers via close contact and verbal communication |
Formal management systems were often not present, particularly in the very small companies, although there was still evidence of a systematic approach to the acquisition and use of new knowledge, and to FEI activities. Companies in which the owner-manager had tertiary education employed a more systematic and better documented approach (Firms 1, 8 and 11).

**Discussion**

The interviews with the participants revealed a variety of ways in which these small companies build ACAP, and how ACAP manifested in FEI. The study contributes to our knowledge of ACAP by reporting on and discussing the diverse ways small companies recognise opportunities and acquire new knowledge; and on how some sources of new knowledge are not widely used by small companies. Lowik et al. (2017) found that individual ACAP can have a significant impact on FEI success and this study highlighted that this is particularly true in small companies where the role of the owner-manager in PI is dominant. The research demonstrated that successful small innovators engender a passion and learning orientation, particularly in the development team, so
that as the company grows the dependence on the owner-manager to be the primary provider of opportunities and new knowledge, reduces. The study showed that when the frequency of change increases, as experienced in the food sector in recent years, the pressure on small companies to respond increases. To satisfy this demand, small companies need to access all possible sources of information and to achieve this they need to have updated electronic capabilities and social media skills.

Networks, clusters, and collaborations with technical institutes and other industry players have a positive impact on the development of ACAP and PI (Zeng et al., 2010; Elisa, 2013); and when this occurred in participants it led to greater success. However, this study shows that PI success can be achieved despite not utilising these sources of knowledge and expertise as evidenced by the fact that the majority of participating companies did not engage significantly with these institutional information/capability sources. Reasons for not using these sources included time constraints on small business owners, trust, and particularly in the case of universities, their structure and conflicting objectives.

In the small companies interviewed the owner, management and organisation were often indistinguishable, and so too the culture and resources of the organisation combined with the capabilities of the individual/s to impact on FEI. This study demonstrated that in small food companies trust, commitment and good communications were significant in assimilating and transforming new knowledge and achieving SPI. The dynamic capability perspective extends RBV by considering how valuable, rare, inimitable, and non-substitutable resources can be created in small firms and how these can be developed in response to changing environments (Ambrosini and Bowman, 2009). The leadership, market vision, and approach to PI planning demonstrated the uniqueness of the resources of each company and how this contributed to FEI and competitiveness.

The outcome of the effective utilisation of the above-mentioned resources and capabilities in the FEI in small companies was demonstrated by the high rate of successful launch of new
products. Relative to the company’s size, the contribution of these products to the total sales mix, and the ongoing growth rate of the companies, was well above national GDP growth.

Conclusions

The study provides insight into how ACAP manifests in FEI, within a cohort of small food manufacturing companies in Australia, which have demonstrated SPI. It shows that, while there was a wide diversity of characters and idiosyncrasies within the participating companies, using ACAP as a lens was successful in revealing a tapestry of how FEI works successfully in small companies and the key factors impacting on the process. It contributes to the understanding of ACAP and PI by studying a discrete size range of small companies in a single sector, as called for by (De Massis et al., 2018), and by revealing the multiplicity of factors which small companies need to address to acquire new knowledge and achieve FEI and SPI success.

The study shows that despite their resource deficiencies, the participating companies successfully overcame these to build ACAP, succeeded in the FEI and successfully sustained product innovation; and shows that the individual capabilities and passion of the owner-manager played a significant role in this success. The participating companies demonstrated a systematic, if not at all formalised approach, to acquiring knowledge and throughout the FEI process – this was somewhat surprising for small companies but clearly was a contributor to their success.

An area where the findings differed from research on larger companies was that collaborations, industry networks, and the use of technical institutions in the product innovation process do not feature significantly in these small companies, which despite this succeeded in building ACAP and achieving SPI.
Limitations, Potential Implications, and Recommendations for Future Research

This research is exploratory and is limited to a degree by the selection of a single industry sector. However, it was important to have taken this approach in order to gain in-depth information, not currently available in literature, on how knowledge (new and prior) is managed in the FEI in small manufacturing companies in a significant sector, namely food, without the factors of size, sector variance, or national culture impacting on the results. It has demonstrated that there are some differences in the results from this cohort when compared with those from medium and larger companies, which make up the bulk of empirical studies in the literature on ACAP and FEI, and from other geographic regions and industry sectors.

The data suggest that there is a threshold in human resource at about 30 employees, above which results more similar to the published literature from medium and large companies are more likely. This result further highlights that future research on companies with less than 30 employees (which represents the very vast majority of all firms) is justified, exploring more deeply the intricacies of how these companies work and how to improve their success. Given the dominant role that the owner-manager of small companies plays in developing its ACAP and the company’s success in FEI, it is suggested that further study is needed into the individual absorptive capacity of these leaders and how they can systematically build ACAP throughout the organisation. The results from this study of the food sector, and the absence of comparable work from other sectors, presents the opportunity to do future research into the same factors within different sectors and between cultures, to better understand the impact of these.

Flexible re-deployment of resources and ‘making do’ with readily available resources was a common feature of the small companies. However, this needs to be studied in more depth, particularly as to how it can develop as a dynamic capability over time, how it forms part of a company’s approach to innovation strategy, and how it relates to other innovation approaches.
which small companies could employ. The research shows that the use of technical institutes, industry organisations, networks and clusters, which have proven successful in other circumstances and is a key feature of many studies, is not a common feature in product innovation in small food manufacturing companies in Australia, particularly in regional areas. While this phenomenon has been recognised (DIIS - Department of Industry, 2017), the reasons behind it need to be better understood, and management and government need to consider how to encourage more engagement, collaboration, open innovation, and improved access to relevant institutions and organisations with the objective of improving the innovation performance of this sector.

A strong feature of the research is the prominence of entrepreneurial passion of the leaders in the participating companies, and its importance in the success of their product innovation. Could this be because of the very sensory nature of food, or is this a phenomenon which occurs in small companies in other industry sectors? It is suggested that better understanding of entrepreneurial passion, how it is fostered throughout a small company beyond the owner-manager, and how it is maintained as the firm grows, is required.

Since this paper has focused on the front-end of the PI process and has shown some significant differences in small companies compared to the broad spectrum of industry, it is recommended that a similar methodology be employed to study the ‘back-end’ of the product innovation process in small companies, focusing post R&D on the market plan, launch, distribution and sales of new products.

From a management perspective, this study confirms the importance of the role of the owner-manager and the responsibility he/she has to develop the resources and capabilities of the company, which will ensure sustained product innovation success. These capabilities include ACAP, a concise market vision, and a strategy incorporating strong corporate values that are clearly communicated throughout the company and to suppliers and customers, driven by the entrepreneurial passion of the leaders within the company. To sustain success, it is suggested that
management need to create a culture of continuous search for new knowledge and avenues for collaboration.

In summary, this study highlights the need for more qualitative and quantitative empirical studies to be conducted to further confirm some of its insights, before definitive policies could be developed for this important sector of the economy. However, the study can act as a direction for policymakers to encourage such research to enable appropriate platforms to be made available which support small companies to improve product innovation performance, and make further contributions to economic growth.
Chapter 3

How Alternative Innovation Approaches impact on the Front-End to achieve Sustained Product Innovation in Small Companies

Abstract

Small companies need to overcome their resource deficiencies to survive and to grow; and to do so they need to innovate. The front-end of the innovation process is crucial to achieving sustained product innovation success, and as part of this process the selection of the strategy and approach to developing a new product is important. In view of the traditional practice of many small companies to be independent, this paper, using a lens of Absorptive Capacity, investigates how a cohort of small food manufacturing companies employ alternative ‘closed’ innovation approaches, including causation, effectuation, bricolage and improvisation, to succeed in the front-end of product innovation. The qualitative research in this study found that combinations of these four approaches, supported by ACAP, passion and the managerial capabilities of the owner-manager, are most effective in achieving front-end success in small manufacturing companies. By contrast, the study also found that reliance solely on readily available internal resources, particularly bricolage, can limit the scope and novelty of the development of new products. The chapter presents the implications of these findings and makes recommendations for future research.

Introduction

The objective of this research is to examine the front-end of innovation in small firms and how alternative innovative approaches (IAs) are used to enable this knowledge intensive phase of the PI process to be undertaken successfully, especially in the face of limited resources. This chapter
examines the literature on the conduct of front-end of innovation (FEI) and its knowledge needs in the context of small business. It examines the way in which ACAP supports FEI in this context. It then considers, in the face of resource deficiencies of small companies, how alternative entrepreneurial approaches may help innovators acquire, assimilate, transform, and employ the knowledge they need to ensure that the FEI is a success and supports successful SPI. The chapter then draws on insights from semi-structured face-to-face interviews conducted with 24 owners and managers in 15 small companies. It uses Absorptive Capacity (ACAP) as a primary lens to study how these IAs, ACAP and the managerial capabilities, particularly of the owner-manager, manifest in the front-end of product innovation.

As the first of the subsidiary questions of the overarching research question of this thesis the primary research question addressed in this chapter is “How do resource deficient small firms use alternative innovation approaches, and knowledge-based capabilities, at the front end of innovation and support sustained and successful product innovation?”. A better understanding of how these IAs work in practice will contribute to a better understanding of what is needed to successfully sustain product innovation in small companies, and expand our knowledge of the key theories of ACAP and dynamic capabilities in established small companies. The study responds to suggestions in the literature (Fisher, 2012a; Welter et al., 2016) of the need to investigate how these entrepreneurial approaches are employed in achieving SPI. To date most research on these IAs has focused on new entrepreneurial ventures, and little has been done in the context of incumbent firms (Andersen, 2008; Burgers et al., 2014). The paper also responds to the call for more sector specific research into entrepreneurship (De Massis et al., 2018).

SMEs make up over 99.5% of all companies in most economies, in particular the US, UK and Australia. Small companies make a significant contribution to innovation, to economic growth (British Institute of Statistics, 2015; Statistics, 2016a; SBA, 2014; Audretsch et al., 2009), and to new job creation (Neumark et al., 2011a; DIISR - Department of Industry, 2012; Triguero et al.,
Product innovation has been shown to be a key driver of the economic performance and growth of small firms (Rosenbusch, Brinckmann, and Bausch, 2011; Wolff and Pett, 2006). However, there is a need to improve understanding of innovation, and of how greater economic growth in small companies can be achieved (Koryak et al., 2015).

This research focuses on small established companies, defined here as having less than 50 full-time equivalent employees, consistent with the recommendations of European Commission 2003/361/EC and commonly used worldwide. This category has not been widely researched as a discrete group, with most innovation research being conducted on larger companies (Hutchinson and Quintas, 2008; Buenechea-Elberdin, 2017), or more recently on new business ventures.

Small companies suffer from resource deficiencies (physical, financial, human and time), and this makes it critical for these companies to define the correct strategies and employ the appropriate mechanisms to deploy precious resources, if they are to achieve competitive advantage and sustain product innovation. Within their resource constraints small companies need to have a number of dynamic capabilities, in particular knowledge capabilities, and to have leadership which builds these capabilities as part of an innovative culture which recognises new opportunities and meets the challenges of the future. One of the most important of these capabilities has been shown to be Absorptive Capacity (ACAP), or the ability to recognise and acquire new knowledge from outside the company and use it to develop new products.

This chapter studies product innovation (PI) which is defined as a good or service that is new or significantly improved in its technical specifications, components, and materials, user-friendliness or other functional characteristics, consistent with (OECD, 2005). The study focuses on the front-end of the innovation process (FEI), which is regarded as critical to the overall success of PI. The front-end covers the activities from recognition of an opportunity through research and experimentation to sample products for trial. The study features interviews with companies which have achieved sustained product innovation (SPI), defined as the generation of multiple new
products, strategically necessary over time, with a reasonable rate of commercial success (Dougherty and Hardy, 1996). Andrew (2013) found that 71 percent of companies in general regarded sustained product innovation in their top three strategic priorities, but only one in ten have been shown to be able to sustain innovation and growth that delivers above-average economic growth for more than a couple of years (Christensen and Raynor, 2013) – the need to improve this ratio would seem obvious.

This chapter examines the relationships between ACAP, managerial capabilities and IAs, and how these relationships combine to impact on the front-end activities, and in turn on SPI.

The following section presents the theoretical background to the study, then outlines the methodology used, and how the data is collected and analysed. The findings of the interviews are presented and discussed and, finally, conclusions and the implications of the study are presented with recommendations for future research.

Theoretical Background

Originally Wernerfelt (1984), and later Barney (1991), determined that the core value of a company is its competitive performance and its ability to exploit its resources, and this became known as the Resource Based View of the firm (RBV). Vermeulen (2005) suggested that small firms incur problems in innovation related to resource levels, and it has been shown that small and medium companies have a number of resource disadvantages including limited financial resources, scarce personnel capacities, and limited time availability (Millward et al., 2006; Laforet and Tann, 2006; Teng, 2007). These resource deficiencies can negatively impact on the ability of small companies to acquire new knowledge, to sustainably engage in product innovation, and to grow. (Martineau and Pastoriza, 2016; Xie and Suh, 2014).

The Front-End of Product Innovation in Small Companies
All companies, including small firms, need to continuously innovate, develop and commercialise new products (SPI) to achieve and sustain a competitive advantage (Rejeb et al., 2008; Muller et al., 2005). Success in the front-end is important in sustained innovation and company growth (Dibrell et al., 2008; Paradkar et al., 2015; Koen et al., 2001). The front-end of the product innovation process has been defined by (Khurana and Rosenthal, 1998) and by (Kim and Wilemon, 2002) and is used in this paper as including market vision and strategy and the communication of these, opportunity identification and assessment, idea generation, product and project definition, and extends through the early stages of trialling. Koen et al Part 1 (2014a) & Part 2 (2014) have extended the understanding of FEI by evaluating the key activities necessary for FEI success. They categorise these into senior management commitment, vision, strategy, resources and culture; and into effective leadership, effective teams and collaboration. The activities in the front-end of product innovation involve companies in recognising, sensing and giving definition to new opportunities. FEI is an intersection of knowledge, information processing and organisational influences, which places ACAP at the core of FEI, as acquisition of new knowledge is a critical factor, particularly in companies where knowledge resources are often limited (Florén and Frishammar, 2012). Several researchers more recently have found that success in the FEI stages have a positive impact on overall PI performance (Markham, 2013; Koen et al., 2014b; Verworn, 2009). According to Riel (2013), this strong influence over the overall outcome of the innovation process is because decisions made in the front-end largely determine not only the success of the product but also the time, costs, and resources required. The effectiveness of the front-end activities in developing the ‘right’ ideas and concepts significantly influences the later phases of the product innovation process and the commercialisation of the new product.

**ACAP and FEI**

Absorptive Capacity (ACAP) was introduced as a framework within which knowledge processes can be studied, and was defined as the capability to recognise and acquire new external
knowledge, assimilate it into the company, transform it, and exploit it for commercial ends (Cohen and Levinthal, 1990). It has subsequently been viewed as a central capability in product innovation (Zhou and Wu, 2010; Ritala and Hurmelinna-Laukkanen, 2013). Technological, market and customer capabilities in combination with ACAP have been shown to improve innovation performance (Tzokas et al., 2015; Rakthin et al., 2016). Knowledge gained from its various internal and external resources, enables a company to develop the capabilities necessary for success in the early stages of PI (Tayaran and Schiffauerova, 2012; Pemberton and Stonehouse, 2000). Success in the front-end is important in sustained innovation and company growth (Dibrell et al., 2008; Paradkar et al., 2015; Koen et al., 2001). The limited amount of published research focused specifically at small companies has shown that knowledge acquisition and ACAP are key drivers for innovation, productivity and growth (Roper et al., 2008; Hervas-Oliver et al., 2011; Parida et al., 2012)

**Small Companies and their Resources**

Small firms are limited by many resource-related factors (Alegre and Chiva, 2008; Teng, 2007), and this can be particularly so in the early stages of their development (Paradkar et al., 2015). While small companies typically demonstrate more flexibility, they have been shown to often lack the organisational and marketing capabilities available in larger companies (Van de Vrande et al., 2009); and this has been shown to create challenges for the innovation activities of small companies (Berends et al., 2014). In a review of published literature, Rosenzweig (2016) reported that the most frequently discussed resource challenges are financial, time and human resources. This same study further found that these resource challenges may occur simultaneously, influence one another, and present cumulative effects, thereby affecting the overall intensity of the challenge faced by the small company. Constraints in product knowledge, resource knowledge and supply knowledge are more likely to be experienced more strongly during the early stages of PI (Gray, 2002). Time is increasingly important for organisations operating under the so-called shift to a
hypercompetitive environment that places increasing pressure on organisations to gain speed and respond faster (Wiggins and Ruefli, 2005) - this time pressure can result in the need to improvise in order to satisfy market demands. Lack of necessary financial resources can limit a company’s innovative performance by not being able to afford to develop multiple technologies, or to experiment with new ideas (Agarwal et al., 2004). For instance, small firms with financial constraints are not able to hire the required employees, which can reduce their creativity, innovativeness and viability (Voss et al., 2008). However, there has also been the suggestion that resource constraints in some cases appear to drive creativity and innovative behavior (Hoegl et al., 2008; Mosakowski, 2002); and that the lack of adequate financing stimulates resourcefulness (Baker and Nelson, 2005) and creative bootstrapping strategies (Carter and Van Auken, 2005). Resource-constrained entrepreneurs appear to be more resourceful by capitalising on an emerging opportunity while employing scarce resources (Baker and Nelson, 2005; Renko et al., 2015).

Resource constraints, such as those experienced by small companies, direct the owner’s attention toward opportunities inside their restricted operating environment rather than outside this constrained domain (Burg, 2012). It has been suggested that recognising resource constraint as a reality rather than avoiding it may be an antecedent for introducing new product innovation methods, particularly for small companies (Cunha et al., 2014). This results in utilising approaches, including causation, effectuation, bricolage and improvisation, for their innovation projects, in which the means required to succeed are evaluated and solutions are often based on re-purposing, re-organising or finding new combinations of available resources. Although these approaches are not new, the study of how they manifest within FEI in small established companies has not been widely published.

**Managerial and leadership Capabilities in Small Firms**

Deficiencies in human resources are recognised as a typical constraint in small companies. The role of the owner-manager in a small company is often dominant and effective leadership has been
shown to be important in FEI and in overall PI performance (Koen, 2014). Drawing on entrepreneurial and transformational leadership theory (Bass and Riggio, 2006; Renko et al., 2015) effective leadership involves vision, strategy, commitment and passion. When a company is led with intention, inspiration, integration and tireless persistence it has been found to result in superior innovation performance (Bicen and Johnson, 2014). Entrepreneurial passion (EP) has been shown to include passion for growth, passion for people, passion for the product or service, passion for inventing, passion for competition, and passion for a social cause (Cardon et al., 2017a). Passion, particularly by the owner-manager, when combined with innovation approaches such as bricolage, help keep their businesses going (Stenholm and Renko, 2016). Owner-managers who are passionate about inventing have been shown to play a significant role in PI, particularly in radical innovation (Strese et al., 2016).

**Alternative Innovative Approaches**

Strategic planning is important in FEI (Koen et al., 2014b) and the success of a strategy can be affected by the approach taken to the development of a new product. In this paper, consistent with (Agarwal et al., 2017), innovation approach is used as the term to describe the method used to provide a solution to a strategic issue, in this case product innovation. The alternative innovation approaches (IAs) examined are causation, effectuation, bricolage, and improvisation.

To grow, small companies need to be entrepreneurial, and this paper draws on the definition used by (Gray, 2002) that entrepreneurs are owners (and/or managers) who manage a business with the intention of growing that business, and who demonstrate the leadership and managerial capabilities required for achieving this growth. Continuous innovation is necessary for SPI and sustained growth of the business. A majority of small and medium companies acknowledge the importance of using alternate decision-making pathways and strategies to achieve innovation success (Nicholas et al., 2015), and entrepreneurial owner-managers often take a different route to identify and exploit opportunities (Fisher, 2012b).
Causation

The traditional model for developing a new product draws largely on economic thinking and findings from studies on large companies. Causation is a goal-directed managerial process typically discussed in texts on decision-making, strategic management, and marketing. This model describes how a firm searches for areas where the demand for a product exceeds supply (Casson, 1982), to discover an opportunity and evaluate whether it is worth exploiting (Shane and Venkataraman, 2001). Then after deciding to exploit an opportunity, the firm seeks resources that will develop and deliver a product to exploit the identified opportunity. However, for small companies, which typically don’t establish formal goals and processes, particularly in the front-end, this approach, which is considered best practice in large companies, might not be best suited (Berends, 2014).

Effectuation

The logic of effectuation suits the characteristics of product innovation in small firms: effectuation concerns action under resource constraints, a central concern for most small firms (Ettlie and Rubenstein, 1987). In the effectuation model, instead of focusing on goals, the entrepreneur exploits the available set of resources over which the entrepreneur has control (Sarasvathy, 2001). At the individual level, this includes personal knowledge, skills and social networks; and at the firm level, this construct includes physical, human, and organisational resources (Barney, 1991). Effectuation measures have been shown to include means (with whom the company has relationships) and experimentation; and in a study by (Roach et al., 2016) these were found to positively mediate product/service innovation leading to improved performance. In a study of small Dutch manufacturing firms, Berends et al. (2014) found that small firms made creative use of existing resources, conducted innovation with available resources, used informal
and flexible project planning, and iterated the generation, selection, and modification of goals and ideas. Effectuation has been shown as the dominant approach in projects requiring a greater degree of innovation and uncertainty (Ortega et al., 2017).

**Bricolage**

Levi-Strauss (1966) described what we could call the process of bricolage, as involving three overlapping stages: stock or repertoire, dialogue and outcome. Stock or repertoire is the materials (including knowledge) that have been left over from previous projects. Dialogue describes the assessment of the available materials or resources with respect to how they can be used to solve current problems or develop opportunities. Outcome then describes the result of the use of these available materials and resources in the bricolage process, which might be quite different from the original vision. Using a bricolage approach the company solves problems by relying exclusively on whatever is at hand (Levi-Strauss, 1966). This making do with resources at hand reflects a fundamental attitudinal and behavioral trait, with the bricoleur continuing to acquire and use resources, cutting costs, and learning new things along the way (Baker and Nelson, 2005). Bricolage should not only be considered as a means of overcoming resource constraints in existing firms, but also as a generator of new knowledge, a developer of increased learning orientation and a stimulator of innovation (An et al., 2018).

Adding more accessible assets, particularly knowledge, over time allows new concepts and alternatives to be observed. As noted by (Senyard et al., 2009) it is what you do with accessible resources that matters, and they found that bricolage can stimulate the level of innovativeness and hasten product innovation in resource-constrained firms. However, extensive bricolage in multiple domains, or over reliance on bricolage as a strategy, can result in a bricolage “trap” and restricted growth (Fisher, 2012b). Typically, the owner of an entrepreneurial firm figures prominently in bricolage as the catalyst to generate value from the available resources (Baker and Nelson, 2005). Fisher (2012b) found that the behaviors associated with effectuation and bricolage appeared to be
more representative of what entrepreneurs do in building their businesses, than the traditional (causal) approach, but how the two relate to and complement one another, and where they diverge remains unclear (Welter et al., 2016).

**Improvisation**

Organisational improvisation can be defined as the amalgamation of content, structure and execution, being carried out by combinations of individuals, teams or companies in real-time (Miner et al., 2001). This definition stresses that when improvising, planning and execution are not separated, and improvisational innovation occurs when there is time pressure which is commonly experienced in small companies. Although not uncommon, improvisation is often not favoured in product innovation because it entails significant risks (Miner et al., 2001; Moorman and Miner, 1998). These same researchers found new knowledge moderates improvisation's impact on organisational outcomes, and this was supported in the work by (Samra et al., 2008; Vera et al., 2016). Improvisation is not inherently good or bad and does not always have a positive result; however, improvisation has been shown to have a positive effect on team innovation (Vera and Crossan, 2005). A food industry study showed that improvisation is not a phenomenon restricted to fast-paced settings, as some studies tended to assume (Eisenhardt and Tabrizi, 1995). A study of the Dutch food industry showed that improvisation increases cost efficiency when new product teams rely on internal market information and on information that is explicitly stored and retrieved, and when they minimise use of external market information (Kyriakopoulos, 2011).

Karagouni et al. (2013) have introduced a new concept of autotelic capabilities which finds that strong bricolage, improvisational and transcendental (the ability to look beyond simple solutions to create novel opportunities) capabilities form the basis for strong dynamic capabilities and has a positive impact on competitive advantage, survival and growth.
Table 3.1 PI in Small Companies and the role of ‘closed’ IAs

<table>
<thead>
<tr>
<th>Themes</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation success is important to small company growth, and FEI is important to SPI</td>
<td>(Reid and De Brentani, 2004; Koen et al., 2001; Roper, 1997)</td>
</tr>
<tr>
<td>Resources, characteristics and capabilities of a company and its owner are important to FEI and SPI</td>
<td>(Zhou and Wu, 2010; Ritala and Hurmelinna-Laukkanen, 2013; Verhees and Meulenberg, 2004; Darling et al., 2007; Hughes et al., 2017b)</td>
</tr>
<tr>
<td>Strategy is important to FEI and SPI</td>
<td>(Shekar, 2011; O'Regan et al., 2006; Schweitzer and Gabriel, 2012)</td>
</tr>
<tr>
<td>Innovation approaches provide solutions to strategic issues</td>
<td>(Agarwal et al., 2017)</td>
</tr>
<tr>
<td>‘Closed’ innovation approaches such as causation, effectuation, bricolage and improvisation are effective in PI, often in combination with dynamic capabilities, and...</td>
<td>(Berends et al., 2014; Harms and Schiele, 2012; Johansson and McKelvie, 2012; Huynh and Patton, 2017; Song et al., 2011; Hmieleski et al., 2013)</td>
</tr>
<tr>
<td>... improve SPI</td>
<td>(Hughes et al., 2017a; Samra et al., 2008; Woschke et al., 2017; Roach et al., 2016)</td>
</tr>
</tbody>
</table>

It is noted that the previous studies shown in Table 3.1 mainly appear in journals focused on new business venturing and entrepreneurship. They include, but are not focused on, established small businesses. These studies are useful as they paint a picture of FEI and SPI composed of a variety of factors which affect innovation and its success. However, there is a limited amount of empirical research into how the four alternative innovation approaches which are included in the table manifest in small established companies, or into the relationship of the IAs with knowledge capabilities as represented by ACAP and managerial capabilities; and how this influences FEI and SPI. While the literature suggests the role of IAs is important, it is not clear how they manifest in the idiosyncratic environments within small companies. This paper examines this by addressing the overarching research question of “How do resource deficient small firms use alternative innovation approaches, and knowledge-based capabilities, at the front end of innovation and support sustained and successful product innovation?”. In addressing this question, the paper also considers what other characteristics of the firm, and its management, affect these approaches in overcoming limitations to innovation success; and answers the following:

a. What are the alternate innovation approaches employed in FEI by small companies?
b. How does ACAP manifest in these approaches and how are knowledge-based limitations overcome using IAs?

c. How do the characteristics and capabilities of small companies, and in particular those of the owner-manager, influence the use of IAs and successful FEI and SPI?

**Methodology, Sampling, Data Collection and Analysis**

**Method**

The topic of how knowledge is acquired and used in resource deficient small companies to successfully develop new products, and how innovation approaches, like causation, effectuation, bricolage, and improvisation work specifically in established small companies has not been well covered in prior literature (Flatten et al., 2011b; Karagouni et al., 2013). Hence, this research has been undertaken via a series of face-to-face interviews to induce comment and insight in order to expand the understanding of the core theories (RBV, ACAP and dynamic capabilities) and to provide management implications (Yin, 2013; Johnson and Harris, 2002).

**Sampling**

This study focussed on small companies with less than 50 full-time equivalent (FTE) employees. Companies in this category represent a significant percentage of total private employment (Neumark et al., 2011a; DIISR - Department of Industry, 2012) and of economic growth. They are typically privately held and represent an important transition from startups and micro businesses, the context of much of the recent research on entrepreneurism and innovation, through to the more structured organisational arrangements and to the greater resources available in medium size and larger businesses, the historic context of most innovation research. The study is based on a cohort of established small companies in the food manufacturing sector each of which had demonstrated sustained product innovation performance over at least three years.
The food industry in Australia was appropriate as the context for this study since it is an important contributor to Australian employment and to its economy, and approximately 60 percent of its manufacturing companies fit the definition of small being used in this study (Statistics, 2016a). The food industry is a globally competitive sector which is continuously changing. Despite its economic significance the food sector has not featured significantly in published literature addressing knowledge issues in FEI and SPI, and with few exceptions not in empirical studies of innovation strategies.

Since the aim of this paper is to study how ACAP and ‘closed’ innovation approaches influence FEI and SPI in small companies, the selection criteria of participants had to reflect not only size but also the sustained success of PI performance of the company over a period. As a result, the selection of companies to be interviewed in the study was based on criteria of:

- Size - less than 50 employees,
- Age - operating and engaged in PI and growth for three years or more
- Sustained PI - demonstrated by commercialising at least four new products each year (Laforet and Tann, 2006).

The pool of participants was generated using non-probability sampling. Companies were selected through (a) discussion with industry bodies, and (b) by internet searches of food industry websites. Using this information, a preliminary assessment was made of each of the companies against the selection criteria. Potential participants were selected from family and non-family businesses, and from metropolitan and rural areas in four states; and covered a range of different food products and markets. Having developed a list of potential participants, the owner-manager of the company was then contacted personally to confirm that the company met the selection criteria of size, age and innovativeness; and the project scope and obligations were explained. If the criteria were satisfied and the individual agreed, an Invitation to Participate was sent out providing a plain English explanation of the study, including its aim, the obligations and rights of
participants, as well as full contact details for the researchers. If this was acceptable to the company, arrangements were made for the researcher to visit the company and conduct the interviews. Following this a consent form, to be completed and signed by each person to be interviewed, was sent out.

**Data Collection and Analysis**

The interviews with company participants were conducted around a series of open and semi-structured questions, derived from prior research on PI and innovation strategies, ACAP, and organisational capabilities (Flatten et al., 2011a; Statistics, 2013; Cardon et al., 2013; Koen et al., 2014b; Fisher, 2012a). These questions are shown in Appendix 2. Using an open interviewing approach, the questions were supplemented as appropriate to the individual conversations to draw out key themes associated with SPI in small companies. The information on the strategies and approaches employed in the innovation process was induced from commentary on how they approached the development of a new product and the actions they took.

A total of 24 individuals in 15 companies were interviewed lasting between 45 minutes and 2 hours. The interviewees varied in age (30 to 80 years), approximately half had a university education, and a quarter had post-graduate degrees. The companies had a wide geographic spread and represented a broad spectrum of food and beverage types. They included family and non-family structures, and all had been operating for more than three years, most more than 10 years. The author conducted all interviews which were voice recorded - both the companies and the individuals being de-identified. The recordings were transcribed, and then the data was manually coded around the key themes of market environment, ACAP, FEI, SPI, resource constraints, innovation strategies and approaches, management and dynamic capabilities. These factors, themes and patterns were consolidated for the total sample, and then examined to search for the features which characterised this cohort of small companies and for differences from published literature.
Table 3.2 - Summary of Companies Interviewed

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Turnover ($million)</th>
<th>Number of Employees</th>
<th>New Products Developed/yr.</th>
<th>Family/non-family</th>
<th>Company Age</th>
<th>Innovation Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Metro</td>
<td>50</td>
<td>50</td>
<td>30</td>
<td>Family</td>
<td>30</td>
<td>E, B</td>
</tr>
<tr>
<td>2</td>
<td>Metro</td>
<td>20-30</td>
<td>20-30</td>
<td>300</td>
<td>Family</td>
<td>30</td>
<td>C, E</td>
</tr>
<tr>
<td>3</td>
<td>Metro</td>
<td>20-30</td>
<td>46</td>
<td>4 to 5</td>
<td>Family</td>
<td>70</td>
<td>E, B</td>
</tr>
<tr>
<td>4</td>
<td>Metro</td>
<td>10</td>
<td>25</td>
<td>20-40</td>
<td>Non-Family</td>
<td>20</td>
<td>E, I, B</td>
</tr>
<tr>
<td>5</td>
<td>Region</td>
<td>10</td>
<td>25</td>
<td>7 to 10</td>
<td>Non-Family</td>
<td>25</td>
<td>E, B</td>
</tr>
<tr>
<td>6</td>
<td>Region</td>
<td>3 to 4</td>
<td>20</td>
<td>10</td>
<td>Non-Family</td>
<td>7</td>
<td>E, I, B</td>
</tr>
<tr>
<td>7</td>
<td>Region</td>
<td>5</td>
<td>20</td>
<td>10 to 20</td>
<td>Non-Family</td>
<td>17</td>
<td>E, B</td>
</tr>
<tr>
<td>8</td>
<td>Region</td>
<td>1.5</td>
<td>7</td>
<td>50</td>
<td>Non-Family</td>
<td>8</td>
<td>E, I, B</td>
</tr>
<tr>
<td>9</td>
<td>Metro</td>
<td>8</td>
<td>50</td>
<td>15-20</td>
<td>Non-Family</td>
<td>25</td>
<td>E, I, B</td>
</tr>
<tr>
<td>10</td>
<td>Metro</td>
<td>30-40</td>
<td>35</td>
<td>&gt;20</td>
<td>Family</td>
<td>70</td>
<td>C, E, I, B</td>
</tr>
<tr>
<td>11</td>
<td>Metro</td>
<td>N.A.</td>
<td>50</td>
<td>&gt; 5</td>
<td>Non-Family</td>
<td>8</td>
<td>C, E, B</td>
</tr>
<tr>
<td>12</td>
<td>Metro</td>
<td>16</td>
<td>45</td>
<td>42</td>
<td>Non-Family</td>
<td>15</td>
<td>C, E, B</td>
</tr>
<tr>
<td>13</td>
<td>Metro</td>
<td>5</td>
<td>10</td>
<td>8</td>
<td>Non-Family</td>
<td>15</td>
<td>E, B</td>
</tr>
<tr>
<td>14</td>
<td>Region</td>
<td>&lt;1</td>
<td>4</td>
<td>4</td>
<td>Non-Family</td>
<td>3</td>
<td>C, E, I, B</td>
</tr>
<tr>
<td>15</td>
<td>Region</td>
<td>25-35</td>
<td>50</td>
<td>15-20</td>
<td>Non-Family</td>
<td>12</td>
<td>C, E, B</td>
</tr>
</tbody>
</table>

Where C=Causal, E=Effectuation, I=Improvisation, and B=Bricolage. Letter in bold print indicates that this approach was primarily used in PI.

Results

As shown in Table 3.2, all participating companies are regular and quite prolific developers of new products. Excluding Company 2, whose numbers were unusually high, because in addition to manufacturing a range of products it has a core activity of creating new ingredient systems for its clients, the participating companies on average created 15-20 new products per year, or approximately one new product per year for each $1 million of sales revenue, and slightly over one new product per year for every two employees. The vast majority of product innovation was incremental with only 30 percent of companies developing new products which could be classified as radical innovations (Firms 2, 3, 9, 14, 15). This finding is double the overall percentage of companies operating in Australia who are considered as actively pursuing product innovation (Commbank, 2016). The participants all commented that their market was constantly changing, and that this was driving a need to more frequently introduce new products and to do so faster.
Table 3.3 summarises the findings from the data collected. This table shows that the participating companies used different innovation approaches at different phases throughout the front-end of the product innovation process, the most prominent being bricolage. Prior knowledge, including technical, market, and customer, and which was often mainly held by the owner/manager, was a significant factor throughout the FEI. Time, finance and human resource deficiencies were frequently mentioned by those interviewed. In addition to ACAP, other capabilities which featured in the interviews included marketing and technical capability, having proactive market and customer orientation; and commitment, entrepreneurial passion and communication of the owner-manager.

As is apparent in Table 3.3, small companies are typically resource deficient, most notably having constraints in time, funding, human resources and information (Rosenzweig and Grinstein, 2016). Access to information useful in PI, and its acquisition was highlighted by most companies as issues - most commonly mentioned were quantitative data on markets and trends, technical information on ingredients, new equipment and processing technology. As has been recognised in the literature, having diverse sources of information is important (Nieto and Santamaría, 2007).

While all the participating companies were active in accessing information from the internet, customers, suppliers and in many cases travelling to national and international exhibitions, most did not access information from proprietary market data sources (because of cost), or from technical institutions (for a variety of reasons including lack of awareness, access, and perceived relevance) - Firm 5 – “There are times when we have probably taken a lot longer to work something out ourselves because we didn’t have access to academia”. The type of knowledge mostly commonly mentioned by participants as presenting challenges were market, technical, and management systems (particularly computer based).
<table>
<thead>
<tr>
<th>FEI process and activities undertaken by small companies</th>
<th>Knowledge processes and needs that feed into FEI process</th>
<th>Knowledge/ACAP based challenges faced in FEI</th>
<th>Other, non-knowledge-based resource deficiencies which impact on FEI</th>
<th>Alternative Innovation Approaches by small companies to dealing with challenges and resource deficiencies in FEI</th>
<th>Other managerial capabilities that support FEI processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a vision</td>
<td>Prior knowledge (PK) of markets, customers, competition and technology; and ACAP Acquisition</td>
<td>Owner/Managerial characteristics, market knowledge</td>
<td>Time</td>
<td>Causation</td>
<td>Effectuation</td>
</tr>
<tr>
<td>Identify new opportunities</td>
<td>PK of markets, customers, competition and technology; and ACAP Acquisition</td>
<td>Access to information, and Owner/Managerial characteristics</td>
<td>Time, finance, human</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Generate and enrich ideas</td>
<td>PK of markets, customers, technology, resources; ACAP Acquisition and ACAP Assimilation</td>
<td>Access to information, human resources, and Owner/Managerial characteristics</td>
<td>Time, finance, human</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Select ideas and define concepts</td>
<td>PK of technology, resources, management; ACAP Transformation and ACAP Exploitation</td>
<td>Human resources, and Owner/Managerial characteristics</td>
<td>Time, finance, human</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Develop Strategies and prepare plans</td>
<td>PK of resources, management skills, and ACAP</td>
<td>Human resources, and Owner/Managerial characteristics</td>
<td>Time, finance, human</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>FEI process and activities undertaken by small companies</td>
<td>Knowledge processes and needs that feed into FEI process</td>
<td>Knowledge/ACAP based challenges faced in FEI</td>
<td>Other, non-knowledge-based resource deficiencies which impact on FEI</td>
<td>Alternative Innovation Approaches by small companies to dealing with challenges and resource deficiencies in FEI</td>
<td>Other managerial capabilities that support FEI processes.</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>Conduct R&amp;D, trials</td>
<td>PK of resources, management skills, technology; and ACAP Transformation and ACAP Exploitation</td>
<td>Human resources, and Owner/Managerial characteristics</td>
<td>Time, finance, human, physical</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Use systematic processes to evaluate and progress new products</td>
<td>PK of management skills; and ACAP</td>
<td>Human resources, and Owner/Managerial characteristics</td>
<td>Time, finance, human, physical</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Despite the resource constraints faced by most of the participating companies, they demonstrated a good level of ACAP, obtaining new information where they could and successfully employing it, as demonstrated by the number of new products and the sustained growth in each company. However, with so much of the corporate knowledge, both existing and new, vested in the owner-manager of small companies this presents a risk to the company, in terms of both retention and potential bias, and a challenge for these owner-managers is to develop the knowledge in key employees, particularly as the company grows in size. While most of the owner-managers recognised this issue, few had active, defined programs for a solution.

It is important with resource deficient companies that the resources (human, physical and financial) are flexible, and several firms specifically mentioned that it was important for them to be able to flexibly redeploy labour and to have equipment which has multiple uses (Firms 1, 2, 6, 7, 8, 9). The owners recognised the need to have the right people (Firms 1, 7, 8, 9), and were frustrated when lack of access to or availability of personnel, or when regulatory environments restricted their ability to achieve the flexibility of human resources they needed (Firms 6, 11,12). A comment shared by both Firm 3 and 7 was "Human resource time is the single biggest barrier we face, and while we might say we have the right people, they don’t have enough time". Financial constraints are common in small companies, and was frequently mentioned by interviewees in the context of product innovation when “not only do you need to fund its development but also support it when it is ready for sale” – Firm 3.

The role of the owner-manager was dominant in the companies interviewed. While there was a diversity in their characters, they were all entrepreneurial and passionate with a strong intention and commitment to grow the business. They had a clear market vision, high levels of personal ACAP, and presented as frequent and effective communicators with their staff. About 40% of owner-managers interviewed had entrepreneurial family backgrounds (Firms 1-4, 6 and 10), even if the company interviewed was not in a family structure - “We came in as entrepreneurs. My
father was a very successful entrepreneur and the generation before him were also entrepreneurs, so we had that sort of spirit”. The owner-managers not only demonstrated entrepreneurial passion about growing the business, but were passionate about their people particularly those directly involved in innovation, and they were passionate about developing new products. The team of people involved in the firm’s product innovation also demonstrated this passion, and were active in exploring new knowledge relevant to product innovation – “The level of commitment and passion about the technology and the business within the staff is exceptionally high”. In several of the owner-managers (Firms 1, 5, 6, 9, 14), despite their passion and leadership strengths of vision, commitment and interpersonal communications, it was observed that they were personally deficient in some managerial skills particularly related to more formal systematic processes and marketing. This potentially poses a threat as the company grows, if additional capabilities are not introduced to or developed within the business.

Table 3.4 provides some examples of specific projects undertaken by participants which were either customer driven or driven by recognising a new market opportunity. The table outlines the aim of the project, the overall strategy and the innovation approach/es used to achieve the desired outcome.

<table>
<thead>
<tr>
<th>Table 3.4 Examples of alternative innovation approaches taken by Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Driver</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Example</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Aim</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Key Strategies</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Key Tactic</strong></td>
</tr>
<tr>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Innovation Approach</strong></td>
</tr>
</tbody>
</table>
It is apparent from these examples that one specific approach is not dominant, and each company needed to employ a number of approaches throughout FEI and the overall PI process to achieve success.

In summary, the key findings of the study are:

- Small food companies typically operate in an environment of ongoing and increasingly frequent market changes which drive a need for new products; and this dynamic environment influences the PI process and the approaches employed in the FEI.
- Resource deficiencies of small companies influence their approach to FEI and SPI, most notably lack of time, human and financial resources. These impact on the ability of the company to access and acquire new knowledge externally which results in small companies often being limited in the degree of novelty developed in new products.
- The impact of the frequency of market demands, and the ever-present resource constraints was generally for the participating small companies to adopt “closed” innovation approaches to product innovation, in particular bricolage.
- The innovation approach adopted and the success of the PI process, particularly at the front-end, is strongly influenced by ACAP, passion and managerial capabilities of the owner-manager, who typically plays a dominant role in FEI in small companies.
- The most successful of the participating small companies addressed product innovation by adopting a flexible approach to FEI, employing combinations of innovation approaches.

Discussion

The ability to acquire and use new knowledge necessary for the development of new products, ACAP, was apparent in all participating companies as was their ability to recognise market trends and identify new opportunities, which forms the early stage of FEI. However, the constrained access to sources of new external information such as quantitative market data, technical data on
ingredients, process technology, and marketing systems presents a number of limitations to small companies in their ability to exploit opportunities most successfully. In particular, reliance on ‘open’ sources such as social media can introduce validity and reliability issues, and limit the depth of knowledge which can be developed and the degree of novelty developed in new products. The common dependence on the owner-manager as the primary source of knowledge, both existing and new (Yew Wong and Aspinwall, 2004), can limit the opportunity to explore alternative sources and ideas, which is a critical feature of FEI (Gomezelj Omerzel and Antončič, 2008).

A common feature of the small companies was dominant role of the owner-manager, and in particular his/her entrepreneurial passion. When this passion was combined with a high level of ACAP and appropriate managerial capabilities, inclusive of having the right people with passion involved in PI, small companies tended to adopt alternative innovation approaches as appropriate to the subject project; and this resulted in higher levels of PI success and company growth. This extends knowledge from earlier research on the role of the owner-manager in small companies (Millward and Lewis, 2005; Hausman, 2005).

The selection of which innovation approach to adopt was influenced by market size, technical requirements, competitive pricing, novelty and urgency of the new product to be developed, as well as the owner-manager’s managerial capabilities, and the financial, physical, human and time resources of the company. The net result of these factors was that the most common strategy employed was bricolage, and often improvisation. These two ‘make do’ approaches evolved from their initial resource deficiencies, particularly related to financial resources, and as the company grew, and changed its resources, it was observed in many of the participants that ‘make do’ innovation became a capability of the company and developed as a competitive strength. Consistent with the findings of (Fisher, 2012a), this study, however, found evidence that over-reliance on internal resources only (bricolage) can limit the scope and novelty of new products. Conversely, the ability to consider and employ multiple innovation approaches was shown to
provide positive FEI and SPI results for small companies. The findings of the study go beyond those of previous studies which generally focussed on examining a single approach, to demonstrate that a combination of alternative innovation approaches to FEI not only can be successful and contribute to SPI, but in fact can improve the level of success. The approaches examined in this chapter, namely causation, effectuation, bricolage and improvisation, were all used in various combinations by the participating companies, but the greatest success and higher growth resulted from the combination of these approaches as appropriate to the specific project. This is consistent with, but an extension to, the research on the combination of causation and effectuation (Berends et al., 2014; Harms and Schiele, 2012) and on effectuation and bricolage (Fisher, 2012a). The success of the participating companies in appropriately employing these innovation approaches supports the need for small companies to be aware of the logic behind each, and understanding how they can be used to improve FEI and SPI. The challenge for small companies will be to learn how to adapt the principles, particularly of causation and effectuation, to the unique culture of the company and to the need for flexibility and speed expected by the market.

This chapter set out to address how resource deficient small firms use alternative innovation approaches (IAs) to overcome ACAP, or knowledge-based limitations, in the FEI, and succeed at SPI. The chapter examines four ‘closed’ IAs: causation, effectuation, bricolage and improvisation; and shows that resource deficiency influences the small companies to favour the use of bricolage and improvisation in FEI. However, the most successful of the participating small companies addressed product innovation by adopting a flexible approach to FEI, and employing combinations of innovation approaches. The research agreed with previous findings that the owner-manager plays a critical and even dominant role in PI, particularly at the front-end when his/her position as a primary source of both prior and the acquisition of new knowledge (ACAP) is important to success. While this together with resource limitations can restrict small firms to incremental innovation, if the ACAP and passion of the owner-manager is combined with appropriate
managerial capabilities the company can be more successful in SPI and achieve greater growth. The research also indicates that resource constraints of small companies can impact on ACAP by limiting the diversity, validity and reliability of sources of new information it has available for PI, and in turn can influence the selection of opportunities to be addressed and the innovation approach adopted.

Figure 3.1 illustrates the findings of the research, presenting a model of how IAs form part of FEI and the role that ACAP, managerial capabilities and other resources play in FEI and how together they influence FEI and the successful achievement of SPI in a small company.

**Figure 3.1 – Overview of FEI and SPI and the role of IAs**

**Conclusions, Implications and Recommendations**

This chapter examines the four alternative ‘closed’ innovation approaches employed by small companies in FEI, how ACAP manifests in these, and how together with the resources and managerial capabilities of the company they contribute to SPI. Unlike most large and medium sized companies, the success of a small company is typically dominated by the characteristics and
capabilities of the owner-manager. Originally driven by resource deficiency, small companies commonly use bricolage and improvisation as their primary approaches to product innovation. However, in order to become more successful at sustaining PI, small companies become adept at flexibly using combinations of innovation approaches. While causation and effectuation are approaches most commonly associated with larger companies, this research shows that they can be adapted to be used effectively by small firms; and that they can be used together with improvisation and/or bricolage. This study shows that combinations of all four approaches, are most effective in FEI in small companies, especially when supported by ACAP, passion and managerial capabilities of the owner-manager and the PI team. By contrast, the study also found that reliance solely on readily available resources, particularly internal, can limit the scope and novelty of the development of new products.

The study expands the understanding of FEI, of the four ‘closed’ innovation approaches studied, and of how combinations of these approaches can be effective in small companies. A contribution is made to the knowledge of causation, effectuation, improvisation and bricolage by presenting examples of how they manifest in small companies and contribute to successful product innovation. This study answers the call for more innovation and entrepreneurship research on a sector specific basis (De Massis et al., 2018), and for more research into innovation approaches in small established firms (Fisher, 2012a; Andersen, 2008; Burgers et al., 2014).

By presenting these insights from practitioners, and reflecting these in the diagram of FEI presented, management can benefit from this research by better understanding that by developing a clear understanding of the logic of each of the IAs, and that by developing the capability to employ them, they can have a positive effect on the success of FEI and SPI. Management can further benefit from better understanding the importance of ACAP in FEI, and how this can overcome resource deficiencies that otherwise would inhibit product innovation performance. The findings can reinforce to the owner-manager the need for his role as a dominant player in FEI to
develop the ACAP and managerial capabilities of the company to produce the best effect from utilising alternative innovation approaches. For business and government agencies trying to help small business, the findings can provide an understanding of the need to provide improved platforms for affordable and fast access to reliable market and technical information required for innovation, and for cost effective and flexible management skills programs tailored to the requirements of small companies.

The limitation from the small sample size is noted, but the insights gained from the practitioners open the way for quantitative research to be conducted on larger samples, either within the food manufacturing industry or in other industries. The research is also restricted to examining innovation approaches which predominantly rely on internal resources, that is more “closed’ innovation, and examination of how collaborative and open innovation processes play out in FEI in small companies should be researched. Building strategic and innovation capabilities, particularly related to knowledge acquisition and exploitation, can contribute greatly to the competitiveness and growth of small companies, and this justifies further empirical research into understanding of the use of alternative innovative approaches over time. There is a need for more research into how entrepreneurial passion in its various forms works in resource deficient environments such as small established companies, and how its potential can be harnessed in driving alternative innovation approaches to improve success in sustaining product innovation. Longitudinal case studies, examining all the factors considered in this chapter, have not been published and would make a significant contribution to improving the understanding of product innovation in small companies and how interventions might improve performance.
Chapter 4 -

How small companies conduct relationships with others to overcome resource deficiencies, develop their ACAP capability and improve product innovation

Abstract

Small companies are typically resource deficient, so how do they engage and collaborate with others who have the additional resources and capabilities they require to sustainably develop new products? This study explores engagement, cooperation, collaboration and the use of open innovation with various stakeholders in the front-end of product innovation. It finds that small companies engage with others in a relatively small sphere. Despite the benefits found in prior research, collaborative and open innovation are typically not used by small food manufacturing companies, and technical institutes and universities are rarely used to access new knowledge and develop new products. The research found that the characteristics and capabilities of the leaders of the stakeholders are critical factors in achieving effective collaboration and open innovation. It also found that there are several organisational barriers to be overcome to achieve successful industry-government-university engagement and collaboration. The study adds to the understanding of collaboration and product innovation in small companies by showing how different market environments, and the idiosyncrasies of owner-managers, can influence the ‘openness’ of the innovation approach adopted. It has implications for policy makers, owners and managers of small companies, government agencies and universities - these implications are considered, and recommendations for action and for future research are presented.

Key Words: FEI, small companies, ACAP, collaborative and open innovation, engagement
Introduction

Just as with individuals, no company can exist as an island, and no company can grow without innovating to maintain its competitive advantage. The objective of this research is to examine how small companies engage externally and employ collaborative (CI) and open (OI) innovation as approaches in the front end of innovation. This chapter examines the literature on the knowledge needs and flows in the front-end of product innovation (FEI) in the context of small companies and their resource deficiencies. It examines the relationships between ACAP, CI, OI and FEI, and the influence these have on FEI performance (FEIP) and on SPI. As part of this examination it will also consider the role of the owner-manager and the organisational and managerial capabilities of small companies and their influence on CI and OI. The chapter primarily focuses on the relationships between small companies and customers, suppliers and universities, and the impact this has on product innovation. It draws on data from 34 face-to-face interviews conducted with small companies which are successfully developing new food products in Australia, and with representatives of universities and government agencies which are involved in the food sector. The study is conducted broadly under the paradigm of the Resource Based View (RBV) using Absorptive Capacity (ACAP) as a primary lens, and considers the resource deficiencies common in small companies, and also their dynamic capabilities.

The chapter presents and discusses published literature on the importance of product innovation in small firms and its role in economic growth, as well as literature on ACAP and other capabilities, and what is known about their impact on engagement, collaboration and open innovation. It then presents data gained from face to face interviews to give insight into how these relationships manifest in practice, and are used to achieve FEI and SPI in the participating successful small companies. The study has implications for practitioners, academics and government agencies; and makes recommendations for future research.
SMEs make up over 99.5% of all companies in most economies and provide over 50 percent of private sector employment, and of economic value added (British Institute of Statistics, 2015; Statistics, 2016a; US Small Business Administration, 2016). Small companies, defined here as having less than 50 full-time equivalent employees consistent with Recommendations of European Commission 2003/361/EC, are the major component of SMEs. Small businesses are faced with challenges such as limited physical, human (including knowledge) and financial resources and time constraints (Millward et al., 2006).

The need for companies large and small to innovate, develop competitive advantage and to grow has been well established in the literature dating back to Barney (1991), and more recently by Gonzalez-Zapatero et al (2016). The front-end activities have been shown to be important in overall innovation performance (Koen et al., 2001; Nicholas et al., 2015). However, even up to recent times, there have been frequent calls by researchers for the need to improve our understanding of innovation and how greater economic growth in companies can be achieved (Koryak et al., 2015). It has also been recognised that innovation can be achieved internally as well as externally; and that the need to be able to access knowledge externally and use it to develop new products is critical to sustained product innovation and growth (Cohen and Levinthal, 1990). To achieve this, engagement with multiple external stakeholders is required, and there are a number of antecedents, both capability and structural, which are necessary to enable collaborative innovation activities (Ketchen Jr et al., 2007).

In response to the call for more sector specific research (De Massis et al., 2018), this study focusses on the food sector in Australia. The food industry is a significant part of all economies (FoodDrinkEurope, 2010; DEFRA, 2014; USDA, 2016). Despite this, food has not featured significantly in studies of knowledge issues in PI, nor in studies regarding CI and OI (Sarkar and Costa, 2008). Selecting the food industry in Australia as the context for this study is appropriate since it contributes in excess of $26 Billion in value add to the Australian economy, employs
245,000 people, and approximately 60 percent of its manufacturing companies fit the definition of small being used in this study (Statistics, 2016a). There has been very limited Australian research involving FEI, CI, OI, and the degree to which literature is available on Australian university-industry linkages it has predominantly been from the perspective of the academics and their involvement with larger companies (Salter et al., 2014; Perkmann et al., 2013; Harman, 1999), not on small companies.

This chapter addresses this scarcity of information by gaining insight into the relationships between small companies and customers, suppliers, government agencies and universities. It aims to understand how these parties engage with each other, how small companies employ these external sources in CI and OI as part of their growth strategies, and how these affect FEI and contribute to SPI. The study aims to answer the third subsidiary question of the overarching research question of this thesis, namely, “How do ACAP and organisational and managerial capabilities influence the external relationships of small companies and the subsequent successfulness of the FEI?”. Prior research (Gibson et al., 2016) provides some guidance to the issues to be investigated including commitment, trust, early investment in understanding the expertise and resources available, and how to access these; as well as to understanding the differences in the objectives and governance structures of the different parties (Noble et al., 2015).

By gaining insights from individuals operating within the innovation process of both the participating companies and from external sources of knowledge, this research contributes to further understanding of FEI and SPI in small companies, collaboration and open innovation, and how ACAP and other capabilities impact on these activities. The data gained from the qualitative interviews suggests that particularly in the early years of a firm’s development, and particularly in the front end of its product innovation, the opportunity and ability to engage, and to make resources available for collaborative and open innovation, is limited. However, if some of these precious resources can be committed to engagement and developing external linkages, and the company
can become involved in collaborative innovation activities, it can have a very positive impact on the company’s success. Notwithstanding the benefits of collaborative innovation, there are significant potential barriers which need to be overcome (Bruneel et al., 2010).

The chapter discusses published literature on the key factors considered significant to the research question. It then outlines the qualitative methodology used and the findings from the interviews conducted. These findings are discussed and a conceptual model is presented showing the relationships between ACAP, engagement, CI and OI in FEI and SPI, which is relevant to small companies. Finally, it concludes and makes recommendations for future research.

**Theoretical Background**

**FEI and Sustained Product Innovation in Small Companies**

Sustained product innovation is fundamental to survival and maintaining the competitive advantage of small companies (Laforet and Tann, 2006). Success during the early stages of the innovation process (FEI) is important to overall PI performance (Markham, 2013; Koen et al., 2014b; Riel et al., 2013). FEI includes establishing a market vision and strategy, and the communication of these, opportunity identification and assessment, idea generation, product and project definition, and extends through the early stages of trialling (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002).

**Resource Based View, Absorptive Capacity, and Dynamic Capabilities**

For more than thirty years it has been accepted in academic literature that the core value of a company is its competitive performance and its ability to exploit its resources (Barney, 1991; Penrose, 1995; Peteraf, 1993; Wernerfelt, 1984). Competitive success is driven by the capability of firms to develop new knowledge-based capabilities that create core competencies (Pemberton and Stonehouse, 2000). These core competencies are important in the innovation process in small
Cohen and Levinthal (1990) introduced the concept of Absorptive Capacity (ACAP) to construct a framework in which the actions related to knowledge could be studied. ACAP is defined as the ability of a firm to recognise the value of new external information (knowledge), acquire, assimilate, and transform it to the targeted application and apply it to commercial ends, and this is critical to the firm’s innovative capabilities (Cohen and Levinthal, 1990). This is particularly relevant to collaborative and open innovation as the internal and external flows of knowledge are at the core of these processes.

Within the ACAP umbrella, technological capability in a company has been shown to make it more receptive to new external information (Berkhout et al., 2010), to sustaining a company’s innovation, and also in being able to participate with others in open innovation (Rosenkopf and Nerkar, 2001; Veugelers and Cassiman, 1999). Backmann (2015) found that ACAP is related to team effectiveness outcomes in an interorganisational context, and that team ACAP is a critical factor in PI management - this suggests that team ACAP is important in collaboration and open innovation since these inherently involve interorganisational activities. This role of team ACAP is reinforced by the finding that the effects of collaborative innovation networks on product innovation capability is only significant when ACAP is also present (Najafi Tavani et al., 2013).

In small companies, the owner-manager plays a dominant role in building the resources, including the capabilities, of the organisation and in how these resources are used in the innovation process (Millward and Lewis, 2005). Effective leadership by owner and managers have been shown to play a major role in FEI and SPI (Koen, 2014). Effective leadership in small, entrepreneurial companies includes vision, strategy, commitment and passion (Renko et al., 2015; Bicen and Johnson, 2014). Entrepreneurial Passion(EP) plays a significant role in PI, particularly in radical innovation (Strese et al., 2016). It has been suggested that team entrepreneurial passion
(TEP) helps team and new venture performance (Cardon et al., 2017b), and while this may be relevant to collaborative research, the literature has not fully explained the relationship which EP has with external collaboration and open innovation.

**Small Companies and their Resources**

There is a scarcity of empirical studies on FEI and SPI which are focused specifically on small companies. Notwithstanding the lack of literature dedicated to small companies, there is literature based on samples of SMEs, which have a significant small company component, and since these can provide useful background, when appropriate these are cited in this paper. This literature indicates that SMEs have a number of resource disadvantages including limited physical and financial resources, scarce personnel capacities, and limited time availability (Laforet and Tann, 2006; Millward et al., 2006; Teng, 2007), as well as issues of managerial capacity, awareness of and access to external knowledge (Bianchi et al., 2011; Van de Vrande et al., 2009; Wynarczyk, 2013). These resource deficiencies have been shown to adversely impact on the ability of small and medium companies to sustainably engage in product innovation and to grow (Darroch, 2005; Martineau and Pastoriza, 2016; Xie and Suh, 2014).

However, small and medium companies have little choice: they need to address market demands by continually developing new products and services – the other alternative is decline of their business (Sørensen and Stuart, 2000; Danneels, 2002). The limited amount of research specialising on small companies (with less than 50 employees) which has been published has shown that knowledge acquisition and ACAP are key drivers for innovation, productivity and growth (Roper et al., 2008; Hervas-Oliver et al., 2011; Parida et al., 2012).

In an early study, Dickson (1995) found that the management of external relationships, necessary for knowledge acquisition, is neither straightforward nor without cost, and potentially required the allocation of considerable technical and managerial resources - these types of resources are often lacking in small companies. Access to and availability of external resources is
an issue, and lack of necessary financial resources can limit a company’s innovative performance by not being able to afford to develop multiple technologies or to experiment with new ideas (Agarwal et al., 2004). For instance, financial constraints can impact on university-industry collaborations, and if this is combined with other constraints, there can be a hesitance to become involved in collaborating (Filippetti and Savona, 2017). Limited financial resources contributed to most small companies relying on speed to market and secrecy to protect the value of their innovation rather than patenting (Leiponen and Byma, 2009), and can also impact on their interest in collaborating with others, particularly universities.

The sources of knowledge used in the development of new products are important to understand, and while small, innovating companies consider the most important sources of knowledge to be internal (greater than 80 percent of companies surveyed), supply chain sources such as customers (approx. 60 percent), and suppliers (approx. 48 percent) were also viewed as important (Cosh and Hughes, 2010). Investigating companies that did look outside for knowledge, Vahter et al. (2014) found that small manufacturers gain significantly more than larger ones from investing in the knowledge linkages within their supply chain. Firms which use multiple external sources of knowledge (sources such as suppliers and customers, fairs and trade associations) also tend to use university research more intensively (Laursen and Salter, 2004). This finding suggests that firms with a more ‘open’ search strategy, and possibly a higher ACAP, have a higher engagement capability, and tend to draw from university research to a greater degree.

‘Open’ Innovation Approaches

Engagement

This paper follows the definition used by (Blok et al., 2015) that stakeholder engagement describes the practices that companies undertake to involve stakeholders in its development activities (in this case, innovation). Engagement has been shown to give access to new information (Sharma, 2005), develop understanding, trust and commitment between stakeholders (Gao and
Zhang, 2006), encourage collaboration (Andriof and Waddock, 2017), and contribute to SPI (Ayuso et al., 2011). Furthermore, it has been found that when firms do not cooperate and exchange information, they reduce their knowledge over time and lose the ability to engage and develop relationships with third parties (Koschatzky, 2001). To achieve sustained competitive advantage a company needs to consider the perspective of each of its key stakeholders (suppliers, customers, competitors, government, and technical institutions) through ongoing engagement (Post et al., 2002; Lasagni, 2012).

Small manufacturing companies have a poor record of engaging and networking because many have a characteristic of being insular and autonomous (Laforet and Tann, 2006). Engagement is influenced at both individual and organisational levels by a number of factors including friendship, common experiences, self-representation, trust, a common goal, resource dependency, level in the organisation, institutional governance, and proximity of parties (Jonas et al., 2018). Particularly in the case of university-small company engagement, many of these factors present a significant challenge to overcome. Potential absorptive capacity (PACAP), which has the most impact on the front-end of innovation, is increased by stakeholder engagement (Scholten and Van der Duin, 2015). Fitjar (2013) differentiated between supply chain interaction (with suppliers and customers) and what they termed Science, Technology and Innovation (STI) engagement (with consultants, universities, and research centres); and found that engagement with local universities had a positive impact on the innovation potential of the firm.

Collaboration

The concept of what collaboration is about is generally understood; however, it is often confused with cooperation. Like collaboration, cooperation involves trust, communication and coordination between the parties (Sivadas and Dwyer, 2000). Cooperation is characterised by the parties transferring or sharing information among parties which remain autonomous and independent (Dillenbourg et al., 1995; Keast et al., 2007). By contrast, in collaboration, the parties
typically have strong linkages and share information and expertise towards some level of shared goal (Nissen et al., 2014).

The clarity of the concept is further obscured by other terms often used similarly: networking, communication and coordination (Himmelman, 2001). Collaboration is fundamental to leveraging resources, including the formation and maintenance of relationships with a variety of stakeholders (Agarwal and Selen, 2009). Collaborative innovation (CI) has been described as the creation of new products and services across company boundaries through the exchange of ideas, knowledge, expertise, and opportunities (Miles et al., 2005). This sharing can occur at any point throughout the innovation process and resulted in a five stage model, co-ideation, co-valuation, co-design, co-test, and co-launch being developed (Russo-Spena and Mele, 2012). For small firms, pursuing new opportunities and innovating collaboratively allows them to retain, and even extend, their creativity and flexibility while minimising the adverse effects of their size. Research has shown that it is important to find the correct partner with which to collaborate (Melander, 2018; Littler et al., 1995), and this can take some time. Firms that choose to pursue collaborative innovation as a strategy must be able to develop the capabilities, structures, and processes to support a collaborative approach (Ketchen Jr et al., 2007). Agarwal and Selen (2009) found that through collaboration with stakeholders several dynamic capabilities are developed at both an individual and firm level, including customer engagement, collaborative agility, and collaborative innovative capacity; and that this has implications for future performance (Love et al., 2014).

There are several approaches to product innovation which a small company may take that involve collaboration with external parties, including: collaborative networked organisations (Camarinha-Matos et al., 2009), STI-DUI (González-Pernía et al., 2015), outsourcing (Whitley and Willcocks, 2011), joint venturing (Docherty, 2006), coopetition (Ritala and Hurmelinna-Laukkanan, 2009), and open innovation (Chesbrough, 2006). In line with the resource-based view (RBV) of strategy, Suarez-Villa (1998) contended that outsourcing R&D, which is potentially a
part of all these approaches, could be beneficial for small firms due to their limited access to capital and other (human) resources.

**Open Innovation**

Open innovation (OI) is not a clear-cut concept and has been expressed in a variety of ways in the literature (Huizingh, 2011; Schroll and Mild, 2012). Perhaps the most useful definition comes from the latest development from one of the originators of the concept: “open innovation is a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation's business model” (Chesbrough and Bogers, 2014). One of the distinguishing features of OI to other innovation approaches is that it includes the purposive outflows of knowledge (West et al., 2014). As with other collaborative approaches, it inherently involves engaging and collaborating with others (Ollila and Yström, 2017).

OI requires a change of mindset, and for the individuals involved to engage directly with various external players, to be involved in external communities and networks, and potentially to work on the innovation project within a partnering organisation (Salter et al., 2014). When combined with effective stakeholder engagement, OI can produce benefits which extend beyond the acquisition of knowledge for which it was originally intended (Wayne Gould, 2012). A systematic review of literature by Schoen (2017) suggests that the open innovation research in the food sector heavily concentrates in the role of clusters, networks and innovation brokers as enablers of innovation activity.

**Engagement, Collaborative and Open Innovation, and University-Government-Industry Linkages**

Consultants and higher education institutes (including universities) have been found to be only considered important by about 15 percent of innovators in UK (Cosh and Hughes, 2010). In the same study, two-thirds of industry, independent of the size of the company, commented that results
of basic research from universities are of little or no relevance to them. It has also been found that
the level of ACAP can influence a firm’s practice of drawing from university sources (Cohen and
Levinthal, 1989; Schartinger et al., 2001; von Hippel, 1998), and this could suggest larger
companies are more likely to collaborate with universities than smaller firms. The barriers to more
effective collaboration between the business sector and universities are many and varied
(Schofield, 2013; Schartinger et al., 2001), including:

1. Lack of resources (on both sides);
2. Various measures of cultural differences, including differences in management styles and
   budgeting processes (Littler et al., 1995);
3. Lack of information;
4. Lack of secrecy;
5. Geographic distance between interaction partners; and
6. Cultivation of university – firm interactions are not traditionally part of the role for senior
   researchers.

A further factor, trust between university and industry partners, has also been recognised as
significant by some researchers (Bstieler et al., 2015; Bruneel et al., 2010). Trust is likely to be
especially important in facilitating university–industry links (Santoro and Saparito, 2003), since
firms and universities are often required to share commercially sensitive information and tacit
knowledge.

It has been shown that there can be inherent differences between the objectives and governance
of the parties, which can impact university–industry collaboration (Noble et al., 2015). University-
based scientists with high research potential have been linked with large firms in joint research,
whereas those scientists with low research potential have been associated with small firms through
less interactive channels such as technical consultation (Fukugawa, 2005). Lack of information or
poor communication about what universities actually do (and what might be the benefits for
industry), and similarly a lack of information and understanding of what small companies are engaged in, reduces the probability for cooperation and collaboration significantly (Siegel et al., 2003). Linkages with universities and researchers are also fraught with risks due to the uncertainty of any commercial applicability of research outcomes (Roper et al., 2008).

The search strategy adopted by a firm (for example, using open innovation) will strongly influence its propensity to use university knowledge and information; and the firm manager’s characteristics and the choices made by the manager matter in determining whether a firm draws from universities (Laursen and Salter, 2004).

Table 4.1 – Key Literature on Engagement, Collaboration and Open Innovation, and FEI in small companies

<table>
<thead>
<tr>
<th>Theme</th>
<th>Source</th>
<th>Method/Context</th>
<th>Key Findings</th>
</tr>
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<tbody>
<tr>
<td>FEI</td>
<td>(Koen et al., 2014b)</td>
<td>Cross-sectional survey - large US companies</td>
<td>FEI is Important to SPI</td>
</tr>
<tr>
<td>ACAP</td>
<td>(Cohen and Levinthal, 1990)</td>
<td>Cross-sectional survey - US manufacturing companies</td>
<td>ACAP is critical to competitive advantage and PI success</td>
</tr>
<tr>
<td>Resources</td>
<td>(Laforet and Tann, 2006)</td>
<td>Cross-sectional survey - SME manufacturing companies in UK</td>
<td>Small companies are deficient in physical, financial and human resources</td>
</tr>
<tr>
<td>Engagement</td>
<td>1. (Filippetti and Savona, 2017)</td>
<td>1. Literature review</td>
<td>Limited resources impact on ability to participate in CI and OI</td>
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<td></td>
<td>2. (Leiponen and Byma, 2009)</td>
<td>2. Cross-sectional survey – small companies in Finland</td>
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<tr>
<td>Collaboration and Open Innovation</td>
<td>1. (Post et al., 2002)</td>
<td>1. Case studies – large US companies</td>
<td>Need to engage with customers, suppliers, competitors, tech. institutions and government</td>
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<td></td>
<td>2. (Lasagni, 2012)</td>
<td>2. Cross-sectional survey-SMEs in Europe</td>
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<td></td>
<td>(Scholten and Van der Duin, 2015)</td>
<td>Cross-sectional survey of new technology firms in Netherlands</td>
<td>Stakeholder engagement increases ACAP</td>
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<td></td>
<td>1. (Rosenkopf and Nerkar, 2001)</td>
<td>1. Sector specific US study</td>
<td>Technological capability is important to CI and OI</td>
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<td>2. (Veugelers and Cassiman, 1999)</td>
<td>2. Cross-sectional survey of Belgian manufacturing</td>
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<td></td>
<td>1. (Sivadas and Dwyer, 2000)</td>
<td>1. Sector specific survey of US technology firms</td>
<td>Cooperation and collaboration require trust, communication and coordination; and can occur anywhere throughout PI process</td>
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<tr>
<td></td>
<td>2. (Russo-Spena and Mele, 2012)</td>
<td>2. Cross-sectional case study of large firms</td>
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<td></td>
<td>(Chesbrough and Bogers, 2014)</td>
<td>Literature review</td>
<td>OI involves two-way flow of knowledge</td>
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<td>Theme</td>
<td>Source</td>
<td>Method/Context</td>
<td>Key Findings</td>
</tr>
<tr>
<td>----------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>(Ollila and Yström, 2017)</td>
<td>Sector specific European case studies</td>
<td>OI inherently involves engagement and collaboration</td>
</tr>
<tr>
<td></td>
<td>(Cosh and Hughes, 2010)</td>
<td>Cross-sectional survey of US and UK firms</td>
<td>Vast majority of companies do not collaborate with technical institutions</td>
</tr>
<tr>
<td></td>
<td>(Noble et al., 2015)</td>
<td>Review of Australian cooperative research programs</td>
<td>There are inherent differences in objectives and governance between companies and universities which impact on collaboration</td>
</tr>
<tr>
<td>Role of owner-manager</td>
<td>(Millward and Lewis, 2005)</td>
<td>Longitudinal case studies of small UK manufacturing firms</td>
<td>Owner-manager plays a dominant role in PI</td>
</tr>
</tbody>
</table>

As can be seen from Table 4.1 extant literature, from different contexts and using a variety of methodologies, provides insight into the key themes associated with CI/OI. However, most is not focussed specifically at small companies nor is sector specific, and does not provide empirical data on how engagement, cooperation, collaborative and open innovation work at the front-end of the innovation process in small companies. It is important to understand how the resources of small companies, ACAP and their other capabilities, and the collaborative approaches employed, manifest in and influence FEI, by studying companies which have achieved success at SPI. This study addresses these issues via the primary research question: “How do ACAP and organisational and managerial capabilities influence the external relationships of small companies and the subsequent successfullness of the FEI?”. The study answers this question by addressing a series of supplementary research questions (SRQs):

- SRQ 1. What are the external relationships small companies establish to enable them to develop new products, and how do these relationships manifest as collaborative and open innovation in FEI?
- SRQ 2. How does ACAP and the characteristics and capabilities of the owner-manager affect the external relationships small companies use during FEI?
- SRQ 3A. How do the resources of small companies affect engagement between small companies and technical institutions, and how does this affect collaborative innovation?
• SRQ 3B. How does the governance and structure of external agencies affect successful small company-institutional collaborative innovation?

• SRQ 4. How do the external relationships of small companies affect FEI and SPI?

The following section in this chapter will discuss the methodology used to investigate how small companies in the Australian food manufacturing sector engage externally and how they collaborate and use open innovation. It outlines how the data is collected via a series of face-to-face interviews, and how this data is analysed. Following this, the findings are then discussed and compared with published literature, conclusions drawn, and implications and recommendations proposed.

Methodology, Sampling, Data Collection and Analysis

Method

How small companies utilise processes like collaborative and open innovation with external parties such as universities, and how they acquire knowledge to do so, has not been comprehensively covered in prior literature. For this reason, this research is undertaken via a series of qualitative interviews to induce comment and insight to develop theory and to provide useful management information, particularly related to FEI in small companies (Yin, 2013; Johnson and Harris, 2002).

Sampling

Most prior research on new product development has been conducted using cohorts of large companies or does not distinguish between different sizes, despite company size having a clear impact on many of the knowledge related issues in product innovation (Alegre and Chiva, 2008; Hervas-Oliver et al., 2011). This study focusses on small companies, defined herein as those with less than 50 full-time equivalent (FTE) employees.
Small Companies

In studying how collaborative and open innovation approaches and ACAP manifest in the FEI it draws information from small established companies which have demonstrated sustained success in product innovation. The selection of companies to be interviewed in the study was based on criteria adapted from (Dougherty and Hardy, 1996) of:

1. Size - less than 50 employees
2. Age - operating and demonstrating good growth for three years or more
3. Sustained Product Innovation demonstrated by commercialising at least four new products each year, with a company sales growth of higher than national GDP growth.

The cohort of participants was generated using non-probability sampling. Companies were selected using a combination of discussion with organisations representing the food industry and independently searching company websites. Publicly available information for each company was assessed broadly against the selection criteria. Potential participants were selected from businesses with family and non-family structures, from metropolitan and rural and regional areas in four states in Australia. They covered manufacturers of different types of food including ingredients, snacks and pre-prepared meals, and beverages, with little if any direct competition between them.

Having developed a list of potential company participants, the owner-manager of the company was then contacted personally to confirm that the company met the selection criteria of size, age and innovativeness, to explain the project scope, and any issues regarding the interview were discussed. If the criteria were satisfied and the individual agreed, an Invitation to Participate was sent out which explained the aim of the study and its intended use, and discussed the obligations and rights of participants as well as provided full contact details for the researchers. This invitation was followed by a consent form to be completed and signed by each person to be interviewed.

External Knowledge Sources
CI and OI by their nature involve external participants. In this study, these external participants were selected from individuals who were engaged in a variety of functions associated with the food sector, including government support agencies, consultants and universities. Participants were approached based on their roles within the organisations they represented, which were selected for their relevance to, and involvement with, the food sector. As with the small company participants, if the criteria were satisfied and the individual agreed, an Invitation to Participate was sent out which explained the aim of the study and its intended use, and discussed the obligations and rights of participants as well as provided full contact details for the researchers. This was followed by a consent form to be completed and signed by each person to be interviewed. The participants were asked to provide insight into the relationships that they had with small companies, particularly in the provision of knowledge and resources for innovation of food products.

**Data Collection & Analysis**

The interviews with company participants were conducted around a series of open and semi-structured questions, shown in Appendix 2, which were derived from studies by (Flatten et al., 2011a; Fabrizio, 2009; Statistics, 2013; Cardon et al., 2013). The interviews with the external knowledge sources were conducted using a series of open questions, shown in Appendix 3, which were based on issues raised in empirical studies by (Laursen and Salter, 2004; Schofield, 2013; Roper, 2008). Using an open interviewing approach, the questions were supplemented as appropriate to the individual conversations to draw out key themes. The two groups can be summarised as:

1. A total of 24 individuals in 15 companies were interviewed lasting between 45 minutes and 2 hours. The interviewees varied in age (30 to 80 years), approximately half had a university education, and a quarter had postgraduate degrees. The company locations had a wide geographic spread and represented a broad spectrum of food and beverage types. They
included family and non-family structures, all had been operating for more than three years, and most more than 10 years.

2. A total of 10 individuals from external organisations including government (federal, state, regional), industry support organisations, universities and consultants with a minimum of 5-10 years’ experience in engaging with companies, inclusive of small companies and the food sector, on matters associated with innovation.

All interviews were conducted by the principal investigator and voice recorded. The recordings were transcribed and the organisations and individuals de-identified. Then the data was manually coded around the key themes of ACAP, CI and OI, leadership, entrepreneurial passion, and other organisational and managerial characteristics related to FEI and SPI. These factors, themes and patterns were consolidated for the total sample. This data was then examined to search for underlying patterns and for any divergence from extant literature.

Table 4.2 outlines the companies interviewed and Table 4.3 the external organisations interviewed.

Table 4.2 - Summary of Characteristics of Companies Interviewed

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Turnover ($million)</th>
<th>Employees</th>
<th>New Products Developed/yr.</th>
<th>Family/ non-family</th>
<th>Age of Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Metro</td>
<td>50</td>
<td>50</td>
<td>30</td>
<td>Family</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Metro</td>
<td>20-30</td>
<td>20-30</td>
<td>300</td>
<td>Family</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Metro</td>
<td>20-30</td>
<td>46</td>
<td>4 to 5</td>
<td>Family</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>Metro</td>
<td>10</td>
<td>25</td>
<td>20-40</td>
<td>Non-Family</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Region</td>
<td>10</td>
<td>25</td>
<td>7 to 10</td>
<td>Non-Family</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Region</td>
<td>3 to 4</td>
<td>20</td>
<td>10</td>
<td>Non-Family</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>Region</td>
<td>5</td>
<td>20</td>
<td>10 to 20</td>
<td>Non-Family</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>Region</td>
<td>1.5</td>
<td>7</td>
<td>50</td>
<td>Non-Family</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Metro</td>
<td>8</td>
<td>50</td>
<td>15-20</td>
<td>Non-Family</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>Metro</td>
<td>30-40</td>
<td>35</td>
<td>&gt;20</td>
<td>Family</td>
<td>70</td>
</tr>
<tr>
<td>11</td>
<td>Metro</td>
<td>N.A.</td>
<td>50</td>
<td>N.A.</td>
<td>Non-Family</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>Metro</td>
<td>16</td>
<td>45</td>
<td>42</td>
<td>Non-Family</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>Metro</td>
<td>5</td>
<td>10</td>
<td>8</td>
<td>Non-Family</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>Region</td>
<td>&lt;1</td>
<td>4</td>
<td>4</td>
<td>Non-Family</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>Region</td>
<td>25-35</td>
<td>50</td>
<td>15-20</td>
<td>Non-Family</td>
<td>12</td>
</tr>
</tbody>
</table>

Table 4.3 - Summary of Characteristics of External Sources Interviewed

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Type of Organisation/Role</th>
<th>Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organization</td>
<td>Role</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>A</td>
<td>Regional Government</td>
<td>Economic Development Manager</td>
</tr>
<tr>
<td>B</td>
<td>Regional Government</td>
<td>Economic Development Manager</td>
</tr>
<tr>
<td>C</td>
<td>State Government</td>
<td>Research Centre Manager</td>
</tr>
<tr>
<td>D</td>
<td>State Government</td>
<td>Economic Development Manager</td>
</tr>
<tr>
<td>E</td>
<td>Industry Development Agency</td>
<td>Innovation Project Manager</td>
</tr>
<tr>
<td>F</td>
<td>Industry Support Agency</td>
<td>Project Development Manager</td>
</tr>
<tr>
<td>G</td>
<td>Industry Consultant</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>University</td>
<td>Research – Professor (Engineering)</td>
</tr>
<tr>
<td>I</td>
<td>University</td>
<td>Researcher</td>
</tr>
<tr>
<td>J</td>
<td>University</td>
<td>Research – Professor (Innovation) and CEO of a CRC</td>
</tr>
</tbody>
</table>

**Results**

This section presents results from the face-to-face interviews and provides information on the external relationships which small companies have as part of their approach to the front-end of product innovation, how the various factors, including the role of the owner-manager, ACAP and managerial capabilities influence the success of FEI. The participating companies all had a strong customer orientation, actively engaging with their customers to maintain their relationships. The participating companies which directly sold to consumers mainly engaged via the company’s websites. The companies generally had less direct engagement with the broader market and potential new customers and consumers, relying for this on distributors, the company website and attendance at industry exhibitions. The participating companies generally had close relationships with suppliers which were often used as sources of new knowledge.

In the relationships which participants had with customers and suppliers, the engagement was principally focused on existing business, and rarely discussed new product development unless a customer had made a specific request for a new product. With two exceptions, the participants did not participate in industry clusters or networks. The companies had limited relationships with government agencies mainly when considering funding possibilities for development, rather than using as a source of business or market knowledge. Only one company maintained an ongoing...
relationship with a technical institution, primarily as a source of information and some analytical activities.

Overall, the participating companies engaged externally within a constrained arena which in their opinion was due largely to limited human resources and time, both of which were influenced by financial considerations; although a strong sense of independence was likely also to be a contributor. The companies did actively pursue new information externally via social media and selective attendance at industry exhibitions, both locally and overseas, and used this as a base for new product development.

Table 4.4 summarises the engagement the participants typically had with different stakeholders, showing the frequency, areas of influence on FEI, and the impact it had on FEI in practice.

### Table 4.4 – Stakeholder Engagement

<table>
<thead>
<tr>
<th></th>
<th>Consumers</th>
<th>Customers</th>
<th>Suppliers</th>
<th>Networks, Clusters</th>
<th>Technical Institutions</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engagement Frequency</strong></td>
<td>Limited</td>
<td>Frequent</td>
<td>Frequent</td>
<td>Rare</td>
<td>Rare</td>
<td>Infrequent</td>
</tr>
<tr>
<td><strong>Impact on FEI</strong></td>
<td>Limited by lack of engagement and collaboration</td>
<td>Limited by lack of Collaboration</td>
<td>Limited by lack of engagement and collaboration</td>
<td>Limited by lack of engagement and collaboration</td>
<td>Limited by lack of engagement and collaboration</td>
<td>Limited by lack of engagement</td>
</tr>
</tbody>
</table>

The participating companies expressed that during the FEI process, there is a need for a wide variety of new information/knowledge which potentially influenced the development of a new product. This need included information related to markets and consumer trends, customer requirements, supplier capabilities (raw materials and equipment), process technology, marketing, distribution logistics, government regulations, human resources and financing. Obtaining this information required access to and relationships with a variety of sources, and the level and nature
of engagement with these sources which was necessary was often significant. The diversity and in some cases, the depth of information required presented significant challenges to the participating companies due to their smallness, which restricted their access to some sources. The lack of engagement with the appropriate sources and the lack of collaboration with them impacted negatively on FEI. The majority of the participating companies preferred to internalise their need for more knowledge and expertise (technical, marketing, and business) and by hiring new personnel aimed at further developing their product innovation programs and grow business. In approximately 40 percent of these companies, this hiring related to someone with tertiary education, and has the potential to result in more collaboration in the longer term (Ahn et al., 2014).

There is a multiplicity of factors required for success, including time, trust and passion as well as capabilities like ACAP, engagement, and managerial capabilities. The characteristics of the respective leaders also plays an important role in success. Table 4.5 outlines the knowledge challenges and resource deficiencies faced by these small companies throughout the FEI process, and where collaborative and open innovation played a role. It also presents the capability factors which impacted on the ability of these innovation approaches to succeed through the FEI process.

Table 4.5 - Knowledge processes, resources, collaboration and open innovation in FEI

<table>
<thead>
<tr>
<th>FEI process and activities undertaken by small companies</th>
<th>Knowledge/ACAP based challenges faced in FEI</th>
<th>Other, non-knowledge-based resource deficiencies which impact on FEI</th>
<th>Collaboration in FEI Processes</th>
<th>Open Innovation In FEI Processes</th>
<th>Factors that impact on Collaboration and OI in FEI processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a vision</td>
<td>Owner-Manager characteristics</td>
<td>Time</td>
<td></td>
<td>X</td>
<td>Time, Trust, Engagement, Prior Knowledge (PK), ACAP, EP, Leader characteristics</td>
</tr>
<tr>
<td>Identify new opportunities</td>
<td>Access to information, and Owner-Manager characteristics</td>
<td>Time, finance, human</td>
<td>X</td>
<td></td>
<td>Time, Trust, Engagement, PK, ACAP, EP, Leader characteristics</td>
</tr>
<tr>
<td>Generate and enrich ideas</td>
<td>Access to information, human resources, and Owner-Manager characteristics</td>
<td>Time, finance, human</td>
<td>X</td>
<td></td>
<td>Time, Trust, Engagement, PK, ACAP, EP, Leader characteristics, Marketing and technical capability</td>
</tr>
</tbody>
</table>
The majority of innovation conducted by the small companies was focused on marketing of new products rather than technological development of products - exceptions were Firms 2 and 10. Although the participating companies actively sought new knowledge from outside the company, particularly for new ideas, this inflow of information was then predominantly employed in closed innovation processes, the companies using their internal resources to progress through FEI. However, there were a number of individual cases where collaborative approaches were used as part of the FEI process – in each of these the knowledge and expertise of the external party was utilised for a stage of FEI (and sometimes later in the PI process), and the contribution was then internalised by the participating company as part of the overall development. These cases of CI and OI are summarised in Table 4.6, and provide some insight into the external relationships of some of the participants that were utilised in FEI.
### Table 4.6 - Examples of collaboration and OI projects by participating companies

<table>
<thead>
<tr>
<th>Collaborator</th>
<th>Customer</th>
<th>Supplier</th>
<th>Contract Manufacturer</th>
<th>Food Manufacturer/Wholesaler</th>
<th>Food Manufacturer/Wholesaler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating Company</td>
<td>Company 2</td>
<td>Company 10</td>
<td>Company 3</td>
<td>Companies 14 &amp; 15</td>
<td>Companies 1, 2, 3, 13</td>
</tr>
<tr>
<td>Primary Aim</td>
<td>Meet existing customer need for new ingredient</td>
<td>Security of supply, and improved sustainability</td>
<td>Expand and strengthen company by diversifying product range</td>
<td>Expand companies</td>
<td>Expand company’s market within region</td>
</tr>
<tr>
<td>Key Strategies</td>
<td>Strengthen customer relationship, speed launch of new end product</td>
<td>Develop improved crop quality and reliability to enable new products</td>
<td>Develop ‘convenience meal’ retail range</td>
<td>Develop first to market natural nutraceutical products</td>
<td>Share information from non-competing regions</td>
</tr>
<tr>
<td>Key Activity</td>
<td>Company and customer personnel worked together in company’s labs to develop new ingredient</td>
<td>Work with multiple growers to develop their knowledge and improve crop</td>
<td>Work with neighbouring manufacturer to use complementary expertise and facilities to develop and manufacture new products.</td>
<td>Work with cluster member to access nutraceutical knowledge, to enable design and manufacture of natural product for distribution by cluster member</td>
<td>Share business, process and market knowledge</td>
</tr>
<tr>
<td>Innovation Approach</td>
<td>OI</td>
<td>CI - outsourcing</td>
<td>CI - cooperation, outsourcing</td>
<td>CI - Networking, cooperation and outsourcing</td>
<td>CI – cooperation</td>
</tr>
<tr>
<td>Knowledge Flows</td>
<td>Inwards/Outwards</td>
<td>Outwards</td>
<td>Inwards</td>
<td>Inwards</td>
<td>Inwards/ outwards</td>
</tr>
</tbody>
</table>

Typically, smaller companies did not participate in industry networks, clusters, and associations due to lack of time and accessibility, particularly in the case of regional companies. Exceptions to this were Firms 14 and 15 who were both members of a local cluster of companies and collaborated with each other to develop new products. A number of companies, mainly family companies, had cooperative relationships with other family companies operating in overseas markets in which they shared knowledge in a non-competitive environment. These relationships were based on shared values and the longevity of the association - “it is shared values. The views that they have on their staff and community are very similar to ours and we also get the decision quickly” (Firm 2).

The diversity of sources of new knowledge, and the degree to which they are used by these small companies in the process of successfully developing new products, indicate that they have a good degree of absorptive capacity, particularly PACAP. According to the findings of (Laursen and Salter, 2004), this should result in an increased affinity for using universities, technical
institutes and government agencies as sources of new knowledge, but in the case of the participating companies the reverse was found. Only one company (Firm 12) maintained an ongoing collaborative relationship with a technical institute, which had been the originator of its core technology, outsourcing some process development but not product innovation. None of the participating companies had CI or OI relationships with universities - “we never had much success in using consultants and universities in product development” (Firm 4), and “the platforms they offer aren’t really right, so it’s better to go ahead and do it yourself” (Firm 10). This finding was in contrast to a previous study (Street and Cameron, 2007). The smaller and regionally based firms had no relationships with technical institutes - awareness, accessibility, costs and culture were noted as significant factors.

In the case of federal and state authorities, any relationship with the small companies resulted mainly from the company seeking funding and with a few exceptions did not utilise the business or market expertise and knowledge available within these agencies. The general perception from small companies was that the universities and government organisations were more relevant to and focused on larger companies. Cost, accessibility and time were considered to be factors (Firms 1, 4, 5, 6, 7, 8, 9 and 13). However, it was often recognised by the participants that effective association with appropriate outside organisations would be beneficial because, for example, “we have probably taken a lot longer to work something out ourselves” (Firm 5).

A key issue affecting ACAP, engagement, CI and OI in small companies was the dominant role played by the owner-manager of the company. Indeed, from the perspective of the external organisations interviewed the characteristics and capabilities of the owner-manager was the difference between success and failure of a collaborative project. This was supported by the findings for those firms which were led by individuals who demonstrated higher managerial and technical skills, combined with entrepreneurial leadership (vision, strategy, commitment, passion)
(Bass and Riggio, 2006; Renko et al., 2015), which collaborated more and were more successful in FEI and SPI.

The main characteristic of the small companies that impacted on engagement and collaboration was their smallness. This smallness generally manifested as limits to the resources (physical, financial, human (including knowledge), and time) that the companies could bring to the engagement and collaboration processes. It also meant that the company often did not have the management systems in place suitable for interfacing with an external party. While there was a strong sense of self-sufficiency and autonomy, the historic insular attitude of small companies (Laforet and Tann, 2006) was not observed in the company interviewees. While there was a sense of independence, the lack of resources rather than attitude was the major impediment to engagement and collaboration. The participants, all of which had demonstrated success in SPI generally acknowledged that they would benefit from increasing their management knowledge and capability and engaging more widely, but despite this limited knowledge, they found ways to overcome their deficiencies and achieve a level of success, albeit principally via incremental rather than more novel innovations. While there was evidence that incremental innovation can build skills that can then be utilised successfully in more novel innovation (Firms 2 and 3), being restricted to incremental innovations has been shown to potentially inhibit growth and to becoming uncompetitive over time, and there was evidence of that with Firm 5. With regard to the institutions, particularly universities, key issues which impacted on engagement and collaboration were related to the structure and governance of the institution and the objectives of the researchers - these impacted on engagement via the degree of motivation and commitment to spend the time required to build relationships; and on collaborative innovation via financial and timing parameters on projects, intellectual property concerns, and academic publishing.
Discussion

There was substantial consistency in the comments from the small participating companies and the external sources with regard to collaborative and open innovation, and to the relationships which small companies participated in externally. The external interviewees, whose experience extended beyond the 15 participating companies and also to sectors other than food, agreed with the insights from the participating companies, and suggested that these insights may have universal application for small companies.

SRQ 1 - What are the external relationships small companies establish to enable them to develop new products, and how do these relationships manifest as collaborative and open innovation in FEI?

The participating companies generally had close relationships with their customers and suppliers. These relationships understandably focused on the sale and purchase of products. While these relationships were cooperative and information was shared about customer needs and market conditions, rarely did they involve collaborative activities focused at the development of new products. In the case of contract manufacturers, the customer indicated the required product but generally left the design and development of the specifics to the participating company.

There were a limited number of examples where the relationship extended to collaboration on the design of the new product and remained engaged with the innovation process and was actively involved in trials of samples and providing feedback. Suppliers sometimes gave input regarding ingredients for new products but did not become further involved through the innovation process. An exception to this was packaging where suppliers may be involved with the company directly in design/redesign of packaging to meet the new product objectives. There was only one example in which a participating company actively employed a strategy of open innovation with specific customers, which proved successful both in product innovation and strategic business terms. With one exception, the companies did not have ongoing relationships focused at product innovation
with consultants, technical institutions or government agencies. Overall, despite the success that the participants had in developing new products, there was evidence that this limited sphere of external relationships regarding PI impacted on the degree of success that might otherwise have been achieved, particularly via more novel products.

**SRQ 2 - How does ACAP and the characteristics and capabilities of the owner-manager affect the external relationships small companies use during FEI?**

While extensively using internal sources of knowledge, which was often principally held by the owner-manager, the participating small companies actively used a variety of external sources, to pursue the new information they needed to innovate (ACAP). However, this acquisition phase was largely performed by the owner-manager which when combined with his/her prior knowledge presented a potential for bias. Although a variety of external sources were used, there is a potential risk which arises from relying on selected industry and social media sources if the validity and reliability of the data cannot be confirmed; and in this regard there were two significant external sources which typically were not used, namely technical institutions (including universities) and government agencies, and these could improve the scope, depth and quality of data for small companies.

All participants (internal and external) agreed that the level of the owner-manager’s managerial capabilities impacted on the development of the external relationships necessary to source information. In particular, it was often observed within the small companies that there was a lack of technology and project management capabilities, which have been found to be critical in managing collaboration with universities (Buganza et al., 2014). It was, however, noticeable that the companies which were led by individuals with higher education and higher managerial skills engaged more widely, demonstrated more collaborative activities, and achieved higher growth (Delmar and Wiklund, 2008).
A high level of entrepreneurial passion and technological capability on behalf of the owner-manager tended to result in more engagement with external parties (Ahn et al., 2014). Commitment of time by the owner-manager to engagement and the development of external relationships played a major role in successful collaboration. Customers and suppliers were by far the most common external sources of new information in the front-end of the innovation process, although social media was widely used particularly to gauge market trends. Packaging suppliers were common external sources of information in the later stages of innovation as the new product neared commercialisation.

SRQ 3A - How do the resources of small companies affect engagement between small companies and technical institutions and how does this affect collaborative innovation?

Engagement has been shown to encourage collaboration (Andriof and Waddock, 2017), but engagement, particularly with a range of stakeholders, requires a commitment of time and human resources, and this is impacted by financial considerations. With limited financial and human resources most of the participating companies limited their commitment towards engaging with customers and suppliers, which in turn limited the time available for engagement with technical institutions, the potential for collaborative innovation, and the benefits these could deliver to developing new products (Brettel and Cleven, 2011). This lack of engagement with technical institutions meant the small companies often did not understand the structure of these institutions and where to look for the expertise they needed, and they were not comfortable with sharing information. As discussed earlier, the owner-manager has a critical role to play in this regard, and few of them expressed great interest in exploring the potential of closer relationships with technical institutions – similarly, there did not appear to be any particular interest on behalf of the technical institutions to become closer to small companies. Lack of technical capability also affected the scope of engagement that some of the small companies were capable of, which limited the
opportunity to collaborate on more technically novel new products, consistent with previous findings (Berkhout et al., 2010).

**SRQ 3B - How does the governance and structure of external agencies affect successful small company-institutional collaborative innovation?**

The objectives, structure and governance of technical institutions present barriers to a commitment by these organisations to proactively engage with small companies and as a consequence participate in collaborative activities, as has been shown in previous studies (Schofield, 2013; Schartinger et al., 2001). The interviews revealed that there was a lack of awareness and understanding by the small companies regarding technical institutions and vice versa. It follows that there was no trust relationship between the two, which is a necessary antecedent to collaboration (Bstieler et al., 2015; Bruneel et al., 2010). As a result, it is not surprising that there was little to no collaborative innovation between the participating companies and universities, a result which was even lower than previous studies (Cosh et al., 2012). The interviews also revealed that there was a lack of mutuality between the objectives which each party sought from an innovation project (Jackson et al., 2017), and that rules related to funding and the management of intellectual property imposed by the institutions often presented barriers to participating collaboratively (Bruneel et al., 2010). This finding of low collaboration was consistent with an examination of industry-university linkage grants awarded by the Australian Research Council to food manufacturing projects over a ten-year period (2005-2014) which showed none had involved small food companies (Australian Research Council, 2015). This finding is consistent with Australia ranking last of 28 OECD countries in SME collaboration (OECD, 2017).
SRQ - How do the external relationships of small companies affect FEI and SPI?

The narrow scope of the external relationships of small companies generally limited their access to new knowledge, but when small companies invested in more diverse and technical relationships this tended to result in higher success in SPI and company growth (Lasagni, 2012). There was some evidence that where the collaborative activity extended across the FEI process and through to product launch the effect on both FEI and SPI was positive. This is consistent with the literature indicating that collaboration in the front-end of innovation was most common in high performing companies (Russo-Spena and Mele, 2012; Verbano, 2015). Within the limited examples from the participating companies, there was only one example where this collaboration early in the front-end was demonstrated, the other examples relate to the process post concept definition to later in FEI, involving R&D and product manufacture and trialling. Having external partners collaborate with small companies in the early stages of FEI (that is, opportunity identification, ideation and idea generation) has the potential to increase the novelty and success of PI. Earlier engagement by small companies with technical institutions and government agencies can provide the companies with better depth and quality of knowledge relevant to market contacts and networking opportunities, to management and marketing technologies, technical data, and lead to improved product innovation. Not engaging more widely and not participating in collaborative activities was observed to result in a limitation to the novelty of the new products developed, which reduced their market impact and longevity – longer term this runs the risk of reduced competitiveness.

The findings of the study, as reflected in Figure 4.1, answer the research question by showing how ACAP and organisational and managerial capabilities influence the external relationships of small companies, and how these act to affect FEI and sustained product innovation. However, the findings also suggest that in practice this model is rarely realised in full, because of the limited engagement between small companies and external stakeholders resulting in the lack of collaborative and open innovation. The existence of some of these issues has been raised in prior
literature from overseas (Cosh and Hughes, 2010), however the significance of the gap in collaboration in the Australian context was greater when compared, for example, to the reported 42 percent of the cohort of SME manufacturers in UK who reported outsourcing at least some of their R&D. By answering the research questions posed this paper has extended knowledge of the issues associated with external relationships and the importance of improving these for the future success of SPI in small companies in Australia.

Figure 4.1 - Conceptual Model of Collaboration in FEI and SPI

Conclusions, Implications and Recommendations

This chapter investigated the relationships that small companies employ in product innovation, how these relationships manifest during the front-end of the innovation process in particular, and how they affect SPI. Success in sustaining product innovation and company growth in small companies can be achieved using both “closed” and “open” approaches to innovation, and the participating companies rarely demonstrated the use of collaborative or open innovation processes. Generally, small companies in the food sector in Australia actively pursue external knowledge but do so within a relatively constrained sphere and do not engage broadly with all stakeholders, which limits the diversity, depth and validity of the new knowledge they access.
This study indicated that ACAP, together with appropriate managerial skills, is important to collaborative and open innovation and to FEI in small companies and that the role of the owner-manager is dominant. The study also showed that if the entrepreneurial passion often associated with this dominance can be employed to invest the time necessary to engage with external stakeholders, and to incorporate collaborative approaches into the company’s innovation activities, a higher level of new product novelty, more success in SPI and improved growth can be achieved. It was found that the level of engagement between small companies and technical institutions in Australia is extremely low resulting in a lack of awareness, understanding, and trust; and this presents a significant restriction to the ability of small companies to innovate, particularly on opportunities for more novel products. Some of the findings of the study contrast with studies overseas and certainly with those involving larger companies, however, this is consistent with the idiosyncratic nature of small companies and with their specific market environments.

This study contributes to our understanding of Engagement, Cooperation, Collaborative and Open Innovation in small companies by obtaining data from not only practitioners in small companies and academics in universities but also from other agencies (stakeholders) in the innovation process; and by considering both individual and organisational issues. It is important to FEI and SPI success that small companies invest in developing long term relationships based on mutual understanding and trust, not only with suppliers and customers but also with other external knowledge sources, and particularly with universities and government agencies. This investment by small companies has to be matched with investment by these external sources in active engagement with industry, and more specifically with small companies. More proactive engagement will require a change of attitude, and in the governance of stakeholders; however, such engagement is necessary for effective collaboration, particularly at the front-end of innovation, and this has been shown to improve SPI.
The findings of this research have implications for small companies, their owners and managers, the food industry, research institutions and governments. Most notably owner-managers, researchers and academics need to invest resources into engagement with each other, in order to develop a culture of CI aimed at growth of the individual company, and the food industry. To achieve this increased collaboration there first needs to be a recognition, at a leadership level of each of the parties, of the mutual benefit which can be achieved, and a commitment to structural/organisational change. It is suggested that government agencies need to take a coordinated approach to improving platforms which encourage and support this engagement. By way of example, if the knowledge and expertise available via technical institutions can be made available to small companies in the very early stages of the front-end of innovation (opportunity identification and idea generation) it potentially will increase the novelty and value of product innovations.

There are limitations to this work, principally the small sample size and the context of a single sector, namely the food manufacturing industry in Australia, although indications from the external sources interviewed, who often deal across different sectors, suggest the findings are relevant to other industry groups as well. It is recommended a quantitative survey be conducted across the food sector in Australia to validate these findings, and that further research be conducted into:

1. How ACAP and managerial capabilities, including leadership and vision, entrepreneurial passion and communications, can be better developed in small companies and external stakeholders to embed collaboration as a key product innovation strategy.

2. University-industry engagement and how to develop it, addressing issues of governance, leadership, and trust. Research in this area could include investigation of best practice from existing collaborative research platforms and how this could be implemented universally.

3. How policy and program changes impact over time to improve collaborative and open innovation, and how this impacts on the success and sustainability of product innovation in
small companies and their economic growth – this is consistent with the suggestion by (Lamprinopoulou and Tregear, 2011).

This study contributes to our further understanding of small companies, product innovation, engagement, and collaborative and open innovation. It further contributes by expanding the understanding of the relationships between small companies and technical institutions. By interviewing both company and external agency representatives, it highlights a need for change to achieve improved innovation outcomes, and in planning this change more research is required into engagement and collaboration. Managers and academics can use the findings of this study to address issues within their organisations to improve their individual and corporate innovation performance.
Chapter 5 -

ACAP, FEI and Sustained Product Innovation – a quantitative study of small food manufacturing companies.

Abstract

Innovation is universally accepted as critical to economic growth and small companies are recognised as key sources of innovation. Small companies are characteristically resource deficient, so how do some overcome this to sustain product innovation and grow?

A survey of the food manufacturing industry in Australia explored absorptive capacity (ACAP), how this and the culture and leadership of small companies impacted on the front-end of the product innovation process (FEI), how this influenced the success of this process; and ultimately how it reflected in the success of these companies in sustaining their overall product innovation performance (SPI). Despite the low response rate which resulted in a small sample size for analysis, this survey provided valid and reliable data resulting in useful insights into ACAP, FEI and the antecedents in practice in small companies.

The findings of the study suggest that the processes and success of the FEI in a small company are influenced by ACAP, the culture and resources of the company, and the innovation leadership demonstrated by the owner-manager; and that these factors influence each other. In a small company, with the owner-manager playing a dominant role, these findings place significant responsibility on this role to appropriately manage all these factors if product innovation is to be successfully sustained over time. The findings also suggest that both bricolage and collaboration can have significant influence on FEI success, although in practice small companies typically do not collaborate on developing new products. The findings have significant implications for owner-
managers of small firms, for academics and for policy makers, and opens new areas of potential research.

**Key Words:** ACAP, FEI, sustained product innovation, small companies, capabilities, owner-managers

**Introduction**

The main objective of this research is to examine how absorptive capacity (ACAP) and organisational characteristics and capabilities influence the front-end of product innovation (FEI) and sustained product innovation (SPI) in small established companies. This chapter presents and discusses current literature which gives theoretical background on the importance of ACAP in product innovation in small companies, on organisational and managerial capabilities and strategies, and on the front-end of the innovation process (FEI), in the context of small enterprises and their success in achieving economic growth. The study draws on insights gained during the series of face-to-face interviews with practitioners in the food manufacturing sector which have been presented in Chapters 2-4; and from these develops a quantitative survey which was emailed to companies in the food manufacturing sector in Australia. The results of this survey are presented and analysed to develop conclusions about the relationships between ACAP, organisational culture and resources, innovation leadership, and the strategies and approaches to innovation; and about their influence on FEI and SPI.

The focus of the study is small companies which make up the vast majority of all companies in most economies, are the major employer in the private sector and typically contribute in excess of 35 percent to economic value added in US, UK, and Australia (US Small Business Administration, 2016; BIS, 2017; Statistics, 2016a). Research has shown that small manufacturing companies contribute positively to job creation (Neumark et al., 2011a; DIISR - Department of Industry,
2012), that their innovation strategies are a driver for a nation’s employment growth (Triguero et al., 2014), and that this growth is maximised when an economy includes a balanced mix of family and non-family small companies (Memili et al., 2015). However, small businesses face a unique set of operational challenges, such as limited time, human and financial resources (Millward et al., 2006; Voss et al., 2008; Díaz-Díaz et al., 2008), and while this has been observed and reported previously in US (Ogbuehi and Longfellow, 1994), UK (Freel, 2000) and Australia (Statistics, 2013), there has been a lack of examination of how these challenges affect the innovation activities and performance of small businesses relative to those of larger firms (Australia, 2015). High failure rates, of the order of fifty percent, is common in new companies in the first few years in developed countries (USBA, 2011; Statistics, 2016a). Research has shown that after operating for 10 years only a small percentage of firms achieve high growth rates (O’Gorman, 1997), and this is important when rapidly growing firms have been shown to generate a disproportionately large share of all new net jobs compared with non-high-growth firms (Henrekson and Johansson, 2010).

While the literature on SMEs is extensive and growing, the size range in this category is very wide (up to 500 employees in some jurisdictions), and the size of a company is relevant when it comes to the availability of resources (Morrison et al., 2003). This research focuses on small companies, defined here as having less than 50 full-time equivalent employees, consistent with Recommendations of European Commission 2003/361/EC and most commonly used worldwide. While this size classification makes up the majority of companies, and represents an important bridge between start-ups and larger organisations, it is under-represented in literature, particularly that related to product innovation. There has been frequent calls by researchers for the need to improve our understanding of innovation and how greater economic growth in companies can be achieved (Koryak et al., 2015). In this study the focus is on product innovation and it uses the OECD definition of product innovation (PI) as ‘a good or service that is new or significantly improved - this includes significant improvements in technical specifications, components and
materials, software in the product, user friendliness or other functional characteristics’ (OECD, 2005). This OECD standard is also used for the definition of radical innovation as that which results in fundamental changes in the firm's products, while incremental innovation entails the refinement and reinforcement of existing products. The study defines sustained product innovation (SPI) as the generation of multiple new products, as strategically necessary over time, with a reasonable rate of commercial success as used by (Dougherty and Hardy, 1996). Andrew et al (2013) found that 71 percent of companies regarded sustained product innovation in their top three strategic priorities, but despite this acknowledgement only one in ten have been shown to be able to sustain innovation and growth that delivers above-average economic growth for more than a couple of years (Christensen and Raynor, 2013).

To improve innovation performance in small companies, it is necessary to not only be aware of the factors involved but also to understand the influence these factors have on each other and on the various stages of innovation. This chapter addresses this need and the issue raised by (Hutchinson and Quintas, 2008) that most prior research into product innovation has been conducted on large companies. It aims to consider some of the multi-dimensional aspects of innovation and growth raised by these authors. While a company needs to be proficient in all phases of the PI process, the front-end activities are especially important (Khurana and Rosenthal, 1998; Kim and Wilemon, 2002). These authors defined the front-end of innovation to include market vision and strategy, and communication of these; opportunity identification and assessment; idea generation; product and project definition and planning. Kim and Wilemon (2002) concluded that the ‘upfront or fuzzy front–end’ of the product development process, referred to in this paper as FEI, is one of the most important and difficult challenges facing innovation managers. Since there is no time when resource deficiencies of a small company are more apparent than in these early stages of PI, this study will have an emphasis on how ACAP and
the organisation’s characteristics and capabilities influence the front-end of the new product development process.

The following section of the chapter discusses the theoretical background to the study and the development of hypotheses, then outlines the methodology used in the email survey which was conducted with companies in the Australian food manufacturing sector. The results of this survey are presented, analysed and discussed, after which conclusions are drawn together with implications for academics and practitioners; and finally, recommendations are made for future research.

**Theoretical Background and Hypotheses Development**

The fourth subsidiary question to the overarching research question of this thesis and the primary research question of this chapter is “How do a small company's ACAP, culture, leadership and innovation activities influence each other, and how do they affect the success of the front-end and sustained PI?”. The research is grounded in the Resource Based View (RBV), and the theories of Absorptive Capacity (ACAP) and Dynamic Capabilities (DC). Under RBV, the core value of a company is its competitive performance and its ability to exploit its resources (Wernerfelt, 1984; Barney, 1986; Barney, 1991; Peteraf, 1993; Penrose, 1995). A key driver of competitive success is the capability of a company to develop new knowledge-based skills that create core competencies (Pemberton and Stonehouse, 2000). Cohen and Levinthal’s seminal work introduced the concept of Absorptive Capacity (ACAP) to construct a framework in which the actions related to knowledge could be studied. ACAP is defined as the ability of a firm to recognise the value of new external information (knowledge), assimilate it, transform it to a new product or service, and apply it for commercial purposes; and this is critical to the firm’s innovative capabilities (Cohen and Levinthal, 1990). Extending Cohen and Levinthal’s work by taking a dynamic capabilities view of the firm, a distinction has been made between a firm’s potential and realised capacity:
potential ACAP being the acquisition and assimilation of knowledge, and realised ACAP being transformation and exploitation of this knowledge (Zahra and George, 2002). Following on from Barney et al (2001), Zahra and George (2002) defined a firm’s capability to effectively create, manage and exploit knowledge as one of a company’s dynamic capabilities and a critical resource.

Figure 5.1 presents a conceptual model of FEI and SPI based on the seven hypotheses to be examined.

**Figure 5.1 - Conceptual model of FEI /SPI Factors**

Where:
AI = Access to Information
OC = Organisational Culture
OR = Organisational Resources
IL = Innovation Leadership
ACAP = Absorptive Capacity
IA = Innovation Approaches
FEIA = Front-end of Innovation Activities
FEIP = Front-end of Innovation Performance
SPIP = Sustained Product Innovation Performance

**Access to Information (AI)**

Access to external information reduces the impact of constraints on the internal resources of small companies (Gupta et al., 2006). Customers, and suppliers, typically form the main source of outside information for small companies, particularly that related to market information (Maes and Sels, 2014). The number and diversity of information sources has been shown to positively affect innovation performance (Ebersberger and Herstad, 2011).

_H1 – A high level of the diversity and degree of use of external information sources (Access to Information) has a positive influence on ACAP_

**Organisational Culture (OC)**

Research has shown that cultural equilibrium in small firms and SMEs in dynamic markets is important for success at both exploratory and exploitative innovation (Limaj and Bernroider, 2019). Trust, commitment and effective communications has been shown to be significant in assimilating and transforming new knowledge and achieving SPI (Geneste and Galvin, 2015; Bergh et al., 2011; Brunetto and Farr-Wharton, 2007); and furthermore it has been demonstrated that there is a positive relationship between communication clarity and credibility, trust and closeness of interpersonal relationships (Kirchmajer and Patterson, 2004). Organisational commitment has significant correlation with ACAP (Rafique et al., 2018), and if managers perceive employees to be affectively committed, they are more willing to trust them (García-Cruz et al., 2018). Proactive market orientation (PMO) has been shown to develop market knowledge which encourages companies to absorb external technological knowledge and increases ACAP (da Mota Pedrosa et al., 2013).

_H2 – A high level of trust, teamwork and interpersonal communication together with a proactive market orientation (Organisational Culture) have a positive influence on_

_H2a – ACAP_
Organisational Resources (OR)

In their search for growth, small companies are faced with a number of resource disadvantages including limited financial resources, scarce personnel capacities, and limited time availability (Millward et al., 2006; Laforet and Tann, 2006; Teng, 2007). These resource deficiencies have been shown to adversely impact on the ability of small companies to sustainably engage in product innovation and to grow (Darroch, 2005; Martineau and Pastoriza, 2016; Xie and Suh, 2014), but by contrast have also been shown to act as a stimulus for innovation (Hoegl et al., 2008).

Innovation Leadership (IL)

Innovation Leadership (IL)

Investing in research and other capability building can improve a company’s ability to identify, value, assimilate and apply knowledge, i.e. its ACAP (Fabrizio, 2009; Caragliu and Nijkamp, 2012). The acquisition and transformation of external knowledge and the firm’s learning orientation has a positive impact on market orientation and entrepreneurial orientation as key dynamic capabilities and in turn on innovation success (Moilanen et al., 2014; Roxas et al., 2014; Rhee et al., 2010).

Developing ACAP as a central capability in sustained product innovation cannot be achieved in isolation and so how key dynamic capabilities impact on ACAP needs to be considered. These capabilities include market vision competence (Reid and deBrentani, 2012), planning and processes (Salomo et al., 2007), leadership and commitment (Ambrosini et al., 2009), entrepreneurial passion (Cardon et al., 2009; Drnovsek et al., 2016). Entrepreneurial Passion plays a significant role in PI, particularly in radical innovation (Strese et al., 2016), and it has been suggested that team entrepreneurial passion helps team and organisational performance (Cardon
et al., 2017b). Passion for sharing knowledge improves performance (Sié and Yakhlef, 2013) and it has been recognised that EP is important for both entrepreneurs and their customers (Turner and Hendry, 2017). Entrepreneurial and transformational leadership theory supports that these capabilities of vision, strategy, commitment and passion are critical to effective leadership of innovation (Bass and Riggio, 2006; Renko et al., 2015).

**H4 – A high level of Innovation Leadership has a positive influence on**

- **H4a – ACAP**
- **H4b – FEIA**
- **H4c – FEIP**
- **H4d – IA**

**Absorptive Capacity (ACAP)**

Cohen and Levinthal’s seminal work (Cohen and Levinthal, 1990) introduced the concept of Absorptive Capacity (ACAP) to construct a framework in which the actions related to knowledge could be studied. Subsequently researchers have recognised ACAP as a dynamic capability, central to product innovation because it describes the process by which knowledge creates and leads to the commercialisation of new products (Verona and Ravasi, 2003; Zhou and Wu, 2010; Sáenz et al., 2014; Ritala and Hurmelinna-Laukkanen, 2013; Lin et al., 2012). Technological capability, in particular, relates to ACAP’s exploratory, transformative and exploitative learning (Zhou and Wu, 2010; Liu et al., 2014). It has been shown that when a firm develops its technological capability, it is more likely to be receptive to new external information (Berkhout et al., 2010). This receptivity further increases the ability of the firm to identify new technological developments and trends as a reinforcing cycle of exploratory innovation, i.e. sustaining its innovation (Rosenkopf and Nerkar, 2001; Veugelers and Cassiman, 1999; Shoham et al., 2017). Ensuring the quality of information during FEI, that is undertaking effective work in early stages (Cooper, 1996), is critical because it
improves the focus of the PI and ultimately its likelihood of success in the form of better products, it leads to long-term product advantage and, in turn, improved financial performance (Calantone, 2006). Speed of information flow has also been shown to positively affect the ability of the firm to achieve an edge over competition by improved customer relationship and first mover advantage (Kerin et al., 1992; Hawk et al., 2013).

The limited amount of published research focused at small companies has shown that knowledge acquisition and ACAP are key drivers for innovation, productivity and growth (Roper et al., 2008; Hervas-Oliver et al., 2011; Parida et al., 2012). Volberda et al (2010) conclude that there is a need to revisit ACAP, with regard to the role of individuals, which in companies with smaller numbers of employees takes on a higher relative importance.

\[ H5 – A\ high\ level\ of\ ACAP\ has\ a\ positive\ influence\ on \]

\[ H5a – FEIA \]

\[ H5b - FEIP \]

\[ H5c – IA \]

**Innovation Approaches (IA)**

Entrepreneurial owners-managers, of small companies in particular, have been shown to take a different route to identify and exploit (Fisher, 2012b; Nicholas et al., 2015) than the traditional model used by larger companies, involving causation (Casson, 1982; Shane and Venkataraman, 2001). Small companies have been shown to preference the use of ‘closed’ innovation approaches. Effectuation, concerns action under resource constraints which is a central concern for most small companies, and it has been suggested as being well suited to the characteristics of product innovation in small firms (Ettlie and Rubenstein, 1987). Improvisation, which can be defined as the merger of composition and execution, does not always have a positive result and as a result has been considered to involve high risk (Miner et al., 2001); however, improvisation has been
shown to have a positive effect on team innovation (Vera and Crossan, 2005). New knowledge has been shown to moderate improvisation’s impact on organisational outcomes (Samra et al., 2008; Vera et al., 2016). Using a bricolage strategy the company solves problems by relying exclusively on whatever is at hand (Levi-Strauss, 1966). Bricolage has not only been shown to be successful in overcoming resource constraints in existing companies (Baker and Nelson, 2005), but also to generate new knowledge, develop increased learning orientation, and to stimulate innovation (An et al., 2018; Fisher, 2012a). Combinations of these strategies have been shown to be successful in achieving innovation success (Welter et al., 2016; Karagouni et al., 2013).

Engagement with external organisations has been shown to give access to new information and knowledge (Sharma, 2005), to develop improved understanding, trust and commitment between organisations (Gao and Zhang, 2006), to encourage collaboration (Andriof and Waddock, 2017), and improve product innovation performance (Ayuso et al., 2011). It has also been shown that to pursue collaborative innovation as a PI strategy companies must be able to develop the capabilities, structures, and processes to support a collaborative approach (Ketchen Jr et al., 2007). There are several approaches to PI which a small company may take that involve collaboration with external parties, including: collaborative networked organisations (Camarinha-Matos et al., 2009), outsourcing (Whitley and Willcocks, 2011), joint venturing (Docherty, 2006), and open innovation (Chesbrough, 2006). The ability and willingness to collaborate has been shown to have implications for future innovation performance (Love et al., 2014; Huizingh, 2011). Higher education institutes (including universities) have been found to be only considered important by a relatively small percentage of innovators (Cosh and Hughes, 2010).

\textit{H6} – A high level of Bricolage (H6a) and Collaboration (H6b), as represented in IA, have a positive influence on FEIP
Front End of Innovation Activities (FEIA)

Innovation has become universally accepted as critical to economic growth (OECD 2007), and small companies are recognised as a key source of innovation. While a significant amount of research has been undertaken and published about product innovation (Sackmann et al., 2009), empirical studies relevant to small companies are scarce. Pertinent to this study of small companies, most historic data on innovation comes from studies of medium and large companies (Buenechea-Elberdin, 2017), and these can provide guidance. Cooper (1983) argued that product innovation had seven phases - idea generation, preliminary assessment, concept agreement, research and development, testing, trialling and launch. Following on from this, it was later found that the activities at the front-end of the process (FEI) are one of the most important factors in PI (Kim and Wilemon, 2002; Khurana and Rosenthal, 1998). Reid and De Brentani (2004) found that each of three perspectives: the market environment, the individual and the organisation, are important to an understanding of the innovation process overall, and of FEI in particular. However, owner-managers of small companies were found to often fail to consider the global picture of their own firm working in its environment, and to take the longer term into account when making strategic decisions. As a result, these owner-managers tend to be more reactive, and to not optimally exploit their resources or innovations (Wang and Ahmed, 2007; Mazzarol et al., 2009).

The product innovation process commences with the identification of an opportunity followed by the generation of an idea, but a disproportionally low number of published research articles have focused on idea generation outcomes and antecedents (Kock et al., 2015; Page and Schirr, 2008). There has also been a lack of research in quantifying idea evaluation (Elerud-Tryde and Soonvald, 2011). Organisational and managerial capabilities have been shown to be important in FEI and overall product innovation (Koen et al., 2014b); and capabilities such as market vision (Reid and deBrentani, 2012) and product vision (Benassi et al., 2016) need to be clear, concise, prioritised, accessible, and aligned with the overall strategy. Highly innovative companies were
found to be more systematic and proficient in the activities in FEI (Koen et al., 2001). Exploring these early stage steps are particularly important to better understanding of and improved efficiency in SPI by small companies, since it was found that in a global survey even the best companies were only able to achieve one commercial success for every 4.5 ideas started through the FEI process, and many companies achieved only a fraction of that success rate (Markham and Lee, 2013).

\( H7 \) – *A high level of systematisation of the front-end processes (of opportunity identification, idea generation, concept definition, evaluation and documentation (FEIA)) have a positive influence on FEIP*

**Sustained Product Innovation Performance (SPIP)**

Innovation is important to a company’s performance and sustainable competitive advantage (Van Auken et al., 2008). Incremental innovations have been shown to significantly affect the overall growth performance of a company (Corsino and Gabriele, 2010), and this result supports the idea that incremental innovations positively affect a company’s ability to sustain its market position by leveraging its capabilities to innovate (Geroski and Mazzucato, 2002). Success at the front end of the innovation process (FEI) have also been shown to have a significant impact of innovation performance (Koen et al., 2014b; Koen, 2014; Markham, 2013).

\( H8 \) – *A high level of FEIP has a positive influence on SPIP*

By addressing these hypotheses, the study explains how these factors influence each other and how they affect the success of the front-end and sustained product innovation. In doing so, this research contributes a new model of FEI in small companies. The remainder of this chapter will outline the methodology used to study the factors involved in FEI, present the statistical analyses conducted, and discuss the findings. Finally, the chapter will present its conclusions and their implications, and propose areas of future research.
Methodology

In this study a quantitative survey of food manufacturing companies in Australia is conducted. In preparing the survey it drew on information gained from qualitative face-to-face interviews that had been conducted by the researcher, and previously reported in Chapters 2-4. These insights and observations were then developed into key themes which formed the basis of the conceptual model and hypotheses, and these formed the structure for the quantitative survey in this paper. The survey questionnaire is shown in Appendix 4. The survey utilised scales from published literature which had been established to study these themes, and these are detailed in Appendix 5. Prior to distribution the survey was first tested with a small sample of companies drawn in part from those which participated in the qualitative interviews. The majority of the items were on a 7-point Likert scale from ‘strongly disagree’ to ‘strongly agree’.

The original plan for the survey was for promotion and distribution to be conducted in collaboration with a quasi-government agency responsible for the development of the food industry in Australia. The aim was to utilise the database of manufacturers held by the agency, and to distribute the survey, with appropriate promotion, via the agency’s website. However, this did not eventuate and necessitated the researcher accessing publicly available databases, including telephone directories and industry network websites, to independently compile a contact list of food manufacturing companies. These companies were then contacted directly via telephone and email to confirm their interest in considering participation in the survey. The companies were located throughout all states of Australia in both metropolitan and rural areas. The net result was that 421 companies were emailed a letter inviting them to participate which included a link to the survey that was hosted on a Qualtrics platform. A small incentive to participate was given in the form of a charitable donation to a charity of their choice. A respondent was deemed to consent to participate by accessing and completing the survey via Qualtrics. All responses were anonymous and the investigators had no way of detecting who had responded and who had not. A reminder
was sent to all recipients after two weeks. A total of 101 responses were received of which a large number were incomplete and the net result was that only 47 valid responses could be used for analysis – for a response rate of 11.2 percent. The responses were downloaded to SPSS v25, and subjected to a variety of statistical analyses to assess the validity, reliability, and correlation, and to conduct bivariate regressions. The low response rate and final sample size restricted the level of statistical analysis which could be validly conducted, and guidance was taken from previous studies involving small sample sizes in analysing and presenting the data (Vlačić et al., 2018; Saad et al., 2017; Diamantopoulos et al., 2012).

Results

This section details the results of the survey and the analysis of the data. It commences with a description of the demographic characteristics of the responding companies in the sample. It will then explain the constructs surveyed and how these are consolidated into 9 factors on which statistical analysis is performed. Reliability and validity results for each of these factors are presented followed by the results of bivariate correlations, independent sample t-tests, and bivariate linear regression analysis.

On average the companies in the sample of respondents had been operating for 11 years and employed 22 full-time staff. The average annual sales turnover was A$8 million with an average of 7% growth in sales, compared to Australia’s national GDP growth rate of between two and four percent over the last 10 years. Respondents considered the market in which they participated to involve fierce competition and frequent change. 80% of the companies were located in metropolitan areas. The average number of new products launched each year was 11, of which the vast majority were considered as incremental innovation.

The factor loadings for the items used for each of the items surveyed are shown in Appendix 5. These loading values satisfy validity requirements of greater than 0.7 (Hair et al., 1998). Appendix
details how each of the items surveyed were components of constructs drawn from the published literature and how each of these constructs were consolidated to become the Composite Factors (CF) used in the analyses.

The reliability and validity of each of these CFs are satisfactory with each having an AVE > 0.5, and a CR > 0.7 (Fornell and Larcker, 1981), as shown in Table 5.1 below.

<table>
<thead>
<tr>
<th>Composite Factor</th>
<th>Mean</th>
<th>S.D.</th>
<th>Alpha</th>
<th>AVE</th>
<th>CR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Information (AI)</td>
<td>4.283</td>
<td>1.337</td>
<td>0.825</td>
<td>0.574</td>
<td>0.902</td>
</tr>
<tr>
<td>Absorptive Capacity (ACAP)</td>
<td>5.07</td>
<td>1.027</td>
<td>0.943</td>
<td>0.765</td>
<td>0.929</td>
</tr>
<tr>
<td>Organisational Culture (OC)</td>
<td>5.08</td>
<td>1.071</td>
<td>0.788</td>
<td>0.826</td>
<td>0.947</td>
</tr>
<tr>
<td>Organisational Resources (OR)</td>
<td>4.09</td>
<td>1.43</td>
<td>0.838</td>
<td>0.673</td>
<td>0.937</td>
</tr>
<tr>
<td>Innovation Leadership (IL)</td>
<td>5.36</td>
<td>0.89</td>
<td>0.737</td>
<td>0.687</td>
<td>0.924</td>
</tr>
<tr>
<td>Innovation Approaches (IA)</td>
<td>4.56</td>
<td>0.93</td>
<td>0.834</td>
<td>0.571</td>
<td>0.871</td>
</tr>
<tr>
<td>FEI Activities (FEIA)</td>
<td>4.95</td>
<td>0.655</td>
<td>0.839</td>
<td>0.617</td>
<td>0.934</td>
</tr>
<tr>
<td>FEI Performance (FEIP)</td>
<td>4.15</td>
<td>1.58</td>
<td>0.641</td>
<td>0.590</td>
<td>0.883</td>
</tr>
<tr>
<td>SPI Performance (SPIP)</td>
<td>5.00</td>
<td>0.630</td>
<td>0.829</td>
<td>0.591</td>
<td>0.926</td>
</tr>
</tbody>
</table>

These relationships between these CFs were then computed in SPSS using two-tailed Pearson Bivariate correlations, the results of which are presented in Table 5.2.

As can be seen in Table 5.2 significant, moderate linear relationships are indicated between all of the CFs associated with the front-end of the innovation process. ACAP shows moderate to strong correlations with all factors related to FEI Performance, although its direct linear relationship with SPI performance is slightly weaker. Organisational Culture (OC), including proactive market orientation, trust, teamwork and interpersonal communications of the company, also has moderate to strong correlation with all the factors involved in FEI Performance. Similarly, Innovation Leadership (IL), including vision, strategy, commitment and entrepreneurial passion, shows strong correlations with all the factors involved in FEIP, and also has a moderate correlation with SPIP. FEIA which covered items related to the systematic processes from opportunity identification through to concept development and trialling shows significant direct correlation with FEIP and SPIP. Whether internally, in the form of bricolage, or externally, involving collaboration, IA has a moderate correlation with the other factors involved in the FEI, but only a
weak direct correlation to FEIP. However, all other front-end CFs including ACAP, OC, OR, and IL show moderate direct correlations to FEIP. IL shows a strong direct correlation to SPIP, and although weaker ACAP also has a significant correlation to SPIP. There was a strong correlation between FEIP and SPIP, which suggests that there is also some contribution from ACAP and the other CF’s to FEIP’s relationship to SPIP and this is to be expected. Although not shown in Table 5.2, the impact of demographic factors was analysed, and neither the number of employees, turnover, age, or location of the company suggest any significant linear correlation with ACAP or the other FEI factors within this cohort of small companies.

Table 5.2 - Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>AI</th>
<th>ACAP</th>
<th>OC</th>
<th>OR</th>
<th>IL</th>
<th>IA</th>
<th>FEIA</th>
<th>FEIP</th>
<th>SPIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACAP</td>
<td>0.806**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC</td>
<td>0.854**</td>
<td>0.848**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>0.543**</td>
<td>0.422**</td>
<td>0.537**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IL</td>
<td>0.902**</td>
<td>0.812**</td>
<td>0.857**</td>
<td>0.376</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IA</td>
<td>0.758**</td>
<td>0.648**</td>
<td>0.653**</td>
<td>0.570**</td>
<td>0.710**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEIA</td>
<td>0.026**</td>
<td>0.822**</td>
<td>0.741**</td>
<td>0.507**</td>
<td>0.719**</td>
<td>0.701**</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEIP</td>
<td>0.666**</td>
<td>0.545**</td>
<td>0.555**</td>
<td>0.442**</td>
<td>0.545**</td>
<td>0.347**</td>
<td>0.630**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SPIP</td>
<td>0.614**</td>
<td>0.335**</td>
<td>0.409**</td>
<td>0.248</td>
<td>0.368**</td>
<td>0.257</td>
<td>0.560**</td>
<td>0.612**</td>
<td>1</td>
</tr>
</tbody>
</table>

Where ** indicates correlation is significant at 99% confidence level, and * indicates correlation is significant at 95% confidence level

Exploring some of the individual construct responses, as would be expected Access to Information (AI), representing the diversity of knowledge accessed, though having a low mean score shows a strong correlation with ACAP, representing the acquisition and use of new knowledge. Bricolage shows a relatively high mean response; whereas collaboration, also a component of the IA factor, shows one of the lowest mean responses, with companies indicating low involvement with universities and technical institutions and in networks and clusters. Market Vision, part of the IL factor, shows moderate to strongly positive relationship with ACAP. Culture (covering issues related to trust, teamwork and communications), and Proactive Market Orientation and part of the OC factor each show a moderate to strongly positive relationship with
ACAP, IL, IA and FEIA; as did Entrepreneurial Passion, a component of IL, with ACAP, IA and FEIA.

Another way of viewing the relationships between the Composite Factors is to separately examine those companies which reported a higher score for a CF (>= 5) versus those scoring lower (<5) and look at the impact of this on other CFs. This was achieved by using an independent sample t-test to determine whether there was a statistically significant difference between the means in two unrelated groups of data. The results of these t-tests are summarised in Table 5.3 below:

**Table 5.3 - Independent sample t-tests**

Note - 34% of FEIP results were higher than the cut point of 5 on 7-point Likert scale

<table>
<thead>
<tr>
<th>Factor</th>
<th>High FEI Performance Mean/S.D.</th>
<th>Low FEI Performance Mean/S.D.</th>
<th>Significance (t-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to Information</td>
<td>5.393/0.463</td>
<td>4.789/0.612</td>
<td>3.405**</td>
</tr>
<tr>
<td>Absorptive Capacity</td>
<td>5.588/0.736</td>
<td>4.794/1.064</td>
<td>2.692*</td>
</tr>
<tr>
<td>Organisational Culture</td>
<td>5.562/0.852</td>
<td>4.836/1.105</td>
<td>2.243*</td>
</tr>
<tr>
<td>Organisational Resources</td>
<td>4.795/1.464</td>
<td>3.727/1.298</td>
<td>2.216*</td>
</tr>
<tr>
<td>Innovation Leadership</td>
<td>5.811/0.587</td>
<td>5.124/0.944</td>
<td>2.758**</td>
</tr>
<tr>
<td>Innovation Approaches</td>
<td>4.793/0.846</td>
<td>4.443/0.973</td>
<td>1.147</td>
</tr>
<tr>
<td>FEI Activities</td>
<td>5.325/0.500</td>
<td>4.756/0.649</td>
<td>2.994**</td>
</tr>
<tr>
<td>SPI Performance</td>
<td>5.307/0.591</td>
<td>4.839/0.600</td>
<td>2.302*</td>
</tr>
</tbody>
</table>

Where ** indicates significance at 99% confidence level, and * indicates significance at 95% confidence level. Note – Equality of means was not assumed.

The t-test results indicated that companies returning high scores on FEIP showed significantly higher mean scores on AI, ACAP, OC, OR, IL and FEIA, but not on IA. High scores on FEIP also suggested a higher mean result on SPIP. Examining the result for IA in more detail, while the overall result was not significant and the mean score on collaboration as one of its components was low, those companies scoring higher on collaboration with universities and technical institutions scored significantly higher on both ACAP and FEIP.
Bivariate linear regression analysis was also conducted using SPSS to further explore the relationships between the Composite Factors. The results of these analyses for each of the hypotheses, conducted at a 95% confidence level, can be seen in Table 5.4. While these results indicate significance, they don’t account for the multivariate nature of the relationships between dependent and independent variables.

Table 5.4 - Bivariate Regression Analysis

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Independent Variable</th>
<th>Dependent Variable</th>
<th>Standardised Beta</th>
<th>t-value</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>AI</td>
<td>ACAP</td>
<td>0.806**</td>
<td>8.169</td>
<td>66.734</td>
</tr>
<tr>
<td>H2 – H2a</td>
<td>OC</td>
<td>ACAP</td>
<td>0.848**</td>
<td>9.606</td>
<td>92.267</td>
</tr>
<tr>
<td>- H2b</td>
<td>FEIP</td>
<td>0.555**</td>
<td>4.003</td>
<td>16.027</td>
<td></td>
</tr>
<tr>
<td>H3 – H3a</td>
<td>OR</td>
<td>ACAP</td>
<td>0.422**</td>
<td>2.790</td>
<td>7.786</td>
</tr>
<tr>
<td>- H3b</td>
<td>FEIP</td>
<td>0.442**</td>
<td>2.959</td>
<td>8.757</td>
<td></td>
</tr>
<tr>
<td>H4 – H4a</td>
<td>IL</td>
<td>ACAP</td>
<td>0.812**</td>
<td>8.353</td>
<td>69.772</td>
</tr>
<tr>
<td>- H4b</td>
<td>FEIA</td>
<td>0.909**</td>
<td>13.100</td>
<td>171.607</td>
<td></td>
</tr>
<tr>
<td>- H4c</td>
<td>FEIP</td>
<td>0.545**</td>
<td>3.900</td>
<td>15.206</td>
<td></td>
</tr>
<tr>
<td>- H4d</td>
<td>IA</td>
<td>0.710**</td>
<td>6.055</td>
<td>36.662</td>
<td></td>
</tr>
<tr>
<td>H5 – H5a</td>
<td>ACAP</td>
<td>FEIA</td>
<td>0.822**</td>
<td>8.657</td>
<td>74.944</td>
</tr>
<tr>
<td>- H5b</td>
<td>FEIP</td>
<td>0.545**</td>
<td>3.896</td>
<td>15.179</td>
<td></td>
</tr>
<tr>
<td>- H5c</td>
<td>IA</td>
<td>0.648**</td>
<td>5.107</td>
<td>26.077</td>
<td></td>
</tr>
<tr>
<td>H6 – H6a</td>
<td>IA-Bricolage</td>
<td>FEIP</td>
<td>0.347*</td>
<td>2.220</td>
<td>4.928</td>
</tr>
<tr>
<td>- H6b</td>
<td>IA- Collaboration</td>
<td>FEIP</td>
<td>0.326*</td>
<td>2.072</td>
<td>4.291</td>
</tr>
<tr>
<td>H7</td>
<td>FEIA</td>
<td>FEIP</td>
<td>0.630**</td>
<td>4.872</td>
<td>23.737</td>
</tr>
<tr>
<td>H8</td>
<td>FEIP</td>
<td>SPIP</td>
<td>0.642**</td>
<td>5.024</td>
<td>25.245</td>
</tr>
</tbody>
</table>

Where ** indicates significance at 99% confidence level, and * indicates significance at 95% confidence level

Figure 5.2 illustrates the relationships between the Factors listed in Table 5.4.
Discussion

All companies are not the same either in size or the markets in which they operate and the issues of sectorial and size diversity in studies have been highlighted as presenting limitations (Becheikh et al., 2006; 2011; Fabrizio, 2009; Alegre and Chiva, 2008; Hervas-Oliver et al., 2011). This diversity results in the tendency to average out data and dampens the significance of individual factors particularly as it relates to small companies. Most research on PI and ACAP has been focused at medium and large companies (Hutchinson and Quintas, 2008; Buenechea-Elberdin, 2017), and there is an absence of and need to develop knowledge which focusses on sustained product innovation performance in small companies, particularly those in manufacturing (Volberda et al., 2010; Van Wijk et al., 2011). It is also true that extant research has focused on the outcomes of ACAP actions by relating the existence of these actions to proxies of innovation such as R&D expenditure, patents, and sales growth (Romijn and Albaladejo, 2002; Coad and Rao, 2008) rather than how ACAP is manifested particularly in small companies. By limiting this
study to only include respondents with less than 50 employees, this study has endeavoured to removed size as a factor affecting ACAP and the FEI as has been the case in some other studies (Wachsen and Blind, 2016; Audretsch, 2001). Similarly, by surveying only food manufacturing companies, cross-sectorial issues were eliminated. “Whereas multiple industry studies are valuable in generalising knowledge, they negate the nuances of a particular industry”, whereas a single industry study “may offer valuable insights to practitioners” (Barczak, 1995: 233). In this study the actual managerial, knowledge and innovation activities which take place in the FEI process are measured, not proxies.

Access to Information (AI) showed a relatively low mean score of 4.28 on the 7-point scale (4.28/7) indicating low to moderate access to different sources overall consistent with the findings of (Nieto and Santamaría, 2007). The results indicated particularly low scores for access to market and university sourced data. Notwithstanding this low mean AI showed a strong correlation with ACAP as might be expected, and a high AI indicated a high FEIP score. *H1 is supported.*

Organisational Culture (OC) had a high mean of 5.08/7, and indicated that in small companies the organisation’s culture has a positive influence on both ACAP and FEIP. This is consistent with the literature which suggests that a positive culture within a company which is based on trust, teamwork, commitment, passion and good interpersonal communications is important in product innovation (Geneste and Galvin, 2015; Cardon and Kirk, 2010). Similarly, proactive market orientation has been shown to be important to success in product innovation (Narver et al., 2004). *H2a and H2b are both supported.*

The Organisational Resources factor (OR), which encompassed financial, human and time resources, was generally neither agreed nor disagreed as an issue by responding companies with the lowest mean score of 4.09/7 although still above the mid-point. This suggests that while the responding small companies are inherently resource constrained in the large part, they found a way to develop new products successfully, consistent with concept of making do. However, the
regression analysis suggests that the level of a company’s resources influences ACAP and the success in the front-end of innovation (FEIP). On average the respondents reported that 20 percent of new ideas successfully progressed through the front end to commercialisation, which compares very favourably with previous research (Markham and Lee, 2013); and that on average they commercially launched eleven new products per year. Although this launch rate was approximately half that of the successfully innovating companies from the face-to-face interviews conducted earlier, it compares well when the size in terms of number of employees and turnover of the two groups are considered. \textit{H3a and H3b are both supported.}

The mean score for Innovation Leadership (IL) was the highest of the CFs at 5.36/7, and consistent with the literature (Ambrosini and Bowman, 2009; Moilanen et al., 2014), with the regression analysis indicating that IL showed moderate to strong influence on ACAP, IA, FEIA and FEIP. This emphasises the importance of innovation leadership, particularly by the owner-manager in small companies, on the overall performance of the firm, and on the role played throughout the entire innovation process since IL showed a significant influence on SPIP. \textit{H4a, b, c, d, are all supported.}

The respondents showed a generally high ACAP with a mean score of 5.07/7, indicating that they were generally motivated to search for new information which enabled them to make existing products/services better, and that developing new products was an important part of their company’s strategy. The responses to access to the alternate sources of information (AI) was consistently low, and there needs to be improvement in this area if improvement in ACAP and innovation performance is to be achieved. Overall however, the linear regression results suggested that in the cohort of small companies ACAP has a positive influence on IA, FEIA and on FEIP, as well as a significant but slightly weaker direct influence on SPIP. Companies which indicated higher levels of success in FEI showed significantly higher mean scores for ACAP. \textit{H5a, H5b, H5c are supported.}
The many different approaches to innovation can be broadly categorised into internal and external, although there are many combinations involving both. This study surveyed bricolage, as a largely internal approach, and collaboration, to represent an external approach. The mean result for the IA composite of 4.56 was perhaps not as high as might be expected for companies averaging 11 new products per year. The explanation for this lower than expected score can be seen in the mean scores of the components, bricolage relatively high at 5.26/7 and collaboration at only 4.32/7. The lower score on collaboration was due mainly to the lower degree of collaboration with technical institutions (universities) which had the lowest individual item score, and low participation on networks and clusters. These lower university collaboration and networking scores are consistent with the low scores in accessing information from these sources. Surprisingly, the independent t-test results did not indicate any significant difference between high and low FEI Performance with regard to IA or the individual components, bricolage and collaboration. However, the regression analysis suggested the composite IA positively influences FEIP. How the alternative innovation approaches, including but not limited to bricolage and collaboration, influences FEIP in small companies requires further investigation. \( H6a \) and \( H6b \) cannot be fully supported.

At the core of the front-end of product innovation are the processes which systematically identify opportunities, generate ideas, and develop these ideas into concepts which are then converted into new products for systematic evaluation (FEIA) (Kim and Wilemon, 2002; Koen et al., 2014a). This study indicated no significant correlation with AI suggesting that access to diverse sources of new information does not have any direct impact on the systems used to progress a new idea through its development. However, there was moderate to strong correlations with all the other Composite Factors contributing to FEI (ACAP, OC, OR, IL, and IA). The mean score for FEIA was 4.65/7 which was mainly impacted by low scores related to systematic approaches in the very early stages of innovation, which is in contrast to earlier research (Bocken et al., 2014).
This suggests that in these small companies while they frequently developed new products, they
did not follow formal routines and were more flexible in their approach, which was consistent with
the insights gained from the earlier interviews, in Chapter 2. Nonetheless, the regression analysis
suggests that the FEIA undertaken had a significant and positive influence on the FEIP consistent
with the results in larger companies (Koen et al., 2001). This result suggests that a less rigid, more
flexible approach in FEI is appropriate for small companies. As a result, H7 is supported.

Companies scoring higher on FEI success (FEIP) showed higher results on overall sustained
product innovation performance (SPIP), and the regression analysis indicated FEIP has significant
influence on SPIP which is consistent with other research on larger companies (Koen et al., 2014b;
Markham and Lee, 2013). IL showed a positive influence on SPIP suggesting that the innovation
leadership shown by the owner-manager of small companies is important throughout the entire
innovation process (Fitjar et al., 2013). The ACAP results also showed a significant influence on
SPIP suggesting that, as would be expected, ACAP plays a role in the latter phases of product
innovation (Lane et al., 2006) not just in the front-end. H8 is supported.

The overarching research question posed was “How do a small company's ACAP, culture,
leadership and innovation activities influence each other, and how do they affect the success of
the front-end and sustained PI?”. Despite the small sample size, the survey generated results
which satisfied validity and reliability criteria, within the context of companies with less than 50
full-time employees. Except for the inconclusive results related to the influence of alternative
innovation approaches on FEIP, the results generally suggested support for the hypotheses and in
so doing addressed the overarching research question. The study found that this cohort was
homogeneous in so far as the number of employees up to fifty in total showed no significant
influence over the front-end CFs or FEIP and SPIP. Highlights of the findings are the importance
of accessing and using a diversity of quality sources of new information, and the reinforcement of
the concept that success at FEI necessitates performance in a multiplicity of areas which have
influence over each other. Interestingly, the data suggested that ACAP, OC, and IL were more significant in influencing FEIP and SPIP than the systematic activities as represented by FEIA. This result was contrary to the findings of (Kim and Wilemon, 2002), but were more aligned with the importance of the individual, particularly the owner-manager, the organisation and the operating environment to understanding the innovation process (Reid and De Brentani, 2004).

**Conclusions, Implications and Recommendations**

This study makes a useful contribution to the understanding of the multiple factors involved in the front-end of product innovation in small companies, and to how these factors interact to achieve successful outcomes in the front-end. The research suggests that while physical resources and systematic processes are important, human factors have the primary influence over the success of FEI and SPI in small companies. In particular, the study indicates that ACAP has direct influence on the approaches taken to product innovation in the FEI process, but also indirectly through the organisational culture and the owner-manager’s leadership. The low response rate which resulted in a small sample size restricted more definitive conclusions, but the general consistency of results from the different analytical tests suggest that the results are of value in understanding small companies. The implication of these findings for practitioners, and specifically the owners of small companies, is that to be successful at product innovation on a sustained basis requires not only an awareness of all the factors which contribute, but also requires active involvement in building the capabilities required, over time, for both themselves and for key personnel involved in product innovation. The latter will increase the breadth and depth of innovation capabilities and reduce the dependence on the owner-manager. For small companies this can be a challenge due to their limited access to the necessary information and resources. For academics these findings confirm that students should be educated in the importance of these factors and how the PI process works in small companies since many, if not most, graduates will find employment within small to
medium companies, or at least have involvement with them. For researchers, the findings confirm other studies that there is a low level of collaboration by small companies with external parties, in particular between universities and small companies, but that when collaboration does take place it contributes positively to FEI success. Understanding how more engagement between universities and small companies can be developed to increase collaboration is as important for researchers as much as it is for the companies. The findings suggest that more research is required to better understand how trust is built both internally and externally as the survey found that it has a positive impact on ACAP, FEI and SPI success; but is not a subject widely covered in literature.

The assembly of scales from previously published studies, which were not specific to small companies, generally proved to be valid and reliable for use in the small company context. It is recommended that the items used in the FEIP and SPIP constructs could be amended to be more meaningful by adding items on the effectiveness of resources for both constructs, and in the case of SPIP by adding items addressing customer satisfaction and market share. The inconclusive results for the IA composite suggest that further research could be conducted, which included a more comprehensive list of innovation approaches including causation, effectuation, improvisation and open innovation in addition to bricolage and collaboration, to investigate their influence on FEIP and SPIP.

By design the study is limited by the sector, food manufacturing, and by the size of companies, less than 50 employees, and while it can reduce its ability of the results to be generalised, this approach provides the opportunity to gain a clearer view of the idiosyncrasies of this cohort, and answers the call for such study by earlier researchers. The study is further limited by the sample size as a result of the restricted access to large numbers of companies within the food sector and by the low response rate. This raises issues related to the promotion and distribution of future email surveys to small companies in particular, especially those surveys which by their nature require a reasonable time commitment to complete.
By gathering data on the activities of practitioners this research is a unique view of the front-end of product innovation in established small companies, focussed on the human factors which affect innovation. Overall, this chapter extends the understanding of how ACAP influences the FEI process and how this contributes to sustained PI performance, and develops an improved understanding of the multiplicity of factors which owners and managers of small companies should address to succeed at product innovation.
Chapter 6 –

Summary, Conclusions and Future Research

Introduction

The core value of a company is its competitive performance and its ability to sustainably exploit its human, physical and financial resources (Wernerfelt, 1984; Barney, 1991). Competitive success is driven by the ability of firms to develop new knowledge-based capabilities that create core competencies (Pemberton and Stonehouse, 2000), and this is important in sustained product innovation (Ngo and O'Cass, 2009; Morgan et al., 2009; Paradkar et al., 2015; Lin et al., 2013). ACAP has been developed as a framework in which to study the recognition, acquisition, development and exploitation of new knowledge (Cohen and Levinthal, 1990). ACAP is an important factor in knowledge transfer and organisational learning (Lane et al., 2006; Volberda et al., 2010) and as such is important at the front end of product innovation (Banerjee and Campbell, 2009; Biedenbach and Müller, 2012). Research has shown that success in the activities conducted in the front-end of the innovation process impact on the overall success of new product development (Kim and Wilemon, 2002; Dewulf, 2013).

Small companies comprise the majority of all firms and make a significant contribution to employment and economic growth (Ayyagari et al., 2011). Innovation is essential to small food companies (De Martino and Magnotti, 2018). There is a need to better understand how small companies acquire new knowledge and develop new products (Zerwas, 2014), and for more sector-specific research in this area (De Massis et al., 2018), inclusive of the food sector in Australia (Soriano, 2019). Small companies are under-represented in research on Absorptive Capacity and product innovation (Buenechea-Elberdin, 2017).

The aim of this thesis is to study sustained product innovation in small food manufacturing companies in Australia using a lens of Absorptive Capacity, by addressing the following
overarching research question: “How does ACAP manifest itself in small companies and how does it together with other dynamic capabilities influence the sustained success of product innovation in those companies?”

The study uses a mixed-methods approach to develop four chapters based on empirical research and structured as potential papers for submission to reputable journals. The thesis presents findings from a series of face-to-face interviews with practitioners within small food companies (Chapter 2). Then two issues which feature in these findings are explored in more detail, namely the various approaches taken by these companies to innovation; firstly, ‘closed’ innovation approaches focused on the use of internal resources, covering causation, effectuation, bricolage and improvisation (Chapter 3); and secondly, ‘open’ innovation approaches, covering collaborative and open innovation, and the associated external relationships involved (Chapter 4). Finally, Chapter 5 presents the findings from a quantitative survey of food manufacturing companies and explores how the factors recognised in Chapters 2-4 relate to each other, and the influence they have on FEI and SPI.

The research shows how product innovation can be sustained in small companies. It shows what happens during the early stages of the innovation process in small companies, how ACAP and other organisational and managerial capabilities influence this, and the paramount role the owner-manager plays in the success of FEI.

The following sections of this chapter provide a summary of each of the chapters in the thesis and the conclusions that are drawn. There is then a discussion on the contribution that the findings make both to Research and to Practice, on the limitations of the research, and on the possible areas of future study. The section concludes with final statements on the contributions of the thesis.

Chapter 2 is an exploratory study addressing the research question: How does ACAP manifest itself in the front-end of the innovation process to foster sustained product innovation in resource
deficient small companies?”. It commences with a review of the published literature on Product Innovation, Absorptive Capacity, Resource Based View and Dynamic Capabilities in the context of small companies. The study then utilises the key themes from this literature as the basis for a series of semi-structured, face-to-face interviews with small food manufacturing companies (employing less than 50 employees) located in four states in Australia.

Using the theory of Absorptive Capacity as a primary lens, this qualitative study, which focusses at the critical front end of product innovation, shows that continuous acquisition of new market, product and business knowledge, even if not necessarily using a formalised process, is a feature of sustained success in product innovation in small food companies. It finds that particularly the first stage of Absorptive Capacity, which involves the recognition and acquisition of new external knowledge, resides largely in the owner-manager, and that generally this results in limiting the scope of sources of information that are utilised. It further finds that the entrepreneurial passion and managerial capabilities of the owner-manager influence the opportunities which are recognised and progressed through product development; and how new knowledge is assimilated into the company and transferred to others involved in the innovation process.

The interviews covered in this chapter discovered that the process of knowledge transfer and the efficacy of the front-end of the product innovation process, in these successful companies, characteristically involved a clear vision, good interpersonal communication, and trust. The small companies typically adopted ‘closed’ approaches to product innovation with bricolage being a common part of innovation strategy, and with rare exceptions did not engage in collaborative or open innovation. The interviews revealed that most of these successful innovators had in recent years hired new human resources with specific skills as a means of acquiring new knowledge, and there was a high sensitivity to bringing the ‘right’ people into the organisation. Time and financial constraints were significant factors in these small companies, impacting on their ability to access
all available sources of new knowledge and innovation expertise, and this was particularly apparent in the lack of involvement with external technical institutions – this potentially impacted on the degree of novelty of product innovations and most new products were incremental. Overall, this study highlighted how Absorptive Capacity, resource, organisational and managerial factors manifested in the front-end of and in sustained product innovation in these successful small companies; and revealed the importance of the personal absorptive capacity, passion and management capabilities of the owner-manager of a small company. This chapter recognises that further research needs to be conducted into some of the specific areas raised, particularly with regard to how small companies efficiently access all the sources of new knowledge they need to increase the success and sustainability of their product innovation, and how Absorptive Capacity is built through the organisation over time. The chapter also suggests that further research would be useful into how entrepreneurial passion can be developed in established small companies; and into different approaches to innovation in the front-end, such as bricolage and collaboration, and how they impact on the success of the front-end of product innovation.

Chapter 3 explores in more detail the issue raised in Chapter 2 regarding the approaches available to small companies when engaging in product innovation. It addresses the research question of “How do resource deficient small firms use alternative innovation approaches, and knowledge-based capabilities, at the front end of innovation and support sustained and successful product innovation?”. In doing so, it responds to suggestions in the literature (Welter et al., 2016; Fisher, 2012b) of the need to further investigate how alternative development approaches, especially causation, effectuation, bricolage and improvisation, are employed in achieving sustained product innovation. The chapter employs data from the same interviews conducted with representatives of small food manufacturing companies which featured in Chapter 2. The resource deficiencies of small companies include not only financial, physical and human but also knowledge, and these can negatively impact on the ability of small companies to acquire new
knowledge, to sustainably engage in product innovation, and to grow (Martineau and Pastoriza, 2016; Xie and Suh, 2014).

To overcome these negative impacts and sustain product innovation small companies need to be flexible and explore utilising innovation approaches most appropriate to the company, its characteristics and capabilities, and to the innovation project – typically this involves use of readily available alternative resources (Fisher, 2012a), particularly during the front-end of product innovation. This Chapter expands our understanding of product innovation and its front-end, Absorptive Capacity, and the application of alternative innovation approaches by small, established companies. The paper demonstrates how successful small companies use combinations of innovation approaches in product innovation; and how this can become a capability of the company to be available for use in future product innovation endeavours.

The chapter presents a conceptual model reflecting the role of Absorptive Capacity and other capabilities and characteristics, such as leadership and entrepreneurial passion, which together with the appropriate innovation approach influence the front-end and leads to sustained product innovation success. The findings suggest that an over-dependence on ‘closed’ innovation processes, in particular bricolage, as the approach taken to developing new products can become limiting on the company by restricting it to incremental innovation. To avoid such limitations, and to optimise their opportunities, it is argued that the management of small companies need to be familiar with the alternative innovation approaches available to them and to be aware of the need to develop a range of capabilities and other resources which are necessary to implement these approaches and which they can readily access.

Chapter 4 deeply explores the issue of collaboration which was raised in Chapters 2 and 3, and in previous research (Cosh and Hughes, 2010; Laforet and Tann, 2006). Specifically, it examines the lack of collaboration and open innovation by the participating small companies. It addresses the research question “How do ACAP and organisational and managerial capabilities influence
the external relationships of small companies and the subsequent successfulness of the FEI?”. It employs data from qualitative interviews conducted with representatives of small food manufacturing companies, as well as additional data from interviews conducted with experts representing organisations which are potential knowledge sources and collaborating partners for small companies engaging in product innovation. Literature suggests that collaboration has a positive impact on building absorptive capacity and on PI performance (Backmann, 2015; Verbano et al., 2015), but many small companies are challenged by collaboration (Goduscheit and Knudsen, 2015; Laforet and Tann, 2006; Jonas et al., 2018).

Chapter 4 explores why small companies do not collaborate but still demonstrate sustained success at product innovation, and how they can improve sustained product innovation when they do adopt collaborative approaches. The interviews showed that there was a lack of engagement between small companies and support institutions, most notably universities, and this resulted in a lack of understanding of their respective needs, capabilities and organisational characteristics. Lack of investment in engagement inhibited development of relationships involving the trust and respect necessary for collaborative and open innovation. The findings suggest that in order to achieve a higher level of success in the front-end of and sustained product innovation through the use of collaborative and open innovation, small companies need to find the resources, including time, to engage more broadly with other organisations and to develop Absorptive Capacity and managerial capabilities. Particularly for very small and/or more remote companies this is an issue of availability and accessibility of suitable knowledge and to collaborative partners. The characteristics of the owner-manager in these critical external relationships and in the innovation process is important, and can be a prime factor in the success, or otherwise, of collaborative innovation. The study also highlights that the objectives, structure and governance of technical and government institutions has a significant impact on engagement and collaborative innovation with small companies. It suggests that government agencies and institutional management need to
incentivise researchers and academics in new ways to increase engagement with small companies with the objective of increasing collaborative projects.

Chapter 5 presents results from a limited quantitative survey conducted with small food manufacturing companies throughout Australia. Its aim was to validate the findings of the qualitative research covered in Chapters 2-4, and to further expand our understanding of Absorptive Capacity and product innovation by addressing the research question: “How do a small company's ACAP, culture, leadership and innovation activities influence each other, and how do they affect the success of the front-end and sustained PI?” A low response rate resulted in a small sample size which, although providing a set of data which demonstrated correlations, limited the more detailed statistical analyses possible which would have enabled full validation.

However, the results did provide useful support to the overall findings resulting from the managerial and institutional interviews. The analyses demonstrated that an organisation’s Absorptive Capacity, resources and characteristics, and its managerial characteristics have significant influence on the approach to innovation and activities in the front-end of product innovation; that success in the front-end leads to success in sustained product innovation; and that Absorptive Capacity and managerial capabilities (of the owner-manager) impact throughout the overall innovation process. The survey data supported the earlier insights and observations from the qualitative interviews that there was a very low level of engagement between small companies and technical institutions, and that there was very little collaborative or open innovation. The low response rate to the survey raised issues related to quantitative studies of small companies, and achieving the depth of data required to make more definitive assessments and recommendations on how to improve innovative performance in the front-end of the process. In conjunction with the qualitative research the findings suggest that there are important implications for owner-managers, in particular, and for academics and policy makers; and proposes that there are several areas for additional research in future.
Conclusion

Absorptive Capacity is the key capability for sustained success in product innovation in small companies. There is an intimate relationship between the Absorptive Capacity of the owner-manager, leadership capabilities, and organisational culture. These factors not only influence the approach taken to innovation (‘open’ or ‘closed’), and the activities in the front-end of product innovation, but also the success of the front-end and of sustained product innovation processes. The leadership and managerial capabilities of the owner-manager of small companies influence both Absorptive Capacity and the approach to product innovation. Entrepreneurial Passion is an important feature in successful small food manufacturers and innovators, at both the leadership and team level. The level of engagement between small companies and external sources of knowledge and expertise, other than with customers and suppliers, is generally low, and almost non-existent between the cohort of participants and technical institutions. This both restricts the scope of validated information utilised by small companies, and results in a low level of awareness, understanding and trust, and consequently in little collaborative product innovation activity. With a resource-constrained predisposition to the use of bricolage and ‘closed’ innovation processes in developing new products the majority of new innovations in small companies tend to be incremental. More needs to be understood about how these factors change and influence product innovation over time in small companies, and how academia and policy makers can positively influence this to improve product innovation performance in small companies. The research in this thesis extends existing understanding of the multiplicity of factors which need to be considered in future innovation programmes, and of theory related to Absorptive Capacity and Product Innovation.

Contributions to Research (Theory)
This mixed methods study of product innovation in established small food manufacturers in Australia is the first of its kind. It presents a unique perspective of how Absorptive Capacity manifests in this context and of the complex factors which are important in the front-end of the product innovation process. The contributions to research from the findings outlined in this thesis can be categorised into five areas, absorptive capacity, owner-manager characteristics, bricolage, collaboration, entrepreneurial passion.

First, and most importantly, the research provides a more nuanced understanding of how Absorptive Capacity manifests in product innovation in established small companies, and specifically in the context of food manufacturers, as called for by previous researchers (De Massis et al., 2018; Koryak et al., 2015; Buenechea-Elberdin, 2017). The research in this thesis indicates that in small companies the capability to recognise, acquire and exploit new knowledge manifests primarily via the owner-manager, but that it is constrained by the scope of knowledge sources accessed. In particular, the thesis findings indicate that in small companies limited access to, or use of, diversified sources of validated market and technical information impacts on the company’s Absorptive Capacity and its performance in the front-end of product innovation. It is argued that in view of the resource constraints of small companies and their extensive reliance on readily available resources, the capability to recognise the value of new information, which is key to Absorptive Capacity (Cohen and Levinthal, 1990), is mirrored by the importance of recognising the value of existing internal knowledge. Successful bricolage is dependent on the ability to reuse and recombine resources (Levi-Strauss, 1966), including knowledge, and to do so the company must be able to recognise the value of these resources and to assimilate these together with new external knowledge into the innovation.

The findings provide support to the theory of Absorptive Capacity presented by (Volberda et al., 2010) which proposes that ‘intra-organisational antecedents’ need to be considered when exploring knowledge related activities such as product innovation. The thesis extends Volberda et
al (2010) findings by suggesting that especially the company’s culture and most notably the innovation leadership including the entrepreneurial passion demonstrated by the owner-manager, in conjunction with Absorptive Capacity, are important to the front-end and to sustained product innovation performance.

Secondly, previous research has recognised the role and characteristics of the owner-manager in small companies as being dominant (Herron and Sapienza, 1992; Millward and Lewis, 2005), perhaps as a natural consequence of at least being the major shareholder, if not actually being the founder. Research has shown that this dominance can be a negative influence on innovation (Faherty and Stephens, 2016), but if the owner-manager possesses transformational leadership, entrepreneurial and technical competence (Ng and Kee, 2018), and higher education (Whittaker et al., 2016) this positively impacts on a small company’s innovativeness. The findings in this thesis extend this literature by providing understanding of how the dominance of the owner-manager of a small company manifests in their individual Absorptive Capacity and Innovation Leadership. My research further suggests that as the company grows, to sustain success the owner-manager needs to engender these capabilities throughout the organisation so they become part of the company’s culture – failure to do this reduces the company’s competitive advantage.

Third, the research in this thesis contributes to further understanding of the theory related to bricolage and its important role in product innovation, by specifically studying bricolage in the front-end of the innovation process in the context of small established companies. The findings from both the qualitative and quantitative studies suggest that bricolage can be built as a valuable capability, provide competitive advantage to established small companies consistent with previous literature (Baker and Nelson, 2005; Fisher, 2012a), and positively contribute to the performance at front end of the innovation process. The research also suggests that if there is an over-reliance on bricolage, and/or it is not supported by a high level of Absorptive Capacity and Entrepreneurial
Passion in the product development team, then making do can limit the scope and novelty of the new products developed.

Fourth, the research contributes to the literature on alternative strategies for product innovation in small companies. While it was shown that bricolage and other ‘closed’ approaches to innovation are most commonly used in product innovation by small established companies, more collaborative and open innovation techniques, when used appropriately, were shown to be valuable particularly when higher levels of novelty are involved (Love and Mansury, 2007; Berkhout et al., 2010). The research in the thesis makes a contribution to the discussion in the literature on the relationships between industry and universities with regard to collaborative product innovation (Schofield, 2013; Bstieler et al., 2015; Cosh and Hughes, 2010). The findings contribute by giving contextual support (small food manufacturing companies in Australia) to the issues of lack of engagement (Jaegersberg and Ure, 2017), structural and governance (Noble et al., 2015), mutuality (Jackson et al., 2017), and management capabilities (Laursen and Salter, 2004). The research in the thesis suggests that small companies are more successful when they employ a combination of different innovation approaches rather than rely solely on ‘closed’ approaches such as bricolage. The thesis extends the theory of collaboration, in the context of small companies, by suggesting that to achieve higher levels of innovation success it is necessary to invest in developing the capability and practice of broader engagement with external stakeholders.

Finally, the research extends theory on Entrepreneurial Passion, which has been predominantly focused on new ventures (Cardon et al., 2009; Drnovsek et al., 2016; Cardon and Kirk, 2010), by considering the role of the theory in established small companies. The findings of the research suggest that Entrepreneurial Passion and Absorptive Capacity together influence the success of the front-end and sustained product innovation, particularly through the innovation leadership of the owner-manager. Furthermore, based on this research it is proposed that for sustained success of innovation the concept of Entrepreneurial Passion in small companies should be extended beyond
its original scope associated with founding, inventing and growing to include passion about searching for and utilising new knowledge, developing a good organisational culture and implementing appropriate innovation activities in the front-end. This expanded concept of Entrepreneurial Passion forms a key part of innovation leadership. It is proposed that not only should the owner-manager have this passion, but that the role of owner-manager should be to develop Entrepreneurial Passion in key employees as the company grows.

**Contributions to Practice**

The findings in the thesis highlight the importance of recognising that there is a multiplicity of resources, capabilities and activities which need to be managed effectively to achieve sustained success at product innovation. Given the idiosyncrasies of small companies the challenge is to have these factors be appropriately developed and managed to develop competitive advantage for each company. The role of the leader, typically the owner-manager in the case of a small company, is paramount. While the leader is typically a primary source of prior knowledge, and has a high level of Absorptive Capacity personally, it is important that he/she recognise that for the company to sustain product innovation and grow, this knowledge and capability needs to be developed in key employees. Similarly, the research found that the entrepreneurial passion of the leader is an important driver of many aspects of product innovation, and is particularly important in the front-end of the product innovation process. A key role of the leader in achieving front-end and sustained product innovation success needs to be hiring and developing the ‘right’ people, and engendering Entrepreneurial Passion in key employees.

A significant constraint found in small companies is the availability of time to progress product innovation efficiently and effectively. The leader needs to establish an innovative culture. In order to do so, it is proposed that it will be necessary to regard time as a resource to be invested in, and to put in place strategies which gain access to diversified sources of quality information, and which
enable time to be available for diverse engagement with external organisations, for the recognition and acquisition of new knowledge, and for the innovation activities in the front-end. Two approaches to product innovation explored both qualitatively and quantitatively in this research were bricolage, and collaborative innovation. Particularly in the early stages of a small company’s development, or during difficult financial periods, making do with limited resources is commonly a necessity, and the research suggested that as the company grows this can be developed as a capability and employed as a strategy in future product developments. It is important for the owner-manager to be able to recognise the value of the company’s resources and how they can be reconfigured to progress innovation. However, it is also important to avoid becoming over-reliant on internal resources, and to have the ability to obtain external resources as appropriate. The owner-manager needs to balance the use of ‘closed’ innovation approaches, such as bricolage and improvisation, with ‘open’ approaches, such as collaborative and open innovation, for example with universities and other technical institutions, which in this and previous research has been shown to contribute positively to product innovation success. The absence of engagement of small companies with a broad range of stakeholders and specifically with universities, as indicated in this research, presents a challenge for the leaders of both small companies and research institutions to prioritise time to develop the ability to engage with each other, and to develop collaborative partnerships leading to increased and more novel innovation.

The model of the product innovation process presented in Chapter 5 can provide a framework for managers to assist them in designing their product innovation programme. The multiplicity of factors covered in this research can provide a guideline for the activities to include in their programme to improve their PI performance, and to consider how each of these factors may influence each other.

For academics and researchers, this research provides a basis for several areas of future research, and presents the aforementioned challenge to develop more collaborative relationships
with small companies. The findings in this thesis and in prior research suggest that having higher levels of education in small company personnel is important in product innovation. This presents an opportunity for academics to develop education programmes, both undergraduate and professional development, which better address the needs of small companies, not only in technological areas, but most importantly in the multiplicity of the human and knowledge factors which this research highlights as important to product innovation success.

For policy makers, this research highlights the factors that combine to affect sustained product innovation, and in so doing provides them insight into the platforms that are necessary to incentivise and support managers, researchers and academics in improving success in the front-end of product innovation which will lead to sustained improvement.

Limitations

The main limitation in this research is the size of sample populations used in the quantitative survey and to a lesser degree the qualitative interviews. The main source of data for the research was owner-managers of small companies. While the number of participants in the qualitative interviews is comparable with other studies which are exploratory, given the diversity of the food sector a larger cohort, particularly including multiple players within each company could improve the richness of insights obtained. The small number of respondents to the survey, particularly from medium and large companies, resulted in not being able to assess the effects of different size ranges. Even within the primary target of small companies the sample size was small, and limited the statistical analyses which could be carried out. The small sample restricted the survey findings to being supportive of the qualitative findings, rather than being able to draw more definitive conclusions and to develop a predictive model as was originally intended. By design, the research focused on small companies and on the Australian food manufacturing sector, and this potentially limits its universal application, and this together with the small sample sizes reduced the
generalizability of the findings. However, the items and constructs in the survey questionnaire derive from studies conducted in different sector, cultural and economic contexts and as such the survey methodology, if not the explicit findings, may be transferable outside of Australia. Finally, while the research was conducted over a period of approximately 18 months, the data effectively represents a snapshot of the activities in each of the companies at a point in time, and the effect of the factors studied over time needs to be considered to obtain a more complete picture.

**Future Research**

The small business sector, its ability to innovate, maintain competitive advantage and grow is important to the economy. The research in this thesis has added to our knowledge of the front-end of sustained product innovation, and how it is influenced by Absorptive Capacity, leadership and organisational culture, in the context of small manufacturing companies in the food sector in Australia. To complete our understanding, it is appropriate to replicate the research focusing on the ‘back-end’ of product innovation, i.e. focusing post R & D on the manufacture, marketing, launch, distribution and sales of new products, where the influence of process and service innovation has the potential to further affect the commercial success of a new product. Given the absence of similar research specific to other sectors in Australia, it is suggested that it would also be valuable to replicate the approach taken in this research in other sectors and contexts.

This thesis focused on small companies with less than 50 employees, and while findings similarities also suggested differences in several areas (Absorptive Capacity, engagement, innovation approaches, and leadership) compared to studies published previously based on larger companies. Since companies typically grow in size over a continuum, a valuable contribution to knowledge of product innovation would be made by conducting a study which captures data from different sized companies in the continuum, from very small through to very large and within the same sector- this would provide useful information to academics, consultants and government
agencies to enable the provision of improved support programs relevant to the needs of companies of different sizes, and as companies grow. A company and its environment changes over time, and in order to sustain product innovation and successfully grow its resources, capabilities and activities need to adapt and change. There is an absence of research on how Absorptive Capacity, and some of the other organisational factors, particularly Entrepreneurial Passion, change over time. It is recommended that a longitudinal study, possibly incorporating action research, based on the findings in this thesis, could make a valuable contribution to further understanding of sustained product innovation.

How small companies approach product innovation is important in its success. Bricolage is a particularly important strategy for small and resource deficient companies, and this work has shown that Absorptive Capacity, innovation leadership and Entrepreneurial Passion can play important roles in bricolage. A question remains as to how bricolage can be built as a capability of the company over time, become one of its valuable resources in sustained product innovation, and not become a limitation – longitudinal case studies could answer this question, and provide valuable knowledge to small companies.

The lack of engagement and collaboration between small companies and universities that was found in this study has also been observed by other researchers (Cosh and Hughes, 2010), and particularly in Australia (OECD, 2017). However, much of the research on university-industry linkages has been from the academics’ perspective, or based on output statistics. The potential for gains in product innovation from improved collaboration justifies further research into the factors which influence engagement and collaboration, and which considers multiple perspectives including those of governments, institutions, researchers, companies and employees. Given that a critical part of collaboration is developing the appropriate relationships which introduces a time element, longitudinal studies are recommended for this research.
While funding was raised as a constraint to PI in this study, it was found that companies with the appropriate leadership, knowledge resources, capabilities and activities still succeeded at product innovation and sustained growth. This suggests that while not ignoring the financial resources of a company and its owner, typically used by commercial funders as the key criteria for innovation funding, the leadership, organisational resources and capabilities of the company may be more important predictors of success. It would be useful to extend the research, reflected in the survey model in this thesis, to investigate the feasibility of a predictive model to assist funding agencies in decision making on funding.

A major difficulty experienced in the research in this thesis related to obtaining buy-in to the survey from potential sources of contact lists in the food sector, and to the time required to complete the survey. This was further exacerbated by the low response rate from those eventually contacted. While it may be tempting to reduce the scope and number of questions, this is likely to reduce the integrity of the study because of the multiplicity of interacting factors involved in product innovation. Low and declining response rates have been reported previously in the literature, and the recommendations on actions to be taken to improve rates were considered in this study, however they had no apparent impact. This is potentially a significant challenge for future studies of this kind, and warrants research into alternative methods of data collection, particularly related to promotion and distribution.

**Final Comments**

Small companies are key contributors to a nation’s economy and growth. Sustained product innovation is important in achieving company, industry and national growth. To remain competitive, to innovate and grow requires the capability to acquire and use new knowledge. Absorptive Capacity provides a framework in which knowledge processes can be studied, and has been shown in this and prior research to be central to success in product innovation. This thesis
extends our understanding of Absorptive Capacity by considering it together with the multiplicity of factors which impact on the front-end and on sustained product innovation. The research presents observations and insights into how these factors manifest in the front-end, and suggests that Absorptive Capacity and the innovation leadership of the owner-manager are separately and collectively critical to the front-end of and sustained product innovation, and to success in growing a small company. It is suggested that these factors influence how a small company engages with external stakeholders, how they recognise and exploit resources (including information), both internally and externally, and the approach a small company takes to innovation; and this in turn influences the novelty and sustained success of product innovations. Small companies do not feature prominently in Australia’s research activities. This thesis suggests that, at least in the context of the food manufacturing sector in Australia, a change in attitude and process is required in small companies, technical institutions and government if significant improvement is to be achieved in innovation performance relative to other OECD countries, and more importantly in its competitive position in the global food market.

Small companies touch everyone’s lives every day; and their success and failures impact on the economy and the society as a whole. It is hoped that the research in this thesis provides useful knowledge to assist stakeholders to achieve greater success by small companies.
APPENDIX 1 ETHICS NOTICES OF APPROVAL

Notice of Approval
Date: 18 June 2015
Project number: 19365
Project title: Sustained Product Innovation in Small Companies through the Lens of Absorptive Capacity
Risk classification: Low Risk
Chief Investigator: A/Prof Mike Reid
Other Investigator: Dr Marion Steel
Student Investigator: Mr. Tony Petley

Terms of approval:
1. Prior to the commencement of the second set of interviews and focus groups the indicative questions must be submitted for checking by the BCHEAN.
2. Prior to commencement the associations who will be recruiting (Innovation Australia Ltd, Family Business Australia, and Australian Chamber of Commerce and Industry) provide written evidence of their willingness to distribute invitations and consent forms to eligible companies.

Responsibilities of the principal investigator:
It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project is aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. Amendments
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment, submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.

2. Adverse events
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

3. Participant Information and Consent Form (PICF)
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.

4. Annual reports
Continued approval of this project is dependent on the submission of an annual report.

5. Final report
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.

6. Monitoring
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.

7. Retention and storage of data
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,
Dr Christopher Cheong
Chairperson
RMIT BCHEAN
Notice of Approval
Date: 24 April 2018
Project Number: 21391
Project Title: Sustained Product Innovation by Small Companies
Risk Classification: Negligible Risk
Chief Investigator: Prof Mike Reid
Student Investigator: Mr. Anthony Petley
Other Investigator: A/Prof Angela Dobele
Project Approved: From: 24 April 2018 to: 1 March 2019

Terms of Approval:
Responsibilities of the Principal Investigator
It is the responsibility of the principal investigator to ensure that all other investigators and staff on a project are aware of the terms of approval and to ensure that the project is conducted as approved by BCHEAN. Approval is only valid while the investigator holds a position at RMIT University.

1. Amendments
Approval must be sought from BCHEAN to amend any aspect of a project including approved documents. To apply for an amendment submit a request for amendment form to the BCHEAN secretary. This form is available on the Human Research Ethics Committee (HREC) website. Amendments must not be implemented without first gaining approval from BCHEAN.

2. Adverse Events
You should notify BCHEAN immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.

3. Participant Information and Consent Form (PICF)
The PICF must be distributed to all research participants, where relevant, and the consent form is to be retained and stored by the investigator. The PICF must contain the RMIT University logo and a complaints clause including the above project number.

4. Annual Reports
Continued approval of this project is dependent on the submission of an annual report.

5. Final Report
A final report must be provided at the conclusion of the project. BCHEAN must be notified if the project is discontinued before the expected date of completion.

6. Monitoring
Projects may be subject to an audit or any other form of monitoring by BCHEAN at any time.

7. Retention and Storage of Data
The investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Regards,

Associate Professor Penny Weller
Chairperson
RMIT BCHEAN
APPENDIX 2 COMPANY INTERVIEW GUIDE
Questions

*Items in italics are key issues, terms that are anticipated from the literature and may be further probed for in questioning if necessary.*

Introduction/Background

These questions are to put the company being interviewed in context and give an overview of its innovation activity.

*Questions 1-4 for CEO only*

1. Can you broadly outline the ownership of the company (family vs non-family), how many family members work in the company?

2. **How many full-time equivalent employees does your company have?**
   - Less than 10
   - 11 to 20
   - 21 to 30
   - 31-50
   - More than 50

   How many people were there 3 years ago?

3. **What is the annual revenue of your company?**
   - Less than $1 million
   - $1-2 million
   - $2-3 million
   - $3-4 million
   - More than $4 million

   How much was it 3 years ago?

4. **Over the last three years how many new products have your company commercialised?**
   
   (A new product includes a slight or major change to composition, a pack size or type change, a product line or market sector extension)

   - None
   - 1-3
   - 4-6
   - 7-12
   - More than 12
5. Approximately how much of your company’s current revenue do you estimate is from products commercialised within the last three years?

- Less than 5%
- 6-10%
- 11-15%
- 16-25%
- More than 25%

6. Can you give me a brief overview of your company, what it does, the market it serves and how you see its future?

- Do you prepare a formal business plan each year? Does it include review of the knowledge resources you need?
- What is its key strength (people (stability/loyalty), knowledge, skill, IP, culture)?

7. What is your role in the company, particularly as it relates to new product development?

8. What changes have you observed in the business in recent years and what sort of changes have been made?

- Products
- Customers, markets
- Staff - skills, numbers
- Facilities and equipment
- Financial
- Measurement processes
- Organisational
- Collaborations
- External environment
- IT/use of social media

9. What do you consider are the key resources of the company?

- Financial, equipment/processes, location/building, people, knowledge (tech/scientific, production, product, market)

10. Please tell me about the types of new products you have developed over the last 3 years – were they incremental (line extensions etc.), radical/game changers (leading the market etc.), a departure from what you normally do (new market, new industry sector, requiring new equipment etc.), IP?

11. Can you walk me through the process of developing a recent new product

- why did it come about?

- profit improvement, customer need, increase market share, diversify markets served, quality improvement, CEO idea

- what was the aim of the product?
- how did you develop it?
  • Was there a project plan produced?
  • What could be learned from previous projects?
  • Who made inputs/suggestions to new product?
  • Was new knowledge required, and if so, who got it and from where?
  • How was the knowledge communicated to everyone involved?
  • Was it necessary to get new resources- people, equipment etc?
  • Was it necessary to do any further R&D, trials etc?
  • How was the new product introduced to customer? How was feedback received?
  • Was social media used? If so How?
  • Was the market performance of the new product monitored and if so how?
  • Was there any celebration of success of product, reward, recognition?

12. When you reflect on the products you have developed over the last 3 years and the product development process you employ, what are the biggest barriers or difficulties?
  • Funds, cost and time of development, staff skills, access to knowledge, uncertain demand, government regulations etc, staff teamwork/cooperation, others (specify)

RBV, KBV, ACAP and the process of NPD

13. Can you tell me what the main driving forces are behind making product changes/new products?
  • Profit improvement, customer need, increase market share, diversify markets served, quality improvement, CEO idea

14. What do you think are the critical success factors for developing products in your company?
  • Adequate funds, having a detailed plan, commitment (CEO/employees), internal skills, access to external knowledge, technical collaborations, customer relationships, teamwork, launch and sales strategy, protectable IP, prepared to take a risk

15. Can you comment on how important it is to take risks to grow the business? Do you think the company is entrepreneurial? Who in the company are the risk takers?

16. Where do you get most of the ideas, suggestions, new information from to develop these new products? Which sources do you find the best?
  • Internal (who?), customers, suppliers, industry, competitors, consultants, websites/internet, social media, conferences/exhibitions etc, industry associations, universities/tech. institutes, collaborations/joint research, management/product training programs

17. How important is it to get the right people involved in a new product development and can you comment on the availability of appropriate people?
  • Skill levels, experience levels, cost, retainability, incentives
18. Are there outside sources of information you have found particularly useful for assisting in your product development?
   - Collaboration agreements, networks, clusters, customers, suppliers, internet (websites, social media sites, blogs) competitors/industry, skills training

19. Does the company encourage employees to learn more, do training programs etc.?

20. Do you conduct R&D for new products inside the company? If so, how does this work? Do you have outside work done also?

21. Do you have any technology ‘partnerships’ with third parties? If so, how do you find these assist in your product development?
   - Knowledge, skill, resources (equipment/people), cost, timing, credibility

22. Can you comment on how your customers and suppliers contribute to developing successful new products?
   - Specialised knowledge (technical, promotional, cost), new product ideas, new sources of knowledge, competitive activity, end user/sensory trends (tacitness issues)

23. How many people in the company typically get involved in new product development, and how do they work with each other? How do all the contributions (internal and external) get brought together? Are there any issues which inhibit progress?
   - Knowledge sharing, willingness to share, degree of formality, communications, cross-fertilisation, multi-skilling

24. How important is the launch campaign and marketing of a new product in your business? And can you explain how this is typically done?
   - Test marketing, co-promotion, joint marketing agreements, distribution methods (direct, wholesale/distributors, on-line), IP protection, use of social media

25. How is knowledge kept in the company for future use?
   - Staff, retention plans, incentives, administrative systems (project files etc)

26. Does the company measure the progress on development of new products? If so, how does this work?
   - Internal measures (vs target timeline, hours, costs), failures/repeats, new vs existing knowledge

27. How does the company measure the performance of commercialisation of new products?
   - Output measures (revenue, price points, profits, market share) – over what time frame? IP protection
APPENDIX 3 EXTERNAL SOURCE INTERVIEW GUIDE

QUESTIONS TO KNOWLEDGE SOURCES

External Knowledge Sources – Regional, State, Federal Development Agencies, Food Industry Consultants, University and industry researchers.

- What has been your experience with small companies?
- From your experience:
  - Do small companies have a clear vision of the market and the future for their company?
  - Do small companies demonstrate a capability to seek out, acquire and exploit new knowledge which is useful for their innovation?
  - What are the main weaknesses you see in small companies?
    - How much does lack of financial and human resource affect their success?
    - Do small companies have good financial, personnel, technical and marketing skills and management?
  - Are companies which are good at making do, good at innovation or does it limit them?
  - Do small companies hire the right people?
  - Do they manage and grow people well?
  - Are the CEOs of small companies’ good communicators?
  - Are CEOs of small companies passionate about their business and finding better ways to do things and better products to make?
  - Do they demonstrate entrepreneurial passion for inventing? Founding? And developing?
  - Do you find small companies have a good technology base, appropriate to their business?
  - Who do they collaborate with more – customers, suppliers, consultants, universities, government agencies?
  - Do they use government agencies for the knowledge/contacts they can provide?
- What is your observation of the relationship between small companies and universities?
  - What defined programs does the universities have to develop linkages and innovation with small companies?
- What are the barriers to greater use of expertise within universities and how can it be overcome?
• Are there any objectives or KPIs of universities which are in conflict with small company innovation needs?
• How can technology held by universities be more effectively transferred to small companies?

**What more can government do to drive open innovation in small companies with universities?**
APPENDIX 4 QUANTITATIVE SURVEY QUESTIONNAIRE

Welcome to the survey

You have accessed this site by clicking on the link provided in an email sent to you by Food Innovation Australia Ltd (FIAL) because of your involvement in the food industry in Australia. The email, and the attached plain English Invitation to Participate, has explained the survey, its objectives and the researchers involved. The survey is designed and hosted by the researchers, Mike Reid and Tony Petley, at RMIT University. Your consent to participate will be implied by clicking on the link provided, completing the survey and submitting it, anonymously, via Qualtrics to the researchers at RMIT. The raw data will only be seen by the researchers, not by FIAL. FIAL will receive a report based on the researchers’ analysis of the aggregated data and it is expected that it will make this available to its stakeholders via its website and use it in its industry programmes. The researchers will use only the aggregated data for academic and industry publication. Your participation in this unique survey is greatly appreciated and it is anticipated will provide valuable information to help support and develop the food industry in the future. The survey is divided into sections which aim to explore the various factors which have been recognised in prior research and in our own face-to-face interviews with industry members in preparation for this survey. Each section will be prefaced by a brief introduction. While a section or individual item may not seem important to your company, it is important for the accuracy of the survey that you provide a response to each item. The survey has been designed so that, unless explicitly indicated otherwise, each question is answered on a 7-point scale from ‘strongly agree’ to ‘strongly disagree’. It is expected that the survey will take up to 30 minutes to complete. We are mindful that your time is valuable and while only a small gesture, in recognition of your time and effort we will make a donation to a reputable charity for every completed and usable questionnaire we receive. We are hoping for at least 200 – 300 usable responses to enable robust conclusions.
Section 1 – Respondent Characteristics

What is your role in the company?

How long has the company been operating? (years)

What is your Gender?

Section 2 – Company Characteristics

The size and demographics of a company has been shown to impact on innovation. Can you please help us characterise your company into broad categories of size, structure and geography?

How many full-time equivalent employees in your company?

What is the annual turnover of your company ($million)?

What has been the average growth in turnover in the last 3 years (%p.a.)?

Where does your company sell its products?

Where is your Company located?

What % of your business is:

- B2B, e.g. to other businesses for their use (8)

- B2C, e.g. to final consumers either direct or via retail outlets (9)

- Other (10)

Section 3 – Market Environment

Please describe the level of ‘turbulence’ in the market environment in which our company operates, by indicating on the 7-point scale for each item whether you agree or disagree with the statement. Please note there is no right or wrong answer please just let us know what you are experiencing.

In our main market customers product preferences change quite a bit over time

In our main market customers tend to look for new products all the time

In our market the technology is changing rapidly
In our market, technological changes provide big opportunities.

Competition in our main market is fierce.

The competitors in our main market frequently make new competitive moves at least monthly.

**Section 4 – Goals and Strategies**

*The goals and strategies of a company are unique to each business and are important to its future. The statements below explore how the goals and strategies for your company are developed. Please indicate on the 7-point scale whether you agree or disagree.*

Developing new products in response to customer requests is an important part of our company strategy.

Developing new products in response to competitive threats is an important part of our company strategy.

Developing new products to either maintain our position as market leader or keep pace with the market leader, whichever is applicable, is an important part of our company strategy.

Developing new products which are first to the market is an important part of our company strategy.

**Section 5 – ‘Make Do’ Strategy**

*The innovation process often requires a company to balance and use their existing resources before acquiring new ones (human, financial, and physical). Please indicate the degree to which the statements below apply to your company using the 7-point scale from agree to disagree.*

We are confident in our ability to find workable solutions to new product innovation challenges by using our existing resources.

We gladly take on a broader range of product innovation challenges with our existing resources than our competitors would be able to do.

We use any existing resource that seems useful to responding to a new product innovation problem or opportunity.

By combining our existing resources, we take on a surprising variety of new product innovation challenges.

When we face new product innovation challenges, we put together workable solutions from our existing resources.

We combine resources to accomplish new product innovation challenges that the resources were not originally intended to accomplish.

We struggle with our limited resources when undertaking product innovation challenges.
Section 6 – Absorptive Capacity

Thank you for getting this far. We really appreciate your help and insights. The ability to recognise, acquire, assimilate, transform and exploit new information has been shown to be important for innovation success. Please indicate the degree to which the statements below apply to your company, on a 7-point scale from ‘strongly disagree’ to ‘strongly agree’. Again, there is no right wrong answer. Just tell us what you do or don’t do.

The search for relevant information concerning our industry is an every-day activity in our company

Our management motivates employees to use multiple information sources within our industry
Our management expects that the employees seek and consider information from outside our industry

In our company ideas and concepts are efficiently communicated between employees and departments

Our management emphasises support between employees and functions to solve problems

In our company when an employee obtains some important information, they quickly communicate it to others who may be affected or who may be able to use it to aid in product development

In our company we regularly have meetings between employees and managers from different functions to exchange information on new developments, problems and achievements

Our employees have the ability to assemble and to use collected knowledge effectively

Our employees are used to absorbing new knowledge as well as to preparing it for further purposes and to making it available to other employees

Our employees successfully link existing knowledge with new insights and knowledge on new products, technology and markets

Our employees are able to apply new knowledge in their practical work

Our management supports the preparation, during the early stages of development, of product samples for market testing

Our company regularly reconsiders technologies and adapts them in light of new knowledge which improves the technology

Our company has the ability to work more effectively by adopting new technologies
Section 7 – Front End of Innovation Activities

The actions we take in the early stages of product innovation (the front-end) can have a significant impact on the success of overall product development program. This section covers activities from idea creation through to project selection, R&D and initial consumer trialling of product but does not include product manufacture, launch and commercialisation. Please indicate how the statements below apply to your company on a 7-point scale from strongly agree to strongly disagree. Again, there are no right or wrong answers just tell us what you actually do or don’t do well.

In the early stages of product development, we have a clear vision of how the new product will be used

In the early stages of product development, we have a clear vision of who the target market (user) will be

In the early stages of product development, we have a clear vision of what the target customers' needs will be.

We always try to discover the additional needs of our customers

We always incorporate customer needs in our new products, even when they have not requested them.

We frequently brainstorm on how customers use our products

We understand what our competitors are trying to develop

We track our competitors’ product innovation activities

We carefully evaluate whether potential new products will generate a sustainable competitive advantage

We carefully evaluate the degree to which products will meet our strategic objectives

We carefully evaluate the degree to which potential products give us a portfolio which is balanced between innovation and risk.

Our senior management champions new front-end product development projects

Our senior management is strongly committed to front-end product development projects

Our senior management plays an integral role in most front-end product development projects.

We evaluate whether team members demonstrate commitment to their product development projects
Our company systematically considers opportunities based on new technologies

Our company systematically considers the regulatory shifts and developments

Our company systematically considers opportunities based on economic and demographic trends

Our company systematically considers the consumer and cultural trends

Our company systematically and actively looks for disruptive opportunities

Our company uses and consistently applies a systematic and formally documented process review for all projects

Our company uses a systematic and consistently applied process for screening out poor projects and approving good projects to proceed to full product development and launch

Our company uses a systematic and consistently applied process for coming up with new ideas

Our company uses a systematic and consistently applied process for capturing and sharing ideas

Our company uses a systematic and consistently applied process for recording ideas

Our company has a defined set of criteria for selection of new product ideas

Our company has a systematic and consistently applied process for evaluation and progression of new product ideas for development

Our company systematically considers the feasibility of an idea and its probability of success with regard to potential manufacturing issues

Our company systematically considers the feasibility of an idea and its probability of success with regard to potential marketing and sales performance

Our company systematically considers the feasibility of an idea and its probability of success with regard to technical requirements (such as nutritional, environmental, safety)

Our company systematically considers the feasibility of an idea and its probability of success with regard to financial risk

There is a high level of trust between managers and employees in our company

People in our organisation have time to consider and test new ideas
People in our organisation discuss and consider opposing opinions

When we are working on the early stages of a new product development, we communicate frequently between team members

During the front end of new product development, we typically spend our time on the following activities: Technical issues, Product Concept issues, Market Research issues, Business case / economic development, Screening the idea or concept to either kill it or keep it

Section 8 – Success of Front End of Innovation

This next section assesses how successful the activities you undertake in the early stages of the product innovation projects are in terms of delivering new products to be fully developed. Please estimate what percentage applies to each item and then whether you agree or disagree with the statements about overall success

What % of your new product ideas are screened out/dropped before being fully developed?

What % of your new ideas receive sufficient funding to efficiently proceed through front end assessment prior to full development?

What % of product concepts that make it through the front-end process go on to be a market success

Overall, we handle the early stages of product development successfully

Section 9 – Entrepreneurial Passion

The passion for the business and for product innovation, particularly by leaders is important. Indicate the degree to which you agree with the statements below, on a 7-point scale from disagree to agree

In our company we find it is exciting to figure out new ways to solve unmet market needs that can be commercialised.

In our company we are motivated to figure out how to make existing products/services better.

In our company we are motivated to figure out how to make existing products/services better.

In our company we get excited about scanning the environment for new product opportunities.

In our company we like inventing new solutions to product problems
In our company we get excited about nurturing and growing new products and the company

In our company we find it exciting to assemble the right people to work on new product development.

**Section 10 – Open Innovation and Collaboration**

*Almost there. Only a few more questions and you are done. We really appreciate your help and insights. Collaboration with others to introduce new knowledge and skills can be a valuable means of improving innovation. Please indicate the degree to which you agree with the statements below (on a 7-point scale)*

Our company actively collaborates with customers to develop new products

Our company actively collaborates with suppliers to develop new products

Our company actively collaborates with competitors to develop new products

Our company actively collaborates with universities and other technical institutes to develop new products

Our company actively collaborates in national networks/clusters to develop new products

Our company regularly attend information seminars, conferences meetings etc.

We actively participate in local business clusters, networks and/or industry associations

Availability of time is the major constraint to us engaging more with knowledge sources and potential collaborators outside the company

**Section 11 – Resource Constraints**

*Businesses can face many types of constraints which impact on their innovation. Please indicate whether your company has sufficient of the following resources achieve your innovation objectives.*

Our company has sufficient funds to develop and test potential new products

Our company has sufficient funds to commercialise new products

We have sufficient time to develop and commercialise new products

We have sufficient human resources and skills to develop and commercialise new products

We can access consumer insights and quantitative market data to come up with new product ideas
We can access the necessary technical information and expertise to develop new products.

Section 12 – Performance of Product Innovation Programme

These are the very last questions. Thank you for getting to this point. The aim of product innovation is to commercially launch a new product and add value to the company. Please indicate the contribution of new products to your company’s performance.

Over the last three years, on average how many new products have you launched?

Over the last three years, what % of the new products launched have been successful in the market?

What % of these products have been an improvement and replacement for existing products?

What % of these products have been line extensions, i.e. while they are new products to the company they fit into and extend the current product lines?

What % of these products allows the company to enter new markets?

What % of the total products launched have been radical innovations in the market, i.e. new to company, the market, and the world?

What is the contribution to sales from new products launched in the last three years, as a % of total sales (%)?

What is the contribution to profits from new products launched in the last three years (%)?

Overall, our new product programme is a success.
## APPENDIX 5 - CONSTRUCTS, ITEMS and LOADINGS

<table>
<thead>
<tr>
<th>Composite Factor</th>
<th>Construct</th>
<th>Items</th>
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</thead>
<tbody>
<tr>
<td>Access to Information</td>
<td>Zeng et al, 2010 Freel, M. S. (2000)</td>
<td>Our company regularly attend information seminars, conferences, meetings etc.</td>
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<td></td>
<td></td>
<td>We actively participate in local business clusters, networks and/or industry associations</td>
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<td></td>
<td>We can access consumer insights and quantitative market data to come up with new product ideas</td>
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<td></td>
<td>We can access the necessary technical information and expertise to develop new products</td>
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<td>Absorptive Capacity (ACAP)</td>
<td>ACAP Acquisition Flatten et al, 2011</td>
<td>The search for relevant information concerning our industry is an everyday activity in our company</td>
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<td>Our management motivates employees to use multiple information sources within our industry</td>
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<td>Our management expects that the employees seek and consider information from outside our industry</td>
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<td>ACAP Assimilation Flatten et al, 2011</td>
<td>In our company ideas and concepts are efficiently communicated between employees and departments</td>
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<td>Our management emphasis support between employees and functions to solve problems</td>
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<td>In our company when an employee obtains some important information, they quickly communicate it to others who may be affected or who may be able to use it to aid in product development</td>
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<td></td>
<td></td>
<td>In our company we regularly have meetings between employees and managers from different functions to exchange information on new developments, problems and achievements</td>
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<td><strong>ACAP Transformation</strong></td>
<td>Flatten et al, 2011</td>
<td>Our employees have the ability to assemble and to use collected knowledge effectively</td>
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<td>Our employees are used to absorbing new knowledge as well as to preparing it for further purposes and to making it available to other employees</td>
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<td>Our employees successfully link existing knowledge with new insights and knowledge on new products, technology and markets</td>
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<td>Our employees are able to apply new knowledge in practical work</td>
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<td><strong>ACAP Exploitation</strong></td>
<td>Flatten et al, 2011</td>
<td>Our management supports the preparation during the early stages of development of product samples for market testing</td>
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<td>Our company regularly reconsiders technologies and adapts them in light of new knowledge which improves the technology</td>
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<td>Our company has the ability to work more effectively by adopting new technologies</td>
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<td><strong>Innovation Leadership (IL)</strong></td>
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<td>In our company we find it exciting to figure out new ways to solve unmet needs that can be commercialised</td>
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<td><strong>Entrepreneurial Passion</strong></td>
<td>Cardon et al., 2013</td>
<td>In our company we are motivated to figure out how to make existing products/services better</td>
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<td>In our company we get excited about scanning the environment for new product opportunities</td>
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<td>In our company we like inventing new solutions to product problems</td>
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<td>In our company we get excited about nurturing and growing new products and the company</td>
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<td>In our company we find it exciting to assemble the right people to work on new product development</td>
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<td>Strategy</td>
<td>Koen et al., 2014</td>
<td>Developing new products in response to customer requests is an important part of our company strategy</td>
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<td>Developing new products in response to competitive threats is an important part of our company strategy</td>
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<td>Developing new products to either maintain our position as market leader or keep pace with the market leader, whichever applies, is an important part of our company strategy</td>
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<td>Developing new products which are first to the market is an important part of our company strategy</td>
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<tr>
<td>Reid and de Brentani, 2010;</td>
<td></td>
<td>In the early stages of product development, we have a clear vision of how the new product will be used</td>
<td>0.967</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In the early stages of product development, we have a clear vision of who the target market (user) will be</td>
<td>0.969</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In the early stages of product development, we have a clear vision of what the target customers’ needs will be</td>
<td>0.924</td>
</tr>
<tr>
<td>Senior Management Commitment</td>
<td>Koen et al, 2014</td>
<td>Our senior management champions new front-end product development projects</td>
<td>0.892</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our senior management is strongly committed to front-end development projects</td>
<td>0.906</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our senior management plays an integral role in most front-end product development projects</td>
<td>0.841</td>
</tr>
<tr>
<td>Composite Factor</td>
<td>Construct</td>
<td>Items</td>
<td>Loading</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>FEI Planning</td>
<td></td>
<td>We carefully evaluate whether potential new products will generate a sustainable competitive advantage</td>
<td>0.931</td>
</tr>
<tr>
<td></td>
<td>Markham, 2013</td>
<td>We carefully evaluate the degree to which products will meet our strategic objectives</td>
<td>0.925</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We carefully evaluate the degree to which potential products give us a portfolio which is balanced between innovation and risk</td>
<td>0.844</td>
</tr>
<tr>
<td>Front-end of Innovation Activities (FEIA)</td>
<td>Opportunity Identification</td>
<td>Koen et al., 2014;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers opportunities based on new technologies</td>
<td>0.732</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers the regulatory shifts and developments</td>
<td>0.803</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers opportunities based on economic and demographic trends</td>
<td>0.881</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers consumer and cultural trends</td>
<td>0.741</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically and actively looks for disruptive opportunities</td>
<td>0.703</td>
</tr>
<tr>
<td>Idea Generation</td>
<td>Koen et al., 2014;</td>
<td>Our company uses a systematic and consistently applied process for coming up with new ideas</td>
<td>0.891</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company uses a systematic and consistently applied process for capturing and sharing new ideas</td>
<td>0.902</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company uses a systematic and consistently applied process for recording new ideas</td>
<td>0.925</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company has a defined set of criteria for selection of new product ideas</td>
<td>0.839</td>
</tr>
<tr>
<td>Composite Factor</td>
<td>Construct</td>
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</tr>
<tr>
<td>Concept Definition</td>
<td></td>
<td>Our company systematically considers the feasibility of an idea and its probability of success with regard to potential manufacturing issues</td>
<td>0.905</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers the feasibility of an idea and its probability of success with regard to potential marketing and sales performance</td>
<td>0.875</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers the feasibility of an idea and its probability of success with regard to technical requirements (such as nutritional, environmental, safety)</td>
<td>0.887</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company systematically considers the feasibility of an idea and its probability of success with regard to financial risk</td>
<td>0.759</td>
</tr>
<tr>
<td>Systematic Processes</td>
<td></td>
<td>Our company uses a systematic and consistently applied process for screening out poor projects and approving good projects to proceed to full product development and launch</td>
<td>0.935</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company uses a systematic and consistently applied process for evaluation and progression of new product ideas for development</td>
<td>0.888</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What percentage of new product ideas are screened out/dropped before being fully developed</td>
<td>0.466</td>
</tr>
<tr>
<td>Organisational Culture (OC)</td>
<td>Culture</td>
<td>People in our organisation have time to consider and test new ideas</td>
<td>0.742</td>
</tr>
<tr>
<td></td>
<td></td>
<td>There is a high level of trust between managers and employees in our company</td>
<td>0.817</td>
</tr>
<tr>
<td></td>
<td></td>
<td>People in our organisation discuss and consider opposing opinions</td>
<td>0.676</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When working on the early stages of a new product development we communicate frequently between team members</td>
<td>0.62</td>
</tr>
<tr>
<td>Composite Factor</td>
<td>Construct</td>
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</tr>
<tr>
<td><strong>Proactive Market Orientation</strong></td>
<td></td>
<td>We evaluate whether team members demonstrate commitment to their product development projects</td>
<td>0.853</td>
</tr>
<tr>
<td>Koen et al, 2014</td>
<td></td>
<td>We understand what our competitors are trying to develop</td>
<td>0.846</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We frequently brainstorm on how customers use our products</td>
<td>0.789</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We track our competitors’ product innovation activities</td>
<td>0.826</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We always try to discover the additional needs of our customers</td>
<td>0.735</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We always incorporate customer needs in our products even when they have not requested them</td>
<td>0.724</td>
</tr>
<tr>
<td><strong>Innovation Approaches (IA)</strong></td>
<td>Collaboration</td>
<td>Our company actively collaborates with customers to develop new products</td>
<td>0.787</td>
</tr>
<tr>
<td>Zeng et al, 2010</td>
<td></td>
<td>Our company actively collaborates with suppliers to develop new products</td>
<td>0.564</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company actively collaborates with universities and other technical institutions to develop new products</td>
<td>0.775</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company actively collaborates in national networks/clusters to develop new products</td>
<td>0.727</td>
</tr>
<tr>
<td><strong>Bricolage</strong></td>
<td></td>
<td>We are confident in our ability to find workable solutions to new product innovation challenges by using existing resources</td>
<td>0.787</td>
</tr>
<tr>
<td>Wu et al, 2017</td>
<td></td>
<td>We gladly take on a broader range of product innovation challenges with our existing resources than our competitors would be able to do</td>
<td>0.844</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We use any existing resource that seems useful to responding to a new product innovation problem or opportunity</td>
<td>0.664</td>
</tr>
<tr>
<td></td>
<td></td>
<td>By combining our existing resources, we take on a surprising variety of new product innovation challenges</td>
<td>0.86</td>
</tr>
<tr>
<td>Composite Factor</td>
<td>Construct</td>
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<tr>
<td></td>
<td>Organisational Resources (OR)</td>
<td></td>
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<tr>
<td></td>
<td>Resources</td>
<td>When we face new product innovation challenges, we put together workable solutions from our existing resources</td>
<td>0.762</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We combine resources to accomplish new product innovation challenges that the resources were not originally intended to accomplish</td>
<td>0.584</td>
</tr>
<tr>
<td>FEI performance</td>
<td></td>
<td>Our company has sufficient funds to develop and test new products</td>
<td>0.782</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company has sufficient funds to commercialise new products</td>
<td>0.792</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We have sufficient time to develop and commercialise new products</td>
<td>0.851</td>
</tr>
<tr>
<td></td>
<td></td>
<td>We have sufficient human resources/skills to develop and commercialise new products</td>
<td>0.852</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Our company uses and consistently applies a systematic and formally documented process review for all projects</td>
<td>0.873</td>
</tr>
<tr>
<td></td>
<td>FEI performance</td>
<td>What percentage of your new ideas receive sufficient funding to efficiently proceed through front end assessment prior to full development</td>
<td>0.784</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What percentage of product concepts that make it through the front-end process go on to be a market success</td>
<td>0.804</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overall, we handle the early stages of product development successfully</td>
<td>0.713</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Over the last three years what percentage of the new products have been successful in the market</td>
<td>0.728</td>
</tr>
<tr>
<td>Composite Factor</td>
<td>Construct</td>
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<td>------------------------------------------------------</td>
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</tr>
<tr>
<td>Sustained Product Innovation Performance (SPIP)</td>
<td>SPI Performance</td>
<td>What percentage of these products allows the company to enter new markets</td>
<td>0.603</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What percentage of the total products launched have been radical innovations in the market, i.e. new to company, the market and the world</td>
<td>0.695</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What is the contribution to sales from new products launched in the last three years, as a percentage of total sales</td>
<td>0.823</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What is the contribution to profits from new products launched in the last three years</td>
<td>0.857</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Overall NPD Success -Overall, our new product programme is a success</td>
<td>0.71</td>
</tr>
</tbody>
</table>
References


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USDA USDa-ERS. (2016) Ag and Food Sectors and the Economy.


Wahyuni D. (2012) The research design maze: Understanding paradigms, cases, methods and methodologies.


