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An exploratory study of the role and contribution of Absorptive Capacity levels in the commercialisation of knowledge in Knowledge Intensive SMEs.

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This thesis is submitted in fulfilment of the requirements for the award of

Doctor of Philosophy (PhD)

Technological University Dublin

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Abstract

Absorptive Capacity (ACAP) is a construct introduced by Cohen and Leventhal in 1990 to describe the process by which an organisation recognises and absorbs new external knowledge to increase its current stock of knowledge, thereby giving it increased capability to create value for its customers, stakeholders and wider society. ACAP, as a construct, has gained widespread acceptance within academia and the construct has been further refined and developed over the last thirty years. However, the application and testing of the construct, is in practice, still in the early stages of development. The aim of this exploratory study was to investigate the role and contribution of varying levels of ACAP for the commercialisation of knowledge in indigenous firms in a small open economy. The Republic of Ireland was utilised in the study as an exemplar case.

This study employs a multiple case study approach to explore the core research question cited above. These cases were selected on the geodemographic criteria of age, size, location and sector to provide a representative sample of the indigenous firms in the internationally traded sector in Ireland. A descriptive case study of each firm (n=19 cases) was produced from secondary and primary research. The data from each of the cases was coded and analysed using process and pattern coding and thematic analysis. A cross-case analysis was then conducted within the three cohorts of firms – Young (n=4), Adolescent (n=6) and Mature (n=9) – to identify variations in levels of ACAP between performing and non-performing firms within each cohort. Finally, a cross-cohort analysis was conducted to analyse how levels of ACAP differ across the stages of development of the firms in the study.

It was found that ACAP, as a Dynamic Capability of the firm, underpins the innovation process in indigenous firms. Higher levels of ACAP were found in the more successful

firms across all three stages of development, as defined in the study. The 5-Loop framework developed in the study from the extant literature, was able to identify varying levels of ACAP in firms using the diagnostic and evaluative instrument developed from this framework. This 5-Loop framework and instrument will be particularly beneficial to firm leadership and policymakers who wish to improve commercialisation results through improving key aspects of the firm's innovation process.

Declaration

I certify that this thesis which I now submit for examination for the award of Doctor of Philosophy (PhD), is entirely my own work and has not been taken from the work of others, save and to the extent that such work has been cited and acknowledged within the text of my work. This thesis was prepared according to the regulations for graduate study by research of the Technological University Dublin and has not been submitted in whole or in part for another award in any other third level institution. The work reported on in this thesis conforms to the principles and requirements of the TU Dublin's guidelines for ethics in research. TU Dublin has permission to keep, lend or copy this thesis in whole or in part, on condition that any such use of the material of the thesis be duly acknowledged.

Signature  Date: October 25, 2022

Francis M Behan

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Inherent in the quote ‘You cannot predict the future, but you can create it’ (Drucker, 2009) is the empowerment of the individual, whether in business or in life, to strive for improvement. My PhD was a journey of improvement and self-development, of a magnitude unlike any other journey that I have undertaken in my life so far. While drawing on many life skills, dedication and sacrifice, but reassured that others have successfully navigated this path before me, I recognise that I could not have accomplished this achievement without the support of others.

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Finally, I will always be indebted to my parents, who set an example for me to recognise the value of the small successes or simple things in life. To my dad, Christy, who constantly said ‘you can’t beat a tryer’. To my mam, Kitty, who gave me this determined attitude of never giving up, as she demonstrates every day of her happy long life.

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Abbreviations

BERD	Business Expenditure on Research and Development
BG	Born Global
CSO	Central Statistics Office
DBEI	The Department of Business, Enterprise and Innovation
EEC	European Economic Community
EI	Enterprise Ireland
EIB	European Investment Bank
EIT	The European Institute of Innovation and Technology
EO	Entrepreneurial Orientation
EOGI	External environment, Organisation, Group, Individual (factors)
EU	European Union
FDI	Foreign Direct Investment
HEI	Higher Education Institutions
HGF	High Growth Firm
HPGF	High Potential Growth Firm
HPSU	High Potential Start Up
IB	International Business
IBEC	Irish Business & Employers Confederation
ICT	Information & Communication Technology
IDA	Irish Development Agency
IPO	Initial Public Offering
IPR	Intellectual Property Rights
IS	Information Systems
IUA	Irish Universities Association
IVC	Innovation Value Chain
KIE	Knowledge Intensive Enterprise
KM	Knowledge Management
MNE	Multinational Enterprises
ND	Neoliberal Developmentalism
NDP	National Development Plan
NDS	Networked Developmental State
NIS	National Innovation System
NTBF	New technology-based firms
OL	Organisational Learning
PACAP	Potential Absorptive Capacity
PRTL	The Programme for Research in Third Level Institutions
RACAP	Realised Absorptive Capacity
RBV	Resource based View
SFI	Science Foundation of Ireland
SIM	Social Interaction Mechanism
SME	Small and Medium Enterprise
TMT	Top Management Team
TNC	Transnational corporations
USO	University Spin Outs
UTT	University Technology Transfer
VRIN	Valuable, rare, inimitable and non-substitutable
WEF	World Economic Forum

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Chapter 1 Introduction

In 1990, Cohen and Levinthal published their seminal article on a ‘new perspective’ of the importance of external knowledge in learning and innovation. Learning and innovation were seen as the focus areas in generating a path to better allocation of resources in the pursuit of commercial gains. They termed their construct ‘Absorptive Capacity’ (ACAP) and they indicated that ACAP is likely developed and maintained as a by-product of other firm routine activities (Cohen & Levinthal, 1990). As indicated in a recent paper by Cunha Filho et al. (2021, p. 6), ACAP has been cited in over 13,000 studies since it was published, indicating the high level of attention the construct has received over the years.

ACAP is grounded in economic theory within a firm (Cohen & Levinthal, 1990). It articulates the individual firm’s decision mechanisms to allocate resources in order to generate economic value where prior knowledge is seen as a prerequisite. The ‘new perspective’ was further clarified in a follow-on paper (Cohen and Levinthal, 1994, p. 227) where it was articulated that the ‘capacity’ to exploit external knowledge is comprised of a set of closely related ‘abilities’. These abilities, as stated by Cohen and Levinthal (1994), allow the firm to recognise and evaluate the technical and commercial potential of knowledge in a particular market domain, assimilate it, and apply it to commercial ends.

As a firm construct, ACAP has generated significant study, debate and recategorization over the last three decades or more. Despite a wide acceptance of the construct amongst academics and business practitioners, and being cited in several research fields including innovation, strategy, knowledge management, organisational learning, managerial cognition, and firm performance, it remains largely empirically untested in practice. As a pragmatic innovator in a Fortune 500 international firm, the intention is to

explore how the presence of different levels of ACAP might affect the innovation levels of a firm and how those levels might be tested in a small state context.

1.1 Rationale for the study of Absorptive Capacity

Studies over several decades note consistent challenges exist for firms in generating a sustainable business.

With 60% of small businesses reportedly failing within their first five years, the life of a UK entrepreneur is exemplified by risk and reward. But even with the challenges and obstacles of the past two years, business founders are not shying away from embarking on their own ventures. (Management Today, 2022)

Some recent statistics in the US show that 8 out of 10 entrepreneurs who start a business, will fail within the first 18 months never reaching the desired SME level of sustainability Neck et al. (2018, p. 48). As reported by O'Reilly and Tushman (2011, p. 5) only a tiny fraction, 0.1 percent, of firms established in the US will survive to the age of 40 years, as a long-term sustainable firm. In terms of new product development, the Conference Board reported a median success rate of 66 percent for consumer products and a lower value of 64 percent for industrial goods (Cooper, 1993, p. 9) highlighting the challenges of learning and sustaining innovation, generating positive results within existing firms. Hence the need for academics to suggest new organisational frameworks to create a better way of organising firm capabilities (O'Connor & Ayers, 2005, p. 28). In this new organisational structure, three key innovation capabilities are suggested as being required to be managed. They are, Discovery, Incubation and Acceleration of growth by the firm. Whether in recently established firms or mature firms, the need to make decisions to allocate resources at the right time and in the most efficient way 'to learn' how a firm can differentiate, is a strategic decision. Open Innovation introduced by Chesbrough and Appleyard (2007) has been described as a necessity of the firm to

leverage networks of knowledge outside of the firm, recognising that all knowledge cannot exist within the firm. This decision to look outside, to explore for knowledge can be described as the market orientation of the firm, either being Responsive or Proactive in the orientation that the firm takes to new products development (Narver et al, 2004, p 336).

A better understanding of how levels of ACAP contribute to and fit with a firm's routines and processes would appear to be valuable. Being able to determine levels of ACAP within a firm that might affect the ability to exchange knowledge and subsequently generate learning, leading to innovation is seen as a valuable managerial skill. The ability to determine the existence of levels of ACAP as a path to learning and collaborative innovation may help address some of the reported firm failures. By determining the levels of ACAP, this may inform firms on actions or processes necessary to react to changing conditions, thus avoiding failures or providing opportunities to seek external knowledge.

1.1.1 Research Scope

This research will add to the extant knowledge, understanding and application of ACAP at an SME level in a small state, late developer context. This research will explore what actions a firm can take to be proactive in the need to invest in knowledge both internally and externally, in advance of future innovative opportunities.

It has been the policy of many states to encourage the creation of new firms as a path to economic progress and employment (Lerner, 2013). These new firms are recognised as a source of knowledge exchange which occur across firm's boundaries to the benefit of all firms in the sector through knowledge spillovers (Audretsch, 2005). This knowledge

spillover is particularly important for states that have encouraged Foreign Direct Investment (FDI) as a way of developing clusters of economic activity in the local economy (Acs. et al., 2013. p. 758). FDI investment has been extensively leveraged by smaller states. Smaller states are defined as those states with a population of less than 10 million (IPINST, n.d.). These smaller states have no alternative but to be ‘open for trade’ and attract foreign investment. These smaller states, particularly those in northern European states, dominate the more specific development indices such as those in the knowledge economy (Buckley, 2016).

An ideal space to examine this approach is the Republic of Ireland, where the population is approximately four million and FDI investments has a long history within the state. For Ireland, the focus of successive government initiatives has been to encourage the development of ‘new knowledge’. As will be presented, small and medium enterprises (SMEs) account for 99.8 percent of all active enterprises and 68 percent of those employed in the Irish economy (CSO, 2020). As a representative of a small state, late developer, this research focuses on multiple case design for SMEs in the Republic of Ireland. The SMEs engaged in this research have been in existence for more than 5 years and employing less than 250 employees in Ireland (EC. 2022).

1.2 Research Question

The aim of this exploratory research was to generate a body of research that seeks to identify the presence and the differing levels of ACAP in a cohort of Irish SMEs. This research is qualitative and it will leverage multiple case interactions with SMEs in an Irish context. It will build on existing understanding of ACAP and it will seek to enhance existing frameworks with a pragmatic engagement of individual informants, to help add to the extant knowledge of the construct.

The research question is

What role and contribution do levels of absorptive capacity play in the commercialisation of knowledge in knowledge intensive SMEs?

Grant (1996) stated that

The enterprise or firm can be conceptualised as an institution for integrating knowledge (p.109).

The articulation of ACAP by Cohen and Levinthal (1990, p. 131) is considered to be a firm construct underpinning the growth and development process leading to the sustainability of the firm through learning and innovation. However, in both of the above definitions, the knowledge of the individual in the firm is critical to the knowledge capacity of the firm. This demonstrates the need for the firm to 'apply' the knowledge of the individual rather than just focusing on the 'creation' alone. Prior knowledge plays a major role in the establishment of a new firm and new opportunities for existing firms. This prior knowledge can originate with the entrepreneur who decides to start a new business or the prior knowledge of an existing firm in its articulated rules and procedures (Shane 2000). The distinction of knowledge and the different forms it takes and how it flows within a firm in 'spirals' has been indicated previously by other researchers as Tacit knowledge and Explicit knowledge (Cook & Brown, 1999; Nonaka, 1994).

While innovation can be described as the process the organisation uses to create and define problems and then actively develop new knowledge to solve the problems (Nonaka, 1994, p.14), knowledge is believed to be a critical component of innovation. Knowledge as a central element to innovation can be transferred through different forms within a firm by members, tasks, tools and networks illustrated by previous researchers

and subsequently updated in the paper by Argote and Fahrenkopf, (2016, p. 148).

Because knowledge resides in individuals (members), there is a tendency for knowledge flows to be within, and external to, the firm. As proposed by Zahra and George (2002, p. 185) and will be covered in Chapter 2.2.1, ACAP is indicated as a Dynamic Capability, one that needs managerial oversight, in the *creation* and *utilisation* of knowledge in a firm's attempt to gain a competitive advantage. The combination of individuals, networks and processes would tend to suggest that a firm can suffer the positive and negative benefits of knowledge inflows and knowledge outflows, referred to as knowledge spillovers (Audretsch, 2005). The context in which the firm exists would also indicate the potential influence and knowledge sources that the external conditions can have on the firm.

1.2.1 Research Objectives

To address the research question, four research objectives guide the research

Research Objective 1.

To critically evaluate the ACAP construct and its role in firms' performance.

A review of the literature spanning more than the last 30 years will reveal the different evolutions of the construct and how it has emerged from its early articulation into an operationalised process multidimensional view, that exists today. This review will highlight the consistencies and the apparent gaps that have evolved as the construct has iterated to support learning, knowledge and innovation for firms existing in the 21st century.

Research Objective 2

To explore the contribution that different ACAP levels make on firms' innovation performance

An understanding of the construct will suggest what different levels of ACAP can exist within a firm. With innovation and competitive advantage as an output of ACAP, (Todorova & Durisin, 2007; Zahra & George 2002) understanding how the different levels of ACAP can influence decision making for future innovation engagements will be explored. Being able to identify different levels of ACAP within a firm and hence illustrate how firms then manage their people, tools, process and networks will lead to further research directions.

Research Objective 3

As ACAP levels are important, to recommend how firms can improve their levels of ACAP.

An appreciation of how firms manage knowledge as a component of ACAP from identification, storage and applications may indicate mechanisms that can be articulated proactively within firms. Generating an ACAP Diagnostic Instrument to identify, and guide firms in the application of learning through the dimensions of ACAP, is believed to be beneficial to entrepreneurs and Management teams. A management instrument to indicate paths available in different contextual situations that SMEs may face, additionally generating awareness of gaps and providing visibility to actions open to management engagement, may provide different outcomes for a firm.

Research Objective 4

To make policy recommendations that may facilitate ACAP practices in firms deemed to be high potential growth firms (HPGF).

As Chapter 3.2 will maintain, governments and the EU commission bodies are focusing on the generation of new knowledge as a path to economic and employment growth, this is sometimes achieved by classifying firms as high potential growth firms. These firms receive additional training and support based on their potential. A better understanding of the components of ACAP and how these components may affect a firm's ability to grow, might motivate policy makers to review the incentives they provide. An understanding of the ACAP components may create critical junctures that could be seen as 'conditional' to accessing funding or additional resources. It might also suggest more equitable investment conditions for different levels of SME growth.

1.3 Thesis structure

In order to provide a logical flow to the thesis, an outline of each chapter is now provided. The present chapter provides an introduction to the context of study, as well as an overview of the research question, scope and objectives.

Chapter 2 will consist of a chronological critical literature review covering the fundamentals of ACAP from the seminal work by Cohen and Levinthal (1990) to the current academic literature on the topic. The central theme of knowledge (Grant, 1996) and the links to ACAP (Cohen & Levinthal, 1990) will be explored. The forms that knowledge can take in a firm will be identified from previous research (Argote & Fahrenkopf, 2016) and from an extensive literature review. Critical to this chapter will

be the reframing of the original theory to include both the *potential* ACAP (PACAP) and *realized* ACAP (RACAP) approaches of the firm as proposed by Zahra and George (2002). This chapter will reveal the emergence and development of Dynamic Capabilities as an important strategic management approach for the firm. The intent is to build on work from previous process-based definitions of ACAP which includes Lane et al. (2006) and Todorova and Durisin (2007) and others. Lessons that have been learned in terms of flexible organisations including organisational slack and unlearning will be explored (Cepeda-Carrion et al., 2012; Wang et al., 2018) in terms of knowledge within the firm. Knowledge management and the role of Management will be presented in depth recognising the important role they play in the firm. The result will be to build on the extant literature and propose a novel progressive integrative process model. Further refinement of this model will lead to a framework that will facilitate ACAP engagement with multiple SMEs in an Irish context, as a focal point of the research.

Chapter 3 is the contextual chapter for the study of different levels of ACAP for SMEs in the Republic of Ireland. This chapter is presented as an historic summary of how successive Irish governments have cultivated the presence of Foreign Direct Investment (FDI) to drive economic growth and employment. This chapter will indicate recent shifts in policy and applications of investment strategies by policy makers. This chapter will articulate the early years of the state to the Celtic Tiger years, through to the end of the second decade of this new century for policy and investment in indigenous firms. The role and influence of the European Union through the European Commission in providing a European template for knowledge and growth will be explored. The recent focus on indigenous Irish firms and the emphasis on ‘born global’ to facilitate growth

will be discussed. The implications of these perspectives for SMEs and how policies are expected to influence the creation of new SMEs going forward will be highlighted.

Chapter 4 sets out the research methodology used to underpin this study. A multiple case approach will be employed in this research (Yin, 2002). A novel research design for engagement with SMEs throughout Ireland using the entrepreneurial lens of ACAP will be proposed. A description of the purposive selection of SMEs that meet the criteria as a path for generalisability of the findings will be proposed (Eisenhardt, 1989). This will include design, selection of cases and individually collecting data on each of the SMEs leading to a cross-case comparison in each cohort. A cross-cohort comparison of High Performers will be described as well as the implications for SMEs. This chapter will outline the coding to be applied at the analysis step using two levels of coding to facilitate the cross-case and cross-cohort comparison (Saldaña, 2016).

Chapter 5 will detail each individual case and how they met the criteria for selection. The framework defined in Chapter 2 will allow for a presentation of the SME interactions through this novel ACAP lens. The data for each individual case will be presented as the findings leveraging a diagnostic approach to indicate different levels of ACAP within each of the firms.

Chapter 6 provides a discussion of the research findings and a summary of the resultant findings from the cross-case and cross-cohort analysis for ACAP will be presented. Each of the three cohorts of the segmented data will be discussed. This will lead to a proposal for the application of a practical Diagnostic Instrument for future research before moving to Chapter 7.

Chapter 7 brings this study to a conclusion. Each of the individual objectives will be reviewed based on what was set out to achieve in answering the research question. The summarised findings are articulated in tabular form. This will lead to a description of the contributions made in three areas, contributions to Theory, contributions to Management practice and contributions to Methodology. The framework devised in Chapter 2 to engage with the SMEs will be revisited as a path to immediate research application. Limitations of this research will be stated based on time and scope. These will be discussed in two parts, Data issues and the Methodological issues of conducting this level of research in an Irish context. Recommendations for future research will be proposed utilising the proposed Diagnostic Instrument as well as implications for future managers, policy makers and researchers, in using such an instrument.

1.4 Summary of this chapter

This chapter has outlined the rationale for the research on ACAP in terms of highlighting the scope in the context of SMEs in late developer small states. This chapter has presented the research question and objectives. It concluded by outlining the structure of this thesis in terms of its constituent chapters. A review of the extant ACAP literature covering over thirty years is now presented in Chapter Two.

Chapter 2 Literature Review

Chapter 2 consists of a chronological review of the major literature developments relating to Absorptive Capacity (ACAP) over the last three decades (Cohen & Levinthal 1990). This approach was taken to highlight the evolution of the construct from its beginnings to what will be reported in section 2.4, a multidimensional construct as it is conceived in 2022. In the first decade it will be shown how the construct was conceptualised in its earliest format, building on theory predating the 1990 publication. The Cohen and Levinthal (1990) paper presented multiple challenges for the research community, given the broad scope of the publication. It will be shown how researchers explored the construct in this first decade attempting to validate the conceptualisation but also providing grounds for future research in the following decades. Two early challenges are explored in this decade, Dynamic Capability in its early articulation and what are described as *Determinants* of ACAP, which will be seen in subsequent decades described as *antecedents* of ACAP. The second decade witnesses a new phase and also ‘a time out’ for the construct, mid-decade, given the level of research being conducted during this decade. Dynamic Capabilities is again revisited by Zahra and George (2002) leading to a *creation* and *utilisation* of knowledge perspective that will be seen to influence the construct going forward. An integrative approach based on a bibliometric analysis over twenty years is carried out by Volberda et al. (2010) that provides a link for researchers entering the third decade. The third decade sees the emergence of both knowledge and knowledge management as key to the application of the construct. It is also in this decade that the attention shifts to the *role* of management and managing knowledge as well as Dynamic Capabilities within the firm. These topics are covered in

detail given the focus of this research is on learning and innovation in knowledge intensive SMEs.

2.1 Absorptive Capacity, 1st decade, an evolutionary decade

This chapter begins with the key elements of the seminal paper in 1990 by Cohen and Levinthal titled, *Absorptive Capacity: A new perspective on Learning and Innovation*.

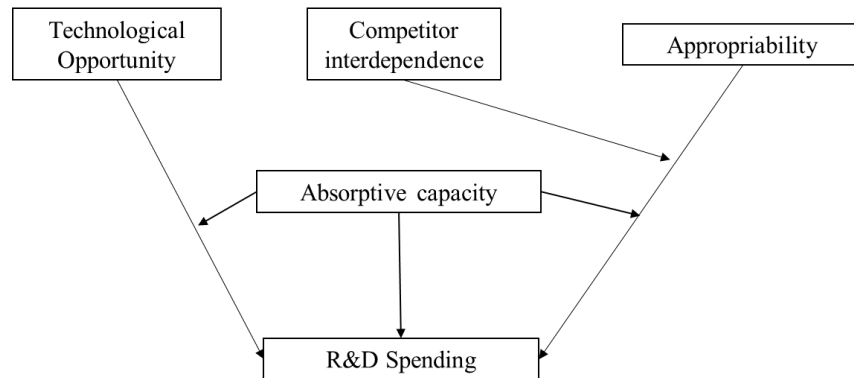
Cohen & Levinthal (1990) proposed in their paper that

The ability of a firm to recognise the value of new, external information, assimilate it and apply it to commercial ends is critical to its innovative capabilities. We label this capability a firm's absorptive capacity and suggest that it is largely a function of the firm's level of prior related knowledge. (p. 128)

With this definition of absorptive capacity for the firm, it suggested that ACAP was based on both the individual's prior knowledge and diversity, as well as being a function of firm's structure and routines. However, Cohen and Levinthal (1990, p. 131) caution against simply taking account of all the individual levels of ACAP in the firm, as a measure of ACAP for the firm. They suggested that ACAP would not be possible without considering the character and distribution of expertise within the firm. Since each firm has a diversity of individuals with varying experience and differing capacities to be innovative, ACAP was illustrated as varying depending on the challenges facing the firm. A measure of different levels of ACAP would prove to be challenging and cause a lack of clarity in the application of the construct. The construct would appear to challenge firms on their economic decision-making regarding investment in potential research paths to innovation. Cohen and Levinthal (1990, p. 138) did propose a model for calculating the intensity by which the firm addressed innovation and learning by proposing R&D spending as a percentage of sales. This however, did not take into account the intensity the firm took in the creation of ACAP within the firm and the

commitment in fostering a diverse and suitable level of experienced staff. It was recognised that the benefits of ACAP are indirect and allocating an optimal investment is hard to quantify (Cohen & Levinthal, 1990, p. 149).

Figure 2.1 – Model of Absorptive Capacity (ACAP) R&D incentives



Source: Cohen & Levinthal (1990, P. 140)

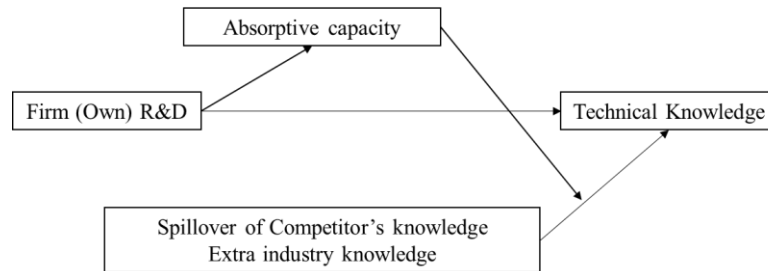
Cohen and Levinthal (1990) further suggested that the decisions that firms make to invest in R&D and learning are driven by the technology opportunity and potential for revenue exploitation. It is tempered by the competitive nature of the market and the difficulty of the learning process as indicated in the Figure 2.1 above.

ACAP mediates the R&D spending to address the opportunity and the potential to generate first mover advantage through e.g., patents or other means of market sustainability. ACAP also mediates the knowledge generated and the counteracting effect of market knowledge in a focus area which may affect the firms decision to invest in R&D and learning.

Figure 2.2 below highlights the flow of knowledge in representing how a firm generates new knowledge based on the commitment to R&D on a particular area or topic. A firm's own R&D efforts generate new technical knowledge. The other source of knowledge is the external environment through competitor knowledge spillovers Audretsch (2005) or through government or university labs. The firm's ACAP will

determine how much of the external knowledge will lead to new technical knowledge which coincidentally is determined by the firm's own R&D levels on this area.

Figure 2.2 – Model of sources of a firm's technical knowledge



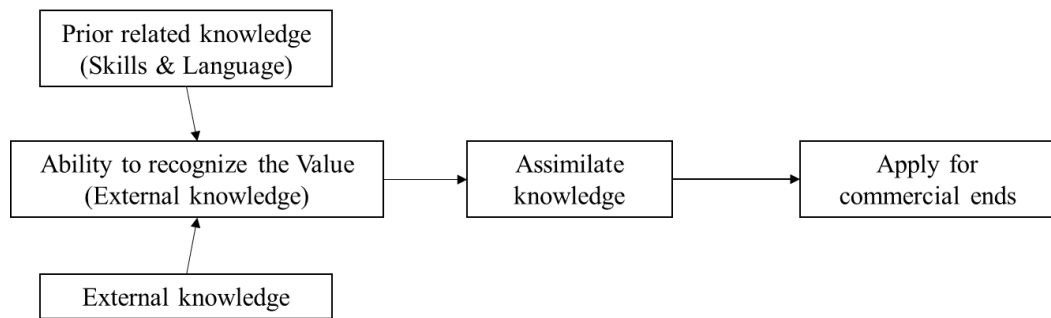
Source: Cohen & Levinthal (1990, P. 141)

In Cohen and Levinthal (1990) they referenced key roles in the construct for the transfer of knowledge for the firm, since knowledge flows inside the firm through defined process and routines of communication. These key roles were identified as boundary spanning roles or gatekeeper roles by Tushman (1997) which required the free flow and communication of knowledge in the firm. Even in this early period this indicates that ACAP was a managerial construct and best suited to the focus area of management research. Cohen and Levinthal proposed that innovation performance in a firm was path dependent. They predicted that decisions made in the past affect the future performance of the firm. The paper also proposed a firm's investment in expertise in the present may influence the future development of a technical capability and hence, the innovative capacity of the firm, in the future. Adding to the broad scope of the publication, Cohen and Levinthal proposed that ACAP was an operational and organisational construct. The publication also positioned the construct where different levels of ACAP might be evident in firms that are more proactive in exploiting opportunities that appear, regardless of the current performance of the firm. This made the comparison to firms

that might focus more on performance metrics resulting in the firm neglecting opportunities to invest for the future (Cohen & Levinthal, 1990, p.137).

A key point clarified from their paper was the articulation of ACAP as an *ability*. This ability of the firm to *recognise* the value of new knowledge through prior related knowledge and then being able to *assimilate* it and create a valuable return, as outlined in the Figure 2.3 below, led to the popularity of the construct and research to further clarify its application.

Figure 2.3 – Absorptive Capacity (ACAP) construct



Source: Cohen & Levinthal (1990, P. 129) adapted by the researcher

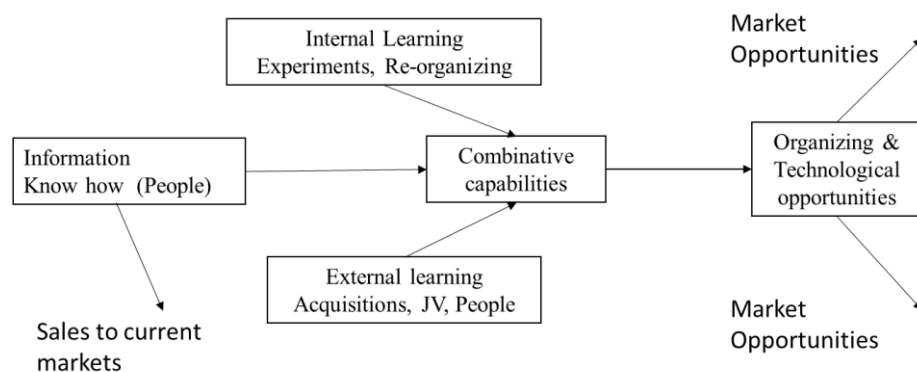
Cohen and Levinthal (1990) emphasise the ‘ability’ of the firm is to exploit external knowledge. This might also suggest that it was applicable to yet another research area of ‘strategy within the firm’. However, it was noted that the emphasis changes from ‘external information’ to the ability of the firm to apply ‘external knowledge’, a higher order of data, indicating yet another research area. From an innovation perspective this conversion from information to applied knowledge indicates a requirement for the firm to acquire a discipline of ‘capture and conversion’ of knowledge, noting a management perspective to the construct.

It was observed that one of the challenges with the Cohen and Levinthal (1990) paper was that it covered many topics while also providing an opportunity to integrate

constructs from previous authors. This chapter now proceeds to highlight the subsequent researchers and their work to further develop the ACAP construct.

For example, Kogut and Zander (1992, pp. 385-386) proposed that a firm shares and transfers knowledge from individuals and groups within the firm as ‘socially constructed’ interactions. They argue that the organising principles of knowledge sharing leads to a set of capabilities that are difficult to replicate. They further state that knowledge in the firm consists of information (who knows what) and know how (e.g., how to organise a research team). Both Cohen and Levinthal (1990) and Kogut and Zander (1992) in this same era, emphasise the key role of the ‘knowledge endowed individual’ in the firm and that knowledge is shared (communicated) in regular exchanges at a social level. Kogut & Zander (1992, p. 385) add to the discourse on innovation by suggesting that firms limit imitation of their activities through the ‘combinative capabilities’ of current knowledge and capabilities outlined in the Figure 2.4 below.

Figure 2.4 – Combinative capabilities that grow knowledge of the firm



Source: Kohut & Zander (1992, p. 385)

Without this combinative capability within the firm, a firm would be prone to failure with the loss of certain key individuals. For this reason, firms differ in their knowledge

endowment from other firms because this knowledge is operationalised in the organisational structure of each individual firm.

Creating new knowledge does not occur in abstraction from its current capabilities.

Rather, new learnings such as innovations, are outputs of a firm’s combinative capabilities to generate new applications from existing knowledge (Kogut and Zander, 1992, p. 391). The role of the individuals with the firm and their level of knowledge is outlined in the Table 2.1 below.

Table 2.1 – Codifiability of knowledge

	Individual	Group	Organisation	Network
Information	Facts	Who knows what	Profits, accounting Data	Prices to whom Contracts – who have what
Know-how	Skill of how to communicate Problem solving	Recipes of organising	Higher order organising principles of how to coordinate groups and transfer knowledge	How to co-operate How to sell and buy

Source: (Kogut & Zander, 1992)

Grant (1996) further supported the view that firms function, as the location where knowledge provided by the individual is ‘applied’ rather than where knowledge is created. Grant (1996, p. 112) makes two assumptions, firstly that knowledge creation is an individual activity and secondly the primary role of firms is in the application of existing knowledge for the production of goods and services. Grant further emphasised that learning takes place at an individual level, with the individual learning and storing knowledge. The challenge for organisations is to create or understand processes in which firms can access and utilise knowledge possessed by its individuals. The primary task of management according to Grant (1996) is to lead to the establishment and the coordination necessary for knowledge integration. Nonaka (1994) further developed the concept of knowledge endowment within the organisation by outlining a dynamic theory of knowledge conversion. This supports the assumption that new organisational

knowledge is created by human interactions among individuals with different types and different forms of knowledge. Nonaka introduced four modes of knowledge conversion which is outlined in the Table 2.2 below.

Table 2.2 – Knowledge conversion modes

	From...	To ...
Socialisation	Individual tacit knowledge	Group tacit knowledge
Externalization	Tacit knowledge	Explicit knowledge
Combination	Separate explicit knowledge	Systemic explicit knowledge
Internalization	Explicit knowledge	Tacit knowledge

Source: Nonaka (1994) Adapted by the author

Continuing to review publications in this decade it was Spender (1996) who suggested that managing knowledge is the basis of a *dynamic theory* of the firm. Spender indicated that knowledge is a problematic concept to be managed within the firm unless it is considered as a ‘knowledge-based activity system’ (Spender, 1996, p. 59). This will be explored later in the following decades building on this approach.

2.1.1 Dynamic Capabilities: an early introduction

As mentioned in the introduction to this chapter, Dynamic Capabilities thinking evolved with the ACAP construct. As the decade progressed, Teece et al. (1997) introduced a framework to address the Dynamic Capabilities associated with the ability of a firm to stay competitive. In their work they highlighted their assertion that firms need to continuously transform their knowledge capacities if they wish to retain a competitive advantage. It noted that there are ‘periods of uncertainty’ for the firm where winners are identified not by a fixed strategy but one that can respond rapidly and flexibly with product innovations as necessary. These are times where management teams can redeploy internal and external competencies differentiating the firm from the competition. They defined ‘Dynamic Capabilities’ in two parts (Teece et al., 1997, p.

515). Firstly, the term '*Dynamic*' refers to the capacity of the firm to renew or reimagine competences to align with the changing business environment. Secondly, they define the term '*Capabilities*' to emphasise the role of strategic management. This is the role managers apply that allows the manager to make choices for adapting, integrating and reconfiguring internal and external skills, resources and important functional competences of the firm, to meet the changing environment.

A challenge with innovation in any firm is the need for 'strategic choice'. The choices strategic managers need to make in terms of competencies development, limits what can be spent elsewhere in the firm. Firms typically follow a strategic path which can be dictated by the history of the firm. The notion that competitive advantage requires both exploitation of existing internal and external firm specific capabilities and the development of new ones was proposed by Teece et al. (1997, p. 515). Their definition outlined the organisational aspects of learning to achieve new and innovative forms of competitive advantage.

We define dynamic capabilities as the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. (Teece et al., 1997, p. 516).

Although later in this decade, it is worth noting that Eisenhardt and Martin (2000) took a resource based view (RBV) to Dynamic Capabilities. In this view it maintained that Dynamic Capabilities consist of well-known processes such as alliancing, product development, and strategic decision making. They also argue that Dynamic Capabilities exhibit some commonalities across firms, where best practices, do exist. Their work suggests that in moderately dynamic external environments, routines are embedded in cumulative existing knowledge. In contrast, in dynamic external environments, the most effective routines are adaptive, providing real-time information, multiple options, and experimentation that generate fast knowledge cycles to replace any analysis. In some

ways Eisenhardt and Martin (2000) link the work of Kogut and Zander (1992) and Teece et al. (1997) definitions in the ability of the firm to generate a competitive advantage. The combinative capabilities from Kogut and Zander (1992) were described earlier in the decade. Later in this chapter the importance of Dynamic Capability will be revisited based on additional insights for ACAP.

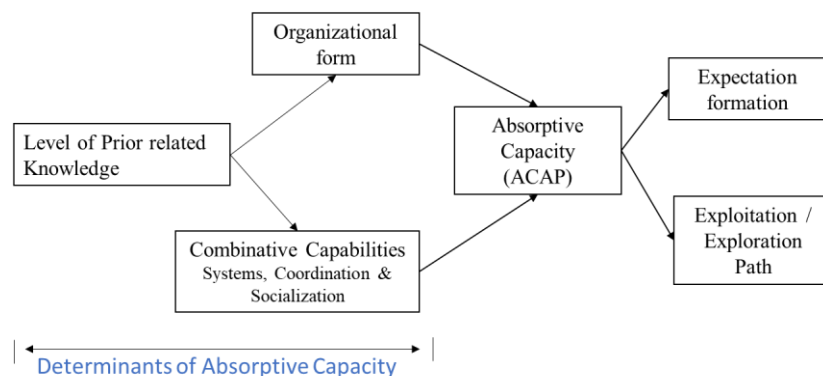
2.1.2 Determinants view of Absorptive capacity

Van der Bosch et al. (1999) proposed a revised process view of Cohen and Levinthal (1990) ACAP construct by asking three questions relative to ACAP.

What are important organisational determinants of Absorptive Capacity?
 How does Absorptive Capacity influence the knowledge environment?
 How can a firm's absorptive capacity be understood as a joint outcome of managerial actions and developments in the knowledge environment?

These questions facilitate the collective learning of the decade relative to ACAP in the process flow model outlined below in Figure 2.5.

Figure 2.5 – Determinants of Absorptive Capacity and Expectation formation



Source: (Van den Bosch et al., 1999)

Van den Bosch et al. (1999) built on the ‘simplistic generalisation’ of ACAP as it applies to the individual and the organisation proposed by Cohen and Levinthal (1990, p. 135) by outlining visually in the Figure 2.5 above, what was referred to as

expectation formation. These expectations are path dependent based on investment by the firm in learning that historically may have generated positive outcomes or in other cases redirected resources from execution of revenue generating activities. Van den Bosch et al. (1999) highlight the ‘combinative capabilities’ within the organisation structure that allows coordination and socialisation as well as job rotation and training in an approach to socialisation and exchange of knowledge. The benefit of these determinants is that they allow for the flow of prior knowledge while allowing for the development of new knowledge which may be explored or exploited to the benefit of the firm.

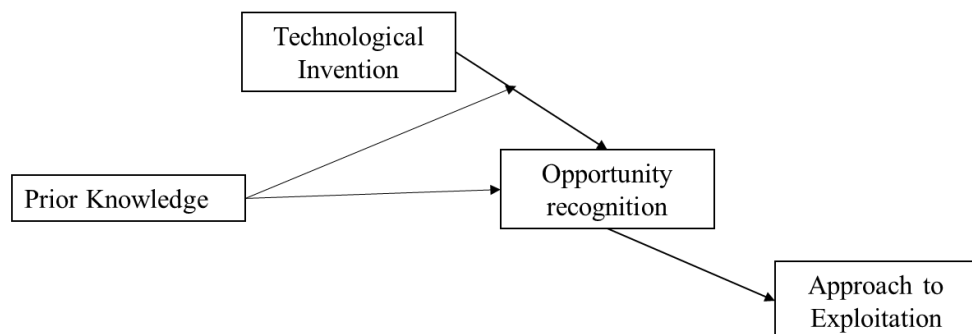
Firms confronted with changing knowledge environments need to ‘reconfigure’ their component knowledge according to Van den Bosch et al. (1999, p. 552). They indicate component knowledge can take three forms. Firstly, knowledge related to products or services, secondly knowledge related to production processes and finally, knowledge related to markets. Management of these components is seen as a ‘critical skill’ within the firm.

Component knowledge can consist of both explicit and tacit knowledge. Building on the work from Grant (1996) and the main role of management, as the establishment of processes for the integration of knowledge, where Van den Bosch et al. (1999, p. 552) describe ‘knowledge absorption’ in three different dimensions of, *efficiency*, *scope* and *flexibility*. In changing environments where changes in organisational form are necessary, changes in combination capabilities can be driven by macro-economic mechanisms. These dimensions consist of changes in competitive dynamics, institutional and industry environment can lead to changes in expectation of the firm. The organisational structure, rigidity and changes in combinative capabilities impact the absorptive capacity of the firm. Expectation formation was indicated as the historical

accumulation of past investment history which can contribute to expectation formation going into the future. This expectation formation can be self-reinforcing both positively and negatively. This in turn leads to the firm's attitude to be proactive or not, in being exploratory and/or exploiting opportunities in the environment. Van den Bosch et al. (1999, p. 551) inferred that research relating to ACAP indicated that only prior knowledge determined the level of ACAP, to this point in the development of the construct. They suggested that two organisational determinants should also be considered as impacting ACAP, Organisational forms and Combinative capabilities as illustrated in the Figure 2.5 above.

Before leaving this decade, two final points on prior knowledge as an antecedent to ACAP are discussed supporting the Cohen and Levinthal proposal. Prior knowledge was investigated from an entrepreneurial perspective by Shane (2000). The importance of this work was that the focus was on the ability of entrepreneurs to 'identify' possible opportunities where others would not. This links start-ups and the new business development area of discovery, with established firms, and the antecedents to exploration leading to the discovery process in the Figure 2.6 below.

Figure 2.6 – Conceptual model for Prior knowledge



Source: Shane (2000) Modified by the author

What can be inferred from the exploration of ACAP in this first decade, as previously referenced, is that the firm consists of individuals with experience and knowledge that exists in certain forms and contexts, based on different experiences. Shane (2000) further emphasises this in terms of the entrepreneur by stating that individuals have different stocks of knowledge based on their life experiences. Luck plays a part in obtaining these stocks of knowledge. As such at any point in time, some people will know more about a market, technology, problems to be solved than others, leading to the entrepreneurial decisions of certain individuals Shane (2000, p. 370). This will be important to consider in Chapter 5 as the SMEs are allocated into different cohorts.

The final paper of this decade to be reviewed, as an early indication of ACAP challenges and understanding of the construct, was Autio et al. (2000). In this paper the researchers indicate that both an orientation to international markets and being born global (BG) early, can affect levels of ACAP based on a sample of firms in Finland. Getting exposed to markets early allows young firms to grow while they are learning and that learning is most efficient in domains close to existing knowledge bases (Autio et al., 2000, p. 911). It is also proposed by the authors that firms that are more mature will develop learning impediments that can affect how firms learn in new environments. The authors observe that the flexibility evident in young firms diminishes with age, while in young firms this is seen as an enabler to growth (Autio et al., 2000, p. 919).

As has been presented in this first decade, ACAP had been embraced by the research community and articulated in different ways both questioning and collectively building on the construct for further exploration in the next decade. As was noted above, one of the challenges with the Cohen and Levinthal (1990) paper was that it covered many topics while also providing an opportunity to integrate constructs from previous authors.

2.2 Absorptive Capacity, 2nd decade, a consolidating decade.

During this second decade following the publications by Cohen and Levinthal (1990), ACAP continued to be researched through a variety of interests. What will be presented here is that ACAP evolved and expanded into a more complex construct. A general discussion in this section is followed by some key concepts that required additional discussion. Once this is completed the third decade will be discussed.

Some researchers went back to the original paper to realign the research community with the original intent of the publication. The research community further progressed the thinking around the individual knowledge and how the firm provides a structure for the '*conversion*' of external knowledge from or internally to the organisation. As the decade progressed, the ability of managers to 'manage knowledge' became a focused research effort. Sveiby (2001) in the paper, '*Knowledge based theory of the firm to guide in strategy formation*', indicated that value creation in a firm lies in the effectiveness of knowledge communication and transformation.

In contrast to tangible goods, which tend to depreciate in value when they are not used, knowledge grows when used and depreciates when not used. (Sveiby, 2001, p. 346)

Sveiby (2001) included the work of Nonaka et al. (1996) writing that it is the team in a firm that benefits from sharing knowledge in a process of socialisation. Sveiby (2001) outlined a knowledge strategy in terms of four heuristics. Firstly, recruit the most highly educated staff. Then create a collaborative environment for staff to mix, also indicating that keeping the organisation flat will help with communication. Finally, that firms should invest in new technology for communication.

Sveiby (2001, p. 345) observed that people are the only true agents in a firm, all tangible physical products, assets as well as intangible relations are the result of human

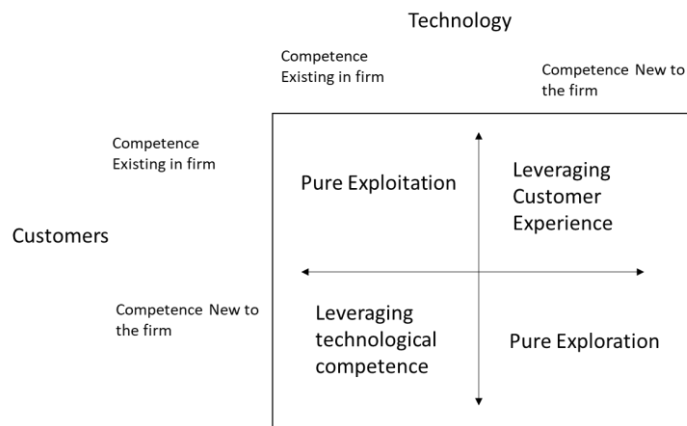
action. Knowledge ultimately depends on people for its continued existence. Tasi (2001) further expanded the concept of individual knowledge sharing to the intra-organisational network. Building on the work from the previous decade from Kogut et al. (1992), organisational learning through knowledge sharing leads to firms' ability to innovate. Sveiby (2000, p. 347) noted that 'knowledge shared is knowledge doubled'. He also noted that a knowledge-based strategy should start with people as the primary resource within a firm. Tsai (2001) referred to knowledge as being 'sticky'. Implying that once adopted it can be hard to change or that it continues to remain within an organisation. Along with other authors (Szulanski, 1996; von Hippel, 1994) the competitive advantage of the firm is the ability of the firm to access and integrate this 'sticky' knowledge. Tsai (2001, p. 998) continued to emphasise that firms with relevant prior knowledge are better able to understand new technologies and how they may generate new ideas and new products which supported the observation proposed by Shane (2000). This also suggest that Cohen and Levinthal (1990) agreed as they stated

This prior knowledge includes knowledge of the most recent scientific or technological developments in a given field. Thus, prior knowledge confers an ability to recognise the value of new information, assimilate it and apply it to commercial ends. (page128).

Danneels (2002) emphasised the dynamics of product innovations and firm competencies by indicating that in a process of generating new products, it is in itself an organisational learning tool. Danneels defined a second order learning competency as the 'ability' to identify, evaluate and incorporate new technological and or customer competencies into the firm. This insight highlighted that existing 'customers' can be a source of 'needs learning' and 'technology identification' which might serve as prior learning for future product innovations. This was a variation from classic theory by Penrose (1959) of finding the right pieces (resources) of the jigsaw puzzle to combine

and recombine within the firm to supply a product. For new product development this requires the combining or recombining of customer (external) and technology competencies internal or external to produce a solution. Danneels (2002, p. 1104) indicated the differences between exploration and exploitation in terms for the firm. Exploitation is described as learning activities involving the use of resources the firm already has, and exploration as learning activities that lead to the addition of new resources. In the Figure 2.7 below Danneels (2002) indicates the differences in competencies for both technology and markets. This framework is based on existing knowledge of the development of competencies for new markets and new technology. As such Danneels (2002) argues that technologies and market (customers) are firm competences that can be leveraged to build new firm competencies. Taking a proactive approach and recognising these competences captures the external environment for ACAP development.

Figure 2.7 – Competence-based new product typology



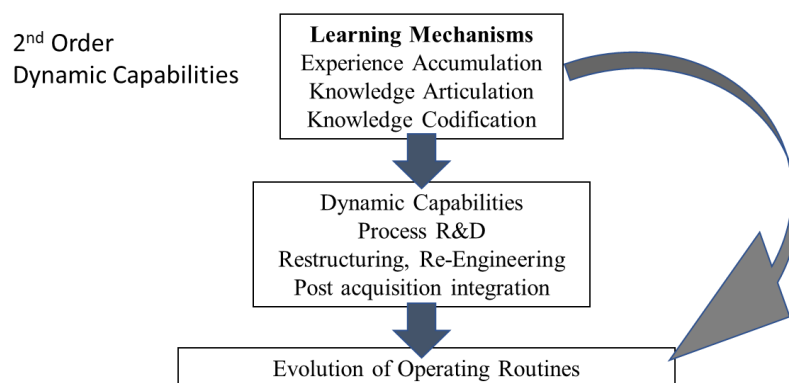
Source: Danneels (2002, p. 1105)

2.2.1 Dynamic Capabilities evolution

As was pointed out in the first decade, Teece et al. (1997) introduced the concept of Dynamic Capabilities which was evolving in tandem with ACAP. The theme of

Dynamic Capabilities was revisited by Zollo and Winter (2002) with their paper exploring the previous work of Teece et al. (1997). They proposed a view of the organisation as the ‘learning organisation’ through the generation of routines for work practices. They hypothesised that organisational learning evolves through experience accumulation over time, as well as a reflective practice to articulate and then provide the codification of knowledge. Zollo and Winter (2002, p. 340) emphasise that a Dynamic Capability is a ‘learned and stable’ pattern of collective activity, where the organisation systematically generates and modifies its operating routines to result in improved effectiveness. Their process outlined below in Figure 2.8 indicates that learning is a second order capability required by the organisation for prioritisation, leading to a habit-forming mechanism requiring practice. Codification of knowledge follows knowledge articulation.

Figure 2.8 – Learning, Dynamic Capabilities and Operational Routines



Source: (Zollo & Winter, 2002)

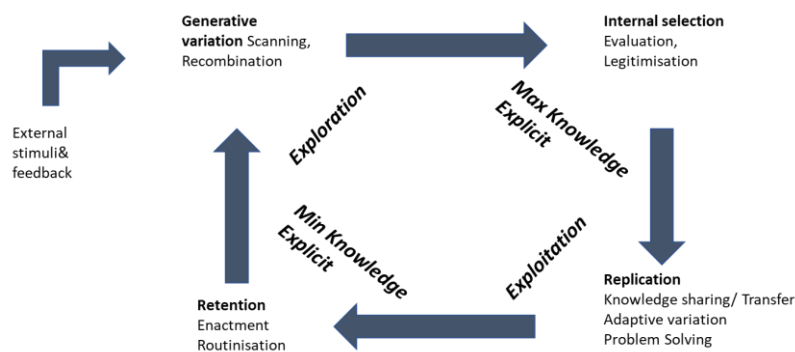
Zollo and Winter (2002) outlined four guiding principles for codification of knowledge.

Codification aimed at developing and transferring “know why” as well as “know how”. Codification efforts should emphasise at an appropriate time in the course

of learning. Codified guidance to be tested by adherence. Codification needs support structure. (page 339)

Zollo and Winter (2002) went on to highlight an approach of collective understanding for organisational tasks as a means to demonstrate how Dynamic Capabilities and operational routines evolve over time. It was proposed that it is an indication of the development of collective learning which occurs over time through a series of stages. As outlined in the Figure 2.9 below, these stages allow for external stimuli and internal knowledge to be combined within the firm resulting in new operational processes.

Figure 2.9 – Activities in the knowledge Evolution cycle

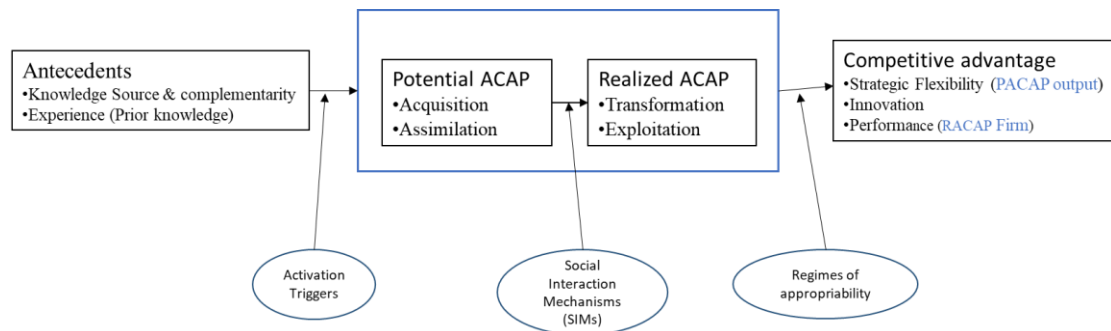


Source: (Zollo & Winter, 2002)

Building on this evolving understanding in this decade of Dynamic Capabilities, Zahra and George (2002) in their seminal paper attempted to resolve some of the difficulties of *interpreting* and *applying* ACAP as a construct. They proposed that Dynamic Capabilities include knowledge ‘*creation*’ as well as knowledge ‘*utilisation*’ in generating a competitive advantage. Dynamic Capabilities are embedded in organisational processes with the intent to provide organisational change and evolution. Zahra and George (2002) indicate that Dynamic Capabilities enable the firm to

reconfigure its resource bases and adapt to changing external environment conditions in order to achieve a competitive advantage. Zahra and George (2002, p. 185) introduced two subset (related) capacities, Potential Absorptive Capacity (PACAP) and Realized Absorptive Capacity (RACAP) outlined in Figure 2.10 below. Potential ACAP is comprised of two capabilities, knowledge *Acquisition* capability and knowledge *Assimilation* capability, while Realized ACAP is comprised of knowledge *Transformation* capabilities and knowledge *Exploitation* capabilities. It was hypothesised that Potential ACAP provides the firm with the flexibility to react in uncertain environments, whereas Realized ACAP is more aligned with performance metrics.

Figure 2.10 – Model of Absorptive Capacity with PACAP and RACAP subsets



Source: (Zahra & George, 2002) Adapted by the author

The key points from this seminal paper by Zahra and George (2002, pp 193-194) are described below

Complementarity – knowledge related to, and different from, internal knowledge.

Prior knowledge also includes prior relevant experience of employees that is relevant to the firm.

Activation triggers are defined as events that force the firm to react to given stimuli (a shock). This could be for example, uncertainty in the environments at the PACAP level.

Building on the work of knowledge exchange as a social mechanism, (Nonaka, Ikujiro. Umemoto, Katsuhiko. Senoo, 1996) and Sveiby (2001) *Social Interaction Mechanisms* (SIMs) is an additional mechanism leading to, (bridging), the two capabilities of Potential and Realized ACAP.

Regimes of appropriability – Institutional and industry dynamics that affect the firm's ability to protect the advantages of (and benefit from) new products or processes (Zahra & George, 2002, p. 196). The dimensions or capabilities of both PACAP and RACAP are listed in the Table 2.3 below. These will be referenced later in Chapter 5.

Table 2.3 – Dimensions of ACAP. A reconceptualisation of Components

Dimensions/Capabilities	Components	Role and Importance
Acquisition	Prior investment Prior knowledge Intensity Speed Direction	Scope of search Perceptual schema New connections Speed of learning Quality of learning
Assimilation	Understanding	Interpretation Comprehension Learning
Transformation	Internalization Conversion	Synergy Recodification Bisociation
Exploitation	Use Implementation	Core competencies Harvest resources

Source: (Zahra & George 2002 p. 189)

A further detailed description of the impact of the Zahra and George (2002) paper is outlined in this section emphasising the shift in understanding of the ACAP construct following this publication. The articulation of ACAP as a Dynamic Capability indicates that a firm may operate in two different dimensions, one that is stable and one that can be unpredictable. This reflects the nature of a real-world organisation by recognising ACAP as a Dynamic Capability, one that influences the nature of the firm's competitive

advantage. ACAP is indicated as a Dynamic Capability pertaining to knowledge *creation* and *utilisation* that enhances a firm's ability to gain and sustain a competitive advantage (Zahra & George , 2002, p. 185). Perceiving ACAP as a Dynamic Capability, it allows exploration of its different antecedents and outputs. It also recognises that ACAP is 'amenable' to management actions to define and redefine the firm's knowledge-based assets. Zahra and George (2002, p. 191) indicated that PACAP and RACAP have separate but complimentary roles in the firm. These sub-capacities also coexist at all times and fulfil a necessary but insufficient condition to improve firm performance. At a high PACAP level it does not necessarily imply high performance. One scenario is where a firm can meet customer needs and is generating a return for the business with its current offering. In another where a firm exists in an unstable environment reflects a period when solutions and customer needs are not readily explicit and hence solutions may not be available.

Narver et al. (2004 p. 338) suggested that these differing environments can be described as a firm having a responsive or proactive market orientation both being positively related to innovation orientation. Responsive orientation is where the firm responds to explicit customer needs. Proactive orientation is where the firm positions itself to meet customer latent needs. In periods of uncertainty, the orientation of the firm should reflect the PACAP capabilities of generating knowledge. In periods of knowledge understanding, the firm should reflect the RACAP capabilities with returns on investments. This state of turbulence, or not, in the firm's environment focuses the attention of management on knowledge as the dominant source of advantage. A dilemma can exist where firms that focus on PACAP only, in that, while they are able to continually improve their knowledge stock, they may suffer from the cost of such a focus, if they cannot generate a return on their investment in PACAP. Conversely firms

focusing on the RACAP may benefit from achieving short term profits, but may suffer from a long-term competence shortfall, if they do not invest in new knowledge stocks to respond to environmental changes in the future. Zahra and George (2002, pp. 191,195) indicated that PACAP and RACAP have separate, but complimentary roles.

Jansen et al. (2005) proposed that the orientation that a firm takes, is due to the organisational antecedents of ACAP that the firm experiences. Merely being exposed to new knowledge is necessary, but it is not sufficient to convert it to an innovation and new products as a firm's output. Organisational mechanisms must exist to recognise the value of the new knowledge and then internalize it. Jansen et al. (2005) built on the work of Kogut and Zander (1992) and the 'combinative capabilities' and map three organisational capabilities as antecedents to the two parts of the Zahra and George (2002) ACAP construct. Jansen et al. (2005) stated these three organisational capabilities reduce the distance between PACAP and RACAP. This would tend to indicate that the collective researchers in this period were building on earlier research to better understand this ACAP construct given that it was a complex construct. The three capabilities are listed below in Table 2.4 Coordination capabilities, System capabilities, Socialisation capabilities. It is noted that firms with well-developed PACAP improved their performance in dynamic environments, while firms with well-developed RACAP do not necessarily increase performance in dynamic environments, rather, exploitation may even decrease performance in dynamic environments (Jansen et al. (2005, p. 1010).

Table 2.4 – Organisational Antecedents linkage to PACAP and RACAP

Capabilities	Organisational Mechanisms (Typical)	Potential ACAP Acquisition & Assimilation	Realized ACAP Transformation & Exploitation
Coordination Capabilities	Cross functional interfaces	Enhances knowledge acquisition & assimilation	Enables employees to combine sets of existing and new knowledge
	Participation in Decision making	Exposure to external knowledge sources through “receptors” & interplay between diverse knowledge structures enables PACAP	Difficulty in gaining consensus and decentralization hampers information processing efficiency decreasing RACAP
	Job rotation	Enables acquisition and assimilation by relating existing knowledge to new knowledge	Enhances awareness of employee’s knowledge and skills in other functional areas. Increases transformation & exploitation of the new external knowledge
System Capabilities	Formalization	Rules, procedures, instructions and communications formalised, written. A frame of reference that constrains exploration efforts, directs attention toward restricted aspects of external knowledge. Inhibits knowledge interaction and hinders individual’s assimilation of new external knowledge	Supports the retrieval of knowledge that has already been internalized. Increases the likelihood the employees will identify opportunities to transform new external knowledge
	Routinization	Limits the search for new external knowledge and narrows the scope of information processing	Provides efficient structures for collective action and decreases efforts spent on decision making and implementation. Permits exploitation of knowledge in pursuing collective objectives
Socialisation Capabilities	Connectedness – density of linkages	Facilitates knowledge exchange. Dense networks are advantageous for developing trust and cooperation. It limits the openness of information to alternative ways of doing things – Collective Blindness. Inhibits acquisition & assimilation of new knowledge	Develops trust and cooperation and fosters commonality of knowledge. Reduces the likelihood of conflict regarding goals and implementation. Allows units to transform and exploit new external knowledge
	Socialisation	Increase the commitment of unit members to past policies and procedures. Creates Mental prisons. Hampers the ability to tap into new external knowledge sources	Lead to strong social norms and beliefs, which enhance commitment and compliance with exploitation process for new external knowledge
In Dynamic Environments (the impact of market dynamism)	P1010	PACAP gives greater flexibility to reorganise resources & effectively time knowledge deployments at lower cost -> competitive advantage. Firms with well developed PACAP improved their performance in dynamic environments.	RACAP – product might revert to an industry standard and become obsolete. Selectively act on PACAP and exploit only certain aspects of newly acquired knowledge. Well developed RACAP do not necessarily increase performance in dynamic Environments

Source: (Jansen et al., 2005) Adapted by the author

In reviewing the description above in Table 2.4 covering the impact of Zahra and George (2002) on the ACAP construct, it is now outlined that other researchers began to look at the new subset capabilities, PACAP and RACAP. Fosfuri and Tribó (2006) studied only the Potential ACAP based on a sample size of 2,464 innovative Spanish companies for the importance of antecedents in innovation. It was concluded by Fosfuri and Tribó that ACAP is a multidimensional construct (Fosfuri & Tribó, 2006, p. 184). Activation triggers may be internal or external but they cause the firm to react to a given stimuli or shock. This reaction is in terms of how the firm acts in acquiring and assimilating knowledge. It is also indicated that Zahra and George (2002) accepted that RACAP will only be a fraction of PACAP and that the magnitude of this 'efficiency fraction' depends on the firm's ability to integrate. Social Interaction Mechanisms (SIMs) were another form of emphasis on the importance of communication of knowledge referenced by Cohen and Levinthal (1990). Fosfuri and Tribó (2006, p. 185) emphasised the important nature of the external environment to firm performance. The research pointed out the important role of external linkages in the process of experiential learning that drives accumulation of PACAP. Firms that participate in collaborative R&D and market-based transactions in R&D, develop a stronger ability to understand and assimilate knowledge flows. It was shown that gaining experience in knowledge search is a key antecedent of PACAP. In focusing on the external environment, it was noted that path dependency for this skill serves the firm long term and firms that practice this skill with R&D show higher rates of knowledge accumulation and innovation measures with new products launched. The important role that PACAP plays in firms was evident in that higher levels of PACAP capability systematically obtains a larger share of their sales from new or substantially improved products. Fosfuri and Tribó (2006, p. 185) indicated that the PACAP dimension is a

strong driver of competitive advantage. These findings are similar to the findings of Zahra and George (2002, p. 191) that PACAP needs RACAP to execute on the advantages gained with the high levels of PACAP. Zahra and George (2002) concluded that their model of ACAP as being a dynamic capability of the firm.

In 2006 Zahra et al. introduced a paper building on the prior work but in the context of 'entrepreneurship' and the role of Dynamic Capabilities play as a firm matures. Before expanding on this view, Table 2.5 summarises the research on dynamic capabilities up to that year of 2006. This table indicates some of the discrepancies in applying the Dynamic Capability uniformly in a firm. It also highlights the varying definitions of Dynamic Capability and how it addresses what was seen as inconsistencies in its application.

Table 2.5 – Key definitions of dynamic capabilities

Author	Definition
Helfat (1997)	The subset of the competences/capabilities which allow the firm to create new products and processes and respond to changing market circumstances.
Teece et al (1997)	The firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments.
Eisenhardt and Martin (2000)	The firm's processes that use resources- specifically the processes to integrate, reconfigure, gain and release resources- to match or even create market change. Dynamic capabilities thus are the organisational and strategic routines by which firms achieve new resources configurations as markets emerge, collide, split, evolve and die.
Griffith and Harvey (2001)	A global dynamic capability is the creation of difficult-to-imitate combinations of resources, including effective coordination of inter-organisational relationships, on a global basis that can provide a firm a competitive advantage.
Lee et al. (2002)	A newer source of competitive advantage in conceptualizing how firms are able to cope with environmental changes.
Rindova and Taylor (2002)	Dynamic capabilities evolve at two levels: a micro-evolution through 'upgrading the management capabilities of the firm' and a macro-evolution associated with 'reconfiguring market competencies'
Zahra and George (2002)	Dynamic capabilities are essentially change-orientated capabilities that help firms redeploy and reconfigure their resource base to meet evolving customer demands and competitor strategies.
Zollo and Winter (2002)	A dynamic capability is a learned and stable pattern of collective activity through which the organisation systematically generates and modifies its operating routines in pursuit of improved effectiveness
Winter (2003)	Those that operate to extend, modify or create ordinary (substantive) capabilities.

Source: (Zahra et al.,2006, p. 992)

Zahra et al. (2006) contribute three key topics to this research. As outlined in the Table 2.5 they indicate there are some inconsistencies of the various definitions of Dynamic Capabilities. Secondly, they position Dynamic Capabilities in the context of both the younger and the more established firms and finally by referencing learning theory they offer a view of the evolution of substantive capabilities and Dynamic Capabilities for firms that differ in age and learning styles.

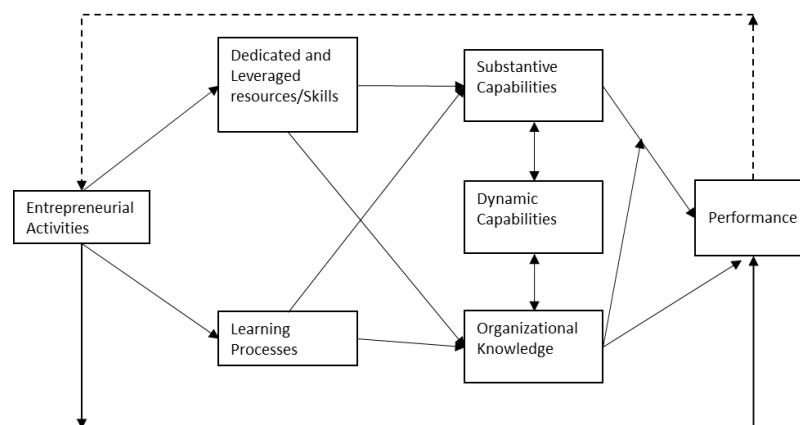
By introducing the difference between the young firm and the established firms, one can believe that a young firm has to survive by having unique and dynamic capabilities.

Whether it is the external environment that drives the need for efficiencies or internal requirements of scarce resources, the management of the resources will be ongoing and cumulative, in learning. Equally Zahra et al. (2006) outlined a revised definition of Dynamic Capabilities

..the ability to reconfigure a firm's resources and routines in the manner envisioned and deemed appropriate by the firm's principal decision makers (page 918).

To emphasise this need to continually manage and be proactive with substantive (ordinary) capabilities Zahra et al. (2006) generated a capability flow diagram represented in Figure 2.11 below. In the diagram, the starting point is the firm's entrepreneurial activities. It is explained that these activities influence the selection of resources and skills and promote organisational learning processes to capture external knowledge as the situations arise.

Figure 2.11 – A Stylized model of capability formation and performance



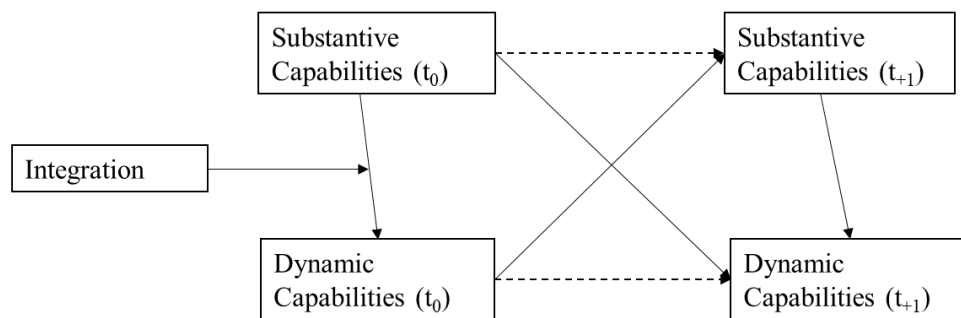
Source: (Zahra et al., 2006, p. 926)

How and what a firm learns and how they change depends on their history and the 'developmental stage of the firm's processes' (Zahra et al., 2006, p. 932). These choices combine to create new substantive capabilities and enhance the organisation's knowledge base. Organisational knowledge is the set of 'all that is known' or understood by the organisation and its members, whereas the firm's substantive capabilities are 'the set of things that a firm can do'. Together, organisational knowledge and substantive capabilities determine which Dynamic Capabilities are necessary to adapt to emerging conditions (Zahra et al., 2006, p. 925). This revised definition also indicates a level of management decision making required to be effective.

What a firm can do, then, is shaped by what it knows. What a firm knows, is affected by what it does. In environments that require the firm to adapt quickly, it is the organisational knowledge and substantive capabilities that determine which Dynamic Capabilities are necessary to adapt. Zahra et al. (2006, p. 943) argue that the effect of Dynamic Capabilities on performance will depend on the quality of the organisational knowledge base. They argue that there are managerial implications in that it is managers' (entrepreneurs) visions and their integration skills that make a difference in directing the development of substantive capabilities. The managerial challenge that exists for entrepreneurial or established firms is the need to establish a systematic openness for upgrading and revising their substantive capabilities through a variety of learning modes and approaches. A spiral of learning and testing outlined by Levinthal and March (1993, p. 104) caution that management plays a role in ensuring that the 'spiral of learning' is positive and reinforcing knowledge for the firm. The alternative is that without this insight, learning can be a negative spiral where knowledge becomes more specialised where it does not add to the firm by creating value. Reinforcing this

approach, as outlined in the Figure 2.12 below emphasises that firms that have a propensity to realise the advantages of accruing Dynamic Capabilities depends on two factors. Firstly, the need to change, secondly the wisdom of the chosen changes (Zahra et al., 2006, p. 942). Substantive capabilities precede Dynamic Capabilities. Over time the relationship between substantive capabilities becomes complex and interlinked .

Figure 2.12 – Evolutionary path dependent Processes in Dynamic Capability development



Source: Zahra et al., (2006)

An alternative was proposed the following year by Wang and Ahmed (2007) that addresses the importance of the dynamic capabilities and linkages to firm resources. It is important to note that the RBV emphasis on resources and capabilities as the genesis for competitive advantage, is that resources are heterogeneously distributed across different firms. The firm has the choice to enter different markets based on their Valuable, Rare, Inimitable, and non-substitutable (VRIN) resources at the firms disposal. However, these resources can be mobile, not static over time, which in turn can lead to equifinality in the marketplace. Wang and Ahmed (2007) indicate that the ability of the firm to apply resources sooner and more precisely than competitors is a Dynamic Capability, in practice. Dynamic Capabilities according to Wang and Ahmed (2007, p. 32) encapsulate the evolutionary nature of resources and capabilities to enhance the RBV. In turn they

provide another definition of Dynamic Capabilities not just as processes, but as “embedded processes” within the firm.

“We define dynamic capabilities as a firm’s behavioural orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage.” (Wang & Ahmed, 2007, p. 35)

In relation to ACAP, the link between ACAP and Dynamic Capabilities is made by stating that ‘the more a firm demonstrates its absorptive capability, the more it exhibits Dynamic Capabilities’ (Wang & Ahmed, 2007, p. 38). They conclude that for managers to effectively interact within a firm, managers can chart the development of Dynamic Capabilities by considering three common factors within the firm that are specific to the firm and that capability development is time dependent. They are identified as

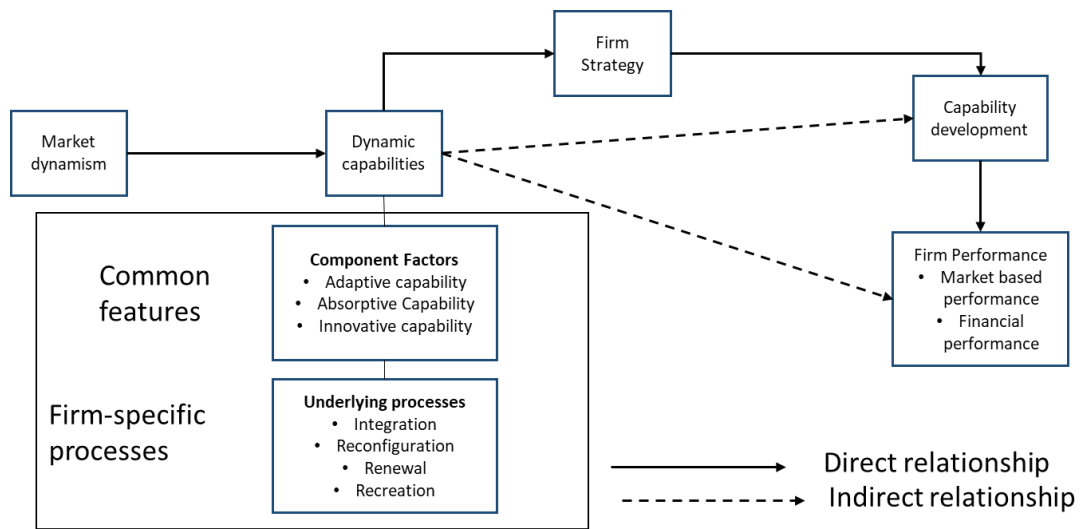
Adaptive capability: Adaptive capability with a focus on effective search and balancing exploration and exploitation strategies. (Staber & Sydow, 2002)

Absorptive capability: (Cohen & Levinthal, 1990). Leveraging the firms’ ability to recognise, assimilate and exploit external knowledge. Zahra and George (2002) indicated 4 different capabilities, Acquisition, Assimilation, Transformation and exploitation

Innovative capability: Innovative capability refers to a firm’s ability to develop new products and/or markets, through aligning strategic innovative orientation with innovative behaviours and processes. (Wang & Ahmed, 2004)

Wang and Ahmed (2007, p. 39) argue that adaptive capability, absorptive capability and innovative capability as shown in Figure 2.13 are the most important component factors of Dynamic Capabilities and underpin a firm’s ability to integrate, reconfigure, renew and recreate its resources and capabilities in line with external environmental changes. They also note that these three factors are correlated, but conceptually distinct.

Figure 2.13 – A research model of Dynamic Capabilities



Source: Wang & Ahmed (2007, p. 39)

What has been discussed in this section is the evolution of Dynamic Capabilities from different perspectives. What is evident, is that ACAP has evolved into a Dynamic Capability with antecedents and that managerial engagement to react to the differing conditions of the firm is necessary to drive performance.

2.2.2 A reification of the construct

Lane et al. (2006) effectively take ‘a time out’ in terms of ACAP theory evolution. Given its timing, it influenced much of the research going forward from this point. Their paper calls this ‘time out’ by discussing the reification of Absorptive Capacity relative to the original intent of the papers provided by Cohen and Levinthal between 1989, 1990, and 1994. For this paper, the definition of reification is

Lukacs used reification to describe the tendency to discuss labour as an abstract concept without acknowledging the workers performing the productive activities. Berger and Luckmann more generally defined the concept of reification as perceiving ‘the products of human activity as if they were something else than human products’ (1966:89-90) seemingly exogenous entities detached from their origins. Reification is the outcome of the process by which we ‘forget’ the authorship of ideas and theories, objectify them (turn them into things) and then forget that we have done so. (Lane et al., 2006, p. 835)

Lane et al.(2006) revisited the original work of Cohen and Levinthal (1990) and captured the key findings from their collective papers captured in the Table 2.6.

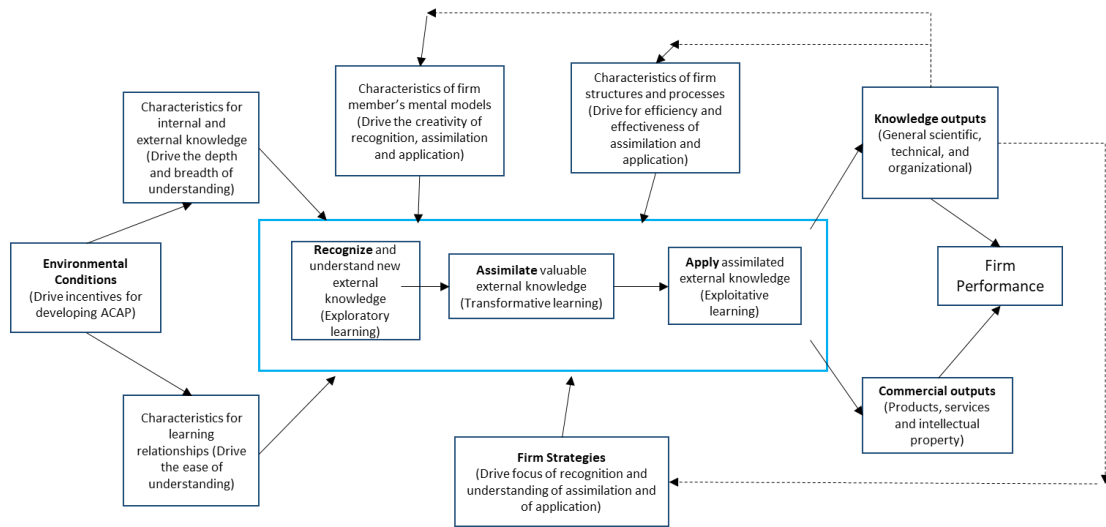
Table 2.6 – Summary of Cohen & Levinthal papers 1989, 1990, &1994

Guiding paper	Insights from individual papers
Innovation & Learning, the two faces of R&D, Economic Journal 1989 (Cohen, W., & Levinthal, 1989)	They present absorptive capacity as a learning process and implicitly as a capability- a potential ability. Merriam – Webster’s Collegiate dictionary P838 Through its R&D activities a firm develops organisational knowledge about certain areas of science and technology and how those areas relate to the firm’s products and markets (ability to identify and value external knowledge) P839
Absorptive Capacity, a new perspective on Learning and Innovation, Administrative Science Quarterly 1990 (Cohen & Levinthal, 1990)	This paper uses research on individuals’ cognitive structures and problem solving to develop a richer explanation of the construct that puts more emphasis on the processes underlying this type of organisational learning. Individual’s learning is cumulative and learning is greatest when the object of learning is related to what the individual already knows. P838 Over time the firm develops processes, policies and procedures that facilitate sharing that knowledge internally. P839
“Fortune favors the Prepared firm”, Management Science 1994 (Cohen & Levinthal, 1994)	A firm’s absorptive capacity is depicted as a capability that not only enables the firm to exploit new external knowledge but also allows it to predict more accurately the nature of future technological advances. P838 The firm becomes skilled at using knowledge to forecast technological trends, create products and markets
Summary of papers	Together these processes define a firm’s absorptive capacity as the ability to identify and value external knowledge, assimilate it and commercially apply it

Source: (Lane et al., 2006) adapted by author

With the summary of the papers and the insight with a review of all ACAP published literature between 1991 and 2002, Lane et al. were able to provide the following view in Figure 2.14 of ACAP, in terms of antecedents, processes and outputs as a more encompassing version of the ACAP construct.

Figure 2.14 – A process model of Absorptive capacity, its antecedents and its outcomes.



Source: (Lane et al., 2006 p. 856)

The focus was on the “learning process-orientation” of the construct, providing a starting point through incentives for action or management drivers, and an end point, the outcomes of the endeavour. Explaining the process model, it is defined as having four components. At the centre is the new definition of ACAP of *recognising, assimilating and applying* external knowledge. To the left are drivers of ACAP partially or totally external to the firm. Above and below are drivers internal to the firm. To the right are the outcomes of their process. Lane et al. (2006, p. 856) stated a more detailed definition of the Absorptive Capacity construct as a firm’s **ability** to utilise externally held knowledge through three sequential processes

*Recognising and understanding potentially valuable new knowledge outside the firm through **exploratory learning***

*Assimilating valuable new knowledge through **transformative learning***

*Using the assimilated knowledge to create new knowledge and commercial outputs through **exploitative learning***

In their summary Lane et al. (2006, p. 859) expressed their assertion that ACAP was a major construct in organisational research.

2.2.3 Firm Impact of Knowledge Management and Open innovation

Throughout this decade the role that management plays in ACAP and the importance of knowledge management within the construct is emphasised by many authors. It can be noted that Zahra and George (2002) indicated that ACAP could be described as knowledge *creation* and knowledge *utilisation*. In Narver et al. (2004) maintain that the orientation of the firm reflects whether the firm takes a Proactive or Responsive market orientation leveraging either the existing knowledge stocks or improving the firm's knowledge stock. In both papers, and a continuing theme during this decade, was the attention given to 'knowledge' as the dominant source of advantage for the firm. For example, du Plessis (2007) links the importance of knowledge management to innovation. du Plessis (2007, p. 20) maintains that for successful innovation, firms must create, build and maintain a competitive advantage through the utilisation of knowledge (in use) and collaborative practices (social practices). The author further indicates the important role of knowledge management in innovation since it is complex and, uncertain and that 'knowledge availability' helps reduce this complexity. The timely availability of knowledge to allow new insights through sharing, refinement (assimilation) at the point of need, is critical. Knowledge management platforms, tools and processes facilitate reflection and dialogue for teams and organisational learning and innovation. A prescriptive definition of Knowledge management was proposed

knowledge management is as a planned, structured approach to manage the creation, sharing, harvesting and leveraging of knowledge as an organisational asset, to enhance a company's ability, speed and effectiveness in delivering products or services for the benefit of clients, in line with its business strategy. Du Plessis (2007, p. 21)

An association made in the paper is that where knowledge is not made explicit and shared through a knowledge management culture, a firm's innovation performance will be adversely affected.

Age impact

Gray (2006) suggested with the data collected by the Small Enterprise Research Team (SERT team) in the UK, during 2003/2004 relating to 2,100 respondents, it provided support to du Plessis' proposal, in that management must play a key role in overt knowledge management in the firm. Gray (2006, p. 345) proposed that the age of the firm as an SME and the educational level of the owners affect the growth orientation of the firm. It was also noted that those growth orientated firms which have higher educated owners provide more formal training and they engage more in more informal and experiential learning leading to higher associated ACAP (Gray, 2006, p. 352). A concerning finding in Gray's (2006) work was that as SMEs age, the managerial motivation to grow appears to diminish. This would seem to overlap with the findings from earlier in the decade where older firms appear to develop learning impediments when comparing firms in Finland (Autio et al., 2000).

Management impact

Laursen and Salter (2006) continue the theme of managerial impact in innovations within a firm where they introduced 'breadth' and 'width' as two components of the openness of the firm's search strategies. They found that firms that engage in wide and deep searches tend to be more innovative (Laursen & Salter, 2006, p. 146). They found that external search depth was associated with radical innovation. The data used for this study was sourced from the U.K. innovation survey for the period 2001 and 2002. While open innovation as a concept was introduced in the early 2000's, the concept is covered by Chesbrough and Appleyard (2007) linking strategy and open innovation. It

was noted by Laursen and Salter (2006, p. 146) that a firm may reach an optimal point of external search where gains in innovation are limited and may subsequently be detrimental to the firm beyond that point where diminishing returns set in. Lichtenthaler and Lichtenthaler (2009) proposed a capability-based framework for Open Innovation linking to knowledge management in Table 2.7, by outlining the difference between internal knowledge and external knowledge. Here it was indicated how different forms of knowledge can be managed within the firm in terms of knowledge exploration, retention and exploitation. This also provided a reference to ACAP as a knowledge management capability and one that the firm's management must make a commitment to prioritise for the firm.

Table 2.7 – Managing knowledge for open innovation

	Knowledge exploration	Knowledge retention	Knowledge exploitation
Internal (Intrafirm)	Inventive Capacity A firm's ability to explore knowledge to generate new knowledge inside the firm	Transformative capacity Refers to a firm's capability of internally retaining knowledge over time	Innovative capacity Innovative capacity comprises the process stages of transmuting knowledge and converting this knowledge into new products or services. As knowledge may be developed internally or acquired from external sources innovative capacity represents the realized, exploitive component of ACAP
External (Interfirm)	Absorptive capacity In a knowledge management capacity comprises the process of acquiring external knowledge and assimilating this knowledge by means of incorporating it into the firm's knowledge base.	Connective capacity Refers to a firm's ability to retain knowledge in interfirm relationships, it comprises elements of alliance capability, and relational capability. External networks have to be maintained and managed overtime. In contrast to ACAP external knowledge retention does not assume inward knowledge transfer	Desorptive capacity Desorptive refers to the process of desorbing which constitutes the reverse of absorbing. Desorptive capacity describes a firm's capability of external exploitation, which is complimentary to internal application in a firm's own products. Hence it can be defined as a firm's ability to externally exploit knowledge

Source: Lichtenthaler & Lichtenthaler (2009, p. 1318) Adapted by the author.

2.2.4 Successes and Failure determinants of Innovation

As indicated in Chapter 1, the data suggests that successful innovation practice in firms is challenging. In the following discussion, ACAP links to innovation outcomes, are explored. One of the links that Cohen and Levinthal (1990) made was the link between firm performance and the innovativeness of the firm. They considered the role that ACAP can have on influencing the aspirational goals of the firm. Innovation within a firm is typically instigated due to a failure to reach some firm aspirational level, whether performance of product or market goal (Cohen and Levinthal ,1990, p. 137). Typically, this performance aspiration level is based on a level being set to a target decided in the past, through strategic processes and practices within the firm. The managerial experience or cognition in reacting to these situations can influence how the firm reacts in the future. However, the firm level of ACAP will also affect the firms sensitivity to future technology and markets. Cohen and Levinthal (1990, p. 137) indicate that the higher the level of ACAP for a firm, the more likely the firm will be proactive and exploit opportunities present in the environment, independent of the current environment. Similarly, organisations with lower levels of ACAP will tend to be more reactive in finding solutions to some shortcomings of performance. The ability or practice of a firm to predict common shortcomings in performance might be beneficial and useful for a firm if they develop standard practices within the firm through Dynamic Capabilities (Eisenhardt & Martin, 2000). Van der Panne (2003, p. 310) referred to the work of Cozijnsen et al. (2000) where it was indicated that only one in five innovation projects initiated were successful in their study of Dutch firms. Some important questions asked following this data were, what factors can be influential in driving success in a firm, and what factors are more likely going to drive failure and how can ACAP influence this performance?

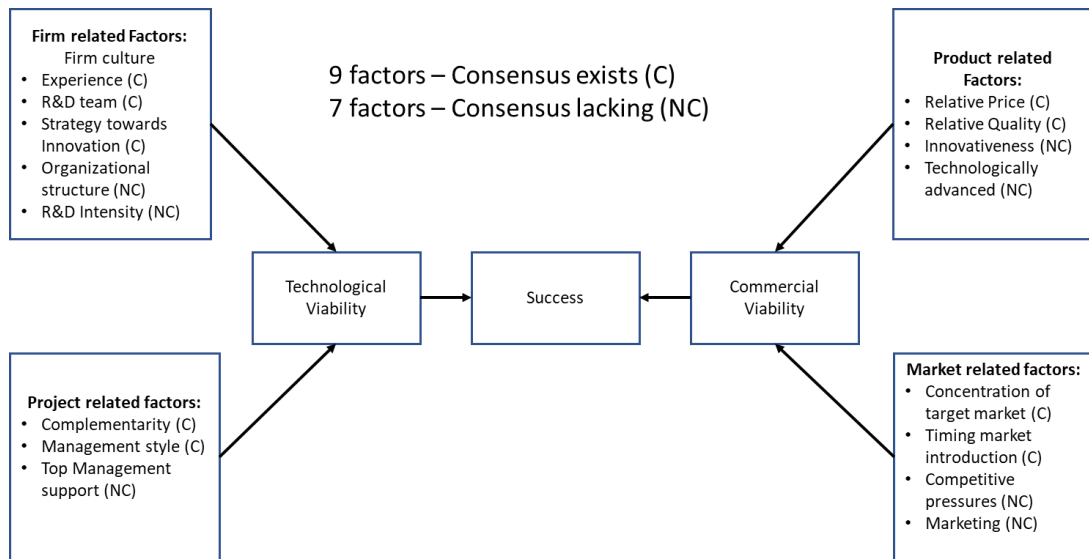
Attempts to answer this challenge have been undertaken by various efforts

Scientific Activity Predictor from Patterns with Heuristic Origins (SAPPHO)
study in the UK in 1970's
Professor R. Cooper New Product understanding in the 1980's
Stanford Innovation Project

While these efforts highlighted different factors, for example research by Cooper (1993) indicated that three factors are important. Firstly, the innovator's knowledge of the market. Secondly some predictability of the future of the market and finally, a product's synergy with the firm's overall technology and manufacturing resources.

It was Maidique and Zirger (1984) following the Stanford Innovation Project who argued that "success is the outcome of a wide range of firm and project related factors". No one single factor is the magic bullet. In an attempt to further quantify the elements of a successful innovation, van der Panne et al. (2003) completed a literature search of 43 different literature studies reporting a large number of possible causes for success or failure in innovation. These related factors were deemed either based on Commercial or Technological viability. The Technological factors included firm related factors which were stated as e.g., the innovation culture. The Project related factors included, alignment to the firms resources and management style. For reasons of Innovation being a strategic effort with ongoing processes, the researcher considers relabelling the Project related factors to "Innovation Process" definitions when a firm is operating over the long term. In terms of Commercial viability, two major factors were identified, Product related and Market related. Each showing consensus with factors such as Pricing and Quality in the Product. While in the Market, factors such as concentration of the market and timing to enter the market were key factors. A graphical representation of the Critical factors is listed in Figure 2.15 below.

Figure 2.15 – Critical factors for innovative success



Source: van der Panne et al. (2003). Note to the figure C indicates that consensus exists. NC indicates that no consensus exists.

Segmentation of the innovation types into innovative or technologically advanced factors is nuanced. This indicates that a broad consensus exists that the relevance of strong marketing skills within the firm, with customer involvement in the innovation process, would generally lead to an innovation project’s success.

2.2.5 Absorptive Capacity and Organisational learning

It was at the end of this decade that the relationships between ACAP and Organisational Learning (OL) were explored by Sun and Anderson (2010) maintaining that the precise nature of the two constructs had not been established. From the initial papers by Cohen and Levinthal (1989, 1990) and referenced in Table 2.6, learning has been their focus as well as innovation in their ‘new perspective’ of the ACAP construct. In the review so far, in the second decade (2010 era) in the development of ACAP, a connection has been presented in this thesis that knowledge, the individual and the organisation working in concert, leads to the sustainability of the firm. What Sun and Anderson

(2010) suggested was a connection between ACAP and OL that leveraged the work of Crossan et al. (1999) which previously made the connection between organisational renewal and organisational learning is appropriate. Using a 4I Model suggested by Crossan et al., (1999, p 525) the model connects the individual, the group and the organisation learning mechanisms and are indicated in Table 2.8.

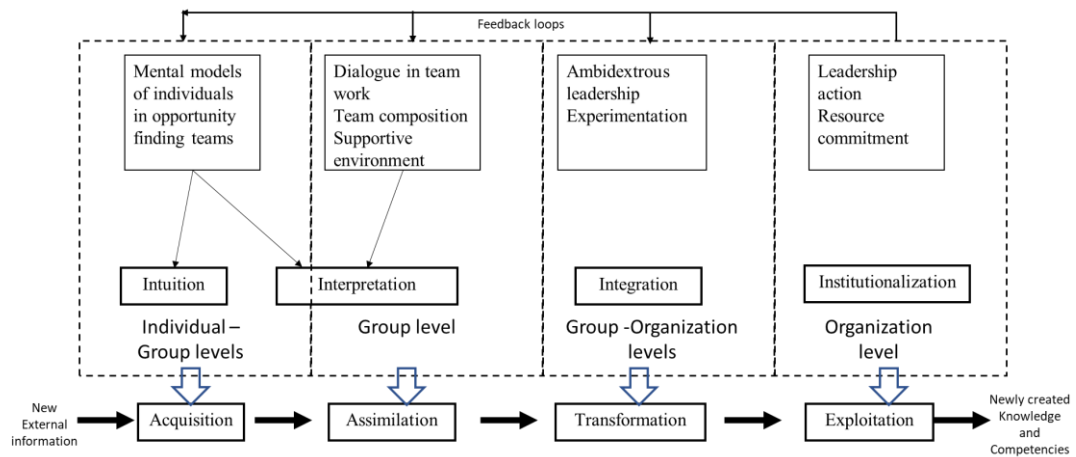
Table 2.8 – Learning or renewal in organisations: four processes through three levels

Level	Process	Inputs/Outcomes
Individual	Intuiting	Experiences Images Metaphors
	Interpreting	Language Cognition map Conversation/dialogue
Group	Integrating	Shared understanding Mutual adjustment Interactive systems
Organisation	Institutionalizing	Routines Diagnostic systems Rules & Procedures

Source: Crossan et al. (1999, p. 525)

Crossan et al. (1999, p. 522) proposed that for renewal to be strategic, it must encompass the whole organisation, not simply an individual or group. Since one of the outputs of ACAP is to effect innovation performance, this would tend to suggest that for innovation to occur, the whole organisation needs to be affected by organisational learning and followed by the application of this learning in a cross functional way. Where Sun and Anderson (2010) built on the work of Crossan et al. (1990) they proposed a Process flow for both ACAP and OL indicating the relationships that may exist as shown in Figure 2.16. This relationship was indicated as a Dynamic Capability within the whole organisation leading to strategic renewal of the firm.

Figure 2.16 – A dynamic capability view of ACAP and Organisational Learning



Source: Sun & Anderson (2010, p. 142)

What this visual would appear to indicate is, that each of the Zahra and George (2002) dimensions of ACAP can be linked to the 4I model and levels of learning articulated by Lane et al. (2006) at the individual, group and organisational levels.

2.2.6 An integrative approach to the ACAP construct at the end of the decade

A Google scholar search revealed that Zahra and George (2002) ‘*A review reconceptualisation and extension*’, has been cited over 14,000 times (dated July 2022) and it clearly has had a major influence on the way researchers approach ACAP. While introducing the Dynamic Capabilities that exist in ACAP, the two subset capacities of Potential Absorptive Capacity (PACAP) and Realized Absorptive Capacity RACAP have been debated in terms of the dimensions/capabilities and the components of each subset. In a contrarian approach, Todorova and Durisin (2007) suggest substantive changes to the model proposed by Zahra and George (2002). A Google scholar search indicated that Todorova and Durisin (2007) has been cited just 3,000 times. The additions to the conceptual developments are outlined in Table 2.9 below.

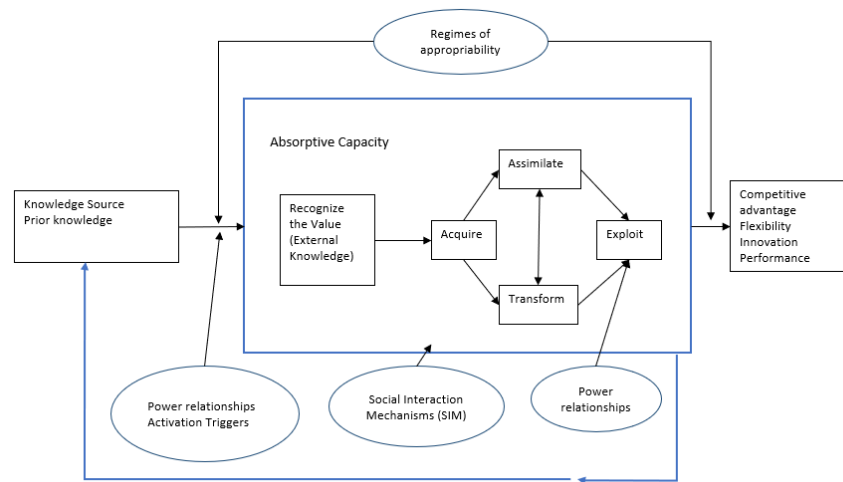
Table 2.9 – Key changes to PACAP and RACAP

Proposed enhancement Zahra & George 2002 model	Description of the additional component
Recognising the value	This is the initial step in the ACAP construct
Knowledge transformation	Is not the step after knowledge assimilation but an alternative process linked to assimilation by multiple paths
Social Interaction Mechanisms (SIMs)	Accepting ACAP as a set of organisational routines SIMs can affect transformation but also other components of ACAP. Not just a bridge between PACAP and RACAP. SIMs can affect the firm both positively and negatively
Power relationships	This contingency factor can affect both the valuing and exploitation of new knowledge
Feedback loop	To capture the dynamic aspects of the construct a feedback learning loop is added

Source: Todorova & Durisin (2007, p. 775) adapted by author

The process changes and flow proposed by Todorova & Durisin (2007) are indicated in Figure 2.17 below

Figure 2.17 – Alternative ACAP model



Source: Todorova & Durisin (2007, p. 776)

By exploring the key additional insights proposed by Todorova and Durisin (2007) it can be seen that they significantly contribute to the ‘operationalisation mindset’ of the ACAP construct pervasive in this decade. Todorova and Durisin (2007, p. 775) recognise ACAP as a set of organisational routines as did Zahra and George (2002).

They indicated the contingency factor of social integration mechanisms must influence the transformation as well as other dimensions in both a positive and negative way. A second contingency is introduced, power relationships, which can both influence the valuation and exploitation of new knowledge. In line with learning theory, they introduce the prospect of feedback loops recognising the incremental learning that happens in typical innovative endeavours.

Additional contributions to their model of ACAP are indicated below,

Recognising value. This dimension refers to Cohen and Levinthal (1990) as an important initial step in the ACAP construct. This value adds to an organisational behaviour of being cognitively proactive in this initial step.

Assimilation or Transformation. While not disagreeing with Zahra and George (2002) with regard to the addition of assimilation and transformation of knowledge as different components to the construct, they see a difference in how firms should approach these two dimensions. Todorova and Durisin (2007, p. 778) indicate that a firm may transform not as a consequence of, but as an alternative process to assimilation knowledge. They propose that firms may transform their knowledge structures when knowledge cannot be assimilated. They further propose that knowledge may move back and forward between transformation and assimilation components before they are finally incorporated into organisational knowledge structures and then ready for exploitation.

Value Creation: the potential and the realized. Todorova and Durisin (2007) challenge the value of PACAP and RACAP as two separate sub capabilities within ACAP. The efficiency measure proposed by Zahra and George (2002) as the ratio of RACAP to PACAP provides a limited benefit to the firm. A more appropriate measure is the ratio of knowledge entering the boundaries of the firm and the knowledge embodied in

successful new process and products as more useful ones that can be analysed, Todorova and Durisin (2007, p. 780). They suggest the measure of the ratio of the available knowledge and applied knowledge after each component or phase can be used as an efficiency factor for knowledge absorption.

Social Interaction Mechanism (SIMs) introduced a way to reduce the barriers between assimilation and transformation of knowledge by Zahra and George (2002). This built on the importance of communication indicated in Cohen and Levinthal (1990, p. 136). Todorova and Durisin (2007, p. 781) proposed that the previous version of SIMs was a limited application of SIMs. They proposed that SIMs have a moderating influence on all components of ACAP in both a positive and a negative way, depending on the specific contingencies. Depending on the 'weak tie' or 'strong tie' relationships of SIMs and the type of knowledge process and the degree of knowledge complexity, they may constrain or accelerate the flow of knowledge into the firm.

Regimes of appropriability were proposed by Cohen and Levinthal (1990) as incentives or barriers to invest in ACAP. Firms with weak appropriability (low returns) regimes have lower returns to the knowledge absorbed and as such are a moderator to ACAP. Todorova and Durisin (2007, p. 782) propose that regimes of appropriability have a moderating effect on the consequences of ACAP, its sustainable competitive advantage as well as the knowledge sources. As such it can be an antecedent and an output of the ACAP construct.

Power relationships are added to the model in terms of the cognitive processes, learning and capabilities of the firm. Todorova and Durisin (2007, p. 782) argue that the power relationships influence both the absorption of new knowledge and on valuing and exploiting new knowledge. Building on the work of Danneels (2002) they recognise the power relationship that customers may have on the successful absorption of new

knowledge into innovative new products. This was highlighted by Christensen (1997) where he indicated that customers can often play an active role in a firm's competence development through their influence on the new products a firm pursues to the detriment of the firm.

Feedback loops were conceptualised by Cohen and Levinthal (1990) in terms of communication within the firm. Zahra and George (2002) reminded us that the path dependency referenced by Cohen and Levinthal (1990, p. 128) of ACAP are linked to prior experience and knowledge investment. Todorova and Durisin (2007, p. 782) propose that feedback loops reflect the learning cycles in innovation, which is path dependent, and that this is a better way of capturing the dynamic arguments of the construct.

Accumulating absorptive capacity in one period will permit its more efficient accumulation in the next. By having already developed some absorptive capacity in a particular area, a firm may more readily accumulate what knowledge it needs in the subsequent periods in order to exploit any critical external knowledge that may become available (Cohen & Levinthal, 1990, p. 136)

As such Todorova and Durisin (2007) add and compliment the Zahra and George (2002) dimensions of ACAP mid-decade.

Bibliometric review in the 2nd decade

The final contribution to be referenced in this decade is by Volberda et al. (2010). This paper is assessed as being important, not just for this decade but it provided a summary through a bibliometric review and analysis of the first twenty years since Cohen and Levinthal (1990) published their paper. A literature search of Volberda et al. (2010) indicated it has been cited over 1,500 times, and is seen to summarize and contribute to the knowledge in this field in an 'operationalised view' of the construct. Volberda et al. (2010) reveal that Cohen and Levinthal (1990) put R&D at the centre of the firm's

innovation processes by linking learning and innovation. They also indicate that ACAP overlaps with themes and fields of management practice such as cognition, knowledge and the important Dynamic Capabilities at work in a firm. Some of the key streams related to ACAP are summarised in the Table 2.10 below giving indicating the contributors, ACAP references and implications. In addition, a brief summary of the key theories are outlined in the following notes.

Learnings are described as the early roots of R&D and innovation. These are rooted both at an individual level as well as at the organisational level. Investments in R&D are focused on sustaining the firm long term but also aimed at developing future capabilities for the firm through early investment in learning.

Innovation plays a role in the important task of expanding the firm's capabilities to assimilate externally available information.

Managerial cognition is recognised as an important factor in how the firm manages R&D, learning and innovation, since managers perceive reality through their own cognitive lenses.

..Managers can be considered 'cognizers' who reduce the complexity they face by developing mental maps that result in a 'dominant logic'. This dominant logic evolves over time, directly influencing the organisational form and indirectly the level of ACAP. (Volberda et al., 2010, p. 933)

ACAP has been shown to this point as a multidimensional construct with antecedents, knowledge conversion and transformation leading to commercial benefits of the knowledge.

Knowledge based view – considers knowledge to be the most important resource of the firm. Knowledge grows when used and depreciates when not, as referenced by the knowledge-based view of the firm emphasised by Sveiby (2001, p. 346). Knowledge stocks and flows are constructs that are related to recognition, assimilation, and

utilisation of new knowledge. The combination capabilities of knowledge play an important role for a firm

Dynamic capabilities recognise PACAP and RACAP sub capabilities. This dynamic capability requires investment and practice.

Coevolution is introduced in support of a theory of evolution whereby ACAP enables or restricts the level and range of exploration adaptations.

Volberda et al (2010, p. 936) make the argument that ACAP is the joint outcome of managerial actions and developments in the knowledge environment.

The details of the study carried out by Volberda et al. (2010) outlined major discrepancies in the organisational field through this bibliometric analysis over twenty years. The analysis was carried out by the Centre for Science and Technology Studies, Leyden University. Their analysis was based on 1,213 publications from 1992 – 2005 and they noted three major findings

*Most attention so far has been focused on the tangible outcomes of ACAP
Organisational design and individual antecedents have been relatively neglected
in ACAP literature
The emergence of ACAP from the actions and interactions of individual,
organisational, and interorganisational antecedents remain unclear*

Table 2.10 – Theories informing Absorptive Capacity

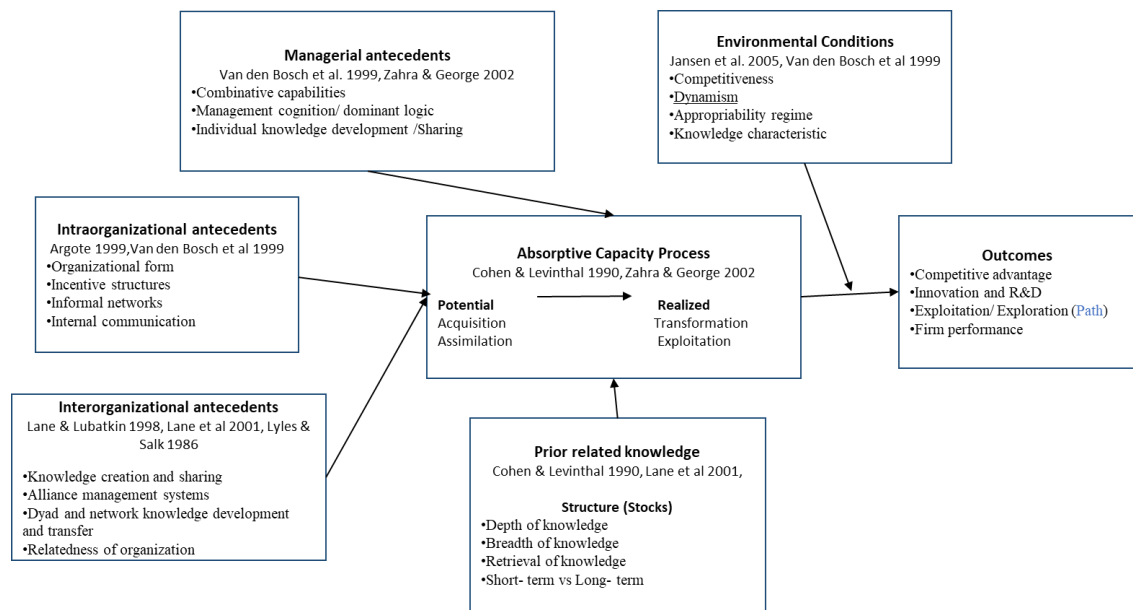
Theories	Main Contributions	ACAP- related constructs	Implications
Learning	Fiori & Lyles (1985) Levitt & March (1985) Cohen & Levinthal (1989, 1990) Lyles & Salik (1996) Lane & Lubatkin (1989) Lane et al., (2001) Reagans & McEvily (2003) Dhanaraj et al (2004) Lane et al (2006)	Organisational learning is based on direct experience and routines, history dependent and target orientated, and influenced by contextual factors	ACAP consists of three dimensions, recognition, assimilation, and exploration, Interorganisational context matters for ACAP Levels of analysis, individuals, organisations, dyads, and networks
Innovation	Kadia & Bhagat (1998) Cohen & Levinthal (1989, 1990) Cockburn & Henderson (1998) Feinberg & Gupta (2004) Rothaermel & Alexandra (2009) Benson & Ziedonis (2009)	The influence of technological opportunity and appropriability regimes on innovation is mediated by ACAP. R&D and ACAP interact to increase a firm's knowledge base and innovation. There is more to ACAP than just R&D, several Interorganisational characteristics play a key role	ACAP influences innovative performance. As a by-product of R&D Cultural differences between countries affect ACAP Interorganisational context matters for ACAP
Managerial cognition	Bettis & Prahalad (1986, 1995) Lyles & Schwenik (1992) Calori et al., (1994) Dijksterhuis et al (1999) Van der Bosch et al (2001) Sanchez (2001) Lenox & Knig (2004) Minbaeva et al (2003)	Complexity tends to be resolved by a dominant logic. More diversity in a firm's activities increased the comprehensiveness and complexity of the CEO's mental map of the environment. Management logics greatly influence a firm's actions in the competitive landscape as well as the emergence of new organisational forms. Providing information by managers as well as individuals' abilities and motivations enhances ACAP	Management logics, through organisational forms, influence absorptive capacity. Managers can develop ACAP by directly providing information Individuals' abilities as well as their motivations enhance ACAP
Knowledge based view of the firm	Kogut & Zander (1992) Starbuck (1992) Garud & Nayvar (1994) Grant (1996a, b) Van der Bosch et al. (1999) Van Wijk et al. (2003) Foss & Pedersen (2004)	Combinative capabilities play a key role in leveraging Organisational knowledge. The knowledge characteristics of the environment influence the characteristics of the knowledge absorption by the firm. Organisational form determines the characteristics of ACAP. Network properties influence the level of ACAP.	High ACAP increases the amount and productivity of knowledge Combinative capabilities, organisational form, and knowledge characteristics all influence the firm's ACAP

	Andersen & Foss (2005) Malhotra et al (2005) Matusik & Heeley (2005)		ACAP is particularly relevant when knowledge is shared
Dynamic capabilities	Cohen & Levinthal (1994) Grant (1996b) Van der Bosch et al. (1999) Floyed & Lane (2000) Zhara & George (2002) Jansen et al (2005) Lichtenthaler (2009)	ACAP is a capability and this requires investments. ACAP being itself a high-level capability is also the result of lower level organisational or combinative capabilities	ACAP is a high-level capability, supported by other capabilities. PACAP consists of knowledge acquisition and assimilation capabilities and is increased by coordination capabilities. RACAP consists of knowledge transformation and exploitation capabilities and is increased by systems and socialisation capabilities
Coevolution	Cohen & Levinthal (1994, 1997) Koza & Lewin (1999) Lewin et al (1999) Lewin & Volberda (1999) Van der Bosch et al. (1999) Huygens et al (2001) Volberda & Lewin (2003)	Macro-coevolutionary effects, Knowledge environments coevolve with emergence of Organisational forms and combinative capabilities that are suitable for absorbing knowledge. Macro-coevolutionary effects, increasing levels of ACAP lead to more readily accumulating additional knowledge in subsequent periods. Higher levels of ACAP raise the aspiration level and increase the level of adaption	AC enables or restricts firm adaptation AC coevolves with the knowledge environment Levels and direction of AC are shaped by the joint effect of managerial actions and developments in the knowledge environment

Source : (Volberda et al., 2010, p. 934)

With an articulation of the theories and the three key findings listed, Volberda et al. (2010) outlined their framework for ACAP with these bibliometric references in the Figure 2.18 below.

Figure 2.18 – An integrative framework for Absorptive Capacity



Source: (Volberda et al., 2010, p. 941)

In building the integrative framework, Volberda et al. (2010) were able to design their framework in sections. The initial section groups the antecedents as inputs to the components of Absorptive Capacity. These antecedents were listed as common areas of research including, managerial, intra-organisational, interorganisational, and prior related knowledge. The ACAP process dimensions were listed as *acquisition*, *assimilation*, *transformation*, and *exploitation* following the Zahra and George (2002) definition as being directly linked to Cohen and Levinthal (1990). In this integrative driven framework, the outcomes were listed as competitive advantage, innovation, and performance. This would tend to imply that ACAP is an antecedent to Competitive advantage, Innovation and the Performance of the firm. The environmental context in

which firms operate is captured as the variation in level of, or lack of turbulence of the knowledge environment. The external environment would appear to influence the outputs of ACAP in either a decision by the firm to focus on exploitation or exploration activities.

At higher levels of ACAP, it is more likely the firm will be proactive in exploiting opportunities present in the environment, independent of current performance (Volberda et al., 2010, p. 942). This concurs with Cohen and Levinthal (1990) contextualisation that an outcome of ACAP is expectation formation and an aspirational level of the firm. Volberda et al. (2010, p. 942) suggest that more needs to be known about the balance between Exploration and Exploitation. Firms focusing too much on knowledge acquisition and assimilation are able to continuously renew their knowledge stock, but they may suffer from the costs of acquisition without gaining benefits of exploitation according to both Lichtenthaler (2009) and Zahra and George, (2002). Conversely, firms focusing on transformation and exploitation may achieve short-term benefits but fall into a competence trap (Jansen et al. 2005). This captures the Co-evolutionary theory of firm absorptive capacity that evolves with other mechanisms within the firm and the inherent knowledge environment,

When the knowledge environment is turbulent, firms tend to develop ACAP aimed at exploration, with low efficiency, a broad scope, and much flexibility. When the knowledge environment is stable, firms tend to develop ACAP aimed at exploitation, with high efficiency, a narrow scope, and little flexibility. (Van den Bosch et al., 1999, p. 553).

Volberda et al (2010) completed the paper by listing each of the components and indicating future research directions as captured in Table 2.11.

Table 2.11 – Building blocks for an integrative framework

Building Blocks for ACAP framework	Key observations and insights
Management antecedent	ACAP requires having porous boundaries, scanning broadly for new knowledge, and identifying and using those employees who serve as gatekeepers and boundary spanners. Dynamic managerial capability refers to the capacity of managers to create, extend, or modify the knowledge resource base of a firm
Intra-organisational antecedent	A firm's knowledge base cannot be separated from how it is organised. An organisation can be viewed as a structure that carries out multiple knowledge related tasks, like evaluating, assimilating, integrating, utilizing, and building knowledge. Internal informal networks are also important for the identification and assimilation of new knowledge
Interorganisational antecedent	Gaining knowledge from external sources and learning from partners are critical parts of the interorganisational antecedents of ACAP. Path dependent and tacit nature of a firm's idiosyncratic prior related knowledge and organisational context may limit quick integration of knowledge acquired outside
Prior related knowledge	Recognised as an important antecedent of ACAP. However, how prior knowledge stocks, are stored and retrieved is lacking. Mechanism for storing prior knowledge are databases and routines, but also stories, norms, etc would influence how prior knowledge is stored and retrieved. Individual storage and retrieval of information can be lacking and not at the right place at the right time
Absorptive Capacity process	The nature of the ACAP process has not been fully studied. Examining the differing effects of organisational antecedents on ACAP process dimensions would help clarify how ACAP can be developed. It would also reveal why firms have difficulty in managing dimensions of ACAP.
Environmental Conditions	The characteristics of the knowledge environment influence the nature of the firm's ACAP. When the knowledge environment is turbulent, firms tend to develop ACAP aimed at exploitation with low efficiency, a broad scope, and much flexibility. When the knowledge environment is stable firms tend to develop ACAP aimed at exploitation, with high efficiency, a narrow scope and little flexibility
Outcomes of Absorptive Capacity	As well as the tangible outcomes of competitive advantage through, innovation, exploitation/exploration and firm performance, ACAP does deliver intangible outcomes. These can be intra-organisation transfer of knowledge, interorganisational learning, and knowledge search. Cohen & Levinthal indicated that ACAP affects expectation formation and the aspiration of the firm, in allowing it to predict commercial potential of technological advances.

Source: (Volberda et al., 2010, pp. 940-942) adapted by author

In the concluding remarks, Volberda et al. (2010) outline future research paths, which is a fitting end to the twenty years following Cohen and Levinthal (1990). Volberda et al. (2010) state that the theoretical foundations of ACAP are lacking. In addition,

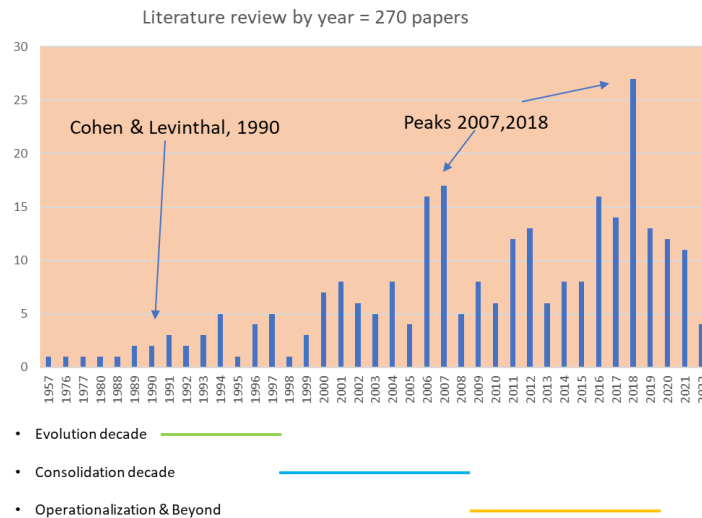
Microfoundations of ACAP were seen as a potential research area giving direction to researchers in the next decade. It was proposed that ‘triggers’ for ACAP were unclear in identifying what prompts ACAP activity in a firm despite its influence on innovation and firm performance. It would appear that this summary helped frame research in the coming decade. The next decade is described below as an operationalisation era.

2.3 Absorptive Capacity, 3rd decade, an operationalisation era

The previous decade described different ACAP frameworks attempting to link the Cohen and Levinthal (1990) paper with evolving process and organisational understanding of Todorova and Durisin (2007), and Zahra and George (2002) into an integrative framework proposed by Volberda et al. (2010). In this section covering the third decade following the publication of Cohen and Levinthal (1990) paper, a continuation of the exploration and refinements to the model, linking microfoundations and antecedents to the ACAP construct as suggested by Volberda et al. (2010) is presented. Knowledge and knowledge management receive more research attention related to the construct. A summary of the large number of publications that were reviewed by the researcher during this exploratory research is outlined in the Figure 2.19 below. This highlights “the waves” of publications that have attempted to add critical understanding of the ACAP construct in different contexts and on different contributing factors of the construct. The main effort of these researchers was to generate data in some cases specific to different microfoundations or antecedents of the construct. The literature review indicated that the topic of the ACAP construct continues to be of interest to researchers across many different research contexts. It would seem to indicate that interest in the construct is continuing to grow. The implications across different managerial, organisational and firm practices related to the construct,

depending on the environmental positioning of the firm, continue to be of interest and be researched. As outlined in the earliest parts of this chapter, the broad scope of the publication by Cohen and Levinthal (1990) is a challenge to researchers.

Figure 2.19 – The waves of published papers reviewed



Source: Author

This plot indicates what the author reported as the waves of interest in the ACAP construct, indicating the broadening context of the construct.

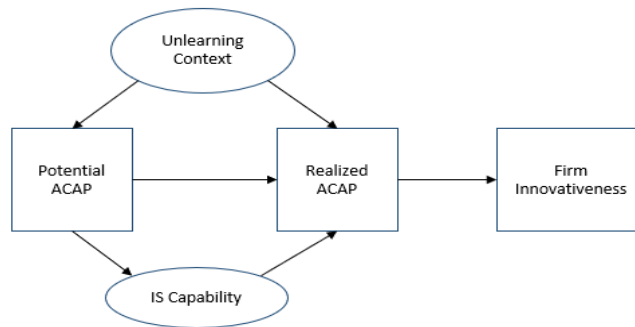
2.3.1 Knowledge Management

One of the major topics researched in this decade relates to knowledge management.

As an addition to the knowledge management discussion Cepeda-Carrion et al. (2012, p. 111) introduced the importance of *information system* (IS) capability. IS, is important as it provides an appropriate balance between PACAP and RACAP. They defined it as the efficient acquisition of new (internal or external) knowledge as a component of PACAP and its integration with the existing knowledge. It could allow firms to incorporate knowledge into their systems through a codification process to complete or substitute

this knowledge with past experiences and to make it available to any member of the firm. In terms of ACAP Cepeda-Carrion et al. (2012, p. 111) indicate that managers need to develop and apply knowledge structures to enable the provision of learned practices. The implication for managers is that they need to actively manage the knowledge gap between the technology they perceive they need and the technology they actually have available to them. As proposed Cepeda-Carrion et al. (2012) managers need to ensure that IS supports RACAP. A big part of this management process is ‘unlearning’ current knowledge as depicted in the Figure 2.20 below. Unlearning needs to occur at both an individual level and at an organisational level. At the individual level this can require a paradigm shift necessary to indicate that previous assumptions no longer hold true. While at the organisational level this unlearning (unfreezing) can occur through changes in processes or routines. Tsai (2001, p. 998) indicated that in the field of organisational learning, organisations that possess relevant prior knowledge, are more likely to have a better understanding of new technology, such that they can generate new ideas and develop new products. Tsai further posits that an organisation is a repository of knowledge, (Tsai, 2001, p. 1003). The ability to access knowledge and to integrate it effectively, is a competitive advantage. Cepeda-Carrion et al. (2012) caution that knowledge is time bound and knowledge needs to be renewed with constant use.

Figure 2.20 – Unlearning old knowledge to enable relearning and developing new knowledge



Source Cepeda-Carrion et al. (2012, p. 116)

Daud (2012) summarised the importance of knowledge as a competitive advantage of the firm. Building on research by previous authors such as Grant (1996), Kogut and Zander (1992), and Sveiby (2001), who noted that knowledge is the firm’s most important resource, taking a knowledge-based view of the firm. In Daud’s analysis of SMEs and large firms in Malaysia, Daud (2012) concluded that how firms manage knowledge, largely depends on the size of the firm. This has managerial implications for the focus of management functions within an SME. Knowledge Management (KM) processes are comprised of three forms of practice, firstly knowledge *acquisition* followed by knowledge *conversion* and finally knowledge *application* (Valentim et al., 2016, p. 713). Firm performance is measured by financial and non-financial perspectives that consist of profit, growth, innovativeness, customer satisfaction, quality and flexibility (Zahra & George, 2002). Considering KM as a capability, it is important to measure its available as the key measure, since knowledge can be distributed throughout the firm (Kogut & Zander, 1992, p. 385). Kogut and Zander (1992, p. 398) indicated that to solve customers’ problems and be innovative, firms must effectively create, locate, capture and share knowledge and expertise. How a firm does this effectively will be reflected in a firm’s performance metrics. In the cross-case example

that compared 394 SMEs and large firms in a survey of Malaysian companies, it indicated that large companies and SMEs manage knowledge differently. The implications for management are outlined below as part of Daud (2012) findings in that KM processes influence firm performance positively.

SMEs need to focus more on knowledge acquisition in order to improve their financial performance and knowledge application so that they could enhance their non-financial performance. While for larger firms, they need to concentrate on knowledge application for firm financial performance and knowledge conversion for firm non-financial performance in order to enhance their businesses (p. 4230).

Emphasising KM in SMEs, Valentim et al. (2016) analysed 260 SMEs in Portugal to identify their KM practices and how they link to ACAP. The findings tended to indicate that SMEs are engaged in KM through collaboration with business partners, and external environment focus. SMEs use these relationships to generate learning practices based on experience, knowledge transfer to employees and knowledge absorption by employees. Drawing on the organisational resource differences of large firms and SMEs, Valentim et al. (2016, p. 720) indicate that in large firms, knowledge management practices are highly formalised, arising from their level of technological, financial and human resources, which is clearly not the case in SMEs where resources can be limited. Valentim et al. (2016, p. 712) state that SMEs depend on ACAP as the fundamental learning process referencing the work of Lane et al. (2006), who further point out that ACAP is the firm's ability to use external knowledge based on the three sequential processes. They are *exploratory* learning, *transformative* learning, and *exploitive* learning. Valentim et al. (2016) maintains that *assimilation* of external knowledge takes place through *transformative* knowledge and combining it with prior existing knowledge within the firm. This sequential process of knowledge management

would appear to support the three-step Innovation Value Chain (IVC) idea generation, idea conversion, idea diffusion thinking proposed by Hansen and Birkinshaw (2008).

2.3.2 The Role of Management

In this section various roles of management are described which tend to indicate the importance of the role that management plays in ACAP within a firm. Valentin et al. (2016, p. 711) indicate that SMEs management practices, are characterised by weakly structured management processes when compared to larger firms. This is due to the lack of resources in many cases making them vulnerable to technological and external environmental changes. SMEs therefore leverage the tacit nature of knowledge, based on learning through experience. In knowledge conversion, SMEs leverage knowledge transfer to and from employees reflecting the importance of employee selection and job rotation. Valentin et al. (2016) indicated that Knowledge application for SMEs is determined by the ability to associate external sources of knowledge with problems and challenges as well as the SMEs' management ability to identify and apply knowledge to changing competitive environments. This tends to indicate SME's lack of human and management capacities which can translate into a reactive management approach. The size of the firm, as in the case of SMEs, is observed as an antecedent to ACAP (Brunswicker & Vanhaverbeke, 2012). Valentim et al. (2016) noted that small firms are most concerned with knowledge management practices through collaboration

The empirical evidence shows how SMEs depend on external resources provided by their business partners, clients and suppliers, and on their collaborator's tacit knowledge to renew their knowledge base (p. 720).

Before exploring some of the focus areas for management of innovation and learning in the current era, it was Roper et al. (2018) who positioned the contextual parameters in

which firms exist and how these factors can affect innovation outcomes. Roper et al. (2018) proposed that managing the spatial, sectoral and network elements of the knowledge context of the firm will have an influence on the innovation output of the firm. They further propose that where firms differ from each other, it is the individual firm's agency and ambition that can have an effect on the innovation outcomes. This implies the role of management can drive any one of these elements differently and at different times in the evolution of the firm (Roper et al, 2018, pp. 348-348).

Resource management

Resource-based management in SMEs, indicates that comprehensive processes for 'structuring' the firm's resource portfolio are necessary. This is achieved by building the resource capabilities, and leveraging those capabilities with the purpose of creating and maintaining value for customers and owners (Sirmon et al., 2007, p. 273). The heterogeneity of different firms' outputs, that possess similar resources may result from choices made by management in structuring, bundling and leveraging those resources. Saemundsson and Candi (2017) discuss the challenges of new technology-based firms (NTBF) i.e., recently created technology firms, and the management challenges associated with the Potential ACAP (PACAP). They posit that PACAP consists of two sets of knowledge which have to be managed by NTBFs. They define these as Problem Knowledge and Solutions Knowledge (Saemundsson & Candi, 2017, p. 45). Their analysis acknowledges other authors previously mentioned in this chapter, Kogut and Zander (1992), and Grant (1996) who indicate that knowledge can take different forms. Knowledge can take the form of understanding propositions, (knowing why, knowing that), and knowledge in action, (knowing how). This distinction is important in terms of innovation, and the external environment. By acknowledging 'knowledge about' users

or customers as to their context of use (von Hippel, 1994). Also, with the learning associated by providing a solution and how much technology is needed to meet customers' needs is based on internal and external knowledge. These two, dimensional knowledge sources emphasise the different components of what Zahra and George (2002) defined as PACAP. They can now be considered as a) knowledge 'about' technical (customer's) problems, Problem Absorptive capacity, and b) knowledge 'about' how to solve them, Solution Absorptive capacity. From the firm's perspective, value creation begins by providing value to customers through managing the available resource (Sirmon et al., 2007). According to Saemundsson and Candi (2017), they note that both problem ACAP and solution ACAP are positively related with the identification of opportunities and that they are mutually reinforced. They reported that problem ACAP is directly related to the identification of opportunities (problems to solve), but solution ACAP is related with opportunity identification only when coupled with high problem absorptive capacity.

Customer needs management

Schweisfurth and Raasch (2018) continue with this theme of antecedents which are critical for innovation, "Need knowledge" and "Solution knowledge". This research provided a view from the employee perspective, through a survey of 864 employees. Since need knowledge and solution knowledge are situated outside the organisation, a strategy must exist to identify and absorb these into the firm since they will likely trigger different innovation types based on the acquired external "need" knowledge. Schweisfurth and Raasch (2018) refer to previous findings that dubbed the ability to invent and create new information as the first face of R&D, and the ability to absorb technological solution knowledge as the second face of R&D (Cohen & Levinthal,

1989). Schweisfurth and Raasch (2018, p. 696) indicate that solution knowledge, in addition to increasing innovation output and intra-domain solution absorptive capacity, has the additional effect of facilitating the absorption of external extra-domain knowledge, specifically new need knowledge. In this sense, they describe need absorptive capacity as the third face of R&D. This third face of R&D is at an individual level. Since it is individuals who evaluate new knowledge in the light of their prior knowledge and their cognitive schemas. The individual's ability to assess novelty in a customer context allows the individual to empathise with the external customers. This empathy leads in turn to an understanding of precisely the customers problems. In this way employees become 'twins to the customers' which facilitates the absorption of customer need knowledge. Scheisfurth and Raasch (2017, p. 689) propose ACAP related to need knowledge as the natural and necessary complement to ACAP for solution knowledge. Need knowledge and solution knowledge are the two key components of innovation and they can be sought by the firm in an explore activity, a traditional customer interaction. It can also occur where customers actively promote their needs, that is customer competency looking for differentiated solutions (Danneels, 2002, p. 1104). In this way customers know what they want, not where the supplier is trying to convince the customer with a sell approach. Need knowledge is defined as knowledge about 'a customer hierarchy of needs'. It comprises use-related problems and unmet requirements situated in users or customers' worlds. Firms need to absorb 'need knowledge' from the environment to develop innovative solutions that can be the basis for future sustainability.

We define absorptive capacity for need knowledge as a firm's ability to identify, assimilate and exploit knowledge about customer's needs from the environment (Schweisfurth & Raasch, 2018, p. 689).

External environmental management

In taking an external view of the firm, the theme of ecosystem empathy was explored in depth by Adner and Koper (2016), where it included the competitive environment as drivers for new product development based on shifting ecosystem needs and evolving technology solutions. Ecosystem partners and customers will share in the knowledge outputs in co-innovation environments broadening the developments of prior knowledge in current and future markets. These too are considered as antecedent to ACAP. The role that managers play in generating mechanisms for managing knowledge in an open Innovation approach was referenced by Zobel (2017). Zobel indicated taking managerial actions to higher levels to delineate the underlined processes to exploit sources of external knowledge. These managerial mechanisms for open innovation indicated in Table 2.12 were identified as *recognition*, *assimilation*, and *exploitation* of external technology, which benefit the development of prior knowledge and codification of external knowledge which can feed into recombination skills within the firm. (Zobel 2017, p. 285).

Table 2.12 – Managerial mechanism for Open Innovation practices

Managerial mechanisms	Process Description
Recognition Capacity	Enable external scanning (building networks) and strategic assessment for the firm (verifying applicability to market segments)
Assimilation Capacity	Institutionalised for integration, coordination and knowledge management process (codification of external knowledge)
Exploitation Capacity	Cognition practices (knowledge gaps and technical needs understanding) and Recombination processes for combining external and internal resources into novel configurations.

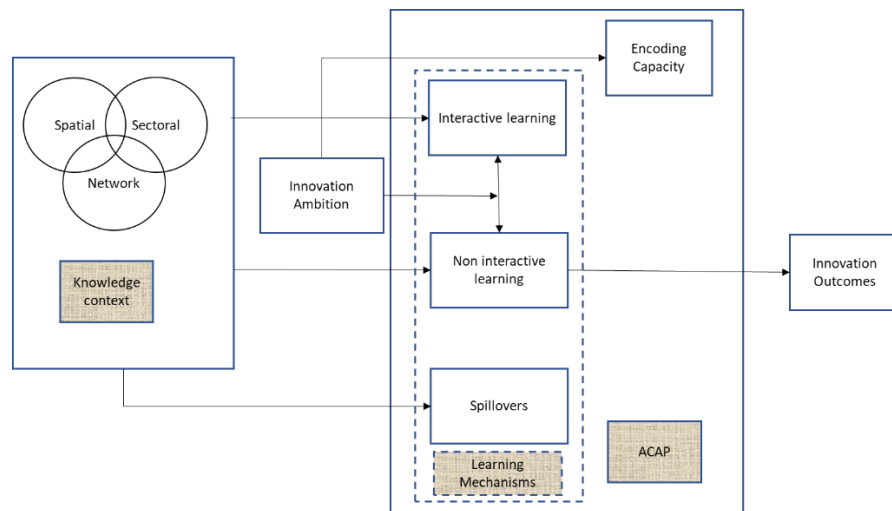
Source: (Zobel, 2017, p. 285) adapted by author

Three learning mechanisms were articulated by Roper and Love (2018) to gain external knowledge. The first mechanism was a deliberative relationship with firms or organisations to access new knowledge. Secondly there is a less deliberate way of

gaining knowledge through networks or knowledge dissemination events through participation and engagement with other entities i.e., Open Innovation. The third mechanism proposed was through knowledge spillovers which could occur through employee mobility, knowledge events or through communication mechanisms. All three forms combined with firm ambition and encoding capacity can enhance the innovative performance of the firm and is outlined in Figure 2.21.

Each component of the resource management process is individually important but to optimize value creation, they must be “synchronised”. Thus, while managing each component of the process is important, the integration and balancing of components to ensure harmony in the process is necessary to create value for customers (Sirmon et al., 2007, p. 287).

Figure 2.21 – Knowledge context and learning



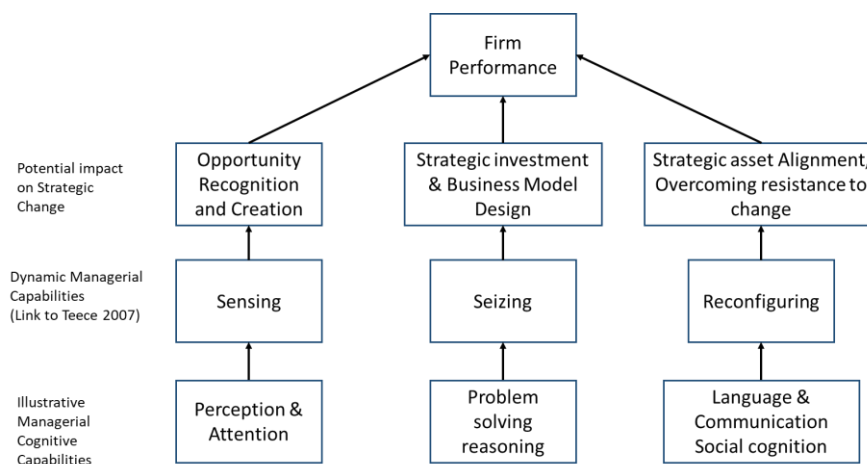
Source: Roper & Love (2018)

Cognitive Capability management

The role of management can be impacted by the ‘capability’ inherent in the firm, i.e., the capacity to perform a function. Capabilities develop in part through practice. The ‘capacity’ of individuals to perform mental activities is a capability, having the mental

ability, to perform certain mental tasks. For this reason, Helfat and Peteraf (2015, p. 835) introduced the managerial ‘cognitive capability’ being the capacity of an individual manager to perform one or more of the mental activities that comprise cognition (attention, perception and problem solving). Building on the previous work of Teece (2007), this paper sought to establish a relationship between dynamic capabilities and organisational capabilities that would include strategic change and organisational performance and is shown in Figure 2.22.

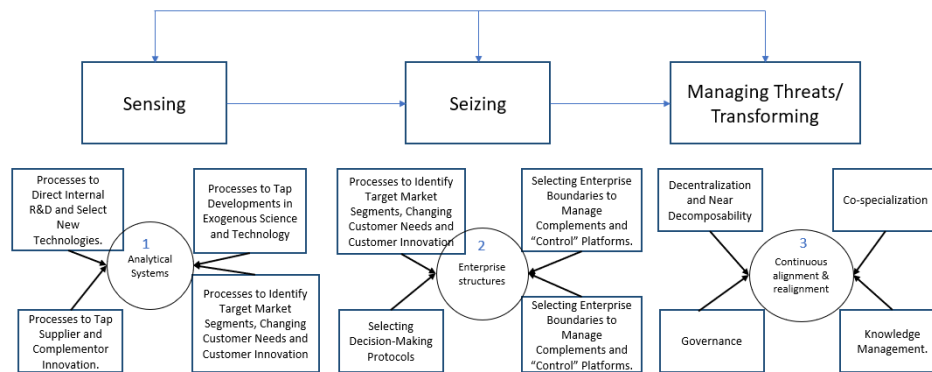
Figure 2.22 – Managerial Cognitive capabilities, Microfoundations of Dynamic Capabilities



Source: (Helfat & Peteraf., 2015, p. 837)

The Helfat and Peteraf (2015) model had origins from Teece (2007) which was a further development of the Teece et al. (1997) work on dynamic capabilities and strategic management. Teece (2007) indicated in Figure 2.23 an explanation of the dynamic capabilities, within the firm. This further enhances the understanding proposed by Sun and Anderson (2010) earlier in this chapter concerning the migration of individual learning to Organisational learning.

Figure 2.23 – Foundations of dynamic capabilities and business performance



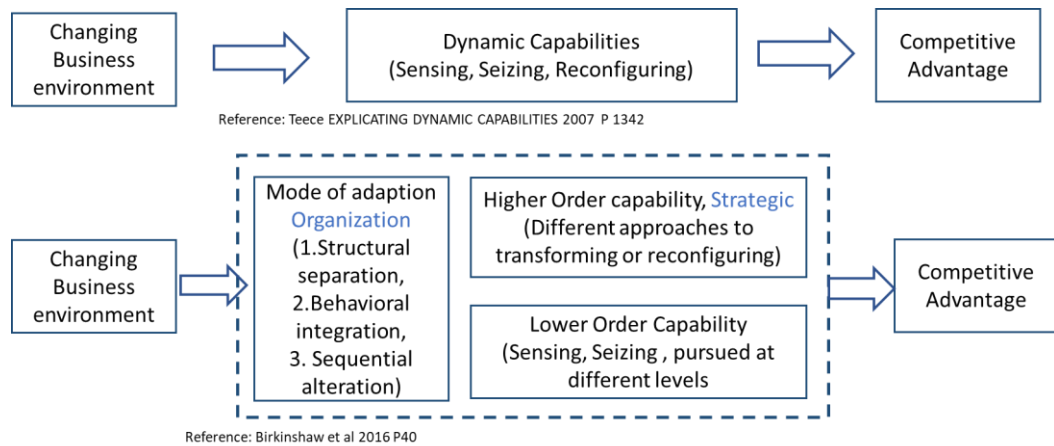
Source: Teece (2007)

Note to the figure Teece (2007) further indicated the continual engagements of management in 1) Analytical systems - (and Individual Capacities) to Learn and to Sense, Filter, Shape, and Calibrate Opportunities. 2) Enterprise structures - Procedures, Designs and Incentives for Seizing Opportunities 3) Continuous Alignment & Realignment - of Specific Tangible and Intangible Assets.

Change Management

Birkinshaw et al. (2016) proposed that it is not possible to identify a universal set of dynamic capabilities for firms to react to discontinuous change. The ‘Reconfiguring’ component part of the statement for dynamic capabilities as outlined by Teece et al. (1997), was challenged by Birkinshaw et al. (2016) where they took a different interpretation of it, as one of a ‘higher order’ capability. This higher order capacity allows the firm through management practices to ‘orchestrate’, i.e., synchronise according to Sirmon et al. (2007), the Sensing and the Seizing capabilities. They also indicate that sensing and seizing are direct counterparts of purposeful *exploring* (recognising) and *exploitation* of the ACAP construct allowing the articulation of their organising framework in the Figure 2.24 below.

Figure 2.24 – Organising framework for discontinuous changes

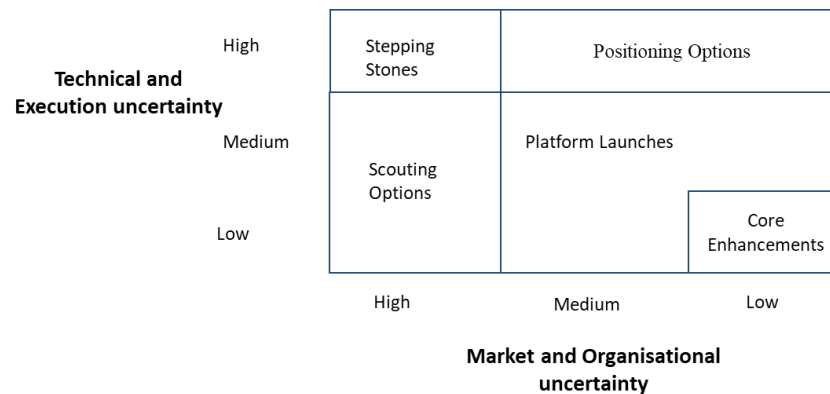


Source: (Birkinshaw et al., 2016, p. 40) adapted by author

In multiple publications O’Reilly & Tushman (2004, 2011, 2013) have highlighted the managerial challenges of balancing an exploration mindset while balancing the necessary exploitation mindset within an organisation in terms of the ‘Ambidextrous Organisation’. In a recent book publication ‘*Lead and Disrupt*’ (O’Reilly & Tushman, 2021) gives focus to the necessary disciplines of ambidexterity being *Ideation*, *Incubation* and *Scaling* as a way of segmenting the managerial efforts in these areas. It is implied managers need the cognitive ability to know when to apply them. Birkinshaw et al. (2016, p. P39) would appear to indicate this discipline as an approach of different defining ‘modes of operation’ being, structural separation, behavioural integration and sequential alternation between the two focus areas of exploration and exploitation. Birkinshaw et al. (2016, p. 39) argue that Dynamic Capabilities and Ambidexterity are *complimentary capabilities*. They maintain that it is the combination of the required mode of ‘adaption’ and an associated set of capabilities that determine how a firm can react to changes in the external environment that matter, leading to a competitive advantage. To define competitive advantage in terms of only performance, is limited, according to McGrath (2013) who argues that where to compete is as important as the

short-term financial results. McGrath (2013) indicates that ‘arenas’ of competition are more-fine grained in analysis, whereby they are connected by customers and the solutions provided, and not by the conventional offerings from certain suppliers. This challenges management to not only focus on current offerings, but to be aware of the external environment and how the customers’ problems might be solved by an alternative technology or supplier from different area of expertise outlined in Figure 2.25. This cognition of management would appear to need to be practiced in an approach of balance between *stability* and *agility*. Management practices need to be aware of the short term and long-term views management should consider. Management being able to balance multiple opportunities and market applications comes with experience and practice.

Figure 2.25 – Management of opportunity Portfolio – definition of gaps



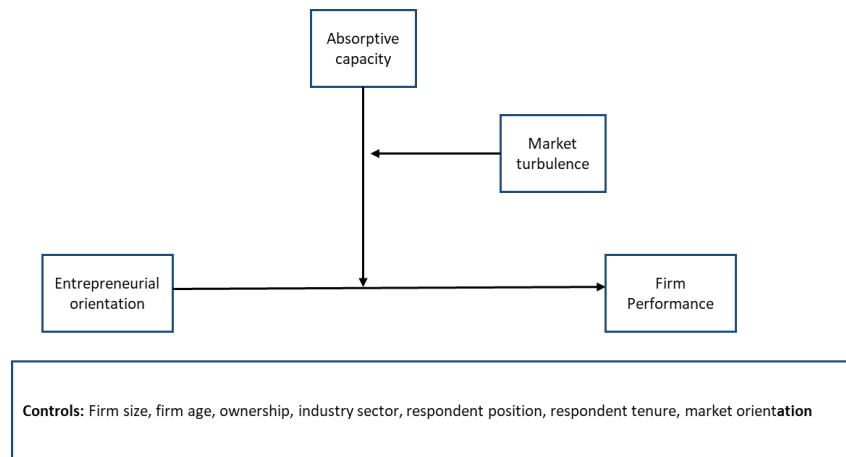
Source: McGrath (2013) adapted by author

Entrepreneurial Orientation Management

Entrepreneurial Orientation (EO), which can be thought of as a typical characteristic of a founder, is also an orientation as a strategic management posture that allows a firm to act in an entrepreneurial way. The EO definition has evolved into three firm level

dimensions, they are *innovativeness*, *proactiveness* and *risk taking* (Engelen et al., 2014 p. 1353). As ACAP has been indicated as a Dynamic Capability by Todorova and Durisin (2007) and by Zahra and George (2002), the implications for EO in all three firm level dimensions is that they bring with them a level of uncertainty that needs to be managed. Engelen et al. (2014, p. 1364) indicate that ACAP helps a firm deploy EO in order to improve its performance, especially in turbulent environments. Their study was based on a research study of 196 SMEs operating in Germany. The role of management in young firms outlined in Figure 2.26 would appear to require management skills tuned to this EO to react to the turbulence witnessed by SMEs in their early years, recognising the constraints of age and size of these firms.

Figure 2.26 – Entrepreneurial Orientation – conceptual framework



Source: (Engelen et al., 2014, p. 358)

Managing Growth

Where those SMEs that have made the initial steps beyond a start-up either through the motivation or prior knowledge of the entrepreneur or initial management team, a trigger point may occur where additional resources and capabilities are required for growth.

These resources due to SME's limited capabilities cannot be easily brought into the firm

but need to come from external sources. Zahra et al. (2009, p. 248) defined Corporate Entrepreneurship (CE) as those activities a firm undertakes to stimulate innovation and encourage calculated risk throughout its operation. For these ‘threshold firms’ reaching this point in their organisational lifecycle, being able to manage these challenges will determine if the firm continues to grow or not. Some SMEs will be locked in a ‘cognitive rigidity’ that does not allow the firm to react to potential opportunities in the market. This management skillset can be augmented with the engagement of a non-Exec board. The recognition that additional skills are required beyond the Top Management Team (TMT) indicates the level of ACAP within the firm. The role of management as well as being stewards of the shareholder interests, also needs to ensure that the firm is active in a role of ‘wealth creation’ for the shareholders. While some SME’s may elect to IPO which will bring with it new investors and additional levels of board requirements, many SME remain private. In this case the engagement of a board plus the ACAP of firm can affect the growth of the firm. The ability of the TMT or the entrepreneur to move from the flexible business processes necessary in the early stages of evolution to evolve into a professionally managed firm is a step change for some SMEs (Bedford et al., 2022). Creating a board will require the TMT to leverage the external networks available to the firm. The ability to recognise the value of external professional knowledge resources that may not be inherent in the TMT. Zahra et al. (2009) proposed an integrative framework where orthogonal dimensions of managerial accountability and absorptive capacity of the firm may contribute to different success levels.

This section has covered a diverse multitude of managerial topics that can drive a firm to different levels of sustainability and competitive advantage. In the next section it is the organisational mechanisms that are discussed and their impact on the firm.

2.3.3 Organisational Mechanisms

Argote and Ingram (2000) recognised knowledge as a basis for the competitive advantage for organisations depending on where it is embedded or not embedded. In the paper it developed mechanisms of knowledge transfer and it outlined factors that facilitated or impeded knowledge transfer. It was noted that knowledge transfer does not just happen. Organisational mechanisms have to be created and managed for this transfer to occur. Knowledge resides in ‘reservoirs or repositories’ according to Argote and Ingram (2000, p. 155). In the framework proposed, knowledge is embedded in fundamental elements of the organisation, outlined as located in members, tasks and tools and the associated networks. Knowledge can be transferred by moving the members, tasks or tools or networks in which the knowledge exists. The contexts of the originating location of the member, tasks or tools will be affected by the destination of the transfer, thus adding to or inhibiting the knowledge reservoir. This framework highlighted the dual role of people (the individual) in knowledge transfer. Argote and Ingram (2000) indicated the different ways people network into and out of the knowledge reservoir. Also, described was the individual capability of adapting knowledge from one context to another. In a review of the findings since the Argote and Ingram paper in 2000, it was Argote and Fahrenkopf (2016) who assessed the cumulative learning in the interim. The paper encouraged research on innovation to recognise organisational learning and knowledge transfer as important mechanisms through which innovations develop and spread. Further, it suggested that innovations developed through these mechanisms are especially likely to convey competitive advantage (Argote & Fahrenkopf, 2016, 156).

In the Table 2.13 below they summarise the historical references to the organisational mechanisms available to firms to be managed, with an observation of the impact the mechanism has on the organisation

.

Table 2.13 – Organisational behaviours for knowledge transfer in organisations.

Themes	Research	Observation
Organisational	Zander & Kogut (1995) Huckman & Pisano (2006) Darr & Kurtzberf (2000)	Knowledge that was codified, teachable and related to capabilities readily transferred within firm boundaries. Turnover of key personnel increased the likelihood of knowledge transfer across boundaries. Knowledge did not transfer across different organisational contexts. Similarity in business strategy facilitated knowledge across organisational units. The negative effect of geographic distance was mitigated by strategic similarity
Members	Kane, Argote & Levine (2005) Enon & Pfeffer (2003) Mathieu & Zajac (1990) Nadler, Thompson & Boven (2003)	Personnel mobility can be a mechanism for transferring routines across groups. Managers devalued internally sourced knowledge and valued externally sourced knowledge. On the basis that internal knowledge elevated colleagues status while external knowledge did not devalue their own status. Groups are more likely to persist with strategies that they have chosen. While failing groups are more likely to adopt a new strategy than those that are succeeding. Training that includes demonstrations and opportunities to observe has been found to be more effective at promoting knowledge transfer than those that lack these features.
Member-Member networks (Social networks)	Granovetter (1973) Hansen (1999) Levin, Walter & Murnighan (2011)	Strength of ties, in terms of frequency and emotional intensity affects transfers. Strong ties were useful for the transfer of complex knowledge, whereas weak ties were useful for finding distant knowledge. Dormant ties and inactive relationships can be rekindled, and found that strong dormant ties can provide the benefits of strong ties and the access to novelty benefits of weak ties.
Tasks	Haunschild & Sullivan (2002), Wiersma (2007) Boh, Slaughter & Espinosa (2007) Staats & Gino (2012)	Task heterogeneity and diverse task experience improves organisational learning. Heterogeneous experience in related software increased productivity in software development teams. Performing heterogeneous tasks over multiple days improved individual productivity
Tools	Feldman & Pentland (2003), Rao & Argote (2006) Hwang, Singh, & Argote (2015) Faraj & Johnson (2011)	A routine is a repetitive pattern of interdependent tasks performed by multiple members of an organisation. Routines enable organisational knowledge to persist in the face of member turnover. Web2.0 technologies, participants initially share information in the same geographic area and same hierarchy. After gaining experience sharing happens across globally distributed members. Enhancing ones reputation and reciprocating others have been found to be key factors of knowledge sharing

Source: Argote & Fahrenkopf (2016) adapted by author

Cordero and Ferreira (2019) summarize the organisational mechanisms that managers can deploy to effect ACAP based on their recent publication. Cordero and Ferreira (2019, p. 70) group their findings for organisational mechanisms that can be applied in firms into four major strategies. They are External search strategies, organisational knowledge management mechanisms, reverse knowledge – a process of knowledge transfer, a fourth group described as mechanisms not orientated to knowledge management. In the Table 2.14 below an articulation and linkage of the strategy is indicated.

Table 2.14 – Organisational mechanisms & strategies

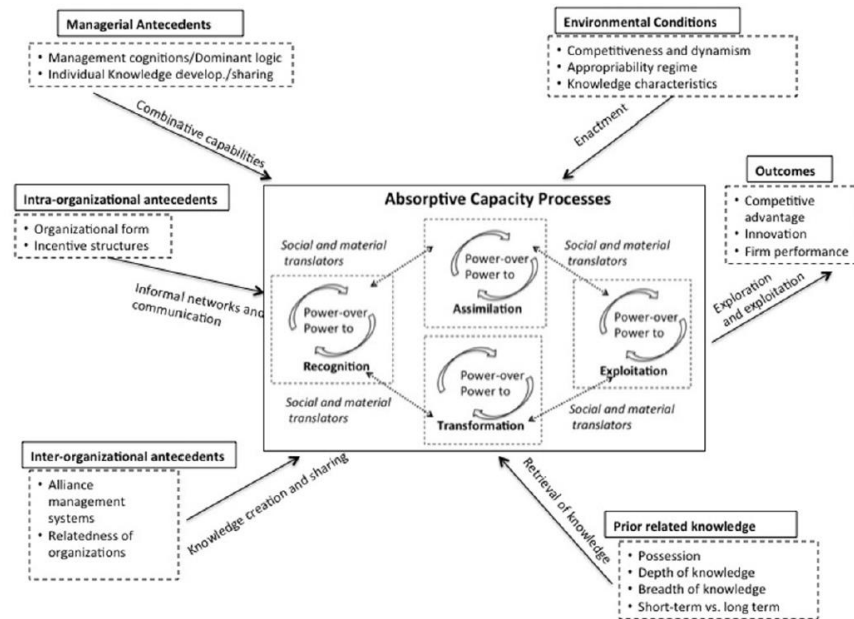
Strategies	Main findings
External search strategies	External search practices support a firm in developing effective and continuous collaboration links within the innovation ecosystem. External search has a positive impact in product innovation
Organisational knowledge management mechanisms	This refers to all the knowledge resources within the organisation that can be realistically tapped by the organisation
Reverse Knowledge	This process refers to knowledge being transferred from the home country parent to a subsidiary. It is a teaching process whereby the parent provides knowledge to its subsidiary through mentoring relationships
Mechanisms not oriented to knowledge management	This mechanism covers the papers where their main objectives was not related to ACAP but to other strategic objectives

Source: Cordero & Ferreira (2019, P70) Adapted by author

2.3.4 Additional ACAP insights from the 3rd decade

This decade saw the advancement of two further enhancements to the integrative framework of Volberda et al. (2010) with two influential publications which include Marabelli and Newell (2014) and Song et al. (2018). Marabelli et al. (2014) took the conceptual integrative framework and built on it with some additional insights indicated in the Figure 2.27 below.

Figure 2.27 – Reconceptualisation of ACAP



Source: Marabelli & Newell (2014)

As can be seen, Marabelli and Newell built on the Todorova and Durisin (2007) visualization that introduced power relationships in the appropriability of knowledge and placed these relationships within each of the ACAP dimensions/capabilities. This reflected that knowledge does not simply flow from individual to organisation but that, collective decisions are made to move the knowledge through the firm incrementally and in learning cycles with appropriate validation processes included. Creating a series of temporary advantages allows the firm to create new value while maintaining the value created in previous periods (Sirmon et al., 2007, p. 274). This would appear to explain why knowledge has a time dimension to its transfer and eventual use in an exploitative manner within the firm. This supports the ‘Stepping Stones’ approach articulated by McGrath (2013) in the portfolio management aspect of organisational strategy. Marabelli and Newell (2014) also updated the antecedents outlined in the Volberda et al. (2010), integrative framework, into epistemological components of knowledge in terms of possession and in terms of practice.

For each of the antecedent's microfoundations, the model indicated in the hashed boxes those items that were seen to be 'possession based' and outside the box it indicated the items as 'practiced' based. Social interaction mechanisms (SIMs), mentioned earlier in the decade with linkages back to Cohen and Levinthal (1990), were now indicated both as a practice and a physical space introducing social and material 'translators' as methods of demonstrating both possessed and practiced knowledge, for each component of ACAP.

The second critical contribution itemized at the end of this decade was from Song et al. (2018). In the Table 2.15 below the nature and characteristics of ACAP dimensions and their theoretical developments related to knowledge processes are outlined.

Table 2.15 – Nature and Characteristics of ACAP dimensions

	Absorptive Effort	Absorptive knowledge base	Absorptive process
Definition	Knowledge-building investments made by a firm	Current knowledge stock of a firm	Internal procedures and practices related to knowledge diffusion
Functional role	<i>Primary:</i> Radar—search, identify, Acquire <i>Secondary:</i> Processor—understand, combine, transform	<i>Primary:</i> Processor—understand, combine, transform <i>Secondary:</i> Radar—search, identify, acquire	<i>Primary:</i> Converter and transmitter—create organisational level knowledge and share and diffuse it <i>Secondary:</i> Radar and processor—search, identify, acquire, understand, combine, transform
Primary mechanisms	<ul style="list-style-type: none"> • Development and use of knowledge search routines—scanning and sensing • Boundary-spanning learning • Direct interface with external knowledge 	<ul style="list-style-type: none"> • Development and use of knowledge-processing routines • Learning through direct experimentation and experience 	<ul style="list-style-type: none"> • Development and use of knowledge-sharing rules, norms, and procedures • Interactive learning
Secondary mechanisms	<ul style="list-style-type: none"> • Development of knowledge processing routines • Development of knowledge base 	<ul style="list-style-type: none"> • Influencing the nature and direction of search • Interface with external knowledge through interpretation, evaluation, validation 	<ul style="list-style-type: none"> • Development of knowledge search routines and knowledge-processing routines • Interface with external knowledge through individuals who are part of internal routines but engage with external environment
Nature of AC dimension	Developmental and forward looking	Cumulative and path dependent	Structured and adaptive
Theoretical foundation	Knowledge externalities and spillover (Griliches, 1979; Jaffe, 1986): <ul style="list-style-type: none"> • Evidence of knowledge spillover: the R&D productivity of firms increase with the R&D expenditure of its neighbours • Firms increase their R&D effort in the presence of knowledge spillover opportunities 	Associative learning and problem solving (Ellis, 1965): <ul style="list-style-type: none"> • Learning occurs when new knowledge is related to prior knowledge • Firm knowledge base development is cumulative and path dependent 	Knowledge integration and information processing (Daft & Weick, 1984; Huber, 1991): <ul style="list-style-type: none"> • Knowledge resides within individuals, and individual knowledge needs to be shared, integrated, or converted to become organisational • The information processing involves acquiring, distributing, or interpreting information
Characterization from Cohen and Levinthal (1990: 128, 132, 138)	“R&D not only generates new knowledge but also contributes to the firm’s absorptive capacity”	“[AC] is largely a function of the firm’s level of prior related knowledge”	“The structure of communication . . . and . . . the character and distribution of expertise” are “aspects of AC that are distinctly organisational”
Subsequent building from the original idea	L. Kim (1998); Lewin, Massini, & Peeters (2011)	Lane and Lubatkin (1998); Carlo, Lyytinen, & Rose (2012); Srivastava, Gnyawali, & Hatfield (2015)	Lane and Lubatkin (1998); Zahra and George (2002); Matusik and Heeley (2005); Lewin et al. (2011); Carlo et al. (2012)

Source: Song et al. (2018, p. 2348) Note: AC = absorptive capacity; R&D = research and development.

In Song et al. (2018) it outlines three characteristics, Absorptive effort, Absorptive knowledge base, and Absorptive Process. Each one of these characteristics have an associated functional role visualised as Radar, Processor, and Converter Translator respectively in terms of knowledge and movement of knowledge within a firm.

2.3.5 ACAP Discussion and Summaries

As it was the case in previous decades, researchers have summarised in this 3rd decade the ACAP literature in an attempt to extract updated learning and propose research directions. This is the case with two bibliometric summaries published in 2017 and 2021. Apriliyanti and Alon (2017) cover ACAP over a 25-year period from 1990 to 2015, covering initially 336 published articles. Their methodological approach was to use bibliometric co-citation and cartography analysis on the term AC (Absorptive Capacity). The results indicated a clustering of the research streams for ACAP (AC), their term. The research indicated that there are five main research streams for ACAP in the International Business (IB) literature in Table 2.16.

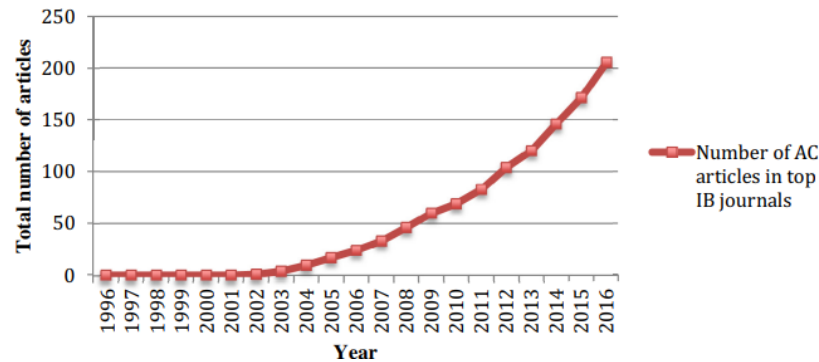
Table 2.16 – Research streams 2017 to 2021

Research streams	Subsections – Research Questions
Intra-organisational learning	How a firm can learn, capture, and exploit the value of external knowledge?
Inter-organisational learning	The role of ACP in identifying learning partners Dyadic inter-organisational relationships Multiple inter-organisational relationships
Knowledge transfer	What the requirements and the role of AC are in the intra- and inter-knowledge transfer process?
Dynamic Capabilities	Question examines the dimensions of ACAP, its components and contingency factors, which re-conceptualized
Micro foundations	Antecedents including the roles of individuals, micro activities and units within the firm that serve as ACAP determinants.

Source: Apriliyanti & Alon (2017)

In the area of international business (IB) research, ACAP has had a continual increase in the number of research articles as illustrated in Figure 2.28, and it continues to draw attention to the ACAP construct as a research topic. The supports the ‘waves of ACAP’ discussed earlier in section 2.3 for literature review in this thesis.

Figure 2.28 – Bibliometric summary of ACAP for International Business (IB)



Source: Apriliyanti & Alon (2017)

The output from these research streams was the development of research questions addressing each of the streams for further research topics.

In the second of the bibliometric analyses, Cunha Filho et al. (2021) focus their research on a period of 2016 to 2020, as the most recent period of ACAP publications. The study initially covered 2,072 publications in academic research with the intent of highlighting ACAP as an organisational ability to assess new valuable knowledge. A technique of bibliographic coupling was used to identify trends and research opportunities related to an organisation’s ability to absorb external knowledge and subsequently their absorptive capacities. A graphic covering the ACAP publication period of interest plus a historical summary of publication is outlined in Figure 2.29.

Figure 2.29 – Summary of ACAP publications from 1998 – March 2020

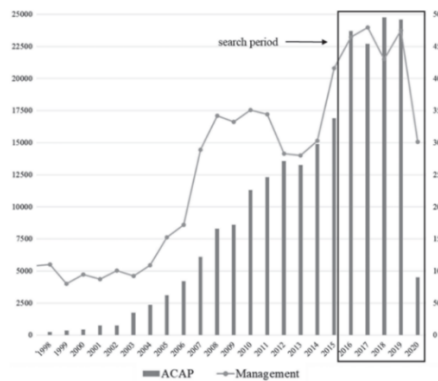


Fig. 1. Number of publications per year from 1998 until March 2020.

Source: Filho et al. (2021, p. 3) indicating area of review

In their findings they indicated five focus areas of research which are listed in Table 2.17.

Table 2.17 – ACAP Research focus areas 2016 - 2020

Findings	Related topic
Organisational capabilities	Knowledge absorption
Alliance Networks	Inter-organisational alliance networks
Open Innovation	Innovation through interaction with other organisations
Intra-organisational learning	Recover and recycle existing knowledge
Ambidexterity	Exploration and Exploitation dichotomy

Source: Filho et al. (2021)

Filho et al. (2021, p. 25) indicate that recognising and acquiring knowledge from the external environment while also developing internal process of learning are widely seen as major contributors to organisational performance. It was noted that search and recognition of valuable external knowledge alone are necessary, but they are not sufficient conditions to achieve innovation outcomes. Assimilation and/or transformation of new valuable knowledge are *paramount* prior to effective application of absorbed knowledge for commercial ends (Filho et al., 2021, p. 27). Similar to

Apriliyanti and Alon (2017) the output from this research is the generation of future research questions where Filho et al. (2021, p. 29) also identified ACAP clusters generated in their bibliometric analysis.

2.4 ACAP development based on literature review

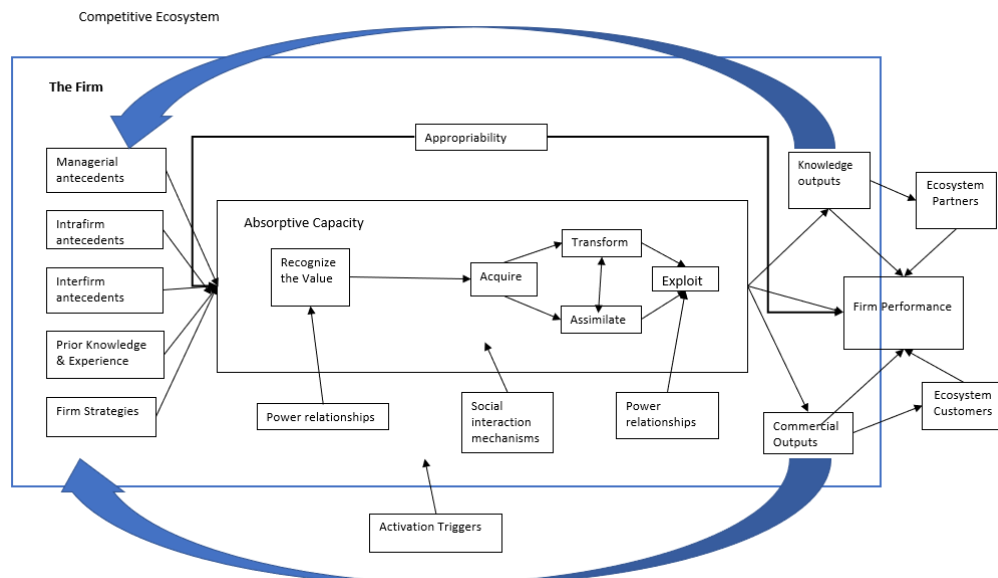
What has been presented thus far in this chapter indicated to the researcher a need to update the integrative typology model, to be more expansive based on the literature review presented in this chapter. Key inputs to the model should be informed to include the topics highlighted in this literature review which include Knowledge Management, the Role of Managers, Organisational mechanisms, and the emphasis on the Management of the transfer of Knowledge and Learning within the organisation. The role of the individual and the social interaction mechanisms providing knowledge transfer within a firm, needs to be included.

This model builds on the evolution of the Absorptive Capacity construct over the last 30 years that has been presented from its earliest articulation by Cohen and Levinthal (1990). Major additions and modifications to the ACAP construct have been highlighted thus far, including researchers Kogut and Zander (1992), Lane and Lubatkin (1998), Lane et al (2006), Todorova and Durisin (2007), Volberda et al. (2010). This includes Zahra and George (2002) who have made valuable contributions to the ACAP development. Knowledge and Knowledge Management understanding has been described previously, as well as the evolution of knowledge, over the decades. How firms are impacted by the decisions managers make on knowledge have also been described through research by Kogut and Zander(1992), Nonaka et al. (1996), Shane (2000), Argote and Ingram (2000), du Plessis (2007), Daud (2012).

2.4.1 A progressive integrative process model contributing to theory

A continuation of the process flow view of the ACAP construct was seen to be a necessary evolution of the ACAP construct to address the gaps identified so far, and provide a contribution to the evolving ACAP theory. By expanding on the integrative typology model of ACAP, additional antecedents and outcomes would appear to be necessary. The gaps include an ecosystem perspective of both current customers and suppliers providing sources of ecosystem knowledge and input as referenced by Adner and Kapoor (2006) and Schweisfurth et al. (2018) and others presented so far. A detailed view of a conceptual framework is outlined in Figure 2.30 below. This is further enhanced by itemising the additional variables and their organisational relationship to the ACAP construct. The detailed model is proposed in the Figure 2.30 below.

Figure 2.30 – A progressive integrative process model for Absorptive Capacity



Source: Author constructed

In the ACAP process outlined in Figure 2.30 there are some additional modifications to the process based on the contributions of other authors to include Zahra and George (2002), Todorova and Durisin (2007), Lane et al (2006), Volberda et al. (2010). These additions are indicated and literary links explained below.

Environmental – The firm exists in a broad environment in which it competes. Stimuli from the environment may prompt action within the firm. Smallbone and Weir (2006) emphasised the influence of the external environment on shaping the growth of the firm. Smallbone and Weir (2006) model linked the Entrepreneur, the Firm and the firm Strategy of the firm in a Venn diagram of influences. Environmental conditions were introduced in this chapter in the models by Lane et al (2006), Volberda et al. (2010). Influences and drivers for innovation are determined by engagements with the external environment indicated by Apriliyanti and Alon (2017) and Filho et al. (2021).

Antecedents- are critical stimuli to the ACAP construct. These antecedents were introduced by Lane et al, (2006), Volberda et al (2010), and emphasised by Marabelli and Newell (2014), but neglected by Zahra and George (2002) and Todorova and Durisin (2007). An additional antecedent, Firm strategy is reintroduced, and referenced by Lane et al. (2006) and the strategic renewal highlighted by Sun and Anderson (2010) and, Helfat and Peteraf (2015). The importance of firm searches is included in the development of the firm as future sources of prior related learning (Laursen & Salter, 2006). The important additions of Problem ACAP and Solution ACAP are not seen as antecedents by Saemundsson and Candi (2017) and, Schweisfurth and Raasch (2107) but as a result of search methodologies in customer and technological engagement perspectives.

Activation triggers – may be introduced by changes in the environment causing the firm to either become proactive in its ACAP process or reactive with links to Narver et al. (2004) and, Zahra and George (2002).

Power relationships – introduced by Todorova and Durisin (2007) can be contributors to how a firm reacts to internal or reacts to external stimuli. Power relationships also affect the firm's commitment to or lack of commitment to explore or exploit knowledge. It has both input and output effects on the ACAP process in this artifact.

Social Interaction Mechanisms – Kogut and Zander (1992) and, Zahra and George (2002) recognised the importance of socialisation within the firm. The importance of social interaction to codify, assimilate and transform knowledge within the whole firm can be traced back to the 4I model. This sharing of knowledge consists of the combinative capabilities of the firm, Kogut and Zander (1992) and van den Bosch (1999).

Recognising the value – a key component introduced by Cohen and Levinthal (1990) and is emphasised in this ACAP process as the first step for ACAP. The definition is reintroduced by Todorova and Durisin (2007) and is maintained in this model including the process of assimilation and transformation that co-exist and are not exclusive linear steps as proposed by Zahra and George (2002).

Knowledge outputs and Commercial outputs – both of these are output measures of the ACAP construct. These have been measured in a firm as R&D performance and they were the focus of Cohen and Levinthal (1990). Collectively these two outputs are indicated as a consequence of ACAP, since what is learned in these outputs can form a learning loop for the firm in future, feeding knowledge creation and innovation. This supports Cohen and Levinthal (1990) that prior knowledge influences what a firm does,

is based on what it knows. Describing the path dependency of a firm as a learning loop for future competitiveness would appear to be valuable in this format.

Appropriability – reference by Cohen and Levinthal (1990) as motivators for investment in innovations is represented as an input and output as introduced by Todorova and Durisin (2007) is maintained in this artifact.

Ecosystem partners and ecosystem customers – can be a source of knowledge as introduced by Adner and Kapoor (2016), where Co-innovation and Adoption chain understanding leads to the creation of new knowledge and is a critical addition to this integrative artifact. As will be discussed later in Chapter 3, the importance of regional parties including universities and regional development (Helix models) agencies in an Irish context can provide knowledge where these entities can be a source of collaboration and technology development (McAdam et al., 2012).

2.4.2 Summary of the progressive integrative model

ACAP is therefore articulated in Figure 2.30 as a process flow of managing learning and knowledge with decisions made by the entrepreneur or managers within the firm. The antecedents of the ACAP construct and the resulting outputs can each be reviewed for their contribution to knowledge recognition, creation and transfer. This articulation also considers the environment in which the firm operates and are made visible.

The process flow within the Figure 2.30 was articulated as indicating the actions and management required to capture, move and store knowledge. Knowledge resides in each of the boxes representing the antecedents. Knowledge is indicated as flowing from these locations into the ACAP construct of the firm resulting in a flow of measurable impacts, as outputs, from the process model moving from left to right. The arrows indicate the sources of knowledge and the directionality of the flow of knowledge emanating from

these locations. It can be observed that there is a cycling or reuse of knowledge that firms have generated through the employee's motivation, training and active engagement. This implies the existence of knowledge reservoirs, with the ability to embed the knowledge. This flow brings attention to the path dependency of the individual knowledge which is based on its active use, resulting in the path dependency of knowledge and creation of capabilities for the firm which is recognised as evolving over time.

2.5 Reflective perspective on developing a higher order artifact for ACAP

Upon further reflection by the researcher on the literature published throughout this recent decade and the development of the progressive integrative process model presented above in Figure 2.30, a pause was taken.

It can be argued that Figure 2.30 follows previous operationalisations of the construct, but it also contributes to the overall construct evolution and theory development of ACAP. This modified process has manifestations similar to Zahra and George (2002), Lane et al. (2006), and, Todorova and Durisin (2007) and their representations.

As proposed, this process model may not fully illuminate ACAP practices applied by managers to innovation processes within a firm creating and managing knowledge. The re-emergence of Dynamic Capabilities in the literature which describes ACAP in its two sub components PACAP and RACAP emphasises the role of management and Top Management Teams (TMT) and how the action they take can impact the value creation of the firm. In the recent publication Teece (2019) emphasises a capability and managerial, strategic management approach to firm's creation of value. Teece (2019) together with a publication by Clauss et al. (2021) propose the role of PACAP and the

management role, together, create an ambidexterity approach to value creation. This supports engaging management in the application of ACAP in a meaningful way. Engagement of management with an updated operationalised ACAP view in the above Figure 2.30 format, may not be readily communicated and understood by firms in their approaches to generating differentiated solutions. This is particularly relevant in SMEs that have limited resources and are age dependent. The impact of age of the firm has been indicated multiple times as having a direct impact on the performance of the firm. This was covered in section 2.2.3 to emphasise the findings. It is therefore not seen as a practical method for management engagement in its current form and another approach was required for this research.

By including the recent work of Volberda et al. (2010) and the recent reconceptualisations of the ACAP construct proposed by Marabelli et al. (2014), and the knowledge dimensions proposed by Song et al. (2018), a more parsimonious representation is considered possible and appropriate for managerial engagement with SMEs.

It is proposed by the researcher that focusing on a *higher order model* instead of continuing to focus on the individual antecedents and microfoundations of the ACAP construct, may lead to a more practical articulation to the multidimensionality and Dynamic Capabilities view of the ACAP construct.

It is recognised that after three decades of research, the number of components articulated within the ACAP construct has continued to vary from the three-step process articulation by Cohen and Levinthal (1990). A variation of four components or five components of ACAP exists depending on the perspective of the authors outlined so far. These variations, represented in Table 2.18, have contributed to the difficulty of

interpretation and they provide a challenge to engaging management with a holistic approach to the ACAP construct.

Table 2.18 – Variation of ACAP components articulated since 1990

ACAP Process	Recognition	Acquisition	Assimilation	Transformation	Exploitation
Cohen & Levinthal (1990)	Recognition		Assimilation		Exploitation (Apply)
Zahra & George (2002)		Acquisition	Assimilation	Transformation	Exploitation
Lane (2006) (Reification)	Recognition Exploratory Learning		Assimilation Transformative learning		Exploitation (Apply) Exploitative learning
Todorova & Durisin 2007	Recognition	Acquisition	Assimilation	Transformation	Exploitation
Marabelli & Newell 2014 (Reconceptualisation)	Recognition		Assimilation	Transformation	Exploitation
Author 2020	Recognition	Acquisition	Assimilation	Transformation	Exploitation

Source: Author constructed

2.5.1 – The 5-Loop Framework

This section outlines an approach to address the challenges of management engagement with the ACAP construct but taking into account the literature learnings presented so far in this chapter.

Table 2.18 indicates that over three decades how the articulated components of ACAP have varied. By combining the recent documented research summary for the last decade, it can be highlighted that certain repeated themes have been the focus of researchers efforts striving for better ACAP component understanding. To help facilitate this, a categorisation list is available in Appendix 1, where publications are summarised by year, the key research, the methodology used and the findings which contributed to informing an alternative novel view for ACAP engagement are listed. This accumulation of past research enabled the researcher to propose these themes in Appendix 1 and they can be summarised as five categories covering firstly the External

environment, secondly the Organisation, followed by the Individual and finally a results or Output category of the firm. These first four categories represent the firm sources and flow of knowledge within a firm leading to performance. By grouping this recent research and using the ACAP knowledge dimensions proposed by Song et al. (2018), a fifth category of ACAP can be added to generate a differentiated ACAP framework illustrated in the Table 2.19 below.

Table 2.19 – Five higher order ACAP capabilities

		ACAP Effort - dimension	ACAP knowledge base. - dimension	ACAP process - dimension
Two Dimensionality	Multi-dimensional ACAP construct Multilevel (dynamic) capability	Knowledge building investments by the firm	Current knowledge stock of the firm	Internal firm procedures & practices related to knowledge diffusion
Individual Y- Axis	Characteristics, Entrepreneur, & Staff			
Organisation Y-Axis	Mechanisms Tools & Processes			
External X- Axis	Inputs & Sources Environment, Networks			
Internal ACAP X- Axis	PACAP & RACAP			
Results X- Axis	Outputs/Outcomes Knowledge, Sustainability			

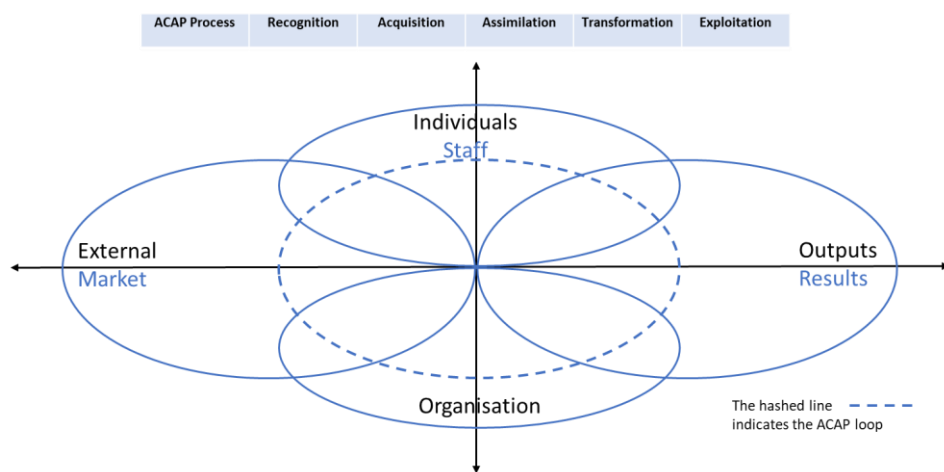
Source: Author constructed

By identifying the categorisations, Appendix 1, at the higher level, they can be traced through the literature back to Cohen and Levinthal (1990). Key insights were identified regarding the contribution of different Individuals, the Organisation choosing to operate in the External environment, the path dependency of knowledge investment through learning now and in the future, which in turn generates an appropriability in terms of Outputs for the firm. With the insight from Song et al. (2018), the interdependencies of knowledge and knowledge flows can be represented in the 5-Loop framework ACAP

artifact, revealing the multidimensionality of the ACAP construct in Figure 2.31. The 5-Loop framework therefore represents a parsimonious engagement tool for discussion with individuals on how ACAP is understood and applied in individual firms.

This 5-Loop framework will be utilised in engaging with a purposive selection of SMEs in Ireland. The application and use of the 5-Loop framework will be described in Chapter 5.

Figure 2.31 – A 5- Loop framework artifact of ACAP



Source: Author constructed

Literary underpinnings to the 5-Loop Framework

The five categories in Appendix 1 can be explained in a two-dimensional representation of the construct. In the X axis, the ACAP process can be envisioned as evolving according to previous research by Zahra and George (2002), Lane et al. (2006), Todorova and Durisin (2007). The ACAP process is indicated as a hashed permeable loop or “porous boundaries” described by Volberda et al. (2010) allowing for the flow of knowledge from many sources. Lane (2006) observed that Cohen and Levinthal (1990) as well as Lane and Lubatkin (1998) and Van den Bosch et al. (1999) imply ACAP is a funnel that emphasises exploratory learning. Lane (2006, p. 855) indicated that Zahra and George (2002) departed from that depiction and refer to ACAP as a pipeline based on efficient knowledge exploitation. This knowledge boundary is

enabled by those individuals acting in the boundary spanning or gatekeeper roles. Jones (2006) articulated that Individual's roles, for mature organisations as well as the entrepreneur and staff can be considered as the interfaces to the Output loop via SIMs. Knowledge can be hypothesised as flowing through the porous boundaries from many sources. This leads to a visual of ACAP as a bounded area covering the External environment and the Output (results) category. ACAP can be considered as a continuum from left to right on the X-axis. This view allows for the segmentation of *Potential* and *Realised* ACAP with the associated dimensions of ACAP positioned where they interact with each other. The positioning of the ACAP dimensions allows for management or TMT discussion on the contribution of each dimension to the outputs of either PACAP or RACAP depending on the dynamism of the environment. The firm has opportunities for prior and future knowledge development across this ACAP continuum. Much of the research to date has focused on the inputs and process for gaining knowledge from the external environment. In the Outputs (results) category, three decades of results have indicated multiple measurable outputs or Outcomes including R&D, innovation, new product introduction or firm performance or simply knowledge accumulation in a specific area.

In the Y-axis, two other categories can be considered, the Individual and the Organisation both have strong literary linkages back to Cohen and Levinthal (1990). The Individual category consists of subcategories including the Individual, entrepreneur/founder, the team level, the manager, individuals in the business units. The Organisational category captures all the organisational mechanisms, tools and processes proposed and researched to manage PACAP and RACAP unique to the firm's environmental context (Argote & Fahrenkopf, 2016; Helfat & Peteraf, 2015).

All of the five categories can be considered to have a ‘ring of influence’, representing how communication, SIMs link and enable or prevent knowledge flows within and across the five categories. The “porous boundary” for the ACAP category emphasises the bidirectional flow of knowledge as the epistemology of possession or practiced knowledge. By including the dimensions of knowledge, knowledge effort, knowledge base and knowledge ACAP process lenses, outlined by the Song et al. (2018), a higher order 5-Loop framework managerial engagement construct was conceived.

2.6 Summary of this chapter

This literature review has been extensive and covered over three decades of research related to the ACAP construct, its antecedents, its microfoundations and outcomes perceived or realised. A large number of published papers have been reviewed with some predating the Cohen and Levinthal (1990) paper, for context of understanding ACAP in the firm. What is apparent from this literature review is that ACAP continues to evolve with major revisions to the construct evolving each decade, emphasising the multidimensional aspect of the construct. Clustering of research topics within ACAP have been highlighted in section 2.3.5. Parallels have been indicated in terms of organisational constructs where ACAP and other constructs including Dynamic Capabilities, Organisational mechanisms, Learning and the role of Management for Ambidexterity overlap in theory. Commonalities of managerial practice including the external environment and technology understanding requires a cognitive understanding of the interrelationships that exist in knowledge generation, storage and knowledge flows within the firm. Studies have indicated the importance of knowledge in generating a competitive advantage which results in innovative solutions that meet customer’s needs. Characteristics of the firm have been identified including age, size and market orientations that affect innovation and performance. The outputs of ACAP have been

described beyond the research measures of the earlier decades, which were purely economic decisions and the financial burdens of R&D. The strategic advantage emphasised in earlier decades has been highlighted as potentially shifting to an holistic approach of the environment understanding to enable sustainability of the firm based on capabilities.

Innovation occurs when knowledge about unmet customer needs intersects with knowledge about technological solutions (Schweisfurth, 2018, p. 687).

Attempts to operationalise the process view of this construct have been evolving since Cohen and Levinthal in 1990. Subsequent researchers have generated a broad array of process models attempting to capture the key drivers, antecedents, microfoundations and outcomes for firms applying ACAP. Zahra and George (2002), Lane et al. (2006), Todorova and Durisin (2007), and, Marabelli and Newell (2014), including the publications by Song et al. (2018) have built on ACAP understanding.

The researcher has provided an updated operationalised view of the construct, Figure 2.30, based on recent insights from the extant literature with a contribution to theory.

What the researcher has further conceptualised is a novel higher order model, a working process model, focusing on, not just the foundations or microfoundations of each of the drivers, antecedents or outputs of ACAP, but on an *holistic* business engagement of ACAP. Emphasis has been placed on the management engagement through the 5-Loop framework, Figure 2.31. This view could inform at a firm level, those actions identified from previous research that might facilitate improved innovation success levels. The literature acknowledges that innovation does regularly fail as part of the learning process and that knowledge is path dependent. It has been indicated that ACAP can have a positive and negative impact on the aspirations of the firm. The 5-Loop framework conceived here, will provide the foundation for the multiple case study research (Yin, 2002) in an effort to identify how SMEs manage the flow of knowledge

through an ACAP lens necessary for sustainability. Chapter 3 will provide the necessary context for this research study.

Chapter 3 Absorptive Capacity and the innovation ecosystem in Ireland

3.1 Introduction to the Knowledge Economy

In Chapter 2, the importance of knowledge and knowledge management as well as other organisational mechanisms and behaviours were discussed and how they have become major contributing factors in the application of ACAP. In this chapter, the context of a small state, fast follower economy is explored as a creator of knowledge. The influence that a supportive SME environment can have on firms, is presented. The conditions for an economic and educational environment where indigenous firms may want to start up and be sustainable will be explored and the implications discussed.

The knowledge economy has arisen from the recognition that many developed economies are dependent on the creation, exploitation and distribution of knowledge as drivers for their economic wealth. The ‘knowledge about knowledge’ has become a central economic resource for developed global economies. According to the OECD, knowledge-based economies are those that

are directly based on the production, distribution and use of knowledge information. This is reflected in the trend in OECD economies towards growth in high-technology investments, high-technology industries and more skilled labour associated gains (p. 3)

Roberts (2009, p. 286) notes that there was not a real consensus on the definition of a knowledge economy. However, it was indicated that there are eight core features of a knowledge economy. They are outlined as follows, firstly the growing importance of knowledge as an input into the economy. This is facilitated by the increasing importance of information and communication technologies (ICT) in economies leading to the rising importance of knowledge as an economic output. Measures such as the growing

commercialisation of knowledge through Intellectual Property Rights (IPR) have become important. Roberts indicated that an overall increase in the proportion of knowledge workers which leads to the increasing impact of knowledge across all sectors of the economy as a feature. Management too, has seen changes with the rise of knowledge management practices. The final feature noted was acknowledging that the influence of globalisation as a force driving for the expansion of the knowledge economy.

Knowledge in the industrialisation of economies is not new. It has always been important in the past, for manufacturing and production of goods and services. This knowledge was handed down and training given through apprenticeships and guilds for centuries. What is different in this era is the availability of Information Communication Technology (ICT) tools and services including the internet that allows for the rapid transfer and connectivity of knowledge between economies. This highlights the role of the internet as the very facilitator in the transfer of, and dissemination of knowledge. Internet infrastructure assets are therefore important nationally and at the level of the firm. The knowledge economy is driven by innovating organisations using new ICT technologies to enable their offerings. David and Foray (2003) propose that this change to a knowledge economy represents a 'soft discontinuity' rather, than as a sharp break from the past innovation cycles of economic growth.

Another recent definition was provided by the UK Economic and Social Research Council ESRC, 2005 as follows

Economic success is increasingly based upon the effective utilisation of intangible assets such as knowledge skills and innovative potential as the key resource for competitive advantage. The term, knowledge economy, is used to describe this emerging economic structure. (ESRC, 2005)

It was Brinkley (2006) who indicated that the distinguishing feature of the knowledge economy was the deployment of new technologies to allow a more systematic exploitation of tacit knowledge. This also included that the stock of knowledge is not depleted by its use and the value to the economy comes from sharing disseminated knowledge. Brinkley (2006) indicated that the knowledge economy is present in all sectors of the economy, not just knowledge intensive sectors. Powell and Snellman (2004) restated the intangible assets discussion, as outlined, that the key components of the knowledge economy includes a greater emphasis on intellectual capabilities, rather than physical inputs or natural resources alone. This approach builds on the work by Solow (1957) in the representation of economic growth with the following equation

$Y = A K^a L^{1-a}$ Y is gross output, where A is knowledge with K representing capital and L, labour. Note that “a” represents that there are diminishing returns on individual inputs. The only way for the neoclassical economy to keep growing on a per capita basis is by continuously expanding the stock of knowledge, A, the intangibles. (Solow based on a neo-classical model, indicated that Gross output is a function of only two factors which led him to include a third component Knowledge to explain the different in performances.) Source: (EIB, 2009. p. 11) The knowledge economy in Europe

Putting this equation in an economic perspective, the role of intangibles in the knowledge components of the equation indicate they are playing an increasingly important role in economic growth. The European Investment Bank (EIB, 2009) in The Knowledge Economy report 2009, state the intangibles as Computerised information (Software and databases), Scientific and creative property (R&D, mineral exploration, copyrights and license costs other product development, design and other research expenses), the Economic competencies (brand equity, firm specific human capital and organisational structure).

It was estimated in this report that intangible assets account for one third to one half the market value of US corporations. This is particularly important when looking at valuations for start-ups and new firms that may have intangible assets that outweighing

their tangible assets and looking for funding in an early round of financing. The role that ICT plays in the Irish knowledge economy and how having an understanding of the drivers for their adoption might affect future economies in the small state, are explored in the following section.

3.1.1 Ireland's evolution into a knowledge economy

The European Council President's meeting notes in 2000 (European Parliament, 2000) where Europe set an ambitious target to become the most competitive and dynamic knowledge-based economy in the world by 2010. Ireland as a full member of the European Union since 1973, adopted this approach in the early 2000's as a way to becoming a knowledge driven economy. The Celtic Tiger years (1993 to 2001) saw the economy experiencing accelerated growth, measured as output per worker as five percent per year. FitzGerald (2007) gave a summary of the drivers of the Celtic Tiger outlining the role of knowledge impacts from high tech industrial projects as well as an increase in labour productivity. The importance of women joining the workforce as well as an increased level of education among the young workers combined with a return of experienced emigrants back to Ireland was presented by FitzGerald (2007).

However, Ireland is a recent knowledge economic state, described as a 'smaller late developer state' (Buckley, 2016). Ireland was considered an inward-looking state until the national pivot to FDI in the 1950s. The state abandoned a policy of import substitution in the 1950s to initiate a long-standing outward looking effort to attract foreign direct investment (FDI) which it has continued to this day. The motivation for this policy was to generate local jobs followed by structural changes in the economy. Van Den Bulcke (2013) observed that many reports in the period 1997 to 2001 were written outlining the evolution of various Irish economic clusters including the ICT,

computer software, dairy, pharmaceuticals and even including the Irish music industry, all viewed from a Porter (1990) diamond model perspective. Porter (1990) highlights four determinants of national competitiveness. They are factor conditions, then demand conditions, followed by related and supporting industries and finally firm strategy, structure and rivalry. Porter (1990) further outlines the role 'chance' and the additional role of government policy plays that can influence the four determinants. Factor conditions are those elements or factors that a country has or inherently possesses, like land, location and natural resources. The outsized role of government industrial policy that is peculiar to the Irish economy, in addition to its role in driving the success in attracting FDI to Ireland over many years through the Irish Development Authority (IDA). Breznitz (2012) theorised that this perspective is a form of the networked developmental state (NDS). Theorising it as a way of indicating Ireland's unique way of attracting FDI and helping to build clusters of similar industries. Breznitz (2012) further describes the role played by the Irish governments as Neoliberal Developmentalism (ND). This version of ND is described as two conflicting philosophies where on one side the government supports free market development for FDI and on the other, it has a strong belief that governments should play a strong role in enhancing competitiveness and encouraging growth within the indigenous economy. It can be argued that despite this policy, or as a result of this policy, it has helped to modernise the Irish economy in a way that is not typical of other industrial policies. Ireland's performance in the World Economic Forum 2018, (WEF, 2018) on a competitive Index, Ireland attained a position of 23. This competitive assessment is built on twelve pillars of economic indicators resulting in a competitive ranking. These twelve pillars form the basis for four components indicating the relative ranking of competitiveness activity in a global knowledge economy. The four focus areas are Enabling environment (Institutions,

Infrastructure, ICT Adoption, Macroeconomic stability), Human capital (Health, Skills), Materials (Product market, Labour market, Financial system, Market size) and the Innovation Ecosystem (Business dynamism, Innovation capability).

Within the European Union (EU) the Innovation Index, 28 countries (pre-Brexit), Ireland was positioned just above the mean in the more established economies referenced as the North West grouping at 23 for 2018. Ireland was positioned at number 10 in the overall 28 countries ranked within the EU. This grouping is indicated in the Table 3.1 below.

Table 3.1 – WEF 2018 ranking of the European 28 economies

North West EU Region I	GCI Score	South East EU Region II	GCII Score
Austria	22	Bulgaria	51
Belgium	21	Croatia	68
Denmark	10	Republic of Cyprus	44
Estonia	32	Czech Republic	29
Finland	11	Hungary	48
France	17	Romania	52
Germany	3	Slovakia	41
Ireland	23	Slovenia	35
Latvia	42	Poland	37
Lithuania	40	Greece	57
Luxembourg	19	Italy	31
Netherlands	6	Malta	36
Sweden	9	Portugal	34
UK	8	Spain	26
Group data is listed below GCI score, South East region respectively II			
Average GI	18.8	Average GII	42
Median	18.8	Median	41
Range	3 – 42	Range	26 - 68
Dispersion	39	Dispersion	42

Source: WEF 2018 Competitive Index rankings. Adapted by author

Visually this can be presented as an update from the WEF (2019) for Ireland

Figure 3.1 – Global Competitive Index 2019



Source: WEF (2019)

With these levels of Innovation, Ireland at levels of (23,24) is not seen as an innovation leader, more so an innovation laggard in recent years. These indexes highlight a combination of FDI investments with global firms and indigenous firms contributing to the indicated levels. It is the combined efforts of an increasing knowledge economy that will alter the perspective of Ireland in these metrics.

For an innovation-based knowledge economy to exist and be sustainable, there must be knowledge generation as well as the conditions to encourage or incentivise individuals present in Ireland to enter into business.

A dependency on FDI alone, to set up new firms to enable the knowledge economy is important, but not sufficient for an integrated knowledge economy. The progression of activities and increasing policies to enable Ireland to position itself as a potential innovation leader will be outlined in the following sections as route to drive SME development.

3.2 The Irish economic performance

The modern Irish economy is understood, by considering the history and evolution of the state. Some of the challenges are highlighted, illustrating how the economy is positioned for participation in the European technology trading block of 27 nations as well as competing globally.

3.2.1 A broad review of the evolution of the Irish economy up to 2022

As indicated by Breznitz (2012) Ireland's successive governments played a very different role in the development of the Irish economy compared to other countries that were seen as variants of the 'late-developer' small state economies. Similar countries like Taiwan, South Korea and Singapore, followed a strategy of enticing Multinational Enterprises (MNEs) into their economy, only to develop supporting infrastructure and supply chains to develop their indigenous manufacturing industries and knowledge (Wang, 2019). These economies then benefited by becoming markets for the inward-bound MNEs. These other 'late-developer' small states supported MNEs, but not to the detriment of indigenous SMEs or to stifle the opportunities of these indigenous firms to grow which was the case in Ireland. For Ireland joining and participating in initially, the

European Economic Community (EEC) in 1973 and subsequently being a strong supporter for the European Union (EU), has led to internal and external advantages in Ireland that other ‘late-developer’ small states did not have.

The initial impact was a negative one for indigenous firms in Ireland in the 1970s.

These firms that were not able to avail of the spillovers from MNEs and they did not have the capabilities to invest to compete in the larger market provided by membership of the EEC. Where Irish firms struggled, was in their ability to meet the minimum threshold in capabilities (Ruane & Udur, 2002).

A series of reports highlighted these deficiencies. The Telesis (1982) report advocated completely overhauling Ireland’s industrial policy following a backdrop of over 44,000 emigrants in 1989, many of whom were the young, educated beneficiaries of the free education introduced in 1966 by the then Minister of Education, Donogh O’Malley.

The Culliton (1992) report called for an overhaul of how Ireland approached FDI and the expectations for the longer-term economy, not just one of providing onboarding services to MNEs, but one where these enterprises could mutually benefit the Irish economy. While it would take another ten years for the benefits of these interactions and the report’s recommendations to be realized, the Celtic Tiger came and went, leaving different economic issues within the construction and banking sectors.

By the end of 2002, Ireland was on a more equal footing relative to other members of the European Union. The Table 3.2 below outlines many of the key governmental interventions and policy changes which enabled Ireland to strive to be a knowledge economy by the end of 2010.

Table 3.2 – Key Irish government economic intervention dates

Date	Event or publication	Comments
1922	Creation of the Irish free State	Break from United Kingdom
1940	Import substitution Industrialisation	A government effort to break economic ties to the UK
1949	Irish Republic declared	External relations act was repealed and Ireland left the common wealth of the UK as a sovereign republic
1949	Irish development agency established. A new era of foreign direct investment (FDI)	Briefed to stimulate, support and develop export led business and enterprise in Ireland. This covered both indigenous and foreign investment and start-up enterprises
1958	Ken Whitaker's Economic Policy	Framework for all subsequent Irish economic and industrial policy
1966	Education Minister Donogh O'Malley	Made secondary education free
1969	Autonomous role for IDA. Autonomous state sponsored body	Responsible for all aspects of industrial development
1973	Ireland joined the European Economic Community	After three attempts Ireland joined the EEC
1981-1983	Telesis Report	Deliberation and publication which advocated completely overhauling Ireland's industrial policy
1986	European Union	A single European market. A "Fortress Europe" with rules of origin and local content requirements.
1989	Irish emigration (Breznitz, 2012) P98	Emigration hits 44,000 or 1.1% of the population.
1992-1993	Culliton Report	Debate and publication of Fianna Fáil-Labour coalition government, which overhauled Ireland's development agencies.
1994	Establishment of Forfás Dissolution occurred in 2014	The national policy advisory board for enterprise, trade, science, technology and innovation in Ireland
1998	IDA split into three organisations. Oversight for agencies was Forfás. IDA focus exclusively on FDI	Promotion and development of high quality FDI. Manufacturing and international services sectors
1998	Creation of Enterprise Ireland	Mandate to promote Irish owned industry
2000	Science Foundation Ireland (SFI) To manage Ireland's Technology Foresight Fund	This agency was established under the Industrial Development Act 2003
1993 - 2001	End of the Celtic Tiger	A period of excessive growth in Ireland. Employment 5X the EU rate begins to stabilize
2004	Eoin O'Driscoll's Enterprise Strategy Review	Strategic industrial development plan. "Ahead of the curve"
2005	Transforming Irish Industry	Ms Harney, Tainiste, Creation of two new divisions at EI. One for Export Marketing and one for R&D
2007	SFI and the Programme for Research in Third level Institutions PRTL (Breznitz, 2012)P105	Collectively invested 1.5 Billion Euros into education
2009	Financial Crisis	Wall street crash affects Irish banking and building sectors

Source: (Breznitz, 2012),(Paus, 2012), IDA website, SFI website, adapted by author

3.2.2 The importance of (FDI) to the Irish economy

It has been acknowledged that Ireland has had a successful history of attracting FDI. In Ireland, similar to smaller states like The Netherlands, Finland, Taiwan and Singapore, the approach taken by successive Irish governments has been one of job creation based on inward investment. It has been proposed that countries with weak indigenous firms and a weak history of knowledge creation benefit from FDI investment with knowledge spillovers (Acs. et al., 2012). The vehicle (agency) to developing this capability was the creation and long history of the Irish Development Agency (IDA, n.d.). The timeline outlined in the Table 3.3 below indicates some key dates for this form of government neoliberalism though the role of IDA has evolved.

Table 3.3 – The IDA and Industrial policy development.

Date	Entity	Scope	
1949	IDA created	As part of Department of Industry & commerce	Briefed to stimulate, support and develop export led business and enterprise in Ireland. This covered both indigenous and foreign investment and start-up enterprises
1952	Córas Tráchtála The Trade Board	A semi state organisation creating exports for Irish produce. Later merged into EI	Founded enable agricultural exports like meat and butter initially to the US and later into Europe
1969	Autonomous role for IDA	Autonomous state sponsored body	Responsible for all aspects of industrial development
1974	Irish Goods Council	Promoted Irish good at home	Developed “G” symbol to guarantee Irish goods at home. Later removed due to infringement of Council of Rome free trade ruling
1994	IDA split into three organisations	The IDA focus was exclusively on FDI	Promotion and development of high quality FDI. Manufacturing and international services sectors
1994	Establishment of Forfás (Dissolution occurred in 2014)	Establishment of Forfás	The national policy advisory board for enterprise, trade, science, technology and innovation in Ireland
1998	Enterprise Ireland was established by the Industrial Development (Enterprise Ireland) Act 1998,	EI superseding two earlier bodies: Forbairt and An Bord Tráchtála	Enterprise Ireland is the government organisation responsible for the development and growth of Irish enterprises in world markets. We work in partnership with Irish enterprises to help them start, grow, innovate and win export sales in global markets. In this way, we support sustainable economic growth, regional development and secure employment.
2017	Target employment levels	2015 plan target was 209,000 jobs from FDI	210,443 jobs created through FDI
2019	Anniversary	70 years in existence	Keystone in Irish economic policy

Source: IDA website, Enterprise Ireland website

Breznitz (2012) indicated that according to ND theory, Ireland's industrial development agencies, the Industrial Development Authority (IDA, n.d.) and Enterprise Ireland (EI, 2022) built a pool of professional skills and knowledge, coupled with extensive domestic and international networks. This was enhanced by recruiting professional managers from industry to network and travel globally promoting the benefits of Ireland and the developing economy as a strategic state objective.

Through these networks, the agencies helped strategically plan and implemented the government policies (O'Riain, 2004). The result was rapid economic growth and exponential development of the indigenous software industry. While some have seen the tax incentives given to transnational corporations (TNC) as too favourable, it has evolved over the years to be a competitive advantage that has evolved into a broader range of advantages of skilled labour and access to EU markets. Paus (2012) noted that the corporate tax rate on profits from exports was changed in the 1980's from 0 percent to 10 percent under pressure from the EEC. It was subsequently revised to 12.5 percent in 2003 for all other corporate activities. This reflects the change in emphasis of the types of TNCs that were attracted to Ireland over the decades of IDA existence. Initially the focus was on companies that saw Ireland as a low-cost manufacturing state.

The products manufactured in Ireland were not for the domestic market but they were destined for export with access to bigger markets in Europe. There was little supply chain integration in the products being manufactured in Ireland and they did little to develop the capabilities of the state.

The skillset changed and also the working population in Ireland became more third level educated through the late 1980s. The younger population entered the workforce when a different type of multinational enterprises (MNEs) began to arrive in the state. These companies were a broader range of companies and from different international locations

than the initial IDA targets for FDI from the US or UK manufacturing companies of the 1950's through to the 1970s. These changes are highlighted below in Table 3.4 showing the increase of inward investment levels over subsequent decades.

Table 3.4 – FDI inflows into Ireland

Year	FDI inflows	Comments
1970s	\$205 M	Focused on establishing US companies in Ireland
1980s	\$141 M	US and European focused
1990's	\$4.9 B	Moved to leverage growing skilled workforce
2000's	5.2 billion Euros	Average FDI investments in Euros

Source: (Paus, 2012) adapted by author

The increase in investment is from individual companies as well as an increase in the number of FDI firms entering Ireland in the 2000 era. Paus (2012) indicated that three other dynamics led Ireland to see this substantial growth occur in the 2000's era. It was a combination of new graduates who were highly skilled entering the workforce. It was also the gender shift to include more females joining the workforce. And finally, where emigration which had penalised the growth history of Ireland for decades, emigration finally reversed with the return of approximately one third of the population who had emigrated in the late 1980's (Paus, 2012).

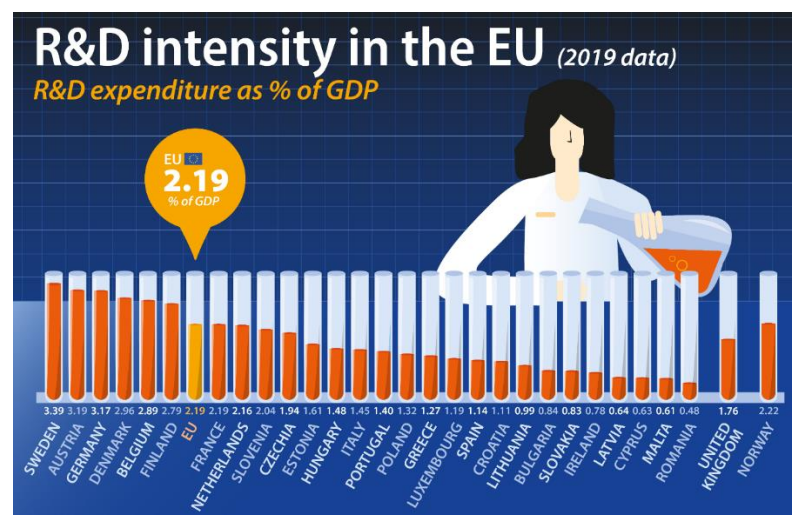
3.2.3 State support for indigenous enterprise growth

R&D spending

For enterprises to leverage the knowledge economy a consistent measure is R&D investment by firms. This was a central theme in Cohen and Levinthal (1990) and the associated economic investment decision for firms. The Central Statistics Office (CSO, 2019) Business Expenditure on Research and Development (BERD) issues this level of statistics in Ireland. In the most recent report, it was indicated that Irish companies were

increasing spending on R&D. In the 2017-2018 period, R&D spending increased to €2.8b, an increase of 24 percent compared to R&D expenditure in 2015. This was the largest biennial increase in the last ten years. Putting this spending in context, the Eurostat data for 2015 – 2016 report showed that Ireland was operating at less than 1 percent of GDP but at the time Ireland was ‘on a runway’ to get to the EU target by 2020. In the 2019 data below, Ireland was 0.78 percent of GDP while EU R&D was at 2.19 percent to a target of 3 percent of GDP. By these metrics Ireland is at a low level of investment in R&D.

Figure 3.2 – EU data on R&D expenditure as a percentage of GDP



Source: EC.europa.eu/eurostat

It is observed that in the Eurostat for Ireland in 2016 report the share of small and medium size enterprises was 15 percent and 21 percent while large enterprises were 63 percent of the total R&D spending. Foreign owned enterprises accounted for 69 percent of the R&D spending. For R&D spending as discussed, Ireland is starting from a low baseline level.

Higher education levels

Another measure regularly reported in the literature is the level of education within the enterprise. This builds on the prior knowledge and prior experience of the individual and staff. As outlined by Volberda et al. (2010) and indicated in Chapter 2, managerial antecedents of ACAP include the individual knowledge development and sharing of this knowledge through SIMS, can have an impact on the ACAP of the firm and ultimately the firm performance.

Ireland has continued to emphasise an increase in education level as a national attainment priority. The Oireachtas (2018) questions relating to The Programme for Research in Third Level Institutions (PRTLTI) indicated that as of 2018 the PRTLTI has received five cycles of expenditure. This programme was launched in 1998. The 5th Cycle initiated in 2010 saw €277m invested with another €59m provided by private investment. This ongoing investment by the Department of Business, Enterprise and Innovation (DBEI) has continued to fund the creation of cohorts of masters and PhD programs with a goal of positioning Ireland as a leader in post graduate research, training and education. From the 2010- 2019 census, CSO (2019), the CSO published data shows that there were 28,759 PhD graduates in Ireland. This indicates a 31 percent increase over 2011 and a 99 percent increase over 2006. The commitment of successive Irish governments to increasing the number of people in high tech level research has continued. In a contrarian comment the extra time spent in education by Irish nationals is now seen as a limitation to Ireland reaching previous employments levels (CSO, 2019).

Science Technology Funding

The focus of SFI has been to generate jobs within Ireland through new skills development or acquisition. SFI have also sought to generate employment through university spin outs (USOs) or alongside collaboration with higher education facilities both in Ireland and across the globe. This is in line with many other national efforts to promote Triple Helix initiatives referenced in the publication by McAdam et al. (2012). The Science Foundation Ireland, (SFI, 2020) report, described the role that the SFI plays in supporting and integrating Universities in terms of staff and collaboration mechanisms across the country. The main SFI dashboard is presented with some key data in Figure 3.3 below.

Figure 3.3 – SFI Excellence in Science for 2020

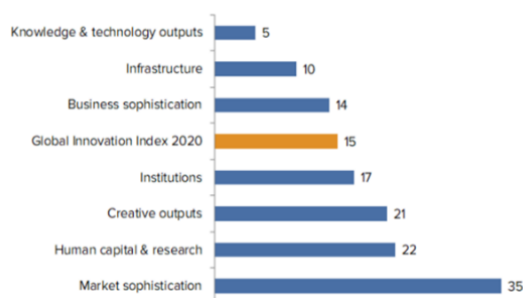


Source: SFI (2020)

SFI data ranks Ireland high in many of the measures in the top 5 ranked positions. SFI reaches across all regions within Ireland and report activity in each of the four provinces. Ireland is only ranked 15th as a most innovative country according to The Global Innovation Index, GII (2020).

Figure 3.4 – Overview of Ireland rankings in the seven GII areas.

Ireland performs best in Knowledge & technology outputs and its weakest performance is in Market sophistication.



*The highest possible ranking in each pillar is 1.

The table below gives an overview of the strengths and weaknesses of Ireland in the GII 2020.

Strengths			Weaknesses		
Code	Indicator name	Rank	Code	Indicator name	Rank
2.1.3	School life expectancy, years	9	2.1	Education	67
3.3	Ecological sustainability	5	2.1.1	Expenditure on education, % GDP	84
3.3.1	GDP/unit of energy use	2	2.1.2	Government funding/pupil, secondary, % GDP/cap	73
5.1.5	Females employed w/advanced degrees, %	8	3.2.3	Gross capital formation, % GDP	58
5.3	Knowledge absorption	3	4.1.2	Domestic credit to private sector, % GDP	79
5.3.1	Intellectual property payments, % total trade	1	4.2.2	Market capitalization, % GDP	40
5.3.4	FDI net inflows, % GDP	6	4.3.2	Intensity of local competition ¹	64
6	Knowledge & technology outputs	5	6.1.3	Utility models by origin/bn PPP\$ GDP	40
6.2	Knowledge impact	1	7.1.3	Industrial designs by origin/bn PPP\$ GDP	58
6.2.3	Computer software spending, % GDP	2	7.2.1	Cultural & creative services exports, % total trade	79
6.2.5	High- & medium-high-tech manufacturing, %	2	7.2.4	Printing & other media, % manufacturing	88
6.3	Knowledge diffusion	1			
6.3.1	Intellectual property receipts, % total trade	7			
6.3.3	ICT services exports, % total trade	1			
6.3.4	FDI net outflows, % GDP	1			

Source: GII (2020)

This was a change from the 2019 position of number 12 for Ireland. It is interesting to note that in the strengths section of GII (2020), Ireland ranks first in the following categories related to knowledge, Intellectual property payments as a percentage of total trade, this is followed by Knowledge impact and finally Knowledge diffusion.

Within Ireland, Dublin was awarded second place in the European Capital of Innovation for 2021, reflecting the overall focus on innovation within Ireland (EC, 2021).

The SFI (2019) noted that the SFI plan for 2019 included continued support for research centres as a focus for PhD research. The minister at the time stated, this funding is addressing to a significant degree, the requirements for increased investment in both

physical infrastructure and human capital in higher education research, as identified in government publication of Innovation 2020 strategy. Dr Ruth Freeman commented that SFI funded 1,500 postgraduate positions in 2018. The Irish Universities Association (IUA) in a report provided by Indecon (2019), reported that a net gain of €1.6 bn was input into the economy from net earnings of graduates of Irish universities between 2017 and 2018. Overseas students also add an additional export income for the government of €386 m in the 2017 – 2018 period. This investment in technology is aligned with a national effort to build knowledge within institutions and universities.

An example of technology clustering in Ireland is represented by MedTech industry (Irish Medtech, 2022). The Irish MedTech noted that there are more than 300 MedTech companies active in Ireland with a combined impact of €12.6 billion worth of export goods with employment levels of 38,000 people in the sector. This emphasis and critical segment is supported by the creation of SFI research centres providing these specific high-tech industries with research initiatives. The CSO (2019) data from the 2016 - 2018 census indicated that the number of enterprise births continued to rise. There is a change in the slope (rate) of start-ups that indicates in the most recent CSO update the rate of ‘deaths of enterprises’ has exceeded births. Access to funding for start-ups has continued to grow with access to funding and training through both EI funding schemes through the HPSU and a range of venture funds. Enterprise Ireland continues to be the biggest investor in indigenous industry in Ireland.

3.2.4 Recent economic performance – A report card on Irish economics

AIB (2018)

Two reports indicated strong economic activity in Ireland. The AIB economy update by Mangan (2018), the Chief economist, gave a summary of the Irish economy up to the end of 2018. Key statistics are referenced post the 2008 crash. Employment as a key measure recovered from 16 percent unemployment in 2012 to 5.3 percent in December 2018. The report notes that the GDP at the end of the crash of 2008/09 had a GDP 25 percent higher level than in 2001 which demonstrated substantial growth up to the crash of 2008. This additional level of GDP over 2001 levels formed a platform for the recovery. With successive governments aggressively attacking the budget deficit, this was cleared off quicker than expected and a small surplus was generated in 2018. GDP growth of 4.1% indicated that the economy was growing again prior to COVID 19. The low interest rate environment and low inflation environment allowed the economy to continue to grow with strong exports. With an open economy and a weakening Euro, FDI continues to be an important national driver for growth. The increase in employment has put pressure on housing and construction of affordable homes, all signs of a vibrant economy. This may indicate a tripwire for future employment growth going forward according to Mangan (2018).

Investec (2018)

In a second report, Investec (2018) published in March 2019, indicated the Irish consumer remained the key beneficiary of the strengthening economy. A complete reversal of the 1980's where one income per household was the norm. 'Household balance sheets have never been stronger, up by 7 percent since the slowdown of 2008'. Investec point out the broad nature of Ireland's expansion and deleveraging of debt in

the last decade, as possible levers to counter any weaknesses in housing and competitiveness.

3.2.5 SMEs and the Irish economy

SMEs account for 99.8percent of all active enterprises and 68 percent of those employed in Ireland (OECD-ilibrary, 2022). Large firms make up the remaining 0.2 percent. A large proportion of these firms are FDI firms that employ the remaining 34 percent of the workforce. Data provided for this report was sourced from the CSO (2020) and it indicates the SMEs distributed across the following sectors.

Table 3.5 – Number of active enterprises & employees by sector and size, 2020

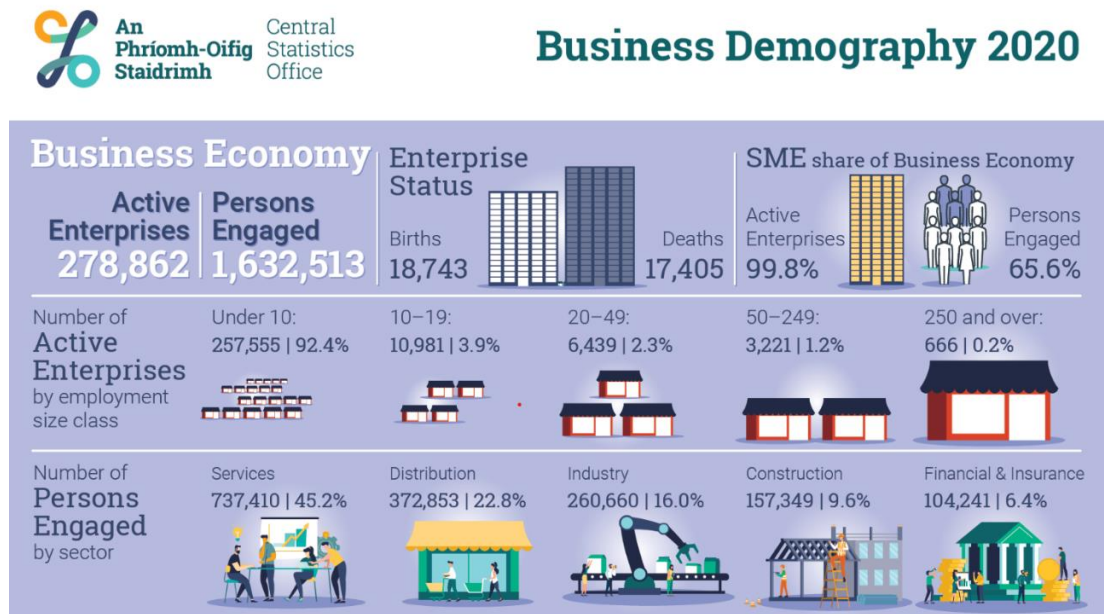
Enterprises	%	Enterprises	Services	Construction	Distribution	Industry	Financial services
Micro <11	92.3%	257,390	131,526	60,487	40,668	16,730	7,979
Small 10-49	6.2%	17,289	7,936	1,885	5,221	1,694	553
Medium 50-249	1.2%	3,346	1,546	204	813	626	157
SME (All)	99.7%	278,025	141,008	62,575	46,702	19,050	8,690
Large >251	0.2%	558	153	239	20	92	54
Total Enterprises	100%	278,583	141,161	62,814	46,722	19,142	8,743
Employees	%	Employees	Services	Construction	Distribution	Industry	Financial services
Micro <10	25.9%	422,821	216,061	99,363	66,806	27,483	13,107
Small 10-49	20.8%	339,563	155,859	37,012	102,548	33,277	10,866
Medium 50-249	19.0%	310,177	143,302	18,921	75,373	58,003	14,578
SME (All)	65.7%	1,072,561	515,223	155,296	244,727	118,764	38,552
Large >251	34.4%	561,584	154,435	240,358	20,217	92,661	53,912.
Total Employees	100%	1,634,146	669,658	395,654	264,944	211,425	92,464

Source: CSO (2020) Business Demography

This data indicates that the micro-SME firms are the largest percentage of enterprises.

The services sector makes up the largest category of the SMEs. The largest category for the large firms is Construction. It is noted that Services has the highest number of employees across the SMEs while Construction has the highest number of employees for the large firms. A visual of the business demography for 2020 is indicated below

Figure 3.5 – Irish Economy 2020



Source: CSO (2020)

SMEs consisted of approximately 66 percent of the workforce, as of 2020. It is shown that approximately 92 percent of firms employ less than 10 people (employees 257,585). Large firms only represent 0.2 percent of the Irish enterprises while they do employ approximately 600,000 people. According to the latest European Commission, EC (2019), annual Small Business Act (SBA) SMEs are particularly important to the Irish economy. SMEs account for 70.1 percent of total employment in the non-financial business economy (in the Figure 3.6 below). The contribution of SMEs to the total value added (TVA) was 41.5 percent. A comparison of the Irish SME sector to the EU28 as whole for 2019 indicated the Irish data is very similar to the EU numbers. However, the value-add contribution for the Small and Medium (SMEs) sized firms in Ireland is smaller than the EU 28 share in 2019.

Figure 3.6 – Irish SME data from SBA 2019 fact sheet

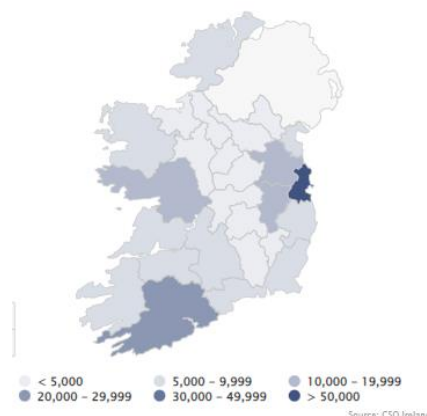
Class size	Number of enterprises			Number of persons employed			Value added		
	Ireland		EU-28	Ireland		EU-28	Ireland		EU-28
	Number	Share	Share	Number	Share	Share	Billion €	Share	Share
Micro	242,501	91.9 %	93.0%	406,580	27.6%	29.7%	48.0	21.7%	20.8%
Small	17,752	6.7%	5.9%	335,843	22.8%	20.1%	24.0	10.8%	17.6%
Medium-sized	3,085	1.2%	0.9%	291,975	19.8%	16.8%	20.0	9.0%	18.0%
SMEs	263,338	99.8%	99.8%	1,034,398	70.1%	66.6%	91.9	41.5%	56.4%
Large	577	0.2%	0.2%	440,943	29.9%	33.4%	129.6	58.5%	43.6%
Total	263,915	100.0%	100.0%	1,475,341	100.0%	100.0%	221.5	100.0%	100.0%

These are estimates for 2018 produced by DIW Econ, based on 2008-2016 figures from the Structural Business Statistics Database (Eurostat). The data cover the 'non-financial business economy', which includes industry, construction, trade, and services (NACE Rev. 2 sections B to J, L, M and N), but not enterprises in agriculture, forestry and fisheries and the largely non-market service sectors such as education and health. The following size-class definitions are applied: micro firms (0-9 persons employed), small firms (10-49 persons employed), medium-sized firms (50-249 persons employed), and large firms (250+ persons employed). The advantage of using Eurostat data is that the statistics are harmonised and comparable across countries. The disadvantage is that for some countries the data may be different from those published by national authorities.

Source: EC (2019) SBA Ireland factsheet

This research will select firms geographically dispersed throughout Ireland. A representation of the data indicating the spread of the firms throughout the 26 counties in the Republic of Ireland is presented in Figure 3.7. At the county level, Dublin and Cork dominate the number of enterprises. Dublin and Cork combined accounted for 43.5% of Enterprises in Ireland in 2020. County Leitrim has the fewest enterprises, with 1,981 (CSO, 2020).

Figure 3.7 – Distribution of enterprises by county 2020 – Business Demography 2020

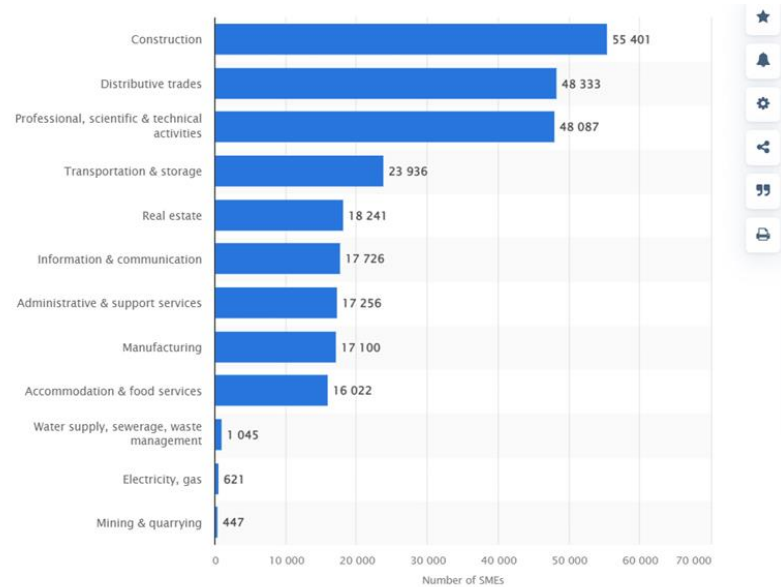


Source: CSO(2020)

A fine-grained breakout of the sectors in Ireland data from another source, Statista (2020), is outlined for the Irish Economy in 2020. The importance of the SME by sector

is indicated in the Figure 3.8 below and how it is distributed across the different economic sectors.

Figure 3.8 – SMEs in non-financial business economy in Ireland 2020



(264,215)

Source: Statista (2020) Ireland

Funding

The Government policy since 2011 has focused on ensuring that all viable SMEs have access to an appropriate supply of credit from a diverse range of banks and non-bank sources. The government has encouraged the creation of sufficient conditions be in place to meet market needs for funding. It was noted that bankruptcies in Ireland decreased by 27 percent in 2020, to their lowest level since 2007, and a return to the continuance of a downward trajectory. This was partly due to the widespread take-up of 6-month loan payment breaks offered by banks and other non-bank lending institutions which were available to SMEs directly impacted by COVID-19 (OECD-ilibrary. 2022). Various funds are available for SMEs for business operations and growth. These include the Covid19 credit guarantee scheme, Micro-enterprise loan funds, Seed and Venture funds. The seed and venture fund is operated by Enterprise Ireland. Through this fund in

2019 – 2024 there was €175 M announced plus an additional €185 M in a July 2020 stimulus package. There is also an Ireland Strategic Investment Fund as well as an array of venture capital funds available. SMEs generated 56.3 percent of total turnover in the business economy and 37 percent of gross value in 2018. The Department of Finance reported in a survey in quarter 2 and quarter 3, 2020, 72 percent of SMEs cited they had sufficient internal funds and did not access credit. This would tend to suggest that access to funding is available if the requirements are met and that firms are sufficiently capitalised to meet their goals without additional burdens on their balance sheet.

Growth

Kidney et al. (2017) reported that Irish firms follow a ‘punctuated equilibrium path dependency’. In support of this growth pattern, it is proposed that there is no evidence to support that Irish firms follow a linear stage pattern of growth. Irish firms tend to follow a process of temporal order, which ‘comprises an initial trigger point, followed by a transition phase culminating in a critical turning point for the firm’s development and growth potential’ as noted by Kidney et al., (2017, p. 7). Bessant et. al. (2005) indicated that growth is path dependent, on the history of the firm, and punctuated by the appearance of tipping points where they are resolved by the acquisition of new knowledge which then positions the firm for future growth. The behaviour of Irish SMEs would appear to mirror similar findings in Scotland (Mason & Brown, 2013) and in Finland (Deschryvere, 2008) for SMEs proposed by Kidney et al, (2017, p. 66). For Irish firms, growth can be funded by the availability of existing funds or easy access to credit when these trigger points occur, in their growth pattern.

It is indicated that trigger points appear from the external environment at different points in the lifetime of the firm. Having the available knowledge within the firm at these points to both recognise them and invest in the resources necessary to avail of the

‘beginning of a new turning point’ in the firm, is critical. This would appear to be dependent on the available resources within the firm, being able to react and set a strategic new course for the firm.

This tends to imply that for growth of Irish firms, availability of financing alone is not sufficient but that the ability to *recognise* change as well as the ability to manage and reconfigure resources will be required in a knowledge intensive future. Given the demographics of the Irish SMEs outlined above, and the sectors they service, Irish SMEs would appear to be positioned to meet this challenge.

3.3 The Forfás (2005) Irish report on Absorptive Capacity

While the previous discussion has highlighted the policy interventions in the Irish economy, Forfás was proactive in generating early learning regarding Absorptive Capacity. At the end of the Celtic Tiger, Forfás (2005) commissioned a report by Technopolis (consultant) that was issued in February 2005. The title of the report was ‘*Making Technological Knowledge work – a study of the Absorptive Capacity in Irish SMEs*’. This report stated in the executive summary that it recognised the importance of external knowledge as articulated in ACAP and the links to innovation. The report outlined the potential for ACAP understanding with the rapidly expanding economy of 2005 and how it might provide advantage to the Irish economy. The report was timed to overlap with the National Development Plan (NDP) 2000-2006 which had allocated €2.48 billion Euros to research and development. Before making this level of investment in R&D, it seemed prudent to investigate the link of ACAP and R&D. The investment in R&D and attempt to create knowledge in the economy was a significant investment by the government at the time. Recognising that a knowledge economy was a shift in focus from previous manufacturing focused approaches through FDI, this was

an attempt to clarify the future components necessary for the economy to recover. It was also an approach in understanding of how knowledge is produced, absorbed as well as managed within the economy. In the foreword to the report, Technopolis outlined the focus of the report was to

..identify areas which require strengthening ensuring that these firms have such 'absorptive capacity' and enable them to play a key role in developing the Irish economy. The unique contribution of this study was to define absorptive capacity in terms of a number of its components that can be identified, benchmarked and incorporated into policy instruments to help improve company performance. In assessing this intent of the report, it should be noted that SMEs are recognised as contributors to the economy. As a consultant, Technopolis' intent was to identify policy "instruments" that could help improve company performance within a national perspective. (Forfás, 2005, p. i)

In terms of policy, this approach to the economy might be seen as a neoliberal developmentalism (ND) effort to influence the environment and create conditions where businesses might flourish. The clear focus of the report was on 'helping' Irish SME's improve their performance.

3.3.1 Methodology applied

The process used by Technopolis to identify absorptive capacity (ACAP) in this era was through a series of interviews, literature reviews, review of policy instruments from other countries and conference attendance by the consultant. Once an understanding of the ACAP construct was in place by the Technopolis, a request for survey participation was sent to 650 firms. Contact details for these firms were supplied by Enterprise Ireland. Initially phone interviews of 123 Irish SMEs were guided and conducted by the consultant, with a response rate of ~19 percent, which is deemed to be low. It was observed from the report that firms that agreed to participate were 'younger' indicating some inherent bias (Forfás, 2005, p. 31). The respondents were typically managing directors or senior staff. It was not clearly indicated if these were single informant responses or a collective response over the phone. It was determined that there was a

bias towards manufacturing firms in the cohort as there was a misapprehension from service firms of their ‘innovativeness’ according to the consultant, (Forfás, 2005, p. 32). These initial firms were followed up with qualitative interviews of a further 15 SMEs. The literature available for the consultant was just over fifteen years old, since the Cohen and Levinthal (1990) publication. The Technopolis report states that the term ACAP was poorly specified and understood at the time of this report. They further stated that their intent was to understand the ‘ingredients’ of ACAP so that only then would it be possible to recommend policies to improve ACAP. The Questionnaire (Forfás, 2005) is listed in Appendix 2, was used for phone interviews and it covered the following sections in Table 3.6 which were deemed to be ACAP contributors.

Table 3.6 – Key sections covered by Technopolis questionnaire

Section	ACAP areas of interest
1	About the company
2	About Product & Processes
3	Success factors for your business
4	About Human Resources
5	Cooperating with others
6	Identifying technological opportunities
7	Support

Source: (Forfás, 2005, pp. 113 -117)

3.3.2 Technopolis findings and recommendations for ACAP

From the literature review (Forfás, 2005) Technopolis indicated that they used manpower and R&D as a proxy measure for ACAP. They proposed that there were five more distinct elements of the ACAP construct. Technopolis listed them as firstly Human Capital, especially in the form of graduates, and especially scientists and engineers. This was followed by the ability to network with external sources of knowledge and other resources. Next there was a focus on the Organisation and the

routines and organisational processes. Learning was emphasised with Learning processes (cognition) and finally they indicated Codification as distinct element.

Findings from the interviews conducted as part of the consultant research, indicated that innovation activities depended upon the employment of skilled people, especially graduates. It was reported that external sources of information were not fully developed in enterprises and that these firms relied only on trade fairs or the internet. Sophisticated methods of networking using third level institutions were rarely used. A systematic or disciplined approach to innovation was not evident in their findings, where innovation opportunities were identified and the value of external knowledge was being used by the firms when they were interviewed. Service sectors were identified as being more successful than manufacturing, despite being low participants (Forfás, 2005, p. 32) and they had more product innovations and better educated and dedicated human resources focusing on innovation. A clear distinction between services and manufacturing enterprises was also noted in how these firms networked and applied processes to capture and exploit innovation opportunities. The disciplined management of innovation while not practiced throughout the enterprises that were interviewed, it did confirm that management of innovation was a key component of the ACAP construct. The most concerning item reported as part of the interviews was that innovation actions were happening in isolation to external networks and knowledge sources (Forfás, 2005, p. 56). Links with higher education were poor. Awareness of Enterprise Ireland (EI) was in place with (easy) access to training and funding but the next level of engagement was missing in terms of coaching and mentoring that could enable higher levels of ACAP within the enterprises (Forfás, 2005, p. 56). It was reported that the willingness of enterprises to engage with external R&D and develop innovation functions are in most cases, isolated, and sub-critical to have an impact. It was indicated that closed

management styles make it as difficult to exploit external financing and other support activities as it is to exploit external knowledge (Forfás, 2005, p. 63).

As indicated in the literature, that the larger the firm the bigger the firm's network (Daud, 2011. P. 4230; Parida et al., 2012. P. 284). It was recommended that measures are put in place to 'accelerate the rate' at which firms develop their technology-networks' (Forfás, 2005, p. 64). It was reported that 'Science push' is not what the firms needed in terms of innovation according to the report, since this was seen as the mission of the Higher Education Institutions (HEI). Applied technological help was highlighted as a key need by enterprises.

The report recommends that a proactive approach should be adopted going forward which is summarised in the main points but expanded in detail in section 5.2 of the Technopolis report (Forfás, 2005, p. 65).

There are opportunities to intervene in broadening awareness of innovation and recognising the value of external knowledge at the firm level. The report suggested that development of human resources as well as an increase networking would be valuable. It was suggested that by improving the organisation, particularly innovation, management and routines are necessary to be in place. The report concluded that developing learning processes within firms should be encouraged. Additionally, it was suggested that codification of practices and innovation was missing and they lacked policy instruments. It was deemed that this approach would promote firms to codify knowledge in their areas of expertise.

3.3.3 Literature gaps and additional insights from the Technopolis report (Forfás, 2005)

The SMEs interviewed ranged in size from 9 to 140 employees. The average number of employees was 51.6 employees. The average length of time in business was 22.4 years

or 17.4 years, if one exceptional company which was in business for 67 years was ignored.

Table 3.7 – NACE classification used for interviewee selection.

	Manufacturing	Total respondents	Services	Total Respondents
Sectors	63	95	10	28
Highest number of respondents	5 Metal fabricators and other plastic products		16 Software consultancy and supply	

Source: (Forfás, 2005, pp. 111-112)

There were significantly more sectors covered in the manufacturing interviews than the service interviews. The number of companies interviewed in each manufacturing sector was typically only one company. The highest number of companies interviewed in one manufacturing sector was five. While the number of sectors was significantly less in the services interviews (ten), it was reported that one sector had sixteen companies interviewed in the software consultancy and supply sector. The questionnaire used was informed by a limited number of academic papers available at the time.

The main paper Cohen and Levinthal (1990) was referenced in terms of the enterprise's ability to exploit external knowledge, (Forfás, 2005, p. 10). Technopolis also interrogated the firms' ability to use external knowledge based on the level of prior knowledge existing in the firm. Technopolis referenced the need for structure and routines existing within the firm beyond the individual level of external knowledge. Technopolis indicated that although the literature was based on 189 papers reviewed, they pointed out that it was disappointing as a guide to understanding the ACAP construct. This led to Technopolis relying on Cohen and Levinthal's (1990) measure of R&D as a proxy, simply because they exist as a statistical category. Technopolis also refer to a previous paper Cohen and Levinthal (1989) which described the two faces of

R&D, one being the face of learning, one which acquires and absorbs technology and the other face, one of innovation which seeks to apply new knowledge. Technopolis therefore took the approach that the limited literature review allows them to represent ACAP in terms of the enterprises' ability, to search for knowledge and opportunities, followed by constantly adapting itself (the enterprise) to changing conditions, and finally being a creature (the enterprise) of adapting to survive and flourish in the evolutionary world, (Forfás, 2005, p. 12).

The questionnaire was limited in its construction to this period commencing 2002, based on Technopolis' understanding of the ACAP construct. How they sought to measure information from the representative SMEs and the learning that can be gained from these enterprises to drive knowledge in a ACAP construct in their daily routines, was limited.

3.3.4 ACAP understanding (2002 – 2005) Technopolis critique

In considering the contribution of Technopolis in the 2005 time-frame, there were additional ACAP publications and understanding available that might have been better utilised. In the period following 2002 to 2005, when the data was being collected and analysed by Technopolis, many published works helped define the difficulty that Technopolis referred to as a measurable form of ACAP. Three major publications including Zahra and George (2002), Jansen et al. (2005) and Lane et al. (2006) helped give clarity to the construct in this period. While the work of Lane et al. (2006) was referenced by Technopolis, it was on Lane et al.(2006, p. 856) where they stated a more detailed definition of the ACAP construct as a firm's 'ability' to utilise externally held knowledge through three sequential processes. Firstly, recognising and understanding potentially valuable new knowledge outside the firm through exploratory learning.

Secondly by assimilating valuable new knowledge through transformative learning. And finally, by using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning

The process model approach outlined by Lane et al. (2006) highlighted the many different components, (antecedents) that can be managed through a disciplined approach and measured in terms of what Zahra & George (2002) referred to as potential and realized absorptive capacity. There was no mention of PACAP or RACAP in the Technopolis report. The Zahra and George dimensions of the construct were not considered in the Technopolis report although it was published in the same period (Forfás, 2005).

The process knowledge flow approach allows for an understanding of both inputs and outputs that can be managed and how the organisational structure and culture can influence the ACAP of an individual enterprise. As indicated by Song et al. (2018), by considering knowledge flows it has three dimensions, ACAP effort, ACAP knowledge base and the ACAP process. While management of knowledge was discussed by the Technopolis report, it focused on Managers gaining additional levels of higher education as well as educational levels of the employees, not specifically knowledge capture, storage and access.

The sub capacities of Potential and Realized ACAP were proposed during this period, and they contained dimensions and capabilities in the construct that might have been useful to leverage in this period. It was recognised by Zahra and George (2002) that it is possible that a firm may be focusing on the potential components of ACAP, as such the processes and culture of the firm will focus on the acquisition and assimilation dimensions of external knowledge. This is more typical of young enterprises planning to

move into new markets or innovate into a new technology. This would be important as many of the cohort of respondents in this report (Forfás, 2005) were young.

External factors and decisions by firms to take account of regimes of appropriability were not considered in the Technopolis report (Forfás, 2005). Technopolis did not account for these different firm components of ACAP in their questionnaire and data analysis.

During the same period of the report, Jansen et al. (2005) and the work of Kogut and Zander (1992) referred to the ‘combinative capabilities’ and how they mapped the three capabilities of the firm as antecedents to the two parts of the Zahra & George (2002) ACAP construct. The importance of these combinative capabilities of knowledge absorption were determinants of ACAP, and were detailed in Chapter 2.

Technopolis in their questionnaire, Appendix 2, did not appear to be focused on antecedents to any great extent as they considered only manufacturing and service organisations limited environments. Subsequent researchers, following the Technopolis published data, further helped to describe the ACAP construct.

Although Open Innovation had been articulated in the 2003 time frame (Chesbrough, 2003), positioning for this knowledge absorption and transfer construct was lacking, although it subsequently developed into a capability-based framework for Open Innovation linking knowledge management (Lichtenthaler & Lichtenthaler, 2009).

While Zahra and George (2002) proposed a new perspective of ACAP, that was not without its critics. Todorova and Durisin (2007) for example challenged the interaction and flow of knowledge between PACAP and RACAP in their model as well as the importance of recognition of external knowledge. This flow of knowledge being sought, captured and reused as a firm construct did not appear to be an emphasis for the Technopolis team.

These additional papers, circulating at the time, could have helped to better outline a series of measurable components to assess ACAP within a firm

3.4 ACAP for Ireland's knowledge economy - 2020's

The Irish economy has evolved since the Technopolis report was issued in 2005. One could argue that the economy has evolved into a knowledge economy where Ireland meets the core features of a knowledge economy outlined by Roberts (2009). The industrial demographics have substantially changed with the use of ICT tools and services in many enterprises in Ireland. Many of the policies have now been implemented as outlined by the Technopolis report. In an open letter to European leaders in July 2019 (WEF, 2019), the co-chairs of the Global Future Council of Europe wrote on the topic of the importance of continued investment in R&D by European countries. The letter emphasised the European target for percent of GDP investment into R&D by 2020 at 2.3 percent increasing to 3 percent by the end of the decade. The letter also indicated the key focus areas for a knowledge economy, Table 3.8, that are important as Europe approached Brexit and the COVID crisis of 2020.

Table 3.8 – New Manifesto for Europe 2019

Item	Proposal	Details
1	Europe needs to deliver on its original promises and prioritize and create a people-centric agenda	Leaders should prioritize a set of “European common goods” where the EU as a whole has a better chance at success than individual member states do alone
2	Step up Europe’s global leadership role	European leaders should build on Europe’s role as a “normative superpower” while taking decisive action to defend the liberal and open democratic model that has created prosperity and stability over the last decades
3	Promote competitiveness, convergence and stabilization	Do not wait until another crisis arrives to strengthen the euro area; action that combines risk sharing with long-term market discipline is needed now.
4	Future-proof Europe for the Fourth Industrial Revolution	As the global race for investment, knowledge, talent and research intensifies, Europe must stay competitive against global powers while it designs its own human-centred approach to technological development.
5	Deliver a climate-smart and sustainable Europe	To secure its common future, Europe needs to continue to lead the global transformation to an inclusive, green and climate-neutral economy in line with the Paris Agreement

Source: (WEF, 2019)

This manifesto emphasises the knowledge understanding, both technical and commercial, that SMEs in Ireland will need to recognise, assimilate and use for commercial ends to compete as a member of the EU going forward. It emphasises many of the human resource actions proposed by Technopolis (Forfás, 2005) as necessary for firms to generate economic growth. The competitive Index score for Ireland referenced earlier in this chapter, (WEF, 2018), indicates that Ireland is adopting and measuring many of the components of the WEF as a measure of the economy, in this new era.

3.4.1 A Summary report of economic indicators for knowledge in Irish firms

Knowledge Intensive indigenous SMEs have become a mainstay of the Irish economy and are recognised as an integral part of the growth of the economy for the future of Ireland. Through the DBEI support and continued funding by SFI success measures are

referenced in the annual report for SFI (2020). The knowledge economy reference is the Global Innovation Index 2018, where Ireland has the following rankings

1st in the world for knowledge diffusion

5th in the world for impact

6th for knowledge absorption

10th most innovative country

There is insufficient data to indicate if these metrics are driven by FDI investment or to the level indigenous SMEs contribute to these levels within the country. In a more recent SFI (2020) report, the following key metrics were presented.

Table 3.9 – SFI Annual report 2020

2020	Highlights	Measure
1	invested in 84 COVID-19 research and innovation projects	€22.8 M Euros
2	Global scientific ranking.	12th place 1st for knowledge diffusion.
3	international collaborations in 86 countries.	5,513 collaborations
4	from industry helping to drive competitiveness.	€49.6m
5	ERC awards won by SFI researchers	10
6	invested in 50 SFI Discover STEM projects	€5.4 M Euros
7	Postgraduate students supported	1,966
8	People reached via SFI-RTÉ's 'Future Island Live'	1 million plus

Source: (SFI, 2020)

The SFI (2020) report, would tend to indicate a national success with regional industry collaborations spread across the country and other international areas. The SFI has industry collaborations with 504 MNCs and 393 SMEs suggesting that the segmentation used for the Technopolis report (Forfás, 2005) would warrant a broader sampling of industries and localities in a future research effort. A critique of this report might be that

the SFI focuses too much on established firms which have located in Ireland through FDI in the past. This might lead to a more balanced approach with some other new clusters developing in Ireland. New research areas leading to potential new industries in the areas of Climate, Medtech, Marine, renewable energy, AgriTech, bio-economy, and smart manufacturing are all candidates for an ACAP analysis using recent concepts and learning.

The small business action (SBA) factsheet report for 2020 issued by the European Commission (EC, 2020), emphasises many of the improvements generated by successive government policies.

Since 2008, Ireland has made substantial progress in implementing the SBA criteria. Many policy measures have been introduced to make it easier for Irish SMEs to do business. Access to finance and entrepreneurship have been the government's key priorities over the last decade. Financial support measures are typically introduced through the annual budget and the annual Action Plan for Jobs (APJ), recently replaced by the Future Jobs Ireland initiative. Entrepreneurship measures have been mainly introduced through the APJ and, more recently, through the 'National Policy Statement on Entrepreneurship. (EC, 2020)

In a report from the Irish Competitive Council, report card 2020, (NCC, 2020), it highlighted some concerns following the period of COVID and the learnings evident for the generation of a flexible educated workforce. While Ireland has lower birth rate for new firms, the survival of the first year is higher than the EU average.

A troubling note is that Irish firms are less likely to survive the first year of operations.

Ireland has one of the lowest access levels to optical fibre broadband in the OECD.

Since the internet is seen as the gateway to knowledge exchange, this is a concern for firm growth in a knowledge economy.

Monitoring the impact of knowledge on MNEs and SMEs would be valuable particularly in the areas of Medtech, digital, data and ICT as they are recognised as critical skills needs for the economy of the future. The various government supported

initiatives which include Agenda 2020, Future Jobs Ireland, Project Ireland 2040 and Global Ireland 2025 could all potentially benefit from the revised and additional learning regarding the ACAP construct in a new Irish industry study.

3.4.2 The Department of Business, Enterprise and Innovation, with Enterprise Ireland and the Science Foundation Ireland

In the final section of this chapter, an outline of the government structure and initiatives to enable and drive SMEs and new business over the next 10 years is outlined. While the previous sections of this chapter have been retrospective, this final section looks to indicate how the importance of SME characteristics, development and the integration of national initiatives overlap with some broader EU objectives of SME development going forward. Collectively these initiatives are focused on knowledge generation and increased employment meeting the economic challenges anticipated in the future.

The Department of Business, Enterprise and Innovation (DBEI)

The Department of Business, Enterprise and Innovation (DBEI, 2019) has a broad remit for supporting enterprise, maintaining and creating jobs, and playing a leading role in Ireland's research, development and innovation system. Under this government department, it houses the agencies responsible for supporting and enabling indigenous SMEs. The agencies include Enterprise Ireland (EI), The Science Foundation Ireland (SFI), Local Enterprise Offices (LEO) and the InterTrade Ireland agency. Enterprise Ireland is the state agency responsible for the development of indigenous industry.

There are two ways to become a client of EI and they are by becoming

A manufacturing enterprise or an eligible internationally traded services business employing 10 or more full time employees or A High Potential Start Up (HPSU)

For those firms that do not qualify as clients, the LEO network offers local assistance. The eligibility as an internationally traded service client with EI are listed in the EI (2022) site. The criteria for becoming an SME with HPSU status is also referenced in the same site.

Enterprise Ireland

Enterprise Ireland has three strategic economic initiatives going forward, they are Strengthen, Transform and Scale. This is achieved by initially *Strengthening* the economy following the COVID19 crisis. Secondly by *Transforming* enterprises through change and innovation with digitalisation and a focus on a low carbon economy. The final step is to *Scale* the range of exports from firms by opening up collaborations and engagement of firms to export more of their products internationally.

Some of the key metrics achieved so far by EI are listed on their site. This strategy and these investments are focused on Irish firms exporting for growth and also jobs creation with current and new SMEs established in Ireland.

Enterprise Ireland also plays an additional role as an investor in Irish industry. These levels of investments have grown and Enterprise Ireland was recognised in 2020 as the largest single investor in the EU. EI was also recognised as the second largest seed funding investor in the world (The Irish Advantage, 2019), EI made 200 seed funding investments in 2019. The article suggested that this is not unusual, as the annual investment level is approximately 200 firms per year over the last 6 years. This role of investor by EI through the different stages of SME development would tend to imply that funding availability to promote new business creation is relatively accessible for many SMEs in Ireland. The investments made by EI are only in Irish SMEs either in Ireland or internationally. The opportunity for EI to affect the make-up of founders and

the demographics of new start-ups would also appear to fit with the DBEI objective of national job creation.

Enterprise Ireland diversity of candidate firms

In the European Startup Monitor (2020) entitled ‘Startup Monitor 2019/20’, it indicates that the vast majority of start-ups are founded by male founders. It is also noted that most start-ups are founded as a collection of multiple individuals. Supporting a trend to be more inclusive and diversified is an EU supported initiative WEgate (2022) which is a platform to support women in creating and growing business within the EU. It highlights that only 30 percent of women are considered entrepreneurs. Other initiatives are available to founders within the EU for SME funding, one reference is COSME “Europe’s programme for small and medium-sized enterprises”. Initiatives in Ireland are being supported to encourage female participation in the foundation of new business nationwide. The department of Agriculture for example supports a programme ‘ACORNS.ie’ focused on supporting early-stage female entrepreneurs living in rural Ireland. Additional University support has been driven particularly by DCU Ryan academy and EI in the development of the #female founders initiative.

The Science Foundation Ireland (SFI)

The second agency of DBEI tasked with job creation is the Science Foundation Ireland (SFI, 2022). The SFI is the largest funder of competitive research in Ireland. Whilst EI focuses on manufacturing and internationally traded services, SFI focuses on the development of Science and Technology in the Irish economy. SFI research promotes and assists the development and competitiveness of industry, enterprise and employment in Ireland. It would appear that SFI (2022) is taking both a short-term and long-term approach to science which will drive the economy of the future. In the

approach of Applied Research, it is investing in research undertaken to acquire new knowledge and is directed primarily towards a specific practical aim or objective. This research focus has recently been supplemented, with legislative approval, allowing a focus on basic research, more exploratory and long-term research. To support both the applied and basic research objectives SFI have invested in Research Centres distributed throughout the country providing local and by different segments, cluster support to industry in these locations. These research centres allow for collaboration and cross sharing of information. In all, 16 centres have been established providing construction, supports and scientific jobs in each of these facilities.

Another focus of SFI (2022) is to increase the academic network for Irish scientists globally. The SFI has established offices internationally to create opportunities for Irish scientists to be placed in international institutions as well as provide a source of international candidates to be relocated and practice science at facilities in Ireland. One such initiative is the “Innovate for Ireland initiative” that was announced in July 22, 2022, which seeks to encourage 400 PhD scientists to study in Ireland (SFI, 2022). This initiative is a collaborative government and industry initiative with a plan to invest multi-million Euro investments over several years. These SFI collaboration programs are aligned with many of the EU initiatives addressing supply chain and key resources supplementing the future growth of Irish SMEs within Europe. Once such initiative is the European Institute of Innovation and Technology for example EIT (2022). The EIT (2022) consists of cross boarder organisations segmented by Innovation Communities tasked to develop innovative products and services with a pan European focus on jobs and economic growth. One key initiative from the EIT (2022) is promotion and participation in the Horizon programme. This programme has allocated 95.5 billion Euros to invest in research and innovation between 2021 and 2027.

3.4.3 A national innovation system perspective

From what has been presented so far, it might be possible to infer that a national innovation recipe (system) for Ireland is under construction. This supports the comment of Mason and Brown (2014) that ‘entrepreneurial ecosystems do not appear but that they need fertile ground’. The idea of a national innovation system (NIS) approach for a state was proposed by Lundvall (1985). The definition of a national innovation system being created is, through socially supported steps promotes learning in the economy. The perspective being that innovation consists of the interaction between people, organisations and the environment. Lundvall (1992) stated that anything that is ‘not chaos’ and promotes learning through engaged individuals at a national level with supporting systems that direct the process of innovation, are important. This promotes the idea that certain states may apply different types of NISs depending on where the economy resides with regard to its innovativeness level. A characterisation of NIS systems was examined by Dworak et al. (2022) indicating that a type of NIS system adopted by a country determines a certain level of innovation in the state. As indicated in Table 3.10, the NIS adopted by Ireland at a national level is described as a developed Innovation system. Other small state late developer economies (the Netherlands, Finland) are also in this category according to this measurement system.

Table 3.10 – Typology of National Innovation Systems

NIS type	NIS subtype	Countries belonging to a given NIS type
TI developed Innovation system	T 1.1. Dynamic NIS	Ireland, Netherlands, Switzerland, Finland, Sweden, Singapore
	T 1.2 Stable functioning NIS	Germany, Great Britain, France, Italy, South Korea, Taiwan, USA, Japan, Canada, Norway, Australia, Austria, New Zealand, Spain
	T 1.3 Unevenly developed NIS	Denmark, Belgium, Luxembourg
T2 Developed Innovation system	T 2.1 Catching Up NIS	Portugal, Greece, Poland, Hungary, the Czech Republic, Slovenia Malaysia, Malta Latvia, Estonia, Lithuania, Slovakia, Ukraine
	T 2.2 Unbalanced NIS	Russia China, Brazil, South Africa, Thailand, Argentina, India, Mexico Turkey, Colombia, Bulgaria, Indonesia, the Philippines, Peru, Romania Egypt, Cyprus, Chile, Venezuela
	T 2.3 Unshaped NIS	Algeria, Iran, Vietnam, Morocco, Bangladesh Pakistan, Kenya, Ethiopia, Tanzania, Sudan, Nigeria, Congo, Myanmar

Source: Dworak et al. (2022)

Whatever NIS is adopted by an economy, the system would appear to vary in its approach, but the knowledge creation and support systems provided indicates the intent is similar, i.e., to provide some level of support. This can be considered as centres of learning with commercial entities and where they provide a structure for engagement. Different cultures and political systems would appear to apply these steps differently. In the United States for example, federal and state wide policies might differ and the influence of government might be seen through differing political lenses, in many states. This might result in a variation in the approaches taken by each state in providing systems to address the knowledge chaos.

An alternative view within NIS theory encompassing the social design, is the Triple Helix approach, proposed to engage Government, Industry and Universities (Etzkowitz, 2008). The intent would appear to foster a knowledge economy or knowledge society for the generation of knowledge and sharing within the society. As a result of this design, it has led to many universities engaging with industry in an approach to promote or channel their learning into industry. This has resulted in the creation for many universities of their own Technology Transfer Offices (TTO) where facilities are developed to engage academics and industry in a culture of sharing information. However, the effectiveness of this model has been questioned (Mason & Brown, 2013; Miller et al., 2018). It would appear that expectations of the results from these engagements have not been met. The measures of impact to GDP and employment levels in various countries have not been evident as a result of these efforts. An alternative model has evolved described as a University Technology Transfer (UTT) Quadruple Helix perspective. The focus of this approach is more on a commercialisation output and is described as a variation UTT mode 2 (Miller et al., 2018, p. 8). This societal based innovation approach changes the technology push from the University in the Triple Helix model to an Innovation Pull from individual firms looking for universities to meet their knowledge needs. This shift from markets focused to individual firms changes how university research might be applied at an innovation level. The efforts of Enterprise Ireland with indigenous SMEs and the investment in knowledge by the Science Foundation Ireland may result in a more Quadruple Helix perspective, if the Universities can adjust to this approach and SMEs engage with them. This may reflect what has been represented by the researcher in section 2.4 with an updated progressive integrated approach of the ACAP construct. This integrated approach of the firm's ACAP, proposed that the value of knowledge from current

engagement with the market and engaged customers can then become antecedents for innovations in the future of the firm. This could then inform firm strategy as part of their ACAP understanding. This would in turn point the firm to sources of knowledge within the ecosystem which could include universities and support networks like EI and the SFI.

3.5 Summary of this chapter

What has been presented in this chapter is an overview of the Irish business evolution in terms of FDI attracting MNEs to Ireland and the creation of indigenous SMEs in Ireland. A history of the early reliance on FDI for job creation in Ireland and access to international markets by FDI firms has been presented. The emergence of a more balanced strategy by successive governments' policies to encourage the creation of SMEs based on an increasing educated population was discussed. These efforts have responded to the shift to a new breed of FDI enticed MNEs arriving in Ireland. It has been indicated that SMEs make up the majority of the firms in Ireland and that they employ the largest number of employees. The burden of SMEs demonstrating their competitiveness to continue to support the economy in a Technology driven economy of the future, can be seen as a concern. How Ireland responds to this changing dynamic either through the creation of newer forms of SMEs or the efficient use of technology in existing firms needs to be considered. A good example of a proactive preparatory approach in the past by Forfás (2005) to prepare for this knowledge economy was evident and the report was critiqued.

Taken together, these national and international efforts seek to promote, encourage and educate both male and female entrepreneurs into the creation of new SMEs that are export focused. The economic focus is on enabling technology which will help leverage

a skilled workforce ready and available to participate in the knowledge sectors in the years to come. Recognition of a Quadruple Helix model in the engagement of entities within the Irish ecosystem may have to evolve for the knowledge economy. This research is designed to explore how ACAP can support the generation of data necessary to help make those strategic decisions either within the firm or at policy levels. In Chapter 4 the research methodology is introduced before presenting the research findings in Chapter 5.

Chapter 4 Research Methodology

4.1 Introduction

The purpose of this chapter is to outline the research methodology used in the selection and collection of data, in a multiple case study to address the research question. The research process is outlined with a discussion of the philosophies and strategies of inquiry in answering an exploratory research question. Once a strategy of enquiry is introduced, the process for identification and selection of cases meeting the intent of the research is outlined. The engagements with multiple cases are described and the subsequent coding and analysis that took place are covered.

This research is exploratory in design. The research will explore the internal and external factors underpinning different levels of ACAP that in turn influence the innovation and sustainability of small state SMEs.

4.1.1 The Research problem

Research to date in the ACAP domain, indicates that the understanding and application of the ACAP construct is not well articulated, despite three decades of study (Cohen & Levinthal, 1990; Volberda et al., 2010; Zahra & George, 2002). What was indicated in Chapter 2, was that there have been incremental amendments to the components of ACAP articulated by Cohen and Leventhal (1990, p. 135) as a ‘simple generalisation’ to include Recognise, Assimilate and Apply knowledge for commercial ends. Prior knowledge applies at the individual level as well as the organisational level. Volberda et al. (2010) indicated that the broad application of the construct is both its attractiveness and at the same time, its weakness. How ACAP applies to SMEs’ performance (Valentim et al., 2016) is the primary interest in this study. The theory development of

this research is in the conversion of an existing articulated operationalised description of the ACAP construct, Figure 2.30, to one that can address the prescriptive necessity of having ACAP articulated for SME engagement, Figure 2.31. More particularly, managerial interaction and the recognition of the importance of the necessary components of the ACAP construct, at specific periods, in the evolution of the firm. The 5-Loop framework and the topic list as a means to interact with a single informant in the top management team is a path to this prescriptive engagement with SMEs, in a small state context. Theory development through multiple cases will be described in this chapter (Eisenhardt 1989).

The increasingly important economic role indigenous SMEs can play in the Irish economy has been indicated in Chapter 3. The role that Ireland plays in the technological vision for the European Union provides the context to this study for Irish SMEs but may be applicable to other small state, open economies (WEF, 2019). This research of the ACAP construct is an amplification to an earlier Irish Government sponsored research by Technopolis (Forfás, 2005). The Technopolis report suggested policy actions to increase the levels of national ACAP following the period of the Celtic Tiger (1995-2002). The research question for this study was outlined in Chapter 1 and is restated here.

What role and contribution do levels of absorptive capacity play in the commercialisation of knowledge in knowledge intensive SMEs?

4.1.2 The Research Objectives

In order to answer the research question, the objectives are indicated below,

Objective 1 – To critically evaluate the ACAP construct and its role in firms’ performance. This evaluation has been presented in Chapter 2 covering over 30 years of publications leading to an articulation of a novel progressive iterative process model.

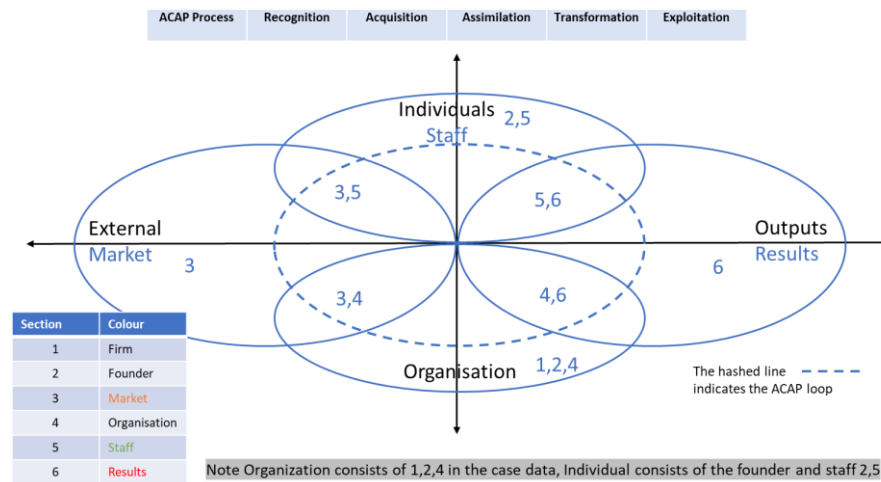
Objective 2 – To explore the contribution that different ACAP levels make on firms’ innovation performance. The 5-Loop framework articulated in Chapter 2 will facilitate the different levels in a firm by completing a multiple cross-case study of geodemographically dispersed SMEs in an Irish context.

Objective 3 – If ACAP levels are important, to recommend how firms can improve their levels of ACAP. Through the data analysis from the multiple cross-case study, this will lead to generalisations based on the data set selected for this study.

Objective 4 – To make policy recommendations that may facilitate ACAP practices in firms deemed to be high potential growth firms (HPGF). By comparing High Performers across the different cohorts for the data set, recommendations will be presented.

The 5-Loop framework, derived from the literature review and extant research in Chapter 2, is highlighted in the Figure 4.1 below. This framework summarises the three decades of ACAP research. It is presented as a parsimonious view of the ACAP construct for engaging SME’s management and policy makers. The 5-Loop framework, provides a visual of the continuum that captures the operationalised ACAP progression from Potential ACAP to Realized ACAP (Zahra & George, 2002). It further shows the interconnection of the External environment with its potential sources of knowledge and engagement. Finally, it allows for the interaction of the internal Organisation and the Individual to be shown, where the Outputs of the interactions leads to knowledge creation, Innovation, Competitive Advantage and Sustainability of the firm.

Figure 4.1 – The 5-Loop framework – Artifact of ACAP multidimensional interrelations



Source: Author

4.2 The Research process

Before undertaking any research, it is important for the researcher to have an appreciation of the paradigms and theory underpinning alternative methodologies, the tools and techniques that may be utilised. The choice of paradigm has implications for research design, data collection and analysis. Three different types of design can be chosen by the researcher depending on the context of the research.

A quantitative approach is historically the one taken by researchers at the end of the 19th century and early 20th century. This means testing objective theories by examining the relationships among variables. Those researchers who engage in this form of inquiry possess assumptions about testing theories deductively, building in protections against bias, controlling for alternative explanations and being able to generalise and replicate the findings.

Whereas in qualitative research, it is an approach for exploring and understanding the meaning given by individuals to social or human problems. This process involves

developing questions and collecting data in a participant’s setting. Data analysis inductively builds from particulars to generalisable themes where the researcher can then interpret meaning from the data.

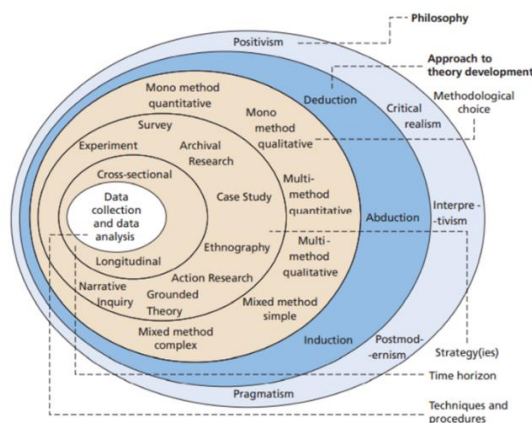
Mixed methods research is an approach that combines both quantitative and qualitative forms. It involves the use of both approaches in tandem so that the overall strength of the study is greater than either the qualitative or quantitative research on its own.

(Creswell, 2009, p. 4)

4.3 Research Philosophy

The term Philosophical Worldview was proposed by Creswell (2009, p. 6) to outline the meaning of the research as ‘a basic set of beliefs that guide action’. Other researchers have called them paradigms, epistemologies, ontologies or broadly conceived research methodologies (Saunders & Tosey, 2013). A common representation of the approach for business students is represented as ‘the research Onion’ (Saunders et al. 2016)

Figure 4.2 – The Research Onion



Source: (Saunders et al., 2016)

This view provides guidance for business students on how to collect data at the centre of the ‘onion’. However, what is evident from this diagram, is that the outer layers of

Philosophy and Theory development comes before the decision on how to collect the data. The methodological choice and Strategies all combine to the researcher's decision on how to approach the research.

In Creswell's worldviews approach, the different worldviews are shaped by the discipline area and the perspective of the researcher captured in Figure 4.3 below. This approach indicates that there are four different worldviews. These are identified as postpositivism, constructivism, advocacy/participatory and pragmatism. In advance of looking at the worldviews it is worthwhile outlining the different assumptions that can be present in using the different worldviews.

The three main assumptions can be grouped into Ontology, Epistemology and Axiology.

Ontology refers to the assumptions about the nature of reality and Ontologists question the nature and being of reality. How businesses look at resistance in organisational change for example, can differ if it is seen as a positive or a negative force to be managed. (Saunders et al., 2016)

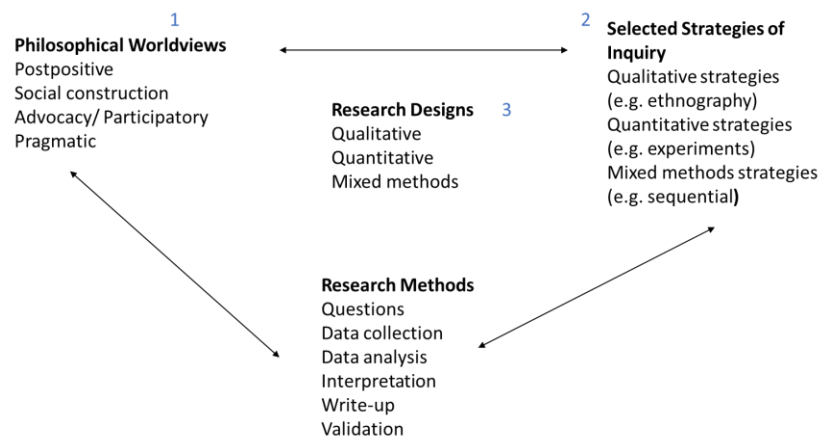
Epistemology refers to assumptions 'about' knowledge. This questions the researcher to challenge what constitutes acceptable, valid and legitimate knowledge, and how knowledge can be communicated to others (Burrell and Morgan 2016). In business there are multiple sources of data that can all be considered as valid and particularly in innovation, it brings with it many contributors with different insights in the innovation process.

Axiology refers to the role of value and ethics. As Heron (1996) argues, our values are the guiding reason for all human action. By being aware of the researcher axiological standpoint, it may impact the questions asked and the methods used for collection of

data.

Returning to the worldview in Figure 4.3, a selected strategy of inquiry can be articulated by the researcher leading to an approach that will indicate a Qualitative, Quantitative or Mixed design, best suited for the researcher. This worldview framework indicates how these strategies lead to a research design and selected research methods. This is the main reference for this portion of the chapter. It provides a coherent linkage between the main components of philosophy, strategy and applied methods.

Figure 4.3 – Design framework - Worldviews, strategies of inquiry & research methods



Source: (Creswell, 2009)

A summary of each of the Worldviews follows culminating with a table of the major elements of each worldview follows.

4.3.1 Postpositivism

Postpositivism worldview represents the traditional form of research. In the scientific method, the researcher starts with a theory, then collects data that either supports or refutes the theory. By making the necessary modifications to the theory, additional tests can be made. This is the accepted research approach of postpositivists. Postpositivism

represents the thinking after positivism, which challenges the thinking that absolute truth of knowledge is possible when dealing with ‘the behaviour and actions of humans’. Positivism also espouses the view that knowledge hinges on direct observation and this frees it from individual perception (Howe, 1988). Postpositivists hold a *deterministic* philosophy in which *causes* probably determine *effects* or outcomes. For the quantitative researcher of postpositivism, being able to develop numeric measures of observations and studying the behaviours of individuals become important. This approach is also *reductionist*, in that the intent is to reduce the ideas into small discrete sets of ideas to test. It is these packages or discrete sets such as variables that comprise hypotheses and research questions. For ‘post positivists’ they accept that imperfections are a reality, and all research can do is posit a ‘partially’ objective account of the world (Denzin and Lincoln, 2005). As this is exploratory research, causal research is anticipated as a potential future step, Postpositivism will not be applied.

4.3.2 Social Constructivism

Social Constructivist (often combined with interpretivism) worldview represents not a theory, but inquirers develop a ‘pattern’ of meaning in their work. Interpretivists refute positivistic claims about the logic of science, suggesting that theory does not generally precede research but follows it (Cohen, et al., 2007). Social constructivists take the approach that individuals seek understanding of the world in which they live and also where they work. This is typically an approach to qualitative research. This research methodology leverages the use of open-ended questions followed by listening to what people say or what they do, in their life settings. The answers are formed by negotiated social norms, formed through interactions with others, (social component) or they are formed through interactions in their daily lives. The social constructivist researcher focuses on the specific contexts in which people live and work. The researcher

recognises their own backgrounds and position themselves in the research. This is to acknowledge their own personal cultural and historical backgrounds as well as recognising their inherent biases. The process is qualitative and inductive with the inquirer generating meaning from the data collected in the field, generating theory. Although qualitative design, in this research it is semi structured with the researcher positioned outside the research topic, positioned as an observer.

4.3.3 The Advocacy and Participatory

The Advocacy and Participatory worldviews originate from a view that postpositivists assumptions impose structural laws and theories, that did not fit marginalised individuals in society or issues of social justice that needed to be addressed. This worldview is typically associated with qualitative research but it can be foundational to quantitative research. Heron and Reason (1997) and Kemmis and Wilkinson (1998) felt that constructivism did not go far enough in representing action for marginalised people. The advocacy/participatory worldview holds that the research inquiry needs to be alert to and intertwined with politics and a political agenda. The focus of the worldview is one of action for the marginalized group. Advocacy research provides voice to the participants raising their consciousness or advancing an agenda for change. Theoretical perspectives may be integrated with the philosophical assumptions that construct a picture of the issues being examined, the people, and the changes to be made. In this research the multiple cross-case SMEs are not considered to be marginalised or politicised and this worldview will not be chosen for this research.

4.3.4 The Pragmatic worldview

The pragmatic worldview arises out of actions, situations and consequences rather than antecedent conditions as in Postpositivism (Rorty, 1990; Murphy 1990; Patton 1990).

The focus in this worldview is with applications, i.e., what works, and solutions to real world problems are questions to be asked (Patton, 1990). Pragmatism is not committed to any one system of philosophy and reality. Inquirers can draw on both qualitative and quantitative assumptions and apply mixed methods research. Pragmatists do not see the world as an absolute unity. Pragmatism are *problem centred* and real-world *practice orientated*. This can be explained as, Truth is what works at the time, not a fixed absolute Truth, from a Positivist perspective. This can allow for a mixed methods approach to look to many approaches for collecting and analysing data rather than determining only a single method. With SMEs are participating in real world export-oriented markets, where innovations efforts lead to complex decision making, including tasks, risk management as well as investments. This research will follow a pragmatic Worldview approach. Saunders et al. (2016) provide the ability to articulate the underlined assumptions contained in a pragmatic worldview approach in Table 4.1 which will be applied to this research.

Table 4.1 – Pragmatism and associated assumptions

Pragmatism			
Ontology (The nature of reality or being)	Epistemology (what constitutes acceptable knowledge)	Axiology (The role of values)	Typical methods
Complex, rich, external 'Reality' is the practical consequences of ideas. Flux of processes, experiences and practices	Practical meaning of knowledge in specific contexts 'True' theories and knowledge are those that enable successful action. Focus on problems, practices and relevance Problem solving and informed future practice as a contribution	Value-driven research. Research initiated and sustained by researcher's doubts and beliefs. Researcher reflexive	Following research problem and research question. Range of methods: mixed, multiple, qualitative, quantitative, action research Emphasis on practical solutions and outcomes

Source: Saunders et al. (2016)

The Pragmatic philosophical worldview fits with multiple cross-case research for export orientated SMEs. The Table 4.2 indicates the contrasting components which lead to the decision that for this research, being action orientated, problem centred real world challenges exist for firms managing innovation for sustainability.

Table 4.2 – The four worldviews (Philosophies) and their major elements

Postpositivist	Constructivist
Determination Reductionism Empirical observation & measurement Theory verification	Understanding Multiple participant understanding Social and historical construction Theory generation
Advocacy/Participatory	Pragmatic
Political Empowerment issue orientated Collaborative Change oriented	Consequences of action Problem centred Pluralistic Real world practice orientated

Source: Creswell (2009, p. 6)

4.4 Strategies of inquiry

Strategies of inquiry (Research strategies) as indicated in the Table 4.3 below logically follow the Creswell (2009) Worldviews and are grouped into three different types (designs),

a) qualitative, b) quantitative and c) mixed methods designs.

Table 4.3 – Alternative strategies of inquiry (designs)

Quantitative	Qualitative	Mixed methods
Experimental designs Non experimental designs such as surveys	Narrative research Phenomenology Ethnographies Grounded studies Case studies	Sequential Concurrent Transformative

Source: Creswell (2009, p. 12)

Strategies of Inquiry have evolved over the last decades, with the daily use of computer technology allowing researchers to choose different procedures for conducting social science research. Researchers must choose and commit to which study to follow. As

Saunders and Tosey (2013) noted, researchers associate particular research strategies with certain research philosophies (Worldviews), and the boundaries between them is sometimes permeable. Whilst Ethnography is frequently associated with Realism and Interpretivism, it is also observed that Experiments and Surveys are associated with post-positivism but as a pragmatic researcher, one is not constrained with such strict boundaries.

4.4.1 Quantitative strategies of inquiry

This form of strategy can be linked back to the traditional true experiments of the 19th and 20th century focusing on measurable data. More recently, complex experiment design with many variables and the use of structural equation modelling are common approaches. Survey research can provide quantitative or numeric trends for numerous factors under investigation. Included in this strategy are structured interviews for data collection and the use of databases for quantifiable variables.

4.4.2 Qualitative strategies of inquiry

Qualitative strategies have evolved over the decades with many more being listed than in the Table 4.3 above, where Wolcott (2001) indicated up to 19 different strategies being identified.

In case studies, it is a research approach in which the researcher explores in depth any of the following, a program, event, activity, process, a firm or one or more individuals. Cases are bounded by time and activity, where researchers collect detailed information on the cases over a set period of time (Johnson & Stake, 1996). Yin (2018) defines a case study as an empirical method that can investigate a contemporary phenomenon (the “case”) in depth and within its real-world context of the phenomena. This is especially applicable when the boundaries between phenomenon and context may not be clearly

evident. It is proposed by the researcher that this situation exists where the context of ACAP in SMEs will benefit from the exploration of how firms can be sustainable.

4.4.3 Mixed methods strategies of inquiry

The concept of mixing different research methods was suggested in the late 1950s. This was born out of the recognition that each method has its strengths and its weaknesses. It was Tashakkori and Teddle (1998) who stated that the results from one method can help identify participants to study or questions to ask for another method. Writers from around the world developed procedures for mixing methods strategies using the numerous different terms in the literature such as multi-method, convergence, integrated, and combined and shape procedures for research.

Sequential mixed methods procedures are those in which the researcher seeks to elaborate or expand on the findings of one method with another method. Concurrent mixed methods procedures are those in which the researcher converges or merges quantitative or qualitative data in order to present a comprehensive analysis of a research problem. Transformative mixed methods procedures are those in which the researcher uses a theoretical lens as an overarching perspective with a design that contains both quantitative and qualitative data. (Creswell, 2009, p. 14)

4.5 Research Methods

Research methods are used by the researcher to collect data, analyse and apply interpretation as part of their studies. Depending on the choices made on Worldview and strategy of inquiry, researchers can collect data on an instrument which could be a questionnaire or information could be gathered on a behavioural checklist. Researchers can also use observation or through the use of structured or semi-structured interviews as structured or unstructured questioning. The choice of method depends on whether the decision is made to specify the type of information to be collected is specified in advance, or whether the intent is to allow the choice to emanate from the interactions.

The type of data collected can be numerical or textual depending on the instrument used. Researchers can then interpret the data collected or they can interpret the text gathered for themes and or patterns. In some research both qualitative and quantitative data are collected, analysed and interpreted. In the case of mixed methods, the researcher can make inferences from one set of collected data to the next as indicated in Table 4.4.

Table 4.4 – Quantitative, Qualitative and Mixed methods

Quantitative Methods →	Mixed Methods ←	Qualitative Methods
Pre-determined Instrument based questions Performance data, attitude data, observational data and census data Statistical analysis Statistical interpretation	Both pre-determined and emerging methods Both open and closed ended questions Multiple forms of data drawing on all possibilities Statistical and text analysis Across databases interpretation	Emerging methods Open ended questions Interview data, observation data, audio visual data Text and image analysis Themes, patterns interpretation

Source: Creswell (2009, p. 15)

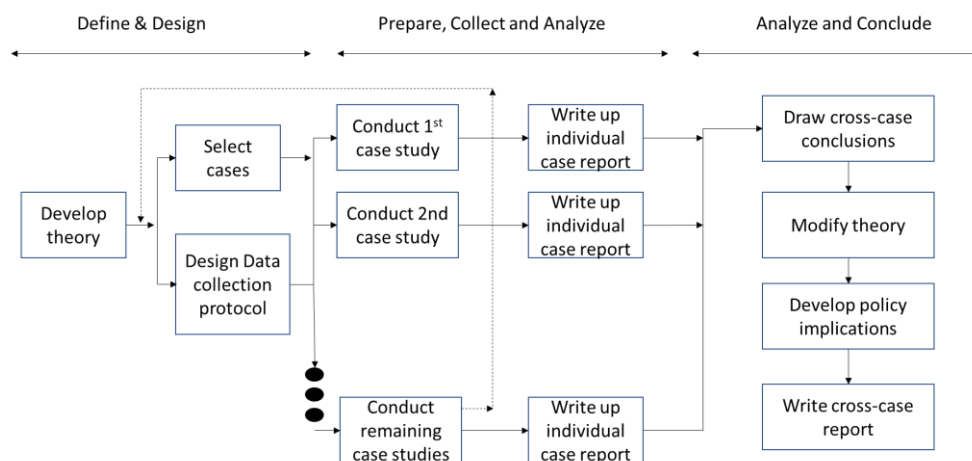
4.6 Research Design

As indicated in the Figure 4.3 above, Philosophical Worldviews, Strategies and Research methods all combine to allow for a selection of a research design to be either Qualitative, Quantitative or Mixed Methods. Depending on the type of research problem to be studied, the researcher must choose a research design that fits best the real-world situation under investigation. Where a problem or concept needs to be explored or understood and little is known regarding the contributing variables, a qualitative approach might be appropriate. Where a broader understanding and generalisation of the findings is desired, a first step might be to explore generally with a small group what variables might apply and then broaden the study to include a larger sample. A variation of methods would allow different instruments to be applied and

allow qualitative and quantitative data to be collected leading to a mixed methods design.

This research design therefore must address the logic of identifying what data are relevant to collect, and how the data will be analysed. This was indicated in the publication ‘The layers of research design’ view in peeling back the layers to get to the data (Saunders et al., 2016). The approach taken for this research will follow the multiple-case study research design proposed by Yin (2018) consisting of five components. Yin (2018) outlined *Case Study Research and Applications* steps as, initially identify a case study’s research question. Then clearly state the case study propositions or objectives and preparation for the identification and location of the cases, considering the number of cases, the study setting and method of interaction. Through data transcription and completion of the complete number of cases, this will allow the analysis of the data leading to a conclusion.

Figure 4.4- Multiple-case study procedure



Source: Yin (2018, p. 58)

4.6.1 Rationalisation

By following the multiple case study procedure outlined in Figure 4.4, this study will take an abductive approach in rationalising the data given the acceptance that the data will be incomplete but representative of the research design. This will be evident from the comparison of individual cases as a single unit before comparing multiple cases and identifying common practices or approaches discovered across the different cases. This iterative approach will be evident in Chapter 5 with the presented data. By emphasising an abduction approach, it allows for a reflective shift back and forward from inductive to deductive reasoning as the research evolves with the re-description and application providing new explanations and insights as the cases are created and analysed. The three different reasoning approaches are outlined as follows.

Deductive reasoning:

Deductive reasoning starts with the assertion of a general rule, and proceeds from there to a guaranteed specific conclusion. Deductive reasoning moves from the general rule to the specific application. The deductive inference itself (the process of ‘connecting the dots’ from premise to conclusion) is either valid or invalid. The inferential process can be valid even if the premise is false. Assuming the propositions are sound, the rather stern logic of deductive reasoning can give you certain conclusions. However, deductive reasoning cannot really increase human knowledge (it is *nonampliative*) because the conclusions yielded by deductive reasoning are tautologies-statements that are contained within the premises and virtually self-evident. Therefore, while with deductive reasoning we can make observations and expand implications, we cannot make predictions about future or otherwise non-observed phenomena. Butte. (n.d.)

Inductive reasoning:

Inductive reasoning begins with observations that are specific and limited in scope. It proceeds to a generalised conclusion that is likely, but not certain, in light of accumulated evidence. One could say that inductive reasoning moves from the specific to the general. Conclusions reached by the inductive method are not logical necessities; no amount of inductive evidence guarantees the conclusion. This is because there is no way to know that all the possible evidence has been gathered, and that there exists no additional bit of unobserved evidence that might invalidate the hypothesis. As inductive conclusions are not logical necessities, inductive arguments are not simply true. Rather, they are *cogent*: that is, the evidence seems complete, relevant, and generally convincing, and the conclusion is therefore probably true. Nor are inductive arguments simply false; rather, they are *not cogent*. It is an important difference from deductive reasoning that, while inductive reasoning cannot yield an absolutely certain conclusion, it can actually increase human knowledge (it is *ampliative*). It can make predictions about future events or as-yet unobserved phenomena. Butte. (n.d.)

Abductive reasoning:

Abductive reasoning typically begins with an incomplete set of observations and proceeds to the likeliest possible explanation for the set. Abductive reasoning yields the kind of daily decision-making that does its best with the information at hand, which is often incomplete. While cogent inductive reasoning requires that the evidence that might shed light on the subject be fairly complete, whether positive or negative, abductive reasoning is characterised by lack of completeness, either in the evidence, or in the explanation, or both. The abductive process can be creative, intuitive, even revolutionary (Thagard & Shelley, 1997).

Since this study will identify themes and attempt to explain patterns in the effort to generate a new view or modify ACAP theory, this research is an abduction approach (Saunders et al., 2016, p. 153).

4.6.2 Multiple Case design

The context for the data collection in this exploratory research has been previously described in Chapter 3 as Knowledge Intensive SMEs in the Republic of Ireland. The case study research strategy will focus on Irish SMEs that meet the desired history of trading criteria of age, size and sector of the firm. A cross-case comparison of the primary data collected from each case will be augmented by the demographic archival data gathered in advance interviews. The 5-Loop framework outlined in Chapter 2 will be used to develop the topic list for the study. Multiple case designs are considered to be more compelling than a single case for this study. (Herriott & Firestone, 1983).

Generalisability is enhanced by the inclusion of many cases (firms) in this research with a target of twenty. Eisenhardt (1989) proposed theory building from case studies. A single case study, indicates that the primary goal is to describe, understand and explain what has happened. In a cross-case analysis, the objective is to select appropriate cases to learn about the relevance or applicability of the findings to other similar settings to transcend the particular, in order to understand the general, hence generalisability. Yin (2018) states that cross-case analysis deepens understanding. Miles et al. (2019) indicate that cross-case helps the researcher to discover the negative cases to strengthen a theory built through similarities and differences across cases. More recently, Goffin et al. (2019) suggest that as new concepts appear, exploratory research taking a theory building perspective is needed, as such the case study research becomes more appropriate. This perspective was based on a source of 5 top journals over 20 years,

consisting of 818 cases on research management of innovation, where case study quality was reviewed leading to a case study evaluation template.

As stated earlier in this chapter, Yin (2018) cautions the researcher that multiple case studies should follow an analogous design. Each case must be carefully selected so that the individual case studies either, predict similar results (literal replication) or predict contrasting results for anticipatable reasons. Importantly, the logic underlying the replication procedures should reflect the theoretical interest and not just that cases should be similar or different.

4.6.3 Eisenhardt methodology for case study research

Whilst Eisenhardt (1989) proposed a theory for case studies, recently an updated paper authored by Eisenhardt builds on the original theory. Eisenhardt (2021) was published over 30 years after the original publication. Eisenhardt clarified '*what is it, and what is it not*', when engaging with case studies. The 'it' being the method. While theory building may not be obvious to all readers, theory building as proposed by Eisenhardt (1989) is,

theory is a set of constructs linked together in relationships that are supported by theoretical arguments (i.e. mechanisms) that seek to explain a focal phenomenon. (p. 148)

This study of ACAP is the focal point for this research, and as such it is a construct that has been in the literature for three decades with some levels of differing opinions. There are opportunities to build on previous literature to provide additional value for SMEs applying ACAP in the context of businesses innovation and sustainability in small states using such an approach. The extracts in Table 4.5 from Eisenhardt (2021) contain several different points of clarity from the 1989 paper.

Table 4.5 – Case study theory building

Eisenhardt (1989) method	ACAP in this research
Method addresses research questions for which there is little and/or no empirical evidence.	ACAP provides conflicting theory
The research method emphasises careful case selection (i.e. theoretical sampling).	This target is 20 cases geodemographically defined
The method is particularly explicit about developing (and defining) constructs and measures during analysis and not waiting until the end.	Multiple cases meeting the research design. The 5-Loop framework is defined.
The Method emphasises explicit theoretical arguments (i.e. mechanisms) that support <i>why</i> ‘particular emergent relationships between constructs’ are likely to hold.	ACAP and Dynamic capabilities utilising the 5-Loop framework
The Method includes identifying boundary conditions and as appropriate, seeking alternative explanations	SMEs in small states.Export orientation SMEs meeting the criteria

Source: Eisenhardt (2021) modified by author

For the clarity of practitioners, Eisenhardt also outlined what were believed to be misunderstandings of ‘what the Eisenhardt method is not’ in the Table 4.6 below..

Table 4.6 – What the Eisenhardt Method is not

Item	Description of what the Eisenhardt method is not
1	The Method is not about particular data – for case-studies, it can be qualitative, quantitative or mixed methods.
2	It is not about the Method focusing on a specific number of cases, while 4 – 10 are common and may work well.
3	It is not about a specific number inherent in the Method.
4	It is also not about performance. Eisenhardt indicated many studies are about performance as an outcome because this illuminates what works and what does not.
5	The final clarification was that the Method is not about variance (versus process).

Source: Eisenhardt (2021) modified by author

In applying this methodology in this exploratory research, the Eisenhardt Method emphasises replication logic in cases, and analysis using constant comparison between theory and data, and with cross-case analysis. Eisenhardt (2021) proposes that ‘constant comparison’ refers to extensive iteration between emergent theory (particularly constructs and relationships) and data, to create an increasingly close fit between the two, both within cases and across cases. While ‘Replication logic’ refers to repeating this iteration by examining each case as a stand-alone observation and not as a data

point in a sample. A cross-case analysis refers to various approaches to improve the creativity and reliability of the analysis (within-case and especially cross-case).

Eisenhardt emphasises cross-case involves developing the underlying theoretical argument, that is ‘why’ explanations of patterns (from a level of coding) in data. With this approach, multi-case theory building, centres on creating strong theory building about under-explored yet significant phenomena as is the case with ACAP.

The successful outcome of multi-case theory-building study is a theory that balances **parsimony** (not complicated spaghetti diagrams), **accuracy** (captures core features of the phenomena) and **generalisability** (relevant beyond the immediate setting) is logically coherent ... and is hopefully surprising. (Eisenhardt, 2021, p. 152)

In summarising, Eisenhardt (2021) stated that the Method is about theory generation, and as broad as theory can be conceived. By taking this approach and focusing on the five steps of what ‘the Eisenhardt method is’, as well as balancing the findings between and across multiple cases, in this specific context of SMEs meeting the research design in small states with Ireland as an exemplar, theory development is proposed.

4.6.4 Firm Case studies selection process

Two sources of data were collected in the following two steps. The first step in the process was defining the target firms based on specific criteria and secondly allocating the firms into different groups, (cohorts) drawn from a target of 20 cases. One case was rejected after review (n=19). The cohort of firms was chosen based on geodemographic criteria including age, size and being export focused. These firms were engaged as Enterprise Ireland clients, and at the vanguard of the export led growth strategy articulated in Chapter 3. An Excel® workbook was created, contained in the supplemental report, with the details of these firms, (available to the examiners only). The data for these firms was collated in the FAME company database prior to commencing selection and semi structured interviews with the firms. The firms were

grouped into different categories of firms, the age of firm with different locations in Ireland. The type of firm either Modern or Traditional as well as the size of firm in terms of staff and Shareholder value. The Table 4.7 below gives details of the data to be presented in Chapter 5 indicating the final distribution of the selected firms.

Table 4.7 – Consolidated participating firms (n=19) by region

# Firms	NUTS (criteria clarified below)	Code
2	North Border	IE041
2	North Western	IE042
2	Mid-Western	IE051
2	South East	IE052
4	South West	IE053
4	Eastern Dublin	IE061
3	Mid-East	IE062
0	Midlands	IE063

Source: Author.

Note to Table the NUTS nomenclature classification links to the Eurostat documentation “Nomenclature générale des Activités économiques dans les Communautés Européennes” (NACE 2.0) which is translated as ‘statistical classification of economic activities in the European Community’. The classification is further defined with two notes.

Note 1. The data covers the ‘non-financial business economy’, which includes industry, construction, trade, and services (NACE Rev. 2 sections B to J, L, M and N), Reference SBA Factsheet 2019, P2.

Note 2. As referenced by the CSO – “The modern sector is defined as the chemicals and pharmaceuticals; computer, electronics, optical and electrical equipment; reproduction of recorded media, and medical and dental instruments and supplies. The traditional includes all other sectors.” Source CSO website

A diversity of founders was sought, to include Irish, Non-Irish born, Male, and Female. Educational levels of the founders were also of interest and whether the founder continued on with their education (Cooney, 2012; Rothwell & Dodgson, 1991; Valentim et al., 2016). By including a range of criteria, this cross-case research design meets the design criteria recommended by Yin (2018) outlined in Figure 4.4, to cover the Define & Design step, the Prepare, Collect, Analyse step and finally the Analyse and Conclude step. By considering the single informant engagement in a structured research setting, with the time horizon of no more than 6 months to collect data, the study details were defined (Sekaran & Bougie, 2013).

4.6.5 Data Generation and Collection

Data was collected using the topic list specified in Appendix 3, for each selected case. This was a semi structured, single informant interview setting. The interviews were scheduled to last 60 minutes in length. The interviews were conducted remotely, because of COVID19 restrictions. Each interview was conducted using Zoom.com (Virtual meetings. (n.d.)).

Interviewees were notified in advance of the process of interview and the confidentiality of the interview between them and TU Dublin was explained. The confidentiality document is contained in the topic list in Appendix 3 and the interviewee indicated their approval and willingness to participate at the commencement of the interview. The interview was recorded on Zoom (Virtual meetings., n.d.) for transcription of the interview. Transcription of the interview was undertaken in part using Otter AI, a web-based technology (Electronic Transcription., n.d.). The transcription from each individual engagement was returned to the interviewee after the interview for their record and for any additional comments. In the Table 4.8 below an outline of the data flow and process used to manage the firm engagement and interviewee data.

Table 4.8 – Data generation, collection and analysis process flow

	Sources	Documentation gathered	Evidence
Data Generation	Export focused SMEs geodemographically dispersed the Republic of Ireland	Categorised Product and services Sub categorisation Economic sectors	Candidate listings potential and selected firms
Data Collection	Fame Database Quantitative data Semi Structured Interviews Qualitative data	Excel® workbook Firm performance data Topic List Firm responses Transcriptions Case studies	Computer files Topic list Firms responses Transcribed responses Case studies
Data Analysis	Multiple cases	Primary and secondary coding leading to a thematic analysis across the cases	Individual case studies Coded cases

Source: Author

4.7 Coding of primary data

Following the process outlined in the Table 4.8 above and once the interview data was collected, a series of steps was followed ultimately leading to the analysis. In this section an outline of the coding process is covered. In describing coding, it is important to make the distinction of what coding is, relative to qualitative research.

A code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing and or evocative attribute for a portion of language based or visual data. Saldaña (2016, p. 4)

In qualitative interviews the transcript is the source of data. Since this data needs to be ‘transcribed’ into some form of attributed meaning, two series of coding was applied to the transcripts in this research. Saldaña (2016) indicates that coding is one way of analysing qualitative data and cautions the researcher to make the determination on which coding method suits the research being conducted. Saldaña points out that there are times to use coding and times where this approach is not an applicable technique. The intent is to generate meaning to the description provided in the transcripts, in the belief that patterns can be assigned to the datum in the analytical process of the research study. There are two coding methods selected for this research, they were the first cycle coding being Process Coding and second cycle coding being Pattern coding. A brief description of each coding process follows.

4.7.1 First Cycle Coding – Process Coding

First cycle coding is a way to initially summarise segments of data. Process coding can be labelled ‘action coding’ given the use of the Gerund (‘-ing’ ending) (Charmaz, 2014). Since it conveys processes of human action that can be intertwined with organisational and environmental dynamics, it is deemed to be suitable as a first level of coding for this research. Once a transcript is generated as an initial step, this leads to the

ability to generate a case for each individual interviewees including secondary and primary data. The 'actions' generated in the firm prompted by the Topic list are captured as Process codes for each case. The process design allows a range of process codes to be generated and subsequently they are compared across the different number of cases.

4.7.2 Second Cycle Coding – Pattern Coding

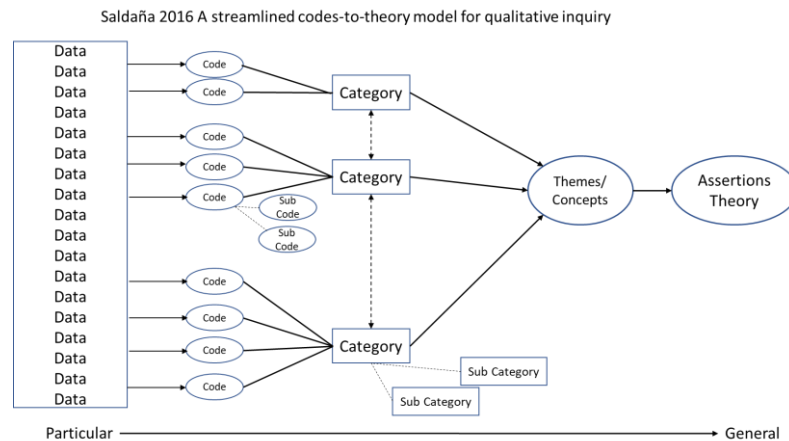
Second cycle coding is a technique to take the outputs from the first cycle coding into a parsimonious number as a second step. It is analogous to cluster analytics and factor analytics used in statistical analysis in quantitative analysis (Yin, 2018, p. 236). Pattern codes are explanatory or inferential codes. They identify emergent themes, configuration or an explanation where an abundance of data is generated in the first cycle coding. The intent is to pull a large quantity of material into a more meaningful and parsimonious units of analysis. Pattern coding is appropriate for laying the groundwork for cross-case analysis by generating common themes and directional processes (Miles et al., 2019, p. 79).

4.7.3 Thematic analysis

In the course of collecting the Pattern Codes and the highlighted comments from the text within each case, multiple themes emerge. Each of these may emerge as a major theme to analyse and develop. In this research, across multiple cross-case analysis, themes appear or there may be cases where patterns do not exist. By considering individual cases and comparing to other cases this leaves the researcher the option to strengthen a theory built through similarities and differences across cases. Figure 4.5 outlines the process of collecting data for each case then allowing reflective

consideration grouping the individual codes into categories across the cases leading to emerging themes and ultimately being able to assert forthcoming theories.

Figure 4.5 – A codes to theory model for Qualitative inquiry



Source: Saldaña (2016, p. 14)

4.8 Research design observations

This research is focused on SMEs in the context of the Irish export focused commercial environment. The Republic of Ireland sits at the edge of the European Union but as a full member of the European Union with commercial networks stretching globally east and west, allowing firms to avail of a global trading ecosystem. As explained in Chapter 3, the demographics of the selected firms provide a platform for innovative businesses based on a young and well-educated population. This research will focus on those firms that have participated with or interacted with Enterprise Ireland and in some cases participated in the International Selling Programme (ISP) run with TU Dublin. Since this research engaged SMEs in semi-structured interviews in calendar year Q4 2020 and Q1 2021, during the COVID19 crisis, the informants were aware of the impact environmental issues can have on their sustainability and business models that were out of their control. The research design outlined in the format above could be considered as

a blueprint to benefit future research efforts focusing on similar small state SMEs focused on exports.

4.9 Summary of this chapter

This chapter outlined the research philosophy and methodology applied in this research. Linkage from the research question and objectives has been provided and the process of engagement with the firms has been outlined. A description of the data capture and analysis has been indicated with a path to facilitating generalisations and theory building for the ACAP construct. This research design supports a call for an improved level of quality of innovation management research, emphasising that cross-case research design is a valuable approach suggested by other researchers like Goffin et al. (2019). The following chapters will cover the findings, the results and analysis of this process. Chapter 5 presents the findings from this research which targeted at least 20 case studies. One case was rejected after review (n=19). Once the findings from Chapter 5 are presented, Chapter 6 will present a discussion of the findings for each of the cohorts before Chapter 7 brings the study to a conclusion with a summary of the research, managerial and policy implications, limitations and areas for future research based on the objectives laid out for this research design.

Chapter 5 Research Findings

5.1 Introduction

The purpose of this chapter is to present the primary research findings. This chapter outlines firstly how the data set was constructed. Secondly, it explains how the data set was segmented into three distinct cohorts. This will be followed by outlining the cross-case analysis of each cohort which concludes with a meta-analysis of the three cohorts to produce the findings across all three cohorts.

5.2 Characteristics of the dataset and selection logic.

The Eisenhardt Method and the research design for this study is outlined below

building theory from case study research is most appropriate in the early stages of research on a topic or to provide freshness in perspective to an already researched topic. Source: (Eisenhardt, 1989, p. 548)

It is the latter perspective from this quote that the researcher intends to explore with this research. The key for inclusion in this exploratory research was that firms should be geographically dispersed with representation throughout the state and that the firms should have an export led focus. It has been recognised by other authors that knowledge management practices and innovation are strongly influenced by age of the firm, its size, sector and export orientation (Brunswick & Vanhaverbeke, 2012; Valentim et al., 2016). This is particularly relevant for SMEs attempting to be innovative in traditional industries (McAdam et al., 2010). This ability and desire to export is a key indicator for sustainable growth of indigenous Irish companies and one that Enterprise Ireland supports and encourages when promoting firms to become EI clients (Mason & Brown, 2013). To get a broad representative selection of firms, a purposive selection

was made across the age ranges 5 to 10 years, 10 – 20 years and over 20 years in existence meeting the EU definition of an SME with employees less than two hundred and fifty. In the Science Foundation Ireland Annual report, (SFI, 2020), it was stated that Innovation is an important pillar of the new Irish economy and this is worthy of further research.

SFI strongly welcomed the establishment of the new Department of Further and Higher Education, Research, Innovation and Science, which will facilitate greater cohesion in the Irish ecosystem. Working with the new Department, and all our partners, SFI intends to execute this strategy so that Ireland can become a green, sustainable, deep tech, innovation leader. One that is also working to expand collaborations with Northern Ireland to create an all-island research ecosystem. Source: (SFI, 2020, p. 8)

To initially generate a dataset, a Microsoft® Excel® workbook, was created listing websites that might give some insight into possible export driven firms. This workbook is available in a supplement document for the examiners' review. It was noted on the Enterprise Ireland (EI) website, firms are listed in alphabetical order for the various company directories. When accessed, firms were classified by 20 sectors showing the number of firms in each sector. At this time, it indicated a total of 7,552 firms were regarded as clients by Enterprise Ireland. These firms are considered the vanguard of the Ireland export led strategy. This site also listed company websites that are available for review for commercial purposes and engagement, totalling 254 as of September 2020. Each of these companies were reviewed and noted for their location and primary source of business as a starting point for candidate selection.

Since innovation is both contextual in terms of the geographical location of the firm and the organisational choices of the firm, a broad geographic range of companies was sought. Glückler (2013) noted that the existence of relations, memberships and positions in external networks all contribute to the firm's innovativeness through the flow of knowledge and knowledge production in these networks. Glückler (2013), indicated that

innovation is the fruit of learning and learning is a social practice that unfolds in two distinct ways, firstly collaborative interactive learning and secondly non-interactive learning in the absence of relationships i.e., rival learning. In order to achieve a broad representative range of firms, the Central Statistics Office (CSO) distribution metric for firms in Ireland was utilised. The NUTS nomenclature was therefore used with the NUTS definition and utilisation was outlined in section 4.6.4 (CSO, 2020).

As the focus of this research is knowledge intensive firms, not all the company sectors listed on the Enterprise Ireland website qualified as candidates and further sources of firms had to be located. For this reason, another spreadsheet was created in the workbook for potential candidate firms, using the NUTS classification for the Republic of Ireland and the type of business activity engaged in by the candidates. Additional secondary sources of potential SMEs information is indicated in Table 5.1

Table 5.1 – Alternate sources for candidate firms

Sources	Resources
LEO (Local Enterprise Offices) websites	Newsletters, Case studies
Enterprise Ireland	Weekly newsletter, Announcements
Irish Times	Newspaper websites, Announcements and business news
Silicon Republic	Website, email newsletter
Miscellaneous	Websites, Incubators,

Source: Author

Once any potential sources were identified, a FAME database search was initiated to review the individual firm data and assess the fit to the requirements for inclusion in the research. The FAME database is a company listing website for Irish and UK registered firms. It is accessible to students and researchers on the TU Dublin website. This gave the author access to all registered companies in Ireland and the UK in a format allowing key information to be extracted. This information was added to populate the section for each candidate of the identified NUTS regions. Some critical FAME database information including the names of the founder, directors and investors was captured for

every potential candidate and stored on the worksheet. Founder's details were identified and gender data was captured to try and ensure a gender bias was avoided (McAdam, 2013). A total of 88 firms were identified and the details were captured for the selected candidate firms. This data included a total of 12 female founders or co-founders identified in the FAME database. Female founders only represent 7 percent to 11 percent of active workers in Ireland in 2012 (EC, 2014). In 2012 when data was first referenced for female founders, the level was 17 percent for female founders engaged as HPSU. This increased to 23.75 percent for the latest set of data 2020 (Enterprise, n.d.). Based on a survival rate of 20 percent for entrepreneurs in the first 18 months to 5 years which was shown in Chapter 1, a low number of female founders would survive to meet the design requirements of this research. The resulting breakdown of firms willing to participate are listed in Table 5.2 below indicating consistent data allowing a tabular representation and comparison of the selected candidate firms.

Table 5.2. – Selected firms by region, critical details from Fame database

Firm	NUTS	Code IE0	Company Registered Name (Available to examiner only)	Founder Gender & Nationality	Founder/CEO Education	Firm Sectors Traditional or Modern	Employee # (Fame database)	Years in operation
1	North Boarder	IE041	See Volume II	Male Irish	Masters	Traditional	24	36
2	North Boarder	IE041	See Volume II	Male Irish	Apprenticeship	Modern	20	12
3	North Western	IE042	See Volume II	Male India	PhD, Professor	Modern	10	8
4	North Western	IE042	See Volume II	Male Irish	Undergrad	Modern	20	14
5	Mid Western	IE051	See Volume II	Male Irish	Masters, PhD candidate	Modern	40	36
6	Mid Western	IE051	See Volume II	Male Irish	Apprenticeship	Traditional	22	26
7	Mid Western	IE051	See Volume II	Male Irish	Masters	Modern	18	14
8	South East	IE052	See Volume II	Male Irish	Undergrad	Modern	46	28
9	South East	IE052	See Volume II	Male Irish	Apprenticeship	Traditional	225	22
10	South West	IE053	See Volume II	Male Greek	PhD	Modern	4	7
11	South West	IE053	See Volume II	Male Irish	Masters	Modern	160 IRL ~300 global	13
12	South West	IE053	See Volume II	Male Irish	PhD	Modern	Not available ~ 100	32
13	South West	IE053	See Volume II	Female Irish	PhD	Modern	16	22
14	Eastern Dublin	IE061	See Volume II	Male Irish	Masters	Modern	10	6
15	Eastern Dublin	IE061	See Volume II	Male Irish	Undergrad	Modern	30	21
16	Eastern Dublin	IE061	See Volume II	Male India	Masters	Modern	68	8
17	Eastern Dublin	IE061	See Volume II	Male Irish	MD, PhD	Modern	9	20
18	Mid-East	IE062	See Volume II	Male Irish	Undergrad	Traditional	3	2
19	Mid-East	IE062	See Volume II	Male Irish	Undergrad	Modern	40	47
20	Mid-East	IE062	See Volume II	Male Irish	Undergrad	Traditional	10	19
21	Midlands	IE063	See Volume II	Male	Did not agree to be interviewed	Traditional	63	35

Source: Author: Note to Table: Firm 18 was removed as it did not have the minimum number of years for financial reporting. Firm 21 was removed since a written response was submitted instead of participating in a semi structured interview.

The number of candidate firms that agreed to participate in this research are highlighted by their geographical coverage in the Table 5.3 below. The number of firms interviewed represents a broad geographic distribution of SMEs in Ireland which was discussed in Chapter 3 in section 3.2.5. In line with the NUTS 02 designation, the two regions covering the Southern Region, and the Eastern and Midland region, contained the majority of the SMEs. SMEs in these two regions were dispersed to include the innovation centres of Dublin, Cork and Limerick (Shannon Development region). The third region defined in NUTS 02 designation, covering the North and Western region of Ireland, are also represented, noting that this includes the innovation centre covering the Galway region. These firms are export focused with a range of ages, size and a range of founder educational backgrounds. The Midlands is the only one of the eight NUTS 03 regions, that did not generate a candidate firm (EC, 2021). It was decided to move forward with the 19 cases as being sufficient, with approximately a 40/40/20 percentage NUTS 2, demographic coverage of SMEs distribution in Ireland. As such these cases meet the design of the research objectives (Eisenhardt & Graebner, 2007) leading to generalisability based on this purposive candidate selection.

Table 5.3 – Consolidated participating firms (19) by region

NUTS 1	NUTS 2	Code	EU Status designation	NUTS 3 Code	Participating Firms
Ireland IE0	Northern and Western Region	IE04	Transition	IE041	2
				IE042	2
Ireland IE0	Southern Region	IE05	More developed	IE051	2
				IE052	2
				IE053	4
Ireland IE0	Eastern and Midland region	IE06	More developed	IE061	4
				IE062	3
				IE063	0

Source: Author. Notes to Table: NUTS3 IE041 Boarder, IE 042 West, IE051 Mid West, IE052 South East, IE053 South West, IE061 Dublin, IE062 Mid East, IE063 Midlands

5.3 Cohort constituents and segmentation within the dataset

This section outlines the logic applied in taking the data outlined in section 5.2 and creating a data set that will meet the Eisenhardt (2021, 1989) method. In choosing the cases listed above there are similarities given the national constraints and antecedents to the firms but enough differences to allow for theory building which will allow for generalisability within the context to take place.

5.3.1 High Growth Enterprises

In any firm, shareholder value creation as measured over time is a good indicator of the sustainability of the firm. The Eurostat/OECD manual on business demographic statistics, Chapter 8, defines high growth enterprises OECD (n.d.). It notes that high-growth enterprises can be defined both in terms of employment (number of employees) and in terms of turnover. In order to study the phenomenon of high growth enterprises, it is recommended that both criteria are used. The definition of high-growth enterprises is outlined below:

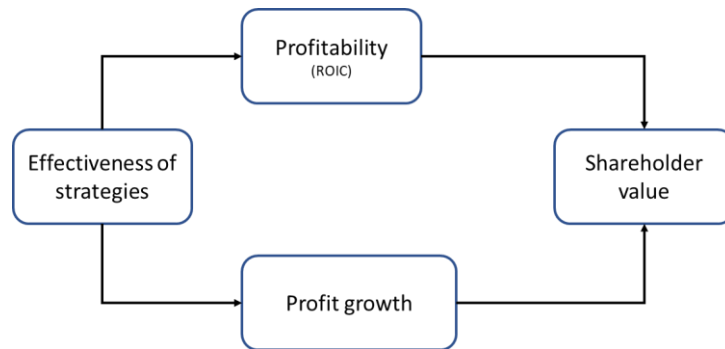
All enterprises with average annualised growth greater than 20% per annum, over a three-year period should be considered as high-growth enterprises. Growth can be measured by the number of employees or by turnover.
Source: (OECD, n.d., Chapter 8, p. 61)

There is a cautionary note that is included in the definition.

A meaningful size threshold (t) should be set to avoid the growth of small enterprises distorting the picture. For instance, an enterprise growing from one to two employees would automatically be a high growth enterprise, using the above growth threshold, although this growth occurs at a very low level with relatively negligible economic impact. On the other hand, the size threshold should be low enough to avoid excluding too many enterprises. A provisional size threshold has been suggested as 10 employees at the beginning of the growth period, but a final recommendation is expected after tests have been performed using different thresholds.
Source: (OECD, n.d., Appendix 12. p. 61)

A more literal illustration of shareholder value by Hill et al. (2018) proposed a process flow to explain the concept in Figure 5.1.

Figure 5.1 – Determinants of Shareholder value



Source: (Hill & Jones, 1989, p. 5) Note to the Figure. Return on Invested Capital (ROIC) Return on invested capital (ROIC) is the amount of money a company makes that is above the average cost it pays for its debt and equity capital (WACC).
 Net profit = Total revenue – Total costs (after tax)

This view of shareholder value and employee levels will form the basis for assessing the performance of the cases in each of the individual cohorts. This will build on the consensus of literature on the measure of the dependent growth variables. (Buckley, 2013)

Employment growth, sales growth, asset growth respectively are the most popular. Increasingly “*shareholder value creation*” is being considered as a more complete measure of a firm’s achievement and thus profitability, profit growth and return on invested capital (ROIC) are poised to assume greater importance in the “firm growth” literature in the future. (p. 64)

5.3.2 Segmentation of data into 3 distinct Cohorts, Age & Performance

Cohen and Levinthal (1990, p. 128) indicated that ‘the development of ACAP and in turn innovative performance are history – or path-dependent’ and they argue how ‘a lack of investment in an area of expertise early on may foreclose the future development of a technical capability in that area.’ Cohen and Levinthal (1990) based their construct on economic theory, the researcher took this direction to accept that time in existence

(Age of firm) plus the firm growth can be measures of SMEs sustainability as they can be predecessors of firm performance (Lane et al. 2006, p. 858). The case data was segmented by each individual case for the time since incorporation (Age of the firm) and then summarised for the total cohort of firms. This allowed a segmentation of the 19 cases interviewed into three specific annualized time segments.

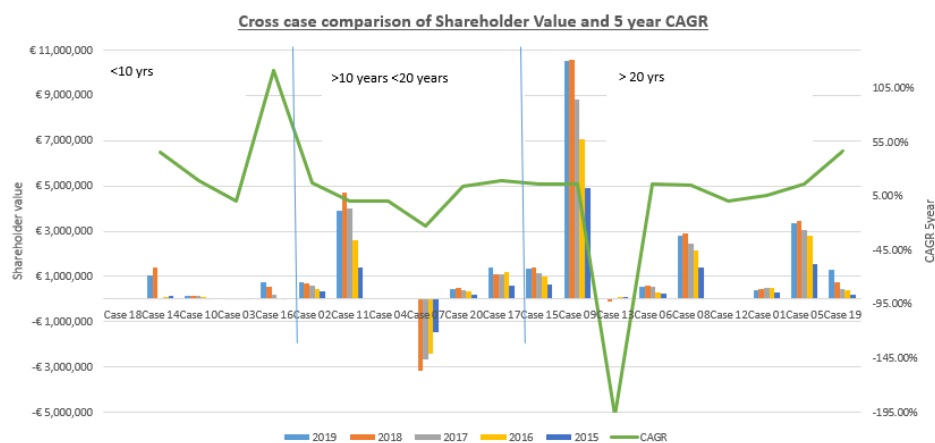
Table 5.4 – Segmentation of data - Three cohorts segmented by Age

Cohort 1	Case Age - Years	Case 14 6	Case 10 7	Case 03 8	Case 16 8					
Cohort 2	Case Age - Years	Case 02 12	Case 11 13	Case 04 14	Case 07 14	Case 20 19	Case 17 20			
Cohort 3	Case Age - Years	Case 1 21	Case 09 22	Case 13 22	Case 06 26	Case 08 28	Case 12 32	Case 01 36	Case 05 36	Case 19 47

Source: Author

By reviewing the cases for shareholder growth in the previous five years and employee numbers against their time in business (Age) as outlined in the Table 5.4 above, three distinct cohorts emerge. Figure 5.2 indicates those firms that can be considered High Performers and Low Performers in each of the three cohorts based on the Fame database for time (Age) segments.

Figure 5.2 – Dataset segmentation – key metrics separation by three-time segments



Source: Author and Fame database

5.3.3 Firm performance measure

Taking the definition of performance from the Eurostat OECD, over a minimum period of 5 years, the CAGR for each of the cases was derived from the shareholder values for each case found in the Fame database. In the supplemental document these performance levels are displayed for CAGR and employee levels over 5 years for each case. A similar reference was used by Taylor (2022) in The Irish Times where firms were included in the FT 1,000 fast growing list using this CAGR calculation for their reporting.

Compound Average Growth Rate (CAGR) is defined as

(Ending Value / Beginning Value) to the power of (1 /number of years) minus 1)

Mathematically $CAGR = [EV/BV]^{1/n} - 1$ Source: CFI (n.d.)

Cohort 1 consists of firms less than ten years old. This cohort contains 4 firms. Cohort 2 consists of firms between ten and twenty years old. This cohort consists of six firms. Finally, Cohort 3 consists of firms that have been on operation longer than twenty years. This cohort consists of 9 firms.

5.4 The Framework for analysis

The framework for analysis consists of 3 separate components (Yin, 2002) where these steps were outlined in Chapter 4. Following the transcription of the case based on a single informant interview for each individual case, Process coding can begin as the initial coding step. Pattern coding follows as the second coding step. The themes emanating from the two coding steps follow. These themes are explored in detail across the three cohorts.

5.4.1 Cross Case Analysis

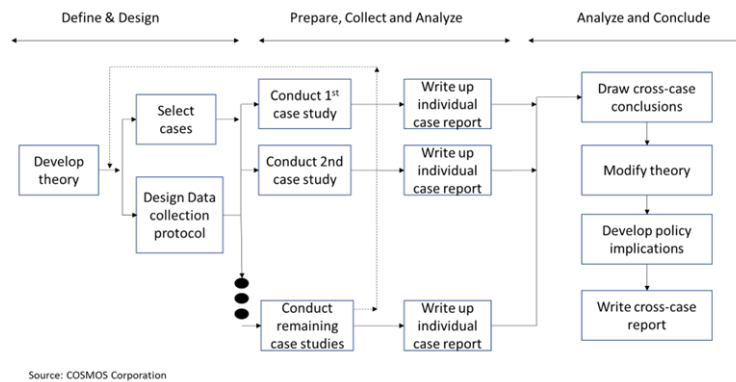
Before engaging with the individual cases, the components of the research for a cross-case analysis (Yin, 2002) is a highly iterative process allowing the researcher to focus on the cases and the data that is generated. Intimate detail of each case allows for critical comparison and analysis. Bringing together the contents of Chapter 3 and Chapter 4, cross-case analysis is particularly suited to qualitative research topics where juxtapositioning across cases allows the researcher to reconcile evidence across cases while increasing the likelihood of reframing data into theory generation. Yin (2002) outlined a multiple case study procedure, Figure 5.3, where the researcher follows a strict process of completing a Define & Design step followed by a Preparation, Collection and Analyse step finally completing the work with the Analyse and Conclude step.

A case study as defined by (Yin, 2002) is an empirical method that

Investigates a contemporary phenomenon (the Case(s)) in depth and within its real word context, especially when the boundaries between phenomenon and context may not be clearly evident. Source: (page. 15)

For a cross-case study, it consists of multiple cases studied as part of the design. It was stated earlier that this mode of inquiry is only effective when time has been spent in clarifying the research question, which was covered in Chapters 2 and clarifying the context which was covered in Chapter 3, only then does a purposeful selection of cases occur (unit of enquiry) in this research is 19 cases.

Figure 5.3 – Multiple case study procedure



Source: (Yin, 2018, p. 58)

The Define & Design steps for this case study have been articulated in earlier Chapter 2, literature review as ACAP. The context of ACAP in SMEs in Ireland was detailed in Chapter 3. An update to Chapter 2 and Chapter 3 has been given regarding the selection and the segmentation of potential cases in this chapter. The Prepare, Collect and Analyse steps were outlined in Chapter 4, the Methodology chapter. In this chapter the Analyse & Conclude steps are described in the following section.

In this exploratory study the data will be divided into three separate cohorts as previously indicated for Age. These three cohorts are analysed separately. The first analysis will consist of cases being compared to each other within each cohort, an *inter-cohort* analysis comparing High and Low performers in each cohort. The second analysis will be a comparison across all three cohorts, an *intra-cohort* analysis. The Eisenhardt (2021) method discussion in Chapter 4 emphasised the benefits of case selection with replication logic and the iterative process of constant comparison leading to theory building. This will allow for the use of the 5-Loop framework to indicate the firm ACAP levels.

5.4.2 Coding cases for data analysis

The coding for each cohort will follow the same process. For each cohort High performers and Low performers will be compared using process and pattern coding before moving on to the next cohort. This will draw out the themes from each cohort segmented by Age. This is indicated as step 1 in the Table 5.5 below. The second step in the Table 5.5, consists of indicating the themes present in the High performers for each of the cohorts having already noted the absence of these themes for the Low performers in each cohort.

Table 5.5 – Cross case and Cross Cohort analysis

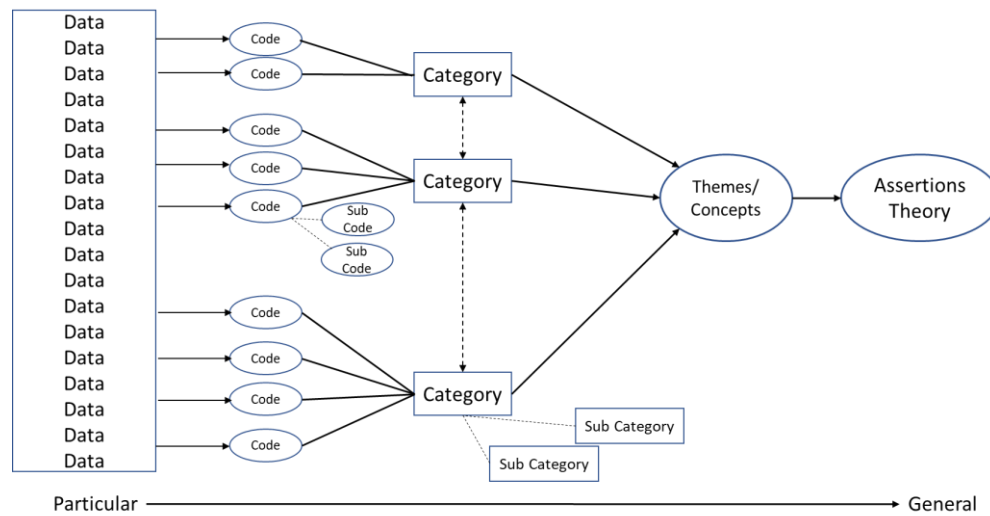
Items	Cross Case comparison Step 1 – Inter (within) Cohort comparison Follow items One, Two and Three
One	4 cases Cohort 1 compared to each other
Two	6 cases Cohort 2 compared to each other
Three	9 cases Cohort 3 compared to each other
	Cross Cohort comparison Step 2 – Intra (between) Cohort comparison Follow items One, Two and Three
One	High Performers from Cohort 1,2,3
Two	Low Performers from Cohort 1,2,3

Source: Author

First step coding – Process coding for each individual case

The process used to analyse the data as indicated by Saldaña (2013) describes a prescriptive thoughtful approach to each case, while drawing from each individual case but allowing the researcher to move from the particular to the general case in terms of themes or concepts leading to assertions of generalized theories.

Figure 5.4 – Codes to theory model for qualitative inquiry



Source: (Saldaña, 2016, p.14)

By adopting a primary and secondary coding approach, the researcher used the initial process coding of each case to allow for a ‘building of consensus’ in terms of key ‘actions’ that are common to the different cases in each cohort. This captures the first level of coding, Process coding being those Action focused behaviours within each firm.

Second step coding – Pattern coding for each individual case

The second level coding used was Pattern coding which allows for patterns to be distinguished with the results of the first level of process coding. Pattern coding is a second cycle method which allows the researcher to ‘group’ the summaries, from the previous Process Coding, into a smaller number of categories, themes or concepts.

(Saldaña, 2016)

Pattern Codes are explanatory or inferential codes, ones that identify an emergent theme, configuration, or explanation. They pull together a lot of material from first cycle coding into more meaningful and parsimonious units of analysis. p. 236

Themes emanating from each case in their external environment

The themes for each cohort were reviewed by case noting the commonalities and gaps between the High performers and Low performers. The themes are tabulated in terms of each firm and the outcomes associated with the 5-Loop framework. The themes associated with the founder are captured separately from the Individuals loop as outlined in section 2.5.1. This recognises other researchers findings such as Smallbone and Weir (2006) that the founder’s prior experience and motivation can drive the firm to adopt different approaches to ACAP in terms of process and structure. The founder acts as a knowledge source in the Individual loop as well as a source in the Organisational loop at different levels. The dynamism of the external environment is an antecedent to ACAP (Lane et al., 2006; Volberda et al., 2010; Wang & Ahmed, 2006). The Organisation, Individual and Outcome loops of the 5- Loop framework will be assessed for themes existing in the External environment where the firm competes, as outlined in Table 5.6.

Table 5.6 – Cohort themes comparison

Themes	High Performer - Case	Low Performer - Case
Founder		
Organisation		
Individual		
Outcomes		

Source: Author

Case themes identified across the 5-Loop framework

The ACAP loop interconnects the other four loops in the 5- Loop framework as conceived in section 2.5.1. The primary research commenced with a single informant (Founder/CEO/MD) in each case using a semi-structured interview. The semi structured interview used a defined topic list based on extant ACAP literature, Appendix 3,

outlined in section 2.4. It was therefore necessary to make a comparison of the themes emanating from each case for ACAP which supported the construction of the 5-Loop framework. The ACAP dimensions were shown graphically interacting in a porous configuration with the other loops in the framework in section 2.5.1. The definitions for the dimensions of ACAP are sourced from Zahra and George (2002, p. 189). As was proposed by Todorova and Durisin (2007), prior knowledge and prior investments are considered as inputs to the ‘*Recognition*’ of external knowledge. Since the ‘*Acquisition*’ dimension is the first step in the ACAP construct in Table 5.7, defined by Zahra and George (2002), prior knowledge and prior investments are captured at this point. These comparisons will be completed for all cases in this format.

Table 5.7 – ACAP Dimensions, Components, Roles and Importance

Dimensions/Capabilities	Components	Role & Importance
Acquisition	Prior Investments Prior Knowledge Intensity Speed Direction	Scope of search Perceptual schema New Connections Speed of learning Quality of learning
Assimilation	Understanding	Interpretation Comprehension Learning
Transformation	Internalization Conversion	Synergy Recodification Bisociation
Exploitation	Use Implementation	Core Competencies Harvesting Resources

Source: Zahra & George, (2002, p. 189)

5.5 Cohort Analysis

Each cohort will be presented in this section. Cases within each cohort will be outlined showing the development of process codes leading to themes for each cohort. The details for each firm are available in the supplemental volume which is only available to the examiners and research supervisor.

5.5.1 Cohort 1, SMEs less than 10 years

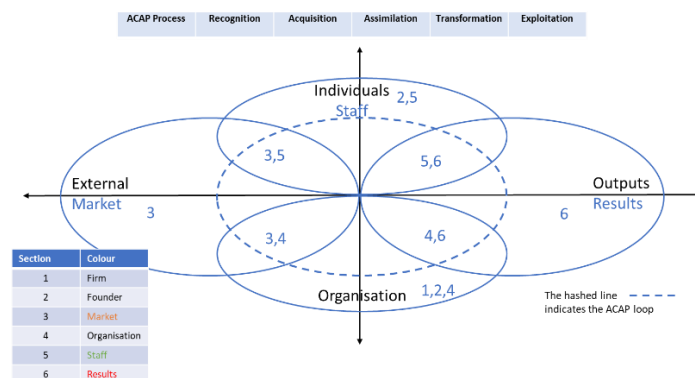
What is presented here is the analysis of the cases agreement with Saldaña (2013) for the first of the three cohorts. This analysis is structured within the cross-case research study process outlined by Yin (2002) leading to theory development and policy implications. The analysis follows the three steps outlined in the coding manual given the individual cases have been transcribed prior to these steps. The coding proposed by Saldaña (2016) is repeated here for reference and in support of the methodological approach

Coding qualitative data has over a half century of use, and a substantive track record in many disciplines and scholarly publications. The technology needed for the enterprise has most certainly evolved through time, as have the methodologies and methods. But the core process of coding remains to this day a legitimate option for qualitative researchers. It is a tradition that has endured, not out of mindless adherence to established protocols, but due to its successful utility as a purposeful analytic approach to voluminous amounts of data. (p. 31)

Once the themes have been articulated and presented for each of the cases in Cohort 1, a review of the themes using the 5-Loop framework is presented. This is followed by a narrative summary for each of the four cases in the context of ACAP. This cohort is closed out with observations that are presented for both the High performers and the Low performers for this cohort.

In reference to Figure 5.5, each of the 4 loops intersects each other with the progressive ACAP hashed loop indicating the '*permeable*' knowledge flows are possible with each of the other 4 loops. The ACAP is visualised as Potential ACAP (PACAP) on the left-hand side and Realised ACAP (RACAP) on the right-hand side as a continuum of the Figure 5.5.

Figure 5.5 – The 5-Loop Framework – Linkages to the semi structured interview



Source: Author Note to Figure. The numbers referenced in the figure are the sections covered in the semi-structured topic list and how interviewees related to the 5-Loop framework. The continuum of ACAP components is highlighted in Blue

Cohort 1 - Description

Cohort 1 consists of 4 firms all under 10 years in existence, Table 5.8. Two High Performers consisting of Cases 14 and Case 16 were identified based on employee numbers and Shareholder value. Two Low Performers consisting of Case 10 and Case 03 were identified. A combination of Shareholder value above €750,00 plus the employee level were used to determine the High Performers and Low Performers. All four firms were identified as being modern sector-orientated firms.

Table 5.8 – Cohort 1 firms

Firm	Location	Sector	Years in existence	Employees in the year 5	CAGR 5 yrs. Growth	Shareholder Value	Performance
Case 14	IE061 Eastern Dublin	Modern	6	20	45.78 %	€1,063,173	High Performer
Case 10	IE053 South-West	Modern	7	4	19.73 %	€121,645	Low Performer
Case 03	IE042 North-West	Modern	8	4	0 %	€1	Low Performer
Case 16	IE061 Eastern Dublin	Modern	8	68	120.74 %	€750,037	High Performer

Source: Author. Note to Table. “The modern sector is defined as the chemicals and pharmaceuticals; computer, electronics, optical and electrical equipment; reproduction of recorded media, and medical and dental instruments and supplies. The traditional includes all other sectors.” Source CSO website

Cohort 1, First level Coding – Process Coding

The first level coding followed a process of identifying key ‘action -ing i.e., gerund’ sentences from the transcript for each case and allocating a process code to that sentence. This sequenced approach was repeated consistently through each case transcript noting the statement determining the coding (gerund) word used. For each case a different number of process codes were generated in the range 40 to 70 across this cohort. These codes were captured in a Microsoft Excel[®] spreadsheet as part of the coding workbook linking the code back to the transcript, Table 5.9. For each case this coding is available in the supplemental volume. Since each case consisted of an individual informant and they were interviewed using the same semi-structured topic list, a consistency of feedback can be inferred from the respondent, allowing a comparison of the emphasised “actions” that each individual case was taking at the time of the interview.

Table 5.9 – Cohort 1 example of process coding in Excel[®] workbook

Code #	Code	Description	Case section	2nd Case section	Code type
1	Educating	master’s degree from UCD and a technical degree from Tallaght	Section 2	Section 4	Process
2	Motivating	motivated to move to a management level and worked with several MNCs	Section 2	Section 5	Process
3	Emigrating	he was the director for their Irish and UK heating business	Section 2	Section 4	Process
4	Owning	became the business owner for this part of the business	Section 2	Section 5	Process
5	Networking	employees he had worked with in Barlow and they ran the company for several years until the Great crash of 2008.	Section 2	Section 4	Process
6	Divesting	Mr. Hynes sold the business entity back to DeLonghi	Section 2	Section 5	Process
7	Experiencing	Mr. Hynes wanted to get more involved with IT	Section 2	Section 5	Process
8	Training	taking additional training at Tallaght IT	Section 2	Section 5	Process
9	Marketing	Hynes saw the market for a new category	Section 3	Section 3	Process
10	Disrupting	was a software approach to the connected home. He saw this as a global market opportunity	Section 3	Section 4	Process
11	Following	NEST ploughed a furrow for quite a lot of product areas including door bells and security systems and all sorts of	Section 3	Section 4	Process

Source: Author. Coding workbook

Cohort 1, Second level coding – Pattern Coding

The second level coding is a grouping technique derived from the first level coding.

Pattern coding is a second cycle method which allows the researcher to group the summaries, from Process Coding, into a smaller number of categories, themes or concepts. (Saldaña, 2016, p. 236)

For each case, Patterns are represented as the frequency of occurrence of the pattern relative to the number of process codes generated for the individual case. This is a consistent approach for organising codes whereby Saldaña highlighted the use of Excel® which allowed him to calculate survey ratings in “means” for further analysis (Saldaña, 2016, p. 26). In this research each case was individually analysed for their patterns as the transcripts were completed and stored in the coding Excel® workbook, Table 5.10. When comparing these cases as a single cohort, the tables listing the patterns for each case were brought together in a separate Excel® spreadsheet within the Excel® workbook. This allows a comparison of each case in a single table for Cohort 1.

Table 5.10 – Second cycle Pattern Codes for Cohort 1

High Performers			High Performers			Low Performer			Low Performer		
Case 14	CAGR	45.8%	Case 16	CAGR	120.7%	Case 10	CAGR	19.7%	Case 03	CAGR	0
2019	2019		2019	2019		2019	2019		2019	2019	
NUTS	Modern	IE061	NUTS	Modern	IE061	NUTS	Modern	IE053	NUTS	Modern	IE042
CAGR	45.78%		CAGR	120.74%		CAGR	19.73%		CAGR	0.00%	
Employees	20		Employees	68		Employees	4		Employees	4	10
Sharhldr fl	11,063,173	1161,490	Sharhldr funds	1750,037	114,311	Sharhldr fund	1121,645	149,431	Sharhldr fur	11	11
Net Tangle	1782,743	Median	Net Tangle Asts	1881,062	Median	Net Tangle As	1121,645	Median	Net Tangle J	11,643	Median
Years in Op	6	3.7%	Years in Op	8	2.9%	Years in Op	7	3.9%	Years in Op	8	4.6%
Case 14	57		Case 16	72		Case 10	49		Case 03	51	
Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%
Networks	9	15.8%	Focus	9	12.5%	Networks	6	12.2%	Skills	10	19.2%
Marketing	6	10.5%	Structures	7	9.7%	Capabilities	6	12.2%	Research	6	11.5%
Finance	5	8.8%	Offering	6	8.3%	Structures	5	10.2%	Networks	6	11.5%
Experience	4	7.0%	Skills	6	8.3%	Research	5	10.2%	Structures	5	9.6%
Culture	4	7.0%	Marketing	5	6.9%	Marketing	4	8.2%	Finance	4	7.7%
Structures	4	7.0%	Experience	4	5.6%	Incentives	3	6.1%	Revenue	4	7.7%
Supply	3	5.3%	Networks	4	5.6%	Finance	3	6.1%	Experience	3	5.8%
Roles	3	5.3%	Finance	3	4.2%	Roles	2	4.1%	Regulations	2	3.8%
Skills	3	5.3%	Investing	3	4.2%	Culture	2	4.1%	Collaboration	2	3.8%
Education	2	3.5%	Communication	3	4.2%	Education	2	4.1%	Market	2	3.8%
Learning	2	3.5%	Measures	3	4.2%	Consultant	2	4.1%	Education	1	1.9%
Revenue	2	3.5%	Education	2	2.8%	Sustainability	1	2.0%	Immigrant	1	1.9%
Growth	2	3.5%	Revenue	2	2.8%	Revenue	1	2.0%	Capabilities	1	1.9%
Divestature	1	1.8%	Process	2	2.8%	Product	1	2.0%	Communica	1	1.9%
Innovation	1	1.8%	Planning	2	2.8%	Leadership	1	2.0%	Measures	1	1.9%
Invention	1	1.8%	Immigrant	1	1.4%	International	1	2.0%	Innovation	1	1.9%
IP	1	1.8%	Startup	1	1.4%	Innovation	1	2.0%	Growth	1	1.9%
Motivation	1	1.8%	Outcomes	1	1.4%	Immigrant	1	2.0%	IP	1	1.9%
Sales	1	1.8%	Segmentation	1	1.4%	Growth	1	2.0%			
Leadership	1	1.8%	Analysis	1	1.4%	Experience	1	2.0%			
Strategy	1	1.8%	Diversify	1	1.4%						
			Growth	1	1.4%						
			Relationships	1	1.4%						
			Pacing	1	1.4%						
			Explore	1	1.4%						
			Targets	1	1.4%						

Note to Table. The shaded highlight indicates the patterns above the median for each case. For the high performers the top 3 patterns were: Case 14 – Networks, Marketing, Finance. Case 16 – Focus, Structures, Offering, and Skill. Offering and Skills scored the same value. For the low performers the top 3 patterns were Case 10 – Networks, Capabilities, Structures, Research., Structure and Research scored the same value, Case 03 – Skills, Research and Networks

Themes emerging from Cohort 1

The themes emanating from the Cohort 1 cases are stated in Table 5.11. For each case the themes can represent the outcome of the coding exercise. Themes can be represented as a categorisation or analytic reflection of the coding, but importantly, it is not something itself, that is coded. In an explanation of the differences of themes and coding Rallis and Rossman (2003) use the summary

think of a category as a word or phrase describing some segment of your data that is explicit, whereas a theme is a phrase or sentence describing more subtle and tacit processes (p. 282).

A common cited example of this difference is that of ‘security’ as a code, but ‘denial’ could be described as a false ‘sense of security’, which could be a theme. Taking the themes from Cohort 1, they are now presented in tabular form indicating the major themes for each case. Within each case, a short phrase indicates the key themes for that case. Themes are a declarative phrase or sentence describing a process, a connection, or an insight (Rossman & Rallis, 2017, p. 240). Think of a theme as an abstraction that explains the pattern. Themes are listed vertically to highlight if and where there are Founder themes followed by the Organisation, the Individual, and the Outcomes themes, might appear as indicated in the 5-Loop framework by the first four loops.

Table 5.11 – Themes extracted for Cohort 1 list of cases

Themes	High Performer - Case 14	High Performer - Case 16	Low Performer - Case 10	Low Performer - Case 03
Founder	Commercial Experience: Strong commercial experienced founder Strong founder mindset Funding & Investment: Founder focus on securing funding through networking for exploration of market	Technical experience: Founder is a market experienced IT technical leader Customer Focused: Founder engagement with customers to understand problems Team builder: Leadership cross functional team to supplement founder's technical experience	Experienced Researcher: Founders are acknowledged researchers Single market: Niche high value market Differentiated solution: Specialised technical solution	Global Researcher: Founder acclaimed researcher and entrepreneur Specialised technologist: Specialised technical solutions Marketing: Broad market applications for research output
Organisation	External focus: focus on understanding market problem, current solutions and exploring a differentiated solution Flexible Structure: Organisational structure	Tools & Processes: Organisation structures and processes in place to deliver customer solutions	Knowledge creation: Organisational structured for knowledge generation Capabilities: Leveraged to UCC university assets for computation Strategy: Slow to evolve from consultancy business model to revenue generating model	Research Funding: Funding dependent on research grants Organisation: Scale up and commercial skills lacking
Individual	Individuals are not fixed in the business model	Growth mindset: Individual's working processes and environment for growth created	Skills: Homogenous Research skills Dual career staff – research and start-up participation	Skillset: Staff clustered at UCG
Outcomes	Patient mindset: Patient in gaining market share while continuing to be sustainable in the market place	Revenue generation: Focus on revenue and Commercial repeat customers Growth: Environment designed for growth through reinvestment	Funding: Lack of additional external funding sources	Knowledge engine: IP knowledge generator

Source: Author. Note to Table: Different themes have evolved for each case regarding the founder, organisation, individual, or outcomes

ACAP components with linkage to the 5-Loop Framework

With this level of understanding of the themes present in each case, it is now appropriate to present the cases from this cohort in terms of the 5-Loop framework indicating the relative levels of ACAP. Since the 5-Loop framework is based on the literature review and conceived in Chapter 2, this allows a direct linkage of the ACAP components to the themes present in each firm. Based on the semi-structured interview it further indicates how the firm is addressing the components of ACAP, at the time of the interview, in the context of managing the flow of knowledge at this point in their development, less than 10 years since creation of the firm

The findings apparent from Cohort 1 will be discussed in reference to Table 5.12 below.

Table 5.12 –Cohort 1 themes in the 5-Loop framework, with levels of ACAP

5-Loop Framework	Case 14	Case 16	Case 10	Case 03
	High Performer	High Performer	Low Performer	Low Performer
Shareholder year 5 value	€1.0M	€0.8M	<€0.5M	<€0.5M
Employee # year 5	20	68	7	8
PACAP Level	High PACAP	High PACAP	High PACAP	High PACAP
ACAP – PACAP Acquisition Prior investments Prior Knowledge Intensity Speed Direction	Commercial Experience: Strong commercial experienced founder Strong founder mindset Funding & Investment: Founder focus on securing funding through networking for exploration of market	Technical Experience: Founder is a market experienced IT technical leader	Experienced Researcher: Founders are acknowledged researchers Single market: Niche high value market	Global Researcher: Founder acclaimed researcher and entrepreneur Specialised technologist: Specialised technical solutions
Assimilation Understanding	Flexible Structure: Organisational structure and Individuals are not fixed in the business model	Customer Focused: Founder engagement with customers to understand problems Team builder: Leadership cross functional team to supplement founder's technical experience	Differentiated solution: Specialised technical solution	Marketing: Broad market applications for research output
RACAP Level	High RACAP	High RACAP	Low RACAP	Low RACAP
ACAP – RACAP Transformation Internalisation Conversion	External focus: focus on understanding market problem, current solutions and exploring a differentiated solution	Tools & Processes: Organisation structures and processes in place to deliver customer solutions Growth mindset: Individual's working processes and environment for growth created	Knowledge creation: Organisation structured for knowledge generation Skills: Homogenous Research skills	Knowledge engine: IP knowledge generator Skillset: Staff clustered at UCG
Exploitation Use Implementation	Patient mindset: Patient in gaining market share while continuing to be sustainable in the market place, albeit low market share.	Revenue generation: Focus on revenue and Commercial repeat customers Growth: Environment designed for growth through reinvestment	Dual career staff – research and start-up participation. Capabilities: Leveraged to UCC university assets for computation Strategy: Slow to evolve from consultancy business model to revenue generating model. Funding: Lack of additional external funding sources	Research Funding: Funding dependent on research grants to generate IP Organisation: Scale up and commercial skills lacking

Source Author. Note to Table: Dimensions and Capability components are taken from Zahra & George 2002, P189 highlighted in blue script

Summary of analysis and findings for Cohort 1

Two findings will be discussed, firstly having high PACAP alone, in itself, would appear to be an insufficient indicator of high-level performance of the firm. This can be seen from Table 5.12 in the case of the High Performers compared to the two Low Performing firms. The second finding for discussion is that for a firm to have a growth imperative, management should demonstrate an equal focus on commercialisation as well as the provision of a differentiated solution to enable value creation for the firm. The difference in motivation and actions of the founders in the high performers compared to the two low performers is indicated in Table 5.11.

As a grouping of 4 cases, this cohort can provide insight where there has been a purposeful selection criteria of the cases allowing for a cross-case analysis leading to theory development (Eisenhardt, 1989). In this Cohort 1, there are two High Performers and two Low Performers in the same time period of operation within the same national context. As a cross-case analysis, the following are the findings when using the 5-Loop framework to assess the levels of ACAP within the firms at this point in their development.

Finding 1: *For Young firms having high PACAP alone, in itself, would appear to be an insufficient indicator of high-level performance of the firm.* This finding would appear to support Zahra and George (2002, p. 198) where they proposed that ACAP follows a multidirectional and fluid path.

In all 4 cases for this cohort, the subset of capabilities for *Potential* ACAP would appear to be in place and indicated as High PACAP by the data, i.e., Refer to Table 5.12.

Acquiring and *Assimilating* external knowledge (Zahra & George, 2002). Having PACAP and securing a competitive advantage depends on how efficient the firm is in

deploying the RACAP sub-capacity. PACAP and RACAP are different but they have complimentary roles in the firm (Zahra & George, 2002, p. 191). By recognising that equifinality can come into play in innovation as proposed by Lowik et al. (2016), in terms of teams, organisational structure and routines, this would tend to indicate that RACAP capabilities might indicate differences in firm performance. RACAP reflects the firm's capacity to leverage the knowledge that it has already absorbed. Case 14 has a strong commercial leadership and experience in the knowledge *Acquisition* dimension of PACAP, while Case 16 has supplemented that technical customer focus of the founder with a strong diverse commercial team in the *Acquisition* dimension. Case 14 has an approach to organisational structure that can be described as 'flexible' in the *Assimilation* dimension of PACAP. That is, resisting the urge to put strict processes in place within the organisation to the point of having high turnover of staff. Case 16 which has a larger number of staff has put structures and training in place for staff development and to discourage attrition losses while enhancing the assimilation dimension. Case 14 and Case 16 approach the market with the intent to secure customer engagement and generate revenue or secure market funding to allow the firm to iterate and provide a differentiated solution. In both the High Performer cases, they would appear to demonstrate High RACAP. These approaches would appear to allow both firms to be sustainable in their 'chosen' markets based on **how** they 'choose to compete' (O'Gorman, 2001). As aptly indicated by Buckley (2013)

If the firm does not gain (sales) traction in the marketplace (early), then the venture cannot generate adequate returns and thus generate internal finance to fund (future) growth. (p.185)

Whereas in Case 10 and Case 03 both founders are technical leaders in their individual areas and hail from an academic heritage. In both cases they are capable of acquiring the knowledge necessary to solve the problems and customer issues from a technological

perspective. In Case 10 it is a niche high value market and in Case 03 it would appear to be a very broad range of market applications. However, the *Transformation* dimension and *Exploitation* dimensions for both of these cases would appear to be technically focused with little commercial experience or focus applied. For the two Low Performers, the RACAP capability components, of *Internalisation*, and *Implementation* would appear to be less developed than the High Performers and hence lead to lower RACAP in the firms. This reflects extant literature where Senaratne and Wang (2018, p. 1027) note that barriers may exist, that in young SMEs, the lower number of staff can prohibit the available expertise for all necessary functions within a firm. It also reflects a lack of established organisational processes of recodification and harvesting of resources (Zahra & George, 2002, p. 189) in the Low performing firms. This finding supports Zahra and George (2002, p. 191) assertion that a high PACAP does not necessarily imply enhanced performance.

Finding 2: *For Young firms it would appear that for a firm to have a growth imperative, management should demonstrate an equal focus on commercialisation as well as the provision of a differentiated solution to enable value creation for the firm.*

This finding would appear to support Cohen & Levinthal (1990,) where it was stated that

an organisation that develops close relationships with buyers and suppliers, a broad and active network of internal and external relationships, individuals' awareness of others' capabilities and knowledge will be strengthened. As a result, individual ACAP are leveraged all the more and the organisation's ACAP is strengthened. (p. 134)

It would seem that an early external market focus is important in sustaining the firm in the early years (Cooney, 2012). Both High Performers have made choices in the markets that they have identified as 'where to compete' although they may differ in

'how to compete' (O'Gorman, 2001) based on their respective capabilities. Both Case 14 and Case 16 would appear to differentiate themselves in their respective markets and they would appear to be providing a competitive advantage to their customers (Cohen & Levinthal, 1990). Case 14 brought an intensity to identifying novel solutions to the identified problem. This was evident with the university engagement and additional training the founder received. This resulted in patent filings for their solution. Equally in Case 16 the founder brought with him a technical understanding of the customers and their problems and a channel to engage with the customers. In Case 16 the founder supplemented his understanding early on with additional commercial and accountancy leadership staff hiring. This demonstrated an intensity and speed to engaging with customers in finding a commercial solution. In the *acquisition* dimensions Case 14 and Case 16 are externally focused with intent, while engaging many different external entities. It would appear that engagement with customers only, is insufficient, but that awareness of the broader environment of context in which the firm operates, is also necessary. For this reason, it would appear that the founder in Case 14 emphasised the External engagement in search of funding to ensure the firm was well funded at all times. Case 14 was aware that the proposed customer solution would not immediately generate revenue, *Assimilation & Transformation*, and so with external agents ensured that the firm had sufficient funding to drive *Exploration* and investment until sales revenue were secured. In Case 14 it would appear that engagement with suppliers and a drive to provide a prototype led to learnings in supply chain and market access, all helping the firm to identify that a solution could be provided. Case 16 could immediately deliver a solution that generated revenue, as a service provider. Case 16 used the founders understanding of the IT firms and their need for 'fast turnaround' of solutions and staff to implement the solution. This allowed the firm to be flexible on the

terms of their contractual agreement. This would appear to ensure repeat revenue and continued engagement with the customers. This tactic would appear to have allowed Case 16 to identify the required level of staff for their firm as they *Transformed* (RACAP dimension) their processes and training to meet this need. These two different approaches taken by the High Performers in *Transformation* of External knowledge ultimately led to high levels of shareholder value and higher staff levels for the High performers.

Whereas, in Case 10 the external engagement, while focused on gaining knowledge of niche customer's problems to solve, lacked the focus and intensity of the high performers to generate recurring revenue. Since only a periodic consultancy business model was initially proposed based on providing proven calculated solutions to entice customer engagement and revenue generation. Case 10 would appear to have leveraged staff that were both working in the firm but also working in the university. This might appear to be a mitigation of risk for the employees, but this did not facilitate 'fast' conversions with customers. *Internalisation* and *Conversion* dimensions would appear to be time bound by the availability of the staff and a research mindset that was pervasive with the staff ultimately leading to a lack of commercial focus and a low RACAP. Equally in Case 03, staff flexibility was determined by the level of funding received or awarded to the firm based on research calls. The focus of Case 03 was on finding research calls that overlapped with the research capability of the founder. Due to the cyclical nature of these calls, staff were leveraged from the university, as needed. *Transformation* dimensions would appear to have been technology driven. Only very recently has the staff been increased to include process and commercial capabilities. This would appear to have limited the implementation of the solution, once identified. It would appear that for the two Low Performers, RACAP capabilities related to

Transformation and Exploitation, are not as developed as the High Performers and hence led to lower RACAP assessment for these firms. This might reflect that the lower number of staff and deficiencies in the Managerial cognition (Helfat & Peteraf, 2015, p. 835), of the Low Performing firms. There is a lack of established organisational processes of recodification and harvesting of resources (Zahra & George, 2002, p. 189) in the Low performing firms. The external engagement of the Low Performers would appear to be limited, both in terms of customer development and potential sources of funding. The lack of understanding by the Low Performers of the broader ecosystem and the interdependencies players/agents for technology developments would appear to limit revenue generating opportunities (Adner & Kapoor, 2016).

It has been stated that entrepreneurial leadership will depend on the ACAP of individual members (Cohen & Levinthal, 1990, p. 131).

ACAP is an organisational construct underpinned by the past experience of the individuals. The founders initially bring their collective business experience and education into the creation of the new firm. Not all founders have complimentary management skills or appropriate education, and neither are they willing to participate in ongoing training or adapt an entrepreneurial mindset. However, it has been shown that firms that display a propensity for higher levels of education, staff development and propensity to innovate, also displayed stronger growth orientation and performance (Gray, 2006, p. 352). In Case 16, the founder complements his own IT technical skills by engaging a cross functional team at the leadership level to drive strategy and market selection. Equally in Case 14, with a strong series of previous commercial experiences by the founder coupled with a 'growth mindset' or in this case an 'entrepreneurial mindset' (Haynie et al., 2010) would appear to drive this firm for sustainability. Both

approaches appear to motivate these firms to be competitive in their markets. It has previously been reported by Teece (2007, p. 1347) that the managerial skillsets for sensing and seizing market opportunities are different. The skillsets that result in the identification and or development of an opportunity are not the same as those required ‘to profit’ from the exploitation of the opportunity. In the *Exploitation* dimension both the High Performers appear to demonstrate growth imperatives in the *Use* and *Implementation* components in the way they engage the customers and drive for measurable improvements. Some of this growth imperative is driven by an available solution and the market urgency to their problems as in Case 16. Both High Performers would seem to apply differing approaches at this phase of their development which would appear to be suitable for their chosen ecosystems.

In contrast, the Low Performers would seem to demonstrate a lack of skill heterogeneity, with too much technology based and solution orientation. This lack of diversity would appear to maintain only the technical and academic transformation of knowledge. In both Low Performers, development of commercially knowledgeable leaders would seem to be absent or are only now being considered after a technology solution appears to be in place.

The role that Universities play in attracting educated researchers and graduates with the presence of three immigrant founders in this cohort of firms would appear to be significant. This SFI strategy to generate Ireland as a knowledge leader was covered in section 3.2.3 (SFI, 2020, p. 19). This importance of this national innovation perspective was recognised as a source to new firm incubation and referenced in Chapter 3 (Mason & Brown, 2013). The arrival of foreign nationals would appear to provide additional research opportunity to develop high tech capabilities in Ireland. What might be lacking in all these 3 cases is an endeavour to upskill the technology trained founders with the

necessary external marketing and commercial focus required to generate a sustainable, competitively advantaged start-up entity. The founder in Case 16 added to his technical knowledge with other leaders who brought additional skill sets. The founder also availed of courses to add to his commercial skills with the TU Dublin's International Selling Programme. The commercial aspects of the innovation have been recognised as the least developed part of the innovation management (Adams et al., 2006, p. 38). Without this commercial imperative step, the previous steps of *recognising* the value of external knowledge, *assimilating* and *transformation* of that knowledge, then the *exploitation* and commercialisation will not occur.

5.5.2 Cohort 2 – SMEs Age 10 to 20 years

What is presented here is the analysis of the cases agreement with Saldaña (2013) for the second of the three cohorts. This analysis is structured in the same way as for Cohort 1 indicated in section 5.5.1. These steps are First level coding, followed by Second level coding and then themes will be extracted.

Cohort 2 - Description

The second cohort of firms are those that are in existence for between 10 and 20 years. There are 6 firms in this cohort as indicated in the Table 5.13 below. A level of €3M Euros was chosen for this cohort as a breakpoint to determine High Performers combined with the level of employees at each firm, which is line with OECD recommendations when including these two measures. One firm, Case 04, consolidated its financials and were not available for comparison for shareholder growth despite having the second highest employee level. Case 11 indicated the highest overall global employee level for any firm, but in Ireland it was noted the employee level was

approximately 160 as this firm expands rapidly in this period of growth for the firm. In this cohort there is an example of a consistently negative growth firm, Case 07. This cohort displays a wide variation of CAGR values ranging from negative 23 percent to positive 19 percent demonstrating different levels of annualized revenue.

Table 5.13 – Cohort 2 firms

Firm	Location	Sector	Years in existence	Employees in the year 5	CAGR 5 years Growth	Shareholder value	Performance
Case 02	IE041 North Border	Modern	12	20	16.88 %	€756,740	Low Performer
Case 11	IE053 South West	Modern	13	349 (Global) 160 Ireland	14.48 %	€5,103,981	High Performer
Case 04	IE042 North Western	Modern	14	34	Consolidated	€ Not recorded	Low Performer
Case 07	IE051 Mid-Western	Modern	14	18	-22.93 % (loss)	€-3,143,914	Low Performer
Case 20	IE061 Eastern Dublin	Modern	19	10	14.44 %	€419,762	Low Performer
Case 17	IE061 Eastern Dublin	Modern	20	9	18.83 %	€1,143,914	Low Performer

Source: Author. Note to Table. “The modern sector is defined as the chemicals and pharmaceuticals; computer, electronics, optical and electrical equipment; reproduction of recorded media, and medical and dental instruments and supplies. The traditional includes all other sectors.” Source CSO website

Cohort 2, First level coding – Process coding

The first level coding followed a process of identifying key ‘action -ing i.e., gerund’ sentences from the transcript for each case and allocating a process code to that sentence. This sequenced approach was repeated consistently through each case transcript noting the statement determining the coding (gerund) word used. For each case a different number of process codes were generated, Table 5.14, in the range 44 to 68 across this cohort. These codes were captured in a Microsoft Excel® worksheet as part of the coding workbook linking the code back to the transcript. Since each case informant was interviewed using the same semi-structured topic list, a consistency of feedback is achieved from the key informant, allowing a comparison of the emphasised ‘actions’ that each individual case was taking at the time of the interview.

Table 5.14 – Cohort 2 example of process coding extracted from Coding

Workbook

Code #	Code	Description	Case section	2nd Case section	Code type
3	Upskilling	received a master degree from the University of Middlesex	Section 2	Section 5	Process
4	Lecturing	occasionally lectures in University College Cork on international business and the circular economy	Section 2	Section 3	Process
5	Focusing	build company focusing on support needed for an MNC located in Ireland	Section 3	Section 3	Process
6	Creating	international in its customer base and the network of companies	Section 3	Section 4	Process
7	Earning	business model was a cost-plus	Section 3	Section 4	Process
8	Networking	Enterprise Ireland came in as we were a high potential startup	Section 3	Section 4	Process
9	Supporting	covered over half his wages for 12 months	Section 3	Section 5	Process
10	Focusing	the principal customer for the first 3 years.	Section 3	Section 6	Process
11	Prospecting	look around at other opportunities	Section 3	Section 3	Process
12	Influencing	directive in the European Union (EU)	Section 3	Section 4	Process
13	Creating	to test and ensure that it was functionally good	Section 3	Section 4	Process
15	Partnering	develop partners and customers all over the world	Section 3	Section 4	Process
16	Sustaining	effectively two revenue streams	Section 3	Section 5	Process
17	Leveraging	experience in managing and organizing principles	Section 4	Section 4	Process
18	Creating	material coming off lease is that its known good material	Section 4	Section 4	Process
19	Disrupting	we're not doing the fix, and you're doing more diagnostic	Section 4	Section 4	Process

Source: Author

Cohort 2, Second level coding – Pattern Coding

For each case, Patterns are represented as the frequency of occurrence of the pattern relative to the number of process codes generated for the individual case. This is a consistent approach for organising codes whereby Saldaña highlighted the use of Excel® which allowed him to calculate survey ratings in ‘means’ for further analysis (Saldaña, 2013, p.26). Each case was individually analysed as the transcripts were completed and stored in the coding Excel® workbook. When comparing these cases as a single cohort, the tables for each case were brought together in a separate sheet within

the workbook. This allowed a comparison of each case in a single Table 5.15, for Cohort 2.

Table 5.15 – Second cycle Pattern Codes for Cohort 2

High Performers		
Case 11	CAGR	14.5%
	2020	
NUTS	Modern	IE053
CAGR		14.48%
Employees		349
Sharhldr funds	15,103,981	12,595,914
Net Tangle Asts	18,624,131	Median
Years in Op	13	4.4%
Case 11		
Pattern	Count #	%
Structures	11	16.7%
Experience	8	12.1%
Revenue	8	12.1%
Networks	7	10.6%
Marketing	6	9.1%
Ambition	5	7.6%
Communication	5	7.6%
Education	4	6.1%
Processes	4	6.1%
Standards	2	3.0%
Finance	1	1.5%
IT	1	1.5%
Collaboration	1	1.5%
Growth	1	1.5%
Roles	1	1.5%
International	1	1.5%

Low Performer			Low Performer			Low Performer			Low Performer			Low Performer		
Case 02	CAGR	16.9%	Case 04	CAGR	NR	Case 07	CAGR	22.9%	Case 20	CAGR	14.4%	Case 17	CAGR	18.8%
	2019			2019			2018			2019			2019	
NUTS	Modern	IE041	NUTS	Modern	IE042	NUTS	Modern	IE051	NUTS	Modern	IE061	NUTS	Modern	IE061
CAGR	16.88%		CAGR	NR		CAGR	22.93%		CAGR	14.44%		CAGR	18.83%	
Employees	20		Employees	34		Employees	18		Employees	10		Employees	3	
Sharhldr funds	1,756,740	1,346,985	Sharhldr funds	NR	NR	Sharhldr fu	-13,143,914	-11,119,825	Sharhldr fu	149,762	1213,871	Sharhldr funds	11,389,656	1586,547
Net Tangle Ast	1,201,410	Median	Net Tangle Ast	NR	Median	Net Tangle	-834,367	Median	Net Tangle	1470,854	Median	Net Tangle Ast	1,128,644	Median
Years in Op	12	3.4%	Years in Op	14	2.8%	Years in Op	14	6.3%	Years in Op	19	4.0%	Years in Op	20	4.4%
Case 02			Case 04			Case 07			Case 20			Case 17		
Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%
Skills	11	22.0%	Skills	8	11.8%	Skills	9	19.6%	Structures	8	16.7%	Skills	5	11.4%
Structures	8	16.0%	Research	7	10.3%	Marketing	7	15.2%	Networks	7	14.6%	Structures	5	11.4%
Networks	6	12.0%	Networks	6	8.8%	Revenue	6	13.0%	Skills	5	10.4%	Markets	4	9.1%
Revenue	5	10.0%	Structures	6	8.8%	Structures	6	13.0%	Marketing	4	8.3%	Process	4	9.1%
Investment	3	6.0%	Revenue	5	7.4%	Finance	5	10.9%	Culture	4	8.3%	Communication	4	9.1%
Competition	2	4.0%	Experience	4	5.9%	Networks	4	8.7%	Finance	2	4.2%	Training	3	6.8%
Collaboration	2	4.0%	Investment	4	5.9%	Experience	3	6.5%	Markets	2	4.2%	Education	2	4.5%
Ambition	1	2.0%	Innovation	4	5.9%	Ambition	2	4.3%	Service	2	4.2%	Experience	2	4.5%
Motivation	1	2.0%	Finance	3	4.4%	Education	1	2.2%	Plans	2	4.2%	IP	2	4.5%
Risks	1	2.0%	Motivation	2	2.9%	Growth	1	2.2%	Roles	2	4.2%	Networks	2	4.5%
Capital	1	2.0%	International	2	2.9%	Consultant	1	2.2%	Revenue	2	4.2%	Marketing	2	4.5%
Benchmarking	1	2.0%	Competition	2	2.9%	Investment	1	2.2%	Education	1	2.1%	Innovation	2	4.5%
Education	1	2.0%	Education	1	1.5%				Efficiencies	1	2.1%	Motivation	1	2.3%
Software	1	2.0%	Ambition	1	1.5%				Sales	1	2.1%	Offering	1	2.3%
Consultant	1	2.0%	IP	1	1.5%				IT	1	2.1%	Standards	1	2.3%
Roadmapping	1	2.0%	Measures	1	1.5%				Measures	1	2.1%	Finance	1	2.3%
Offering	1	2.0%	Quality	1	1.5%				IP	1	2.1%	Growth	1	2.3%
Measures	1	2.0%	Marketing	1	1.5%				Training	1	2.1%	Culture	1	2.3%
Growth	1	2.0%	Commitment	1	1.5%				Competition	1	2.1%	IT	1	2.3%
IT	1	2.0%	Diversify	1	1.5%						0.0%			
			Distribution	1	1.5%						0.0%			
			Optimization	1	1.5%						0.0%			
			Planning	1	1.5%						0.0%			
			Software	1	1.5%									
			Growth	1	1.5%									
			Outsourcing	1	1.5%									
			IT	1	1.5%									

Source: Author Note to Table. The shaded highlight indicates the patterns above the median for each case. For the high performer the top 3 patterns, unless they score the same, were: Case 11 – Structures, Experience, Revenue. For the low performers the top 3 patterns were Case 02 – Skill, Structures, Networks. Case 04 – Skills, Research, Networks, Structures. Case 07 – Skills, Marketing, Revenue. Case 20 – Structures, Networks, Skills. Case 17 – Skills, Structures, Markets, Process

Themes emerging from Cohort 2

The themes from Cohort 2 are now presented in tabular form in Table 5.16, indicating the major themes for each case. Within each case, a short phrase indicates the key themes for that case. It is useful to remember that themes are a declarative phrase or sentence describing a process, a connection, or an insight (Rossman & Rallis, 2017, p. 240). Think of a theme as an abstraction that explains the pattern. Themes are listed vertically in an attempt to highlight if and where there are Founder themes followed by the Organisation, the Individual, and the Outcomes themes, might appear as indicated in the 5-Loop framework by the first four loops.

Table 5.16 – Themes extracted for Cohort 2 list of cases

Themes	High Performer - Case 11	Low Performer - Case 02	Low Performer - Case 04	Low Performer - Case 07	Low Performer - Case 20	Low Performer - Case 17
Founder	<p>Managerial Experience: Strong management experienced prior to becoming the founder Strong Networks: EY, EI and University networks put in place early Customer focused solutions leveraging value play with IT novel solution and engagement. Never lost a customer! Strong Entrepreneurial mindset. Thrust into leadership role by employer not willing to negotiate with and employee</p>	<p>Leveraged Skills: With an eye to increase their individual market value Lifestyle entrepreneurs: Growing market demand for individual skills Management Shock: Late acknowledgement that something needed to change. Engagement of leadership training.</p>	<p>Sales Engineer: international technical Sales experience Destiny’s Child: Motivated farmers son destined to start a firm Engineering Solutioning: Problems can be solved Category creation: disrupted glass hospitality recycling market Marketing networks: Created networks early with EY and international contacts</p>	<p>Business Experience: Founder’s exposure to medical devices industry Practical technologist: Linked industry opportunity to own research interests External focus: Single known market based on work history Networks: integrated into diverse entrepreneurial networks Networks: Fragmented financial support</p>	<p>Marketing trained: Opportunistic mindset Flexible Marketing: Follow the flow, market and costs Networks: Will leverage any route to engage customers</p>	<p>Medical Innovator/Educator: 2nd career passion Evolving new category creation: Linked medical with consumer health trend Hand to Hand Combat: Market exploration for customers Great communicator: Non-hierarchical organisation</p>
Organisation	<p>External focus: Leveraged single customer initially. EU standards provided opportunities for International market growth. US market next opportunity Structured Organisation: training Leveraged process understanding</p>	<p>Regional embeddedness: Propinquity (nearness) Limited local markets and skills networks Initially Local market focus with plans to supplement wages.</p>	<p>Flat structure – Founder Designer, Engineer, Inventor and decision maker- All in one Engineering Engineer: Lean manufacturing, Unit cell concept in place early</p>	<p>Organisation: Dispersed organisation lacking cultural centre. Leadership: Owner driven lacked diversity of leadership support</p>	<p>Niche Market: MNE global supply Organisation: Fast response, customer focused Performer long-term: Differentiated solution offering through efficiencies and structures</p>	<p>Patient Revenue: Time and effort led to a single customer. Customer selective: Revenue only for the right customer match Networks: for customer engagement and access to MNE</p>

	and Lean for differentiated offering. Strong Exec team: Experienced board in place, prudent choices in appointees	Organisational growth junctures: Implementation of Customer engagement ABM process. Implementation of LEAN process Organisational Maturity: Tools, process and structures being implemented				
Individual	Leveraged local resources: MNE was a source of employees already trained Promotes and trains internally: employees trained from within the firm	Staff diversity: Blended staff and training, apprenticeships	Staff development: New and young staff as source of new processes	Commercial desert: Getting suitable commercial staff recurrence	Limited resources: few resources multitasking	Professional development: A career growth platform
Outcome	Recurring Revenue: Strong market growth with strong customer demand leads to high shareholder value growth	Chasing revenue: Market expansion and diversification of markets with research investments	IP Protection: Leverages IP to gain markets and differentiate in the market	IP powerhouse: multiple market applications	Responsive Supplier: Access to MNE requires service differentiators	IP generator

Source: Author

ACAP components with linkage to the 5-Loop Framework

With this level of understanding of the themes present in each case, it is now appropriate to present the cases from this cohort in terms of the 5-Loop framework in Table 5.17, indicating the relative levels of ACAP in each case. Since the 5-Loop framework is based on the literature review and conceived in Chapter 2, this allows a direct linkage of the ACAP components to the themes present in each firm. The themes have emerged through the data and provide linkages back to the 5-Loop framework. It further indicates how the firm is addressing the components of ACAP in the context of managing the flow of knowledge at this point in their development, having been in existence for more than 10 years. The researcher has applied a declarative approach in describing a theme since a theme implies some claim or assertion as a result of the process (Rossman & Rallis, 2017, p. 242).

Table 5.17 – Cohort 2 themes in the 5-Loop framework, with levels of ACAP

5-Loop Framework	Case 11	Case 02	Case 04	Case 07	Case 20	Case 17
	High Performer	Low Performer	Low Performer	Low Performer	Low Performer	Low Performer
Shareholder year 5 value	€5M	€0.8M	NR(€0)	-€3.0M	€0.4M	€1.4M
Employee # year 5	160 (349 total)	20	34	18 (6 at interview)	10	9
PACAP Level	High PACAP	Low PACAP	High PACAP	High PACAP	Low PACAP	Low PACAP
ACAP – PACAP Acquisition Prior investments Prior Knowledge Intensity Speed Direction	Managerial Experience: Strong management experienced prior to becoming the founder External focus: Leveraged single customer initially. EU standards provided opportunities for International market growth. US market next opportunity	Leveraged Skills: With an eye to increase their individual market value Lifestyle entrepreneurs: Growing market demand for individual skills Regional embeddedness: Limited local markets and skills networks Initially Local market focus with plans to supplement wages.	Sales Engineer: international technical Sales experience Destiny’s Child: Motivated farmers son destined to start a firm Engineering Solutioning: Problems can be solved Category creation: disrupted glass hospitality recycling market	Business Experience: Founder’s exposure to medical devices industry Practical technologist: Linked industry opportunity to own research interests External focus: Single known market based on work history	Marketing trained: Opportunistic mindset Flexible Marketing: Follow the flow, market and costs Niche Market: MNE global supply	Medical Innovator/Educator: 2 nd career passion Evolving new category creation: Linked medical with consumer health trend
Assimilation Understanding	Strong Networks: EY, EI and University networks put in place early Strong Entrepreneurial mindset. Thrust into leadership role by employer not willing to negotiate with and employee Leveraged local resources: MNE was a source of employees already trained	Management Shock: Late acknowledgement that something needed to change. Engagement of leadership training. Organisational growth junctures: Implementation of Customer engagement ABM process. Implementation of LEAN process	Marketing networks: Created networks early with EY and international contacts Staff development: New and young staff as source of new processes	Networks: integrated into diverse entrepreneurial networks	Organisation: Fast response, customer focused Limited resources: few resources multitasking	Hand to Hand Combat: Market exploration for customers Patient Revenue: Time and effort led to a single customer. Professional development: A career growth platform

RACAP Level	High RACAP	High RACAP (recent)	Low RACAP	Low RACAP	High RACAP	Low RACAP
ACAP – RACAP Transformation Internalisation Conversion	Structured Organisation: Leveraged process understanding and Lean training for differentiated offering. Promotes and trains internally: employees trained from within the firm Strong Exec team: Experienced board in place, prudent choices in appointees	Organisational growth junctures: Implementation of Customer engagement ABM process. Implementation of LEAN process Organisational Maturity: Tools, process and structures being implemented Staff diversity Blended staff and training, apprenticeships	Knowledge centre – Founder, Designer, Engineer, Inventor and decision maker – All In one Engineering Engineer: Lean manufacturing, Unit cell concept in place early	Leadership: Owner driven, lacked diversity of leadership support Networks: Fragmented financial support Commercial desert: Getting suitable commercial staff recurrence Organisation: Dispersed organisation lacking cultural centre.	Networks: Will leverage any route to engage customers Performer long-term: Differentiated solution offering through efficiencies, structures and IT tools.	Customer selective: Revenue only for the right customer match Networks: for customer engagement and access to MNE Great communicator: Non-hierarchical organisation
Exploitation Use Implementation	Customer focused solutions leveraging value play with IT novel solution and engagement. Never lost a customer! Recurring Revenue: Strong market growth with strong customer demand leads to high shareholder value growth	Chasing revenue: Market expansion and diversification of markets with research investments.	IP Protection: Leverages IP to gain markets and differentiate in the market model to revenue generating model	IP powerhouse: multiple market applications	Responsive Supplier: Access to MNE requires service differentiators	IP generator

Source: Author Note to Table: Case 02 has high RACAP based on a pivot in recent years leading to opportunities to outperform. Case 04 had high PACAP from the start while RACAP is low based on the founder individualistic performance for generating returns. Case 20 would appear to demonstrate High RACAP in this competitive market but the PACAP for this firm would appear to be low from the start.

Summary of analysis and findings for Cohort 2

Two findings will be discussed below, firstly the need to formalise and systematise organisational innovation processes are a significant value adding process that underpins sustainable growth as demonstrated in Table 5.16 when we compare the high growth firms. The discussion will move to address the second finding that firm growth must be managed through proactive managerial cognition and action for learning and innovation where the high performers are compared to the low performers in this phase of the organisation lifecycle.

In this Cohort 2, there is a sole High Performer with the other 5 firms being designated as Low Performers by the criteria. These firms existed in the midst of the financial crisis of 2008 and that they were still in business during the period of this research. What is outlined below are the findings across the cohort operating in the same time period within the same national context. The 5-Loop framework has been leveraged to assess the levels of ACAP within the firms Table 5.17, at this point in their development. It is observed that while each firm demonstrated different levels of performance not all low performers had both Low PACAP and Low RACAP.

Table 5.18 – Cohort 2 cases with assessed levels of ACAP

Case 11	Case 02	Case 04	Case 07	Case 20	Case 17
High PACAP	Low PACAP	High PACAP	High PACAP	Low PACAP	Low PACAP
High RACAP	High RACAP	Low RACAP	Low RACAP	High RACAP	Low RACAP

Source: Author

Finding 1: *The need to formalise and systematise organisational innovation processes are a significant value adding process that underpins sustainable growth.*

This would tend to support that for ACAP, a firm needs prior related knowledge to assimilate and use new knowledge (Cohen & Levinthal, 1990, p. 129).

To develop ACAP it is insufficient to merely expose an individual, or firm, to relevant prior knowledge, Intensity of effort is critical (Cohen & Levinthal, 1990, p. 131). The four organisational capabilities outlined by Zahra & George (2002) are knowledge-based capabilities embedded within a firm's routines and processes. The more mature an organisation becomes, the more time the firm has to develop suitable routines and processes. As such, a firm that develops and hones its skillset and offering by focusing on a single market segment or customer need and becomes profitable, it has a higher probability of being successful long term (Davidsson et al., 2009; Hafaïedh & Hamelin, 2022). This would seem to be the approach that Case 11 applied in its early operation growing from a single employee whose salary was supplemented by EI in the first year. While it may appear that the market was limited with a single local customer, learning was gained from understanding the customer needs and the operational efficiencies needed to sustain the business in early operation through the prior experience of the early employees. Viewing ACAP as a Dynamic Capability infers that it can be formulated or systemised in its application. This also allows for a broad and influential role for managers in the application of ACAP. Case 11 has strong leadership, a mature board and a history of promoting from within to help drive the *transformation* and *exploitation* dimensions for this firm. Zahra et al. (2009) propose that the inclusion of a non-executive board can enhance the ACAP of young firms or those that are moving beyond their current level of development, *Threshold firms*. This has not happened

overnight but would seem to build on each of the capabilities and demonstrating the cumulative path of learning dependent nature of ACAP. It is observed that ‘luck’ or timing, played a role in the evolution of the market for Case 11, with the introduction of mainly EU regulations for this industry. Regulations have been recognised as a potential key driver of innovation (Tushman & O’Reilly, 1997). The recycling market has evolved allowing Case 11 to generate shareholder value consistently over its existence by having controlled processes and meeting the regulations requirement within the EU and globally. Whereas Case 04, which had high PACAP, given the intensity with which the founder disrupted the glass hospitality market, it would appear to have a slower growth potential and an increased level of competition. The market dynamism (Eisenhardt & Martin, 2000; Jansen et al., 2006) is seen as an antecedent to ACAP development where it can have both a positive and negative impact on value creation. Also, in Case 07 with a high PACAP, where a novel technology was targeted at a single market segment, it was not validated by the customer as generating the value assumed by the founder. In Case 07, the founder had to pivot to another, unexplored, unanticipated market, to search for customer value. The value of the firm having a flexible PACAP can only be realised if the value is confirmed by the market. The value would not appear to be forthcoming in any market of substance to this point in the firm’s existence resulting in a low RACAP for this firm. This would appear to indicate a lack of organisational processes in the *transformation* of technical knowledge into sustainable market opportunities resulting from a lack of commercial trained and focused employees. In both these Cases, 04, 07, ‘other factors’ or lack of suitable organisational routines and Managerial processes would appear to affect the RACAP and the abilities of these firms to achieve greater shareholder values, (Hueske &

Guenther, 2015, p. 116); (Vega-Juardo et al., 2008, p. 395) Organisation knowledge, Formalisation, SIMs, EOGI. (Abbreviation: EOGI – External environment, Organisation, Group, Individual)

Finding 2: *Firm growth must be managed through proactive managerial cognition and action for learning and innovation, in this phase of the organisation lifecycle.*

RACAP is an output generating sub-component of ACAP, where RACAP involves *transforming* and *exploiting* the assimilated knowledge by incorporating it into the firm's operations, thereby improving its performance. (Zahra & George 2002, p. 191)

By drawing attention to the different managerial aspects in PACAP and RACAP as being 'nurture' and 'harvest', Zahra and George (2002, p.191) highlight the different managerial skillsets required for long term sustainability of a firm and the defined output of the ACAP construct. These skillsets are linked by the mechanisms best outlined as social interaction mechanisms (SIMs), that are a key component of the Zahra and George (2002, p. 194) and Todorova and Durisin (2007) models covered in detail in Chapter 2. While RACAP is described as processes that rely on routines to provide structural, systemic and procedural mechanisms, managerial cognition as proposed by Helfat and Peteraf (2015, p. 835) can influence firm performance. SIMs are the bridge that link PACAP to effectively managed RACAP and reduce barriers to information sharing. Case 11 seems to leverage the harvesting capabilities by providing an organisational structure rooted in LEAN process and production 'Unit cell' thinking. Combining this with the recognition of the internal investment in staff, by embedding this knowledge throughout the firm provides SIMs opportunities as these staff take up positions elsewhere in the firm. It would also look as if the Dynamic Capabilities of *reconfiguration*, as proposed by Teece, (2007) is present, in adapting to growing market

opportunities required the addition of leadership input with the appointment of seasoned members of the board (Zahra et al. (2009). This appointment, albeit, regretted by the MD who received an advanced degree, admitted that the time it took to bring on a board was a long process and was five years too late.

For Case 17 where the founder had demonstrated high levels of individual ACAP and actively lectures on the subject of innovation, the firm would appear to be managing the intent and direction in which the firm acquires new business. This is a strategic and explicit approach by the founder where managerial cognition of the investment and conversion costs of customers to revenue generation required a paced engagement in creating this new market segment. By recognising a slow pace of market dynamism for Case 17 this segment would appear to allow the firm to put training, employees development and process in place as a priority for future unrealised growth. This would suggest the firm is managing the cumulative nature of ACAP dimensions, path dependency, where this firm is willing to pace its growth expectations. This would appear to be a managed approach to what Kidney et al. (2017, p. 74) proposed where Irish firms follow ‘a punctuated equilibrium path dependency’.

Whereas Case 02, did not appear to demonstrate managerial cognition in the early years until the MD took further training, which is recognised as a key driver of firm performance (Bessant & Trifilova, 2017; Gonera & Prexl, 2021). This training would appear to have alerted the leadership, being a critical juncture (Messina et al., 2022) or ‘trigger points’ as proposed by Brown and Mawson (2013), to customer focused actions that could be taken to improve revenue generation. This led to a more mature use of the tools and processes being managed than used previously. This change in cognition seems to have resulted in the firm taking a less adverse approach to ‘perceived risk’

following the training, which was demonstrated with the expansion into the UK with a new facility. Prior managerial behaviour would not have considered this tactic, as it was seen as risky given the manager's experience through the 2008 recession. This resulted in Case 02, achieving a high RACAP (note this is based on recent behaviour) as rated for the firm with the defined criteria.

Additionally, Case 20 with a marketing trained founder, and an approach by management that would seem to leverage the firm capabilities to provide a culture of 'fast response'. This firm would appear however, to be burdened by the decisions made 20 years prior, on the markets they chose to compete (O'Gorman, 2001). A decision the founder reflected on that, 'it has been such a difficult journey'. The existence of systematic routines and processes in the execution dimension for this case would appear to allow this firm to consistently produce new goods, systems and knowledge to provide this 'customer centred response' culture. Similarly, successful established companies are likely to establish routines that target and deploy their knowledge to enhance existing initiatives or encourage new initiatives within a firm (Zahra & George, 2002, p. 190). Nonetheless a firm's performance would appear to be ultimately the result of the markets where they exist. Managerial cognition would seem to drive decisions to explore new opportunities either in new products or new markets. Recognising that this is a 'capabilities dance', management have to demonstrate their understanding that exploration returns can be more uncertain and remote in time than continuing to pursue exploitation based on proven cognitive models (March, 1991, p. 73). This managerial cognition evolves with experience and training and would appear to be a managerial capability that is needed in the adolescent period of a firm's existence.

5.5.3 Cohort 3 – SMEs more than 20 years in existence

What is presented here is the analysis of the cases agreement with Saldaña (2013) for the final of the three cohorts, Cohort 3. This analysis is structured in the same way as for Cohort 1 indicated in section 5.5.1. These steps are First level coding, followed by Second level coding and then themes will be extracted.

Cohort 3 – Description

The final cohort of firms are those firms that have been in existence for more than 20 years. The firms range in age from 21 to 47 years in operation. This is the largest cohort of the three studied as part of this exploratory research. There are 9 firms in this cohort as indicated the Table 5.19 below and they are referred to as Cohort 3. A level of €10M Euros of shareholder value was chosen for this cohort to determine High Performers combined with the level of employees at each firm, which is line with OECD recommendations to include these two measures. There are 2 High Performing firms and there are 7 Low Performing firms presented in this cohort.

Table 5.19 – Cohort 3 firms

Firm	Location	Sector	Years in existence	Employees in the year 5	CAGR 5 yrs. Growth	Shareholder Value	Performance
Case 15	IE061 Eastern Dublin	Modern	21	30	16.25 %	€1,345,642	Low Performer
Case 09	IE052 South East	Traditional	22	215	16.61 %	€10,541,816	High Performer
Case 13	IE053 South West	Modern	22	14	198.68 % (Loss)	€-126,825	Low Performer
Case 06	IE051 Mid-Western	Traditional	26	22	16.02 %	€535,622	Low Performer
Case 08	IE052 South East	Modern	28	48	15.41 %	€2,813,600	Low Performer
Case 12	IE053 South West	Modern	32	>250	Unlimited	€10,000,000 (D&B)	High Performer
Case 01	IE041 North Border	Traditional	36	24	5.21 %	€399,329	Low Performer
Case 05	IE051 Mid-Western	Modern	36	40	16.52 %	€3,374,399	Low Performer
Case 19	IE061 Eastern Dublin	Modern	47	45	46.50 %	€1,309,026	Low Performer

Source: Author. Note to Table D&B summary since firm was unlimited. Note to Table. “The modern sector is defined as the chemicals and pharmaceuticals; computer, electronics, optical and electrical equipment; reproduction of recorded media, and medical and dental instruments and supplies. The traditional includes all other sectors.” Source CSO website

Cohort 3, First level coding – Process coding

The first level coding followed a process of identifying key ‘action -ing i.e., gerund’ sentences from the transcript for each case and allocating a process code to that sentence. This sequenced approach was repeated consistently through each case transcript noting the statement determining the coding (gerund) word used. For each case a different number of process codes were generated in the range 39 to 65 across this cohort. These codes were captured in a Microsoft Excel® spreadsheet Table 5.20 as part of the coding workbook linking the code back to the transcript. Since each case informant was interviewed using the same semi-structured topic list, a consistency of feedback can be obtained from the key informant, allowing a comparison of the emphasised ‘actions’ that each individual case was taking at the time of the interview.

Table 5.20 – Cohort 3 example of process coding in Excel®, extracted from the Coding Workbook

Code #	Code	Description	Case section	2nd Case section
2	Experiencing	Armor Salmon or Irish Sugar in the same county to get experience outside	Section 2	Section 3
3	Interning	Once he returned, he took various roles to ensure he had the proper	Section 2	Section 4
4	Specializing	mobile machinery globally with hydraulic cylinders.	Section 3	Section 4
5	Selling	focus solely on the OEMs and do not target the aftermarket, service Market, or the repairs market	Section 3	Section 4
6	Segmenting	all the mobile machinery that complements those pieces of equipment, a Personnel lifts for	Section 3	Section 3
7	Emerging	OEM embedded strategy in that is continually applied to the territories that they target	Section 3	Section 4
8	Leveraging	English speaking territories, Ireland, UK and then Scandinavian countries	Section 3	Section 4
9	Diversifying	Germany and France their product has a long lifecycle	Section 3	Section 4
10	Collaborating	capability to work in parallel with engineers from the OEMs	Section 3	Section 4
11	Supporting	include Life cycling and testing Burnside product in parallel which shortens the time to market	Section 3	Section 4

Source: Author

Cohort 3, Second level coding – Pattern Coding

For each case, Patterns are represented as the frequency of occurrence of the pattern relative to the number of process codes generated for the individual case. This is a consistent approach for organising codes whereby Saldaña (2013) highlighted the use of Excel® which allowed him to calculate survey ratings in “means” for further analysis (Saldaña, 2013, p. 26). Each case was individually analysed as the transcripts were completed and stored in the coding Excel® workbook. When comparing these cases as a single cohort, the tables for each case were brought together in a separate sheet, shown here as Tables 5.21, 5.22, 5.23 within the Excel® workbook.

Table 5.21 – Second cycle Pattern Codes for Cohort 3 – High Performers

High Performers			High Performers		
Case 09	CAGR	16.6%	Case 12	CAGR	N/A
NUTS	2019	IE052	NUTS	NR	IE053
CAGR	Traditional	16.61%	CAGR	Modern	NR
Employees	215	14,890,208	Employees	500	NR
Sharhldr funds	10,541,816	Median	Sharhldr funds	NR	Median
Net Tangle Asts	10,996,317	3.7%	Net Tangle Asts	32	3.4%
Years in Op	22		Years in Op		
Case 09			Case 12		
Pattern	Count #	%	Pattern	Count #	%
Experience	5	10.0%	Experience	7	12.7%
Structures	4	8.0%	Marketing	6	10.9%
IT	4	8.0%	Skills	6	10.9%
Training	3	6.0%	Networks	4	7.3%
Marketing	3	6.0%	Benchmarking	4	7.3%
Strategy	3	6.0%	Offering	3	5.5%
Networks	3	6.0%	Structures	3	5.5%
Measures	3	6.0%	Education	2	3.6%
Markets	2	4.0%	Roles	2	3.6%
Collaboration	2	4.0%	Experiment	2	3.6%
Capabilities	2	4.0%	Capabilities	2	3.6%
Investment	2	4.0%	Forecasting	2	3.6%
Financing	2	4.0%	IP	2	3.6%
Education	2	4.0%	International	1	1.8%
Risk	2	2.0%	Coaching	1	1.8%
Roles	1	2.0%	Exploring	1	1.8%
Communication	1	2.0%	Innovating	1	1.8%
Development	1	2.0%	Supply chain	1	1.8%
Research	1	2.0%	Differentiation	1	1.8%
Innovation	1	2.0%	Optimization	1	1.8%
Skills	1	2.0%	Communication	1	1.8%
Process	1	2.0%	Revenue	1	1.8%
Competition	1	2.0%	IT	1	1.8%
Family			Family		

Source: Author Note to Table. The shaded highlight indicates the patterns above the median for each case. For the high performer the top 3 patterns : Case 09 – Experience, Structures, IT. Case 12 – Experience, Marketing, Skills.

Table 5.22 – Second cycle Pattern Codes for Cohort 3 – Low Performers A

Low Performers			Low Performers			Low Performers		
Case 15	CAGR	16%	Case 13	CAGR	-197.7%	Case 06	CAGR	16.0%
NUTS	2019	IE061	NUTS	2018	IE053	NUTS	2019	IE051
CAGR	16.25%		CAGR	-197.68%		CAGR	16.02%	
Employees	30		Employees	14		Employees	22	
Sharhldr funds	11,345,642	1633,902	Sharhldr funds	-1126,825	1142,636	Sharhldr funds	1535,622	1254,805
Net Tangle Asts	11,839,565	Median	Net Tangle Asts	-1126,825	Median	Net Tangle Ast	1951,656	Median
Years in Op	21	3.1%	Years in Op	22	3.1%	Years in Op	26	4.1%
Case 15			Case 13			Case 06		
Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%
Experience	6	11.3%	Experience	7	10.9%	Revenue	5	9.6%
Structures	5	9.4%	Finance	6	9.4%	Collaboration	5	9.6%
Communication	4	7.5%	Structure	6	9.4%	Networks	4	7.7%
Training	3	5.7%	Markets	4	6.3%	Markets	4	7.7%
Networks	3	5.7%	Networks	4	6.3%	Marketing	4	7.7%
Revenue	3	5.7%	Offering	4	6.3%	Skills	4	7.7%
Skills	3	5.7%	Communication	4	6.3%	Experience	3	5.8%
Education	2	3.8%	Processes	4	6.3%	Investment	3	5.8%
Offering	2	3.8%	Marketing	3	4.7%	Ambition	2	3.8%
Standards	2	3.8%	Innovation	3	4.7%	Growth	2	3.8%
Marketing	2	3.8%	Culture	3	4.7%	Consultant	2	3.8%
Research	2	3.8%	Education	2	3.1%	Standards	2	3.8%
Ambition	2	3.8%	Roles	2	3.1%	Training	2	3.8%
Markets	1	1.9%	Standards	1	1.6%	IT	2	3.8%
Collaboration	1	1.9%	Consultant	1	1.6%	Education	2	3.8%
Innovation	1	1.9%	Economy	1	1.6%	Capabilities	1	1.9%
Accreditation	1	1.9%	Learning	1	1.6%	Communication	1	1.9%
Infrastructure	1	1.9%	Training	1	1.6%	Structures	1	1.9%
IT	1	1.9%	Revenue	1	1.6%	Measures	1	1.9%
Culture	1	1.9%	Decisions	1	1.6%	Research	1	1.9%
Growth	1	1.9%	Skills	1	1.6%	Finance	1	1.9%
Competition	1	1.9%	Measures	1	1.6%			
Capabilities	1	1.9%	Sustainability	1	1.6%			
Planning	1	1.9%	Divestature	1	1.6%			
Coaching	1	1.9%	Motivation	1	1.6%			
Risk	1	1.9%						
Forecast	1	1.9%						

Source: Author Note to Table. The shaded highlight indicates the patterns above the median for each case. For the Low performer the top 3 patterns, unless they score the same, were: Case 15 –Experience, Structures, Communication. Case 13 – Experience, Finance, Structures. Case 06 – Revenue, Collaboration, Networks, Markets.

Table 5.23 – Second cycle Pattern Codes for Cohort 3 – Low Performers B

Low Performers			Low Performers			Low Performers			Low Performers		
Case 08	CAGR	15.4%	Case 01	CAGR	5.2%	Case 05	CAGR	16.5%	Case 19	CAGR	46.5%
	2019			2019	Year 1		2019			2019	
NUTS	Modern	IE052	NUTS	Traditional	IE041	NUTS	Modern	IE051	NUTS	Modern	IE061
CAGR	15.41%		CAGR	5.21%		CAGR	16.52%		CAGR	46.50%	
Employees	48		Employees	24		Employees	40		Employees	45	
Sharhldr fund	12,813,600	11,374,167	Sharhldr fund	1,399,329	1,309,775	Sharhldr fund	13,374,399	11,570,877	Sharhldr fund	11,309,026	1193,958
Net Tangle As	13,091,295	Median	Net Tangle As	1,449,447	Median	Net Tangle As	13,762,672	Median	Net Tangle As	11,967,691	Median
Years in Op	26	4.0%	Years in Op	36	4.6%	Years in Op	36	4.5%	Years in Op	47	3.4%
Case 08			Case 01			Case 05			Case 19		
Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%	Pattern	Count #	%
Networks	8	17.4%	Networks	7	15.2%	Networks	7	17.9%	Experience	5	7.7%
Finance	5	10.9%	Experience	6	13.0%	Markets	4	10.3%	Skills	5	7.7%
Investment	4	8.7%	Markets	4	8.7%	Skills	4	10.3%	Finance	4	6.2%
Consultant	4	8.7%	Marketing	3	6.5%	Experience	3	7.7%	Markets	4	6.2%
Training	3	6.5%	IT	3	6.5%	Capabilities	3	7.7%	Structures	4	6.2%
Skills	3	6.5%	Education	3	6.5%	Collaboration	3	7.7%	Marketing	4	6.2%
Marketing	2	4.3%	Skills	3	6.5%	Research	2	5.1%	Communication	4	6.2%
Collaboration	2	4.3%	Innovation	2	4.3%	Investment	2	5.1%	IT	4	6.2%
IP	2	4.3%	Competition	2	4.3%	Culture	2	5.1%	Networks	3	4.6%
IT	2	4.3%	Structures	2	4.3%	Finance	1	2.6%	Revenue	3	4.6%
Experience	2	4.3%	Culture	2	4.3%	Roles	1	2.6%	Innovation	3	4.6%
Education	1	2.2%	Training	2	4.3%	Structures	1	2.6%	Collaboration	3	4.6%
Markets	1	2.2%	IP	2	4.3%	IT	1	2.6%	Roles	2	3.1%
Growth	1	2.2%	Collaboration	1	2.2%	Consultant	1	2.6%	Mentor	2	3.1%
Innovation	1	2.2%	Benchmarking	1	2.2%	IP	1	2.6%	Processes	2	3.1%
Process	1	2.2%	Risks	1	2.2%	Regulations	1	2.6%	Roles	2	3.1%
Research	1	2.2%	Process	1	2.2%	Marketing	1	2.6%	Training	2	3.1%
Measures	1	2.2%	Mentor	1	2.2%	Revenue	1	2.6%	Customer	2	3.1%
Structures	1	2.2%	Family			Family			Education	1	1.5%
Ambition	1	2.2%							Motivation	1	1.5%
									Investment	1	1.5%
									Strategy	1	1.5%
									IP	1	1.5%
									Regulations	1	1.5%
									Ambition	1	1.5%
									Family		

Source: Author Note to Table. The shaded highlight indicates the patterns above the median for each case. For the Low performer the top 3 patterns, unless they score the same, were: Case 08 –Networks, Finance, Investment, Consultant. Case 01 – Networks, Experience Markets. Case 05 – Networks, Markets, Skills. Case 19 – Experience, Skills, Finance, Markets

Themes emerging from Cohort 3

The themes from Cohort 3 are now presented in tabular form indicating the major themes for each case. Within each case, a short phrase indicates the key themes for that case. It is useful to remember that themes are a declarative phrase or sentence describing a process, a connection, or an insight (Rossman & Rallis, 2017, p. 240). Think of a theme as an abstraction that explains the pattern. Themes are listed vertically, shown here in Tables 5.24, 5.25, in an attempt to highlight if and where there are Founder themes followed by the Organisation, the Individual, and the Outcomes themes, might appear as indicated in the 5-Loop framework by the first four loops.

Table 5.24 – Themes extracted for Cohort 3 list of cases

Themes	High Performer - Case 09	High Performer - Case 12	Low Performer - Case 15	Low Performer - Case 13	Low Performer - Case 06
Founder	Legacy Experience: Cultivated 2 nd generation management experience Deep roots: Technically trained with broad MNE external and internal work experience	Legacy Experience: Educated 2 nd generation science and management experience Deep roots: Farming and engineering focusing on growing markets.	MNE Engineer: Experienced Engineers' engineer in multiple MNE Broad Based: Many market segments leveraging core engineering learned in one segment	Female Founder: PhD Educated ambitious founder MNE and Overseas experience in technology and people management Dr Ambitious: Motivation to own her own firm. Category creator: Skills not available in the market, jumped in with a consultancy solution. Skilled Investor: sought expertise from Investors as well as funding from EI Train the trainer: Academic became consultant that resulted in sales task master	Skilled toolmaker: tradesman trained Regional business: Local opportunities for supply of quality products Comfort zone: Single market sector drove firm for 20 years Retirement Awakening: Critical juncture by Founder retirement needed more security Chief cook: Founder manages and sets strategy with flat structure
Organisation	Locally formulated: Initial Irish markets led to global OEM customer engagement Focused Collaboration: OEM path to supply chain integration Risk investments: Long lead-times require paced risks for future revenue Samurai structure: Strong alignment to Japanese process and cellularised workflow IT leveraged: Knowledge bases supported by ERP systems and ongoing investment Knowledge seekers: Sources of information through many channels	Marketing growth: Followed the markets to continue to provide practical solutions Pareto Savy: today's market needs, supplemented with new market opportunities Informed Decision makers: Financial decisions not always secure the future. Risk tolerance is required. Knowledge scouts: 2 nd generation brought technology solutions to create agri-tech new category generators Feedback: Strong customer feedback dependent on new solution provision	International: Multiple channels to market defined Organised Organisation: Processes rule this firm of engineers with current and future planning Networks: Board created, only recently, bringing additional expertise No regrets: they have a few, not aggressive enough early on in the development cycles of the firm	Build it yourself. Solutions not readily available, added IT additional skillsets Customer solution centric: Focused on key account to drive supporting firms. EU standards provided opportunities for International market Flowing structures: Flexed and pivoted structure as the firm evolved from consultancy to a software provider	Motivation rebirth: New market segment and access to Aerospace market Standards: New markets required new standards and quality supported by EI IT age: new investment in tools and systems
Individual	Knowledge channels: through hiring, training and apprenticeships deep knowledge bases Introducing Nelly: Established internal transfer of knowledge through "sitting with Nelly" sessions	Rural Renewers: Belief that rural engineering provide lifestyle and brain drain benefits	Chartered House: Growth opportunities for engineers to engineer, and build an engineering world	Shepard's crook: set tasks, targets for sales teams to drive the business process	People person: Founder hires similar skills with similar work ethics Networks: University source of staff and additional training
Outcomes	Bricklayers for the future: Building the business "brick-by-brick" has served the firm well with established and recurring revenue.	IP trail blazers: Modern approaches to farming problems provides opportunities to create IP Globalisers: Multiple companies worldwide providing networks for business innovation	Cost drivers: Innovative project management secured consistent revenue	Software solution: Home grown platform with customers engaged. Sweet deal: After 22 years acquired by software house with staff secured in new firm	Big fish: Firm delivers in a niche local market on quality and reputation. New Era: Leading Consortia for aerospace engagement. Marketing moves: Leveraging the power of others and becoming more aggressive in new markets

Source: Author

Table 5.25 – Themes extracted for Cohort 3 list of cases, continued

Themes	Low Performer - Case 08	Low Performer - Case 01	Low Performer - Case 05	Low Performer - Case 19
Founder	Returning Irish: Engineer trained with a desire to return to Ireland All in: Management buyout of initial investors. Founder became MD Start-up mentality: Slow steps to build stable business Networks needed: Leveraged heavily Irish universities for future proof technologies and markets	Family history: Local merchants and suppliers Next generation: Managerial trained, returned from MNE to be MD	Family planning: Deliberate education and grooming of 2 nd generation son as MD FDI benefits: MNE in locality led to local and international sales Deep roots: became expert in supply of quality products leading to consistent supply	Mentored succession: Founder sold on the family business to a motivated 10-year employee New Reins: MD led a management buyout to change the direction of the firm
Organisation	Niche market: One customer for 3 years, before expanding outward within Ireland Slow burn marketing: It took over 10 years to become international sales focused Coaching: EI mentor played pivotal role in management training and growth Profit before growth: Incremental growth included funding and grants to broaden Org. structure Process learning: added LEAN through EI training and coaching IT learning: Investments in knowledge with new tools	Niche market: Small, niche but international sales Networker: Leveraged Networks from EI for market access to customers and even competitors Traditional: Small with organisation flat with open communication Renewed vision: MD is driving new IT and ERP systems plus University engagement Innovation: New product push	Regulations drivers: market dependence of quality allowed the firm to grow Multi markets: Leveraged network FDI to address multiple markets It depends: Consultancy support for R&D process Building on the base: Historical markets are in place with MNE.	The bread winners: “Loved key OEM ”customer to death” who adopted the technology into their value chain leading to further growth State support: Investors included major investment by EI A new broom: Culled one part of the business to focus on a more attractive market segment generating consistent revenue Nimble team: structure with key leaders and mobile staff ready to take “more risk” Innovation for growth: Created R&D task force focused on growth trajectories within the market Mentor me: EI leveraged their investment with significant training and coaching
Individual	Hire for purpose: Skills are sought as needed. Staff retention high	New blood: Recognised homogenous workforce proactive in renewal of educated staff	New Blood: New focus on R&D and high value product lines University supply: local and national Universities are the source of new employees. Switching to highly educated employees. Partners: Local engagement and national sources of new learning	Variety is the: Generated a more diverse skilled workforce Leveraged Interns at EI
Outcomes	Stable revenue R&D incubator: New technologies are poised for growth	IP generation: Leveraging GMIT and local skills Family ties: Board control for spending and investment within the family	New R&D building on this business sustainability of the last 30 years IP and new market segments evolving	New markets: Leveraged their solution for unheard of market segments prior to buyout Measures: CAGR levels and new markets, passion for the future

Source: Author

ACAP components with linkage to the 5-Loop Framework

With the themes present in each case, it is now appropriate to present the cases from this cohort in terms of the 5-Loop framework indicating the relative levels of ACAP in each case. Since the 5-Loop framework is based on the literature review and conceived in chapter 2, this allows a direct linkage of the ACAP components to the themes present in each firm. The themes have emerged through the data, Tables 5.26, 5.27, and provide linkages back to the 5-Loop framework. It further indicates how the firm is addressing the components of ACAP in the context of managing the flow of knowledge at this point in their development, having been in existence for more than 20 years. The researcher has applied a declarative approach in describing a theme since a theme implies some claim or assertion as a result of the process (Rossman & Rallis, 2017, p. 242).

Table 5.26 – Cohort 3 themes in the 5-Loop framework, with levels of ACAP

5-Loop Framework	Case 09	Case 12	Case 15	Case 13	Case 06
	High Performer	High Performer	Low Performer	Low Performer	Low Performer
Shareholder year 5 value	>€10M	>€10M (D&B source)	€1.3M	-€100k	€500k
Employee # year 5	>215	~500 Cumulative Global	30	~14	22
PACAP Level	High PACAP	High PACAP	Low PACAP (slow burn!)	High PACAP	Low PACAP
ACAP – PACAP Acquisition Prior investments Prior Knowledge Intensity Speed Direction	Legacy Experience: Cultivated 2 nd generation management experience Deep roots: Technically trained with broad MNE external and internal work experience Locally formulated: Initial Irish markets led to global OEM customer engagement Focused Collaboration: OEM path to supply chain integration	Legacy Experience: Educated 2 nd generation science and management experience Deep roots: Farming and engineering focusing on growing markets. Marketing growth: Followed the markets to continue to provide practical solutions	MNE Engineer: Experienced Engineers' engineer in multiple MNE Broad Based: Many market segments leveraging core engineering learned in one segment International: Multiple channels to market defined recently	Female Founder: PhD Educated ambitions founder MNE and Overseas experience in technology and people management Dr Ambitious: Motivation to own her own firm. Category creator: Skills required not available in the market so jumped in with a consultancy solution. Build it yourself: Solutions not readily available led to need to add IT additional skillsets, not consultants	Skilled toolmaker: tradesman trained Regional business: Local opportunities for supply of quality products. Proximity trap (nearness) Comfort zone: Single market sector drove firm for 20 years Retirement Awakening: Critical juncture by Founder retirement needed more security Motivation rebirth: New market segment and access to Aerospace market Standards: New markets required new standards and quality supported by EI
Assimilation Understanding	IT leveraged: Knowledge bases supported by ERP systems and ongoing investment Samurai structure: Strong alignment to Japanese process and cellularised workflow Knowledge channels: through hiring, training and	Pareto Savvy: today's market needs, supplemented with new market opportunities Informed Decision makers: Financial decisions not always secure the future. Risk tolerance is required.	Organised Organisation: Processes rule this firm of engineers with current and future planning	Skilled Investor: sought expertise from Investors as well as funding from EI Customer solution centric: Focused on key large accounts to drive supporting firms. EU standards provided	Chief cook: Founder manages and sets strategy with flat structure

	apprenticeships deep knowledge bases			opportunities for International markets	
RACAP Level	High RACAP	High RACAP	High RACAP	Low RACAP	Low RACAP
ACAP – RACAP Transformation Internalisation Conversion	Knowledge seekers: Sources of information through many channels Introducing Nelly: Established internal transfer of knowledge through “sitting with Nelly” sessions	Knowledge scouts: 2 nd generation brought technology solutions to create agri-tech new category generators Rural Renewers: Belief that rural engineering provide lifestyle and brain drain benefits	Networks: Board created, only recently, bringing additional expertise Chartered House: Growth opportunities for engineers to engineer, and build an engineering world	Flowing structures: Flexed and pivoted structure as the firm evolved from consultancy to a software provider Train the trainer: Academic became consultant that resulted in sales task master Shepard’s crook: set tasks and targets for sales teams to drive the business process, rigorously. Software solution: Home grown platform with engaged customers.	IT age: new investment in tools and systems People person: Founder hires similar skills with similar work ethics Networks: University source of staff and additional training Big fish: Firm delivers in a niche local market on quality and reputation.
Exploitation Use Implementation	Risk investments: Long lead-times require paced risks for future revenue Bricklayers for the future: Building the business “brick-by-brick” has served the firm well with established and recurring revenue.	IP trail blazers: Modern approaches to farming problems provides opportunities to create IP Feedback: Strong customer feedback dependent on new solution provision Globalisers: Multiple companies worldwide providing networks for business innovation	Cost drivers: Innovative project management secured consistent revenue No regrets: they have a few, not aggressive enough early on in the development cycles of the firm	Sweet deal: After 22 years acquired by software house with staff secured in new firm	New Era: Leading Consortia for aerospace engagement. Marketing moves: Leveraging the power of others and becoming more aggressive in new markets

Source: Author Note to Table: Because the case 12 was unlimited, no financials were not available through the Fame database, a secondary source of shareholder value was used, namely Dun & Bradstreet information with a note of approximately €10M. Case 12 is recorded in the full transcript, contained in vol II. Case 13 was allocated Low RACAP because ACAP is a firm construct, despite the founder receiving a favourable buy out. The firm was deemed by the researcher to not have demonstrated Sustainability & Competitive advantage, with their financials, unless acquired into another firm.

Table 5.27 – Cohort 3 themes in the 5-Loop framework, with levels of ACAP, continued

5-Loop Framework	Case 08	Case 01	Case 05	Case 19
	Low Performer	Low Performer	Low Performer	Low Performer
Shareholder year 5 value	€2.8M	€400k	€3.4M	€1.3M
Employee # year 5	48	24	40	45
PACAP Level	Low PACAP	Low PACAP	High PACAP	Low PACAP
ACAP – PACAP Acquisition Prior investments Prior Knowledge Intensity Speed Direction	Returning Irish: Engineer trained with a desire to return to Ireland All in: Management buyout of initial investors. Founder became MD Niche market: One customer for 3 years, before expanding outward within Ireland	Family history: Local merchants and suppliers Next generation: Managerial trained, returned from MNE to be MD Niche market: Small, niche but international sales	Family planning: Deliberate education and grooming of 2 nd generation son as MD FDI benefits: MNE in locality led to local and international sales Deep roots: became expert in supply of quality products leading to consistent supply Regulations drivers: market dependence of quality allowed the firm to grow	Mentored succession: Founder sold on the family business to a motivated 10-year employee New Reins: MD led a management buyout to change the direction of the firm State support: Investors included major investment by EI A new broom: Culled one part of the business to focus on a more attractive market segment generating consistent revenue The bread winners: “Loved key OEM ”customer to death” who adopted the technology into their value chain leading to further growth
Assimilation Understanding	Slow burn marketing: It took over 10 years to become international sales focused Start-up mentality: Slow steps to build stable business Networks needed: Leveraged heavily Irish universities for future proof technologies and markets	Networker: Leveraged Networks from EI for market access to customers and even competitors Traditional: Organisation flat with open communication	Multi markets: Leveraged network FDI to address multiple markets University supply: local and national Universities are the source of new employees It depends: Consultancy support for R&D process	Nimble team: structure with key leaders and mobile staff ready to take “more risk” Innovation for growth: Created R&D task force focused on growth trajectories within the market
RACAP Level	Low RACAP	Low RACAP	High RACAP	High RACAP
ACAP – RACAP Transformation Internalisation	Profit before growth: Incremental growth included funding and grants to broaden Org. structure	New blood: Recognised homogenous workforce proactive in renewal of educated staff	New Blood: New focus on R&D and high value product lines	Variety is the “ “: Generated a more diverse skilled workforce

Conversion	<p>Process learning: added LEAN through EI training and coaching</p> <p>Coaching: EI mentor played pivotal role in management training and growth</p> <p>Hire for purpose: Skills are sought as needed. Staff retention high</p>	<p>Renewed vision: MD is driving new IT and ERP systems plus University engagement</p> <p>Family ties: Board control of spending and investment within the family</p>	<p>Switching to highly educated employees.</p> <p>Partners: Local engagement and national resources, of new learning</p>	<p>Mentor me: EI leveraged their investment with significant training and coaching</p> <p>Leveraged Interns at EI</p>
Exploitation Use Implementation	<p>IT learning: Investments in knowledge with new tools</p> <p>R&D incubator: New technologies are poised for growth. Not yet proven.</p>	<p>Innovation: New product push</p> <p>IP generation: Leveraging GMIT and local skills</p>	<p>Building on the base: Historical markets are in place with MNE. New R&D building on this business sustainability of the last 30 years</p> <p>IP and new market segments evolving</p>	<p>New markets: Leveraged their solution for unheard of market segments prior to buyout</p> <p>Measures: CAGR levels and new markets, passion for the future</p>

Source : Author Note to Table: Case 05 has both High PACAP and High RACAP reflecting the earlier family generation with high PACAP and the new second generation of high RACAP leading to a stable business willing to build on for the future. Case 5 with High PACAP and High RACAP but remains a low performer based on the shareholder and employee levels set by the researcher for this cohort

Summary of analysis and findings for Cohort 3

Two findings will be discussed below, firstly the importance of strategic planning including succession planning for sustainable value creation in multigenerational firms. The High Performers demonstrate organisational approaches to sustaining and diversifying the business compared to the Low Performers in Tables 5.24 and 5.25. Both Dynamic Capabilities and an ambidextrous approach is evident in Table 5.26 for the High Performers. The second finding to be discussed is, the requirement for continual management investment and reinvestment in innovation regardless of the external environment for long term sustainability of the firm. This is evidence in the High Performers in both the Organisational and Individual approached shown in Tables 5.24 and 5.25. The focus on knowledge management and the processes that are in place for the High Performers compared to the Low Performers is evident in *Assimilation and Transformation* sub components in Table 5.26.

In this Cohort 3, there are 2 High Performers and 7 Low Performers. These firms have existed through many different economic cycles given the age range of 21 – 47 years with a median age of 28 years in existence. What is outlined below are the findings across the cohort operating in the same time period within the same national context. The 5-Loop framework has been leveraged to assess the levels of ACAP within the firms, at this point in their development. In this cohort note there are 5 multigenerational family firms in this cohort refer to Tables 5.21, 5.23.

Table 5.28 – Summary of ACAP levels by cases for Cohort 3

Case 09	Case 12	Case 15	Case 13	Case 06	Case 08	Case 01	Case 05	Case 19
High PACAP	High PACAP	Low PACAP	High PACAP	Low PACAP	Low PACAP	Low PACAP	High PACAP	Low PACAP
High RACAP	High RACAP	High RACAP	Low RACAP	Low RACAP	Low RACAP	Low RACAP	High RACAP	High RACAP

Source: Author

The cases in this cohort have been in operation during many different cycles of the Irish economic environment. While moderate changes in the environment occur frequently and along predictable linear lines (Eisenhardt & Martin, 2000), for firms to survive multiple decades, they may see unpredictable and large shocks to their environment as they progress. This market dynamism can educate the leadership in how to cope with these changes in the future, but the ability to develop Dynamic Capabilities (Teece, 2007) and learn how to reconfigure resources (Helfat & Peteraf, 2015) will help sustain the firm for the long term. Dynamic Capabilities are the antecedent organisational and strategic rules as well as routines through which managers ‘establish the coordination of knowledge’ in order to alter their resource base to generate new value creating strategies (Grant, 1996, p. 120). Long term competitive advantage lies in the resource configurations that managers can configure using Dynamic Capabilities (Eisenhardt & Martin, 2000, p. 1117). Restating this and clarifying that Dynamic Capabilities are necessary, but not sufficient conditions for long term competitive advantage.

Findings 1: *The importance of strategic planning including succession planning for sustainable value creation in multigenerational firms.*

By viewing ACAP as a Dynamic Capability it also makes it amenable to change through managerial actions that effectively redefine and deploy the firm's knowledge-based assets. (Zahra & George, 2002, p. 186)

The two High Performers are discussed: A family business context, Cases 09, 12

In Case 09, this firm has evolved based on a family of businesses created by the MD's father and brothers. This firm leveraged the stability of the other businesses to move into an adjacent market with the toolmaking skills that the firm had developed. While

the firm leveraged their key capability, tool making, fitting and turning, the current MD gained external operational experience with a local MNE. It is this 2nd generation and mentoring over several years as an apprentice to the founder, that the current MD appears to have influenced the firm as it is today. The strategic positioning of tool making (Helfat & Peteraf, 2015) within different markets allowed this family to meet the identified market need and reconfigure resources (Teece, 2007). The benefit of a stable business would appear to address the challenge of searching for new opportunities while driving for revenue, a challenge younger firms need to address, which is a key challenge highlighted by other authors (Lichtenthaler, 2011). This balance ‘dance’ is recognised as a key challenge specifically for SMEs who are incumbered with limited staff and resources (O’Reilly & Tushman, 2013). Revenue would appear to be reinvested in generating a sufficient level of skills in Case 09. The development of the staff is addressed with apprenticeships in toolmaking as it is seen as a key capability for the firm. This investment is made despite the long period to full qualification, and it is one that the firm has invested in, over the long term. This knowledge capture and sharing through apprenticeships is further refined with investment in systems and processes particularly in organisational IT systems for creating knowledge databases and engagement with customers (Song et al., 2018). An ERP system was indicated as being part of this organisation for over 20 years. Case 09 has adopted a Japanese ‘team leader’ organisations approach to data capture and sharing driven by the 2nd generation MD. This would seem to be a demonstration of SIMs organised in a business and unit leader structure to facilitate knowledge sharing within teams and knowledge flow (Leal-Rodríguez et al., 2014, p. 894). R&D is embedded in the organisation as a collaborative effort with this firm sharing the cost of new product innovation with its customers emphasising the organisation and external environment

engagement necessary. This has been described by Leal-Rodríguez et al. (2014, p. 895) as ‘relational learning’ a construct of joint activity between an organisation and one or more parts of the value chain. It is seen as a necessary investment, a ‘balanced risk’ given the lifetime of the product, once in production and the revenue it can generate long term. The long lifecycle of products which the firm has learned would appear to allow the firm to recover the investment and competitively differentiate the firm from the competition, a key output of ACAP.

Similarly, in Case 12 which has evolved by leveraging a dedication to the current customer base but also focusing on new customers using a pareto approach of 80/20 where it continually seeks new markets and opportunities. The long-term cultivation and planning for the next generation of family leaders would appear to be evidenced in this case with a full professor trained in science but also recognised prestigiously by E&Y as an entrepreneur of the year. This professor is leading the firm as the current MD. This infusion of next generation expertise has allowed the firm to look for new market segments and also add technology to the creation of a new category of ‘Agri-tech’ products, not originally envisioned by the original founder. Forays into new technology, with technology as diverse as gaming, as a skill-set development for the firm in the farming sector, would appear to have been a differentiator. This practiced approach can be described as experiential learning (Kolb, 1984), and it would appear to demonstrate the flexibility and exploration associated with PACAP (Zahra & George, 2002, p. 196). This has been reported as an under studied capability of the ACAP construct when compared to RACAP and the outputs of competitive advantage and sustainability. This PACAP is required in building ‘knowledge stocks’ (Foss, 2006) which can be internalised and assimilated later with new product innovations. Case 12 would also appear to demonstrate the infusion of new capabilities by bringing educated employees

into the firm from different aspects of technology. These skillsets would not normally be associated with farming machine manufacturing firms or this industry sector. This looks like it might be a strategic effort in terms of the 2nd generation leadership vision (firm specific processes) of creating a technology firm outside the population centres in Ireland (Wang & Ahmed, 2007, p. 39). This firm would appear to provide salaries and opportunities for rural Ireland that would only be available in other high density population centres demonstrating sensitivity to the employee's heritage from this part of the country. Allowing for this gradual increase in staff numbers over time with new skillsets provided the flexibility of thinking and social embeddedness of the staff in the local area. Case 12 would appear to recognise that ACAP is a firm construct, but it has its foundations in individual cognition, motivation action and interaction (Volberda et al., 2010, p. 944).

In both cases, a second-generation family succession plan would appear to add new vision and motivations to the firm providing linkages between PACAP and RACAP with PACAP being an antecedent of RACAP leveraged by the next generation. This cultivated next generation approach would also appear to address the 'cognitive rigidity' than can evolve in mature firms reducing the desire to strive for new business (Zahra et al., 2009).

The Low Performers: A family business context, Cases 05,19,01

This is the second group of multigenerational firms, but in this section, challenges are identified in meeting the sustainability levels of the High Performers. In Case 05, a 2nd generation family firm which has transitioned with a family member to the role of MD. This MD has been educated in technology with advanced degrees at different universities in Ireland and Northern Ireland. This son of the founder has now recently

assumed the leadership role and introduced an R&D perspective and Innovation process rigor that did not exist during the prior founder period. This RD&I with 'I' being an innovation perspective built on the quality architecture expertise, 'knowledge stock' inherent in the medical device segment created by the founder. The founder seems to have succeeded in building a sustainable business meeting the needs of the precision medical market over several decades with processes and routines necessary for that market. This has allowed the next generation, his son, to introduce new technology aspects of the material, being metal understanding, capability into the firm. This looks to be providing direction for new market segments exploration not previously considered by the founder. This linkage would appear to emphasise the organisational capabilities development and the exploration of new external market engagement. While this firm would appear to demonstrate both High PACAP and High RACAP, in comparison to Case 09 and Case 12, it has not yet reached the shareholder value or employee levels of these high performing firms. This reflects the founder's original decisions on what markets to enter (O'Gorman, 2001) and the potential for these new markets to grow. It would also seem to demonstrate that ACAP is a path dependent firm construct of learning in different areas, including antecedents of market selection (Lane et al., 2006; Volberda et al., 2010). In addition, innovative performances are dependent on the scale of investment and timing in areas of expertise, as outlined in the opening paragraph (Cohen & Levinthal, 1990, p. 128). It would also appear to demonstrate the cumulative nature of ACAP and the investment necessary in PACAP, in the belief that it 'may provide access to future developing markets based on the knowledge developed in this area' (Cohen & Levinthal, 1990). The areas being explored now by Case 05, are distinct to where the founder started the firm, and would appear to position the firm for future market growth. This trigger of additional growth has not yet materialised. As

such this firm has not (yet) generated shareholder growth to the level of Cases 09 and Case 12.

Case 19, being the oldest firm in the cohort in this case study, demonstrates a change in leadership with a family firm but not to a 2nd generation family member, but to an employee who showed motivation to assume the MD role. This firm seemed to have reached a level of growth with the experience of the family owners. As previously stated, ACAP has managerial antecedents attributed to the construct (Volberda et al., 2010) and managerial skills can be a limitation to the success of the firm. These managerial antecedents include managerial cognition and the dominant logic of the individuals. This dominant logic may inhibit growth in mature organisations (Jones, 2006). It would appear in this case, that leadership cognition and combinative capabilities of the family leadership were limited, or it can be inferred that the desire to exit was more attractive. The succession planning of a new leader with external experience would appear to have been well planned by the founder since the new MD had 10 years of experience with the firm, prior to his succession. More importantly it would seem that the successor indicated that a change was necessary for the firm to grow. This may reflect the recognition by the founder, at the time, that the experience in managing Dynamic capabilities were limiting the ability of the firm to make the necessary changes to deploy and develop the resources for the next stage of growth (Ochie et al., 2022). It seems as if this change is having an impact. Of all the cases studies in this exploratory research, this case had the highest CAGR rate of 46 percent in the last five years. This might also reflect the growth trajectories of SMEs as proposed by Kidney et al. (2017, p. 74) following ‘a punctuated equilibrium path dependency’. However, for the levels of performance set for this cohort, this firm is

deemed based on the data, as a Low Performer based on shareholder value and employee numbers. It would however tend to indicate that critical junctures of management intervention can make an impact on a firm in the trajectory of its performance.

In this section on Low Performers of family run businesses, Case 01, while not the oldest firm in the cohort, does benefit from the longest continual family business in operation for over 3 generations. What would appear to be different in this generation of the firm is the additional experience, MNE sales experience, and education to a masters' degree level, that the current MD has over previous generations. This individual experience and education as prior learning has been emphasised by other authors including Bessant and Trifilova (2017) and Gonera and Prexl (2021). This prior learning can have an impact on the contribution to new innovations. This MD has focused on shifting the personnel demographics to be more balanced between young and older and moving from only skilled employees to some employees educated to higher degrees in the employee mix. This recognises the role of individuals in supporting the strategic direction of the firm. Case 01 seems to demonstrate an ability to broaden its sources of knowledge particularly with a local university providing design and marketing skills to allow the firm to explore new markets. With the inclusion of new organisational investments in IT approaches, communication and marketing, this has allowed this firm to be more proactive in the search for new markets while also recognising the limitation of their product offering in the current market. This would appear to be an example of the challenge of managing in a dynamic market (Helfat & Peteraf, 2015). This would appear to indicate the difficult decisions necessary in applying Dynamic Capabilities changes in a firm, where this firm sells to its competitors, to survive. Decision making

is largely performed by the MD. However, legacy family members are consulted on major decisions including capital spending and other items, a family board (Zahra et al., 2009). The market that this firm participates in would appear to be limited and niche in its opportunity. The MD is exploring new markets which may drive shareholder value in the future while continuing to generate stable but low revenue levels in the current market.

Finding 2: *The requirement for continual management investment and reinvestment in innovation regardless of the external environment for long term sustainability of the firm.*

There are two features of absorptive capacity, its cumulateness in time to achieve success and its effect on expectation formation, imply that its development is domain-specific and is path or history-dependent. (Cohen & Levinthal, 1990, p. 136)

For the low performers, a discussion on pacing and patient growth SME's representing Cases 08,15,06

Case 08 seems to demonstrate the potential evolution of the firm from a single focused customer that provided revenue and stability for the firm. Early investors benefited from their investment through a management buyout within 15 years of commencement. This allowed the managers to broaden their market reach based on their skills and capabilities. This firm has taken time to build their network in other market segments, exploring opportunities through knowledge search as an antecedent to innovation (Fosfuri & Tribó, 2006; Leal-Rodríguez et al., 2014). The management team leveraged their existing capabilities through international competitions to find problems worth solving. Further exploration has occurred with national universities allowing the firm to have research connections in place, while the firm did not invest in R&D, per se. A flat

organisation structure has allowed the firm to achieve financing through research grants, leveraging the National and European funding available. Investments have been made in knowledge capture and processes for exchange of information (Song et al., 2018), through the purchase of IT systems, only recently. An ERP system was seen as critical but while identified as expensive, the necessary qualified staff were not available in the firm to benefit from an investment in this system and hence it was delayed for several years. A prudent approach to growth and financial leverage would appear to follow ‘the profitability before growth’ approach of certain SMEs (Davidsson et al., 2009). Staff have been a focus of the firm in order to add to the level of skills within the firm. However, capital investment in buildings and particularly a canteen as well as a research lab were made in advance, in order to present the image of a firm that is more attractive to new entrants. This approach would appear to be directed towards creating an environment, culture, that would attract the required motivated skilled staff in the future. This supports learning from other authors that have maintained that SMEs that invest in staff development and a propensity to innovate, will develop higher ACAP overtime (Gray, 2006). However, after 28 years, Case 08 still has not reached the performance level indicated as a High Performer, Table 5.27, but would appear to have demonstrated incremental growth and market diversification.

Case 15 represents a professional service organisation that is driven by process and systems. This is a professional organisation ‘for professionals’ in what seems to be a highly specialised market segment. What this firm would appear to have demonstrated once again in this exploratory research, is a patient approach to growth in Irish SMEs. The learning from one industry has led to the next and successes in certain markets have led to opportunities in other markets, a demonstration of positive expectation formation (Cohen & Levinthal, 1990, p. 136). A path dependency and an understanding of its

processes for exploration and exploitation (March, 1991) would appear to have become systemised within the firm (Zahra et al., 2006, p. 927). The founder being an engineer, educated with chartered engineers around him, would appear to have demonstrated the integration of substantive capabilities into a process through deliberate action of market search and opportunity development. Recognising a key capability is the availability of a resource of engineers, this firm acquired a resourcing firm in the UK to ensure that there is a continuing source of engineers joining or within the firm. In turn these engineers follow a predefined route of training and are being exposed to new industries. This seems to be a systematic approach that the founder has explored in education and market development. While the firm is over 20 years in existence, it would appear that only recently has the firm invested in R&D. It would therefore indicate that R&D investment is seen as a 'later stage' investment step occurring when more established processes are in place within the organisation, over 20 years. This is consistent with Cohen and Levinthal (1990, p. 138) indicating that the level of spending on R&D is a function of "the need for learning" and the environmental expectations of the firm. Recognising that managerial antecedents can influence a firm's output, this case would appear to demonstrate the ongoing learning path of a founder. In this case the founder expressed that he regretted not being more ambitious in the early years. Since managerial antecedents would appear to have an influence on ACAP through individual learning but also on the organisational learning of the firm and the time dependency of this learning, this can impact the firm's performance (Rezaei-Zadeh & Darwish, 2016, p. P83). The authors Rezaei-Zadeh and Darwish (2016) put managerial antecedents above other antecedents to show their direct and indirect influence on ACAP. Case 06, would appear to demonstrate a desire by the founder to have his own firm. The founder leveraged his toolmaking skills and for 20 years met the demands of the MNE

medical device market, clustered in the west of Ireland and overseas. The founder admitted that he has no managerial training but that he delivered a quality product. Networks were all customer focused and the firm was intent on generating revenue for sustaining the firm. It would appear that little or no marketing was done apart from the targeted customers. It seems that the management antecedents were absent in this case (Volberda et al., 2010). It seems to indicate that the firm was not exposed to management opportunities or there were other factors that kept this firm focused on current customers, a failure trap in this case suggesting propinquity, as evidenced by Zahra and George, (2002, p. 195). However, as with a critical juncture (Messina et al., 2022. p. 5), similar to a university spin out (USO), there must be an opportunity recognition 'trigger' by the leadership that things must change. This event, trigger, occurred for the founder by recognising that a path to a pension was not sustainable unless the owner built the firm to a new level. By participating in a new market segment and hiring consultants, a boundary spanning (Cohen & Levinthal, 1990, p. 132) tactic allowed this firm to engage in new market segment for the firm, the Aerospace market. This change of direction has created momentum in the firm with new networks and the ability to move from a LEO level after 20 years to an EI client status more recently. This realisation of new management impetus and managerial skills development has allowed the firm to take a more aggressive approach to building new capabilities to meet the new markets. Quality has been a foundation of this firm, and this would appear to have enabled the firm to swiftly move into the aerospace market, building on a capability embedded in the firm, but for a different market. This firm would seem to be leveraging the stable revenue, 70 percent of its revenue comes from one market segment, to allow it to explore and invest in this new market segment. This firm is indicated as a Low Performer based on the shareholder value and low employee levels.

What is interesting in this case is the impetus to providing the stimulus or activation triggers (Zahra & George, 2002, p. 193) that motivated this firm. This motivation has resulted in investing in the exploration of other markets and new revenue opportunities. This management motivation would seem to be a clear antecedent to both PACAP and RACAP. It would appear to also be based on managerial cognition recognised by the founder (Volberda et al., 2010, p. 994) and as an antecedent to ACAP in general for firm performance.

An alternative for low performers – Exit strategy, Case 13

Case 13, which is indicated as a Low Performer, had a negative CAGR in the five years of the study despite being in operation for twenty-two years and having 14 employees. It did not appear to have a succession plan in place other than the PhD, female founder selling the business to another entity. There would not appear that there was any indications that individual staff development was a priority. It would seem that the focus of the firm was a commercialised product that meets customer needs. A sustainability model while initially feasible would appear to be the case, but ‘other factors’ (Vega-Juando et al., 2008, p. 395) which could be software capability as a skillset and development, were not evident in the firm. The founder demonstrated that she had the experience, initial motivation and training for the product solution in the market, potentially a high Individual ACAP level. The founder seemed to demonstrate through process and training that the founder could develop and lead a sales team. However, the case would appear to demonstrate the founder’s willingness to attract external financing, twice, five years apart, but that ‘it was distracting’ and that it impacted the management team (motivation) from the ongoing operation of the business. This is the one case that was successfully ‘bought-out’ by another entity in the research study. It was indicated as

a success by the founder in that all the employees were integrated into the acquiring firm. It would also seem to demonstrate the ultimate output of the ACAP process, not being sustainability or competitive advantage but return on Shareholder value.

5.6 Cross Cohort comparison

5.6.1 Naming convention for the three Cohorts

What has been presented here has been three cohorts segmented by age and performance geodemographically distributed in Ireland. The EU definition of firms (EC, 2022) allocate a Micro, Small and Medium based on the size and revenue. Innovation literature makes reference to the three phases of high tech Start-ups, as Stand-up, Start-up and Scale up (Roy & Nepelski, 2016).

In terms of this research, the three cohorts reported can be identified (labelled) based on a biological growth convention. They are, a Young firm, consists of a firm less than 10 years in existence, secondly an Adolescent firm, is a firm that is older than 10 years but less than 20 year. Finally, the third cohort is designated as a Mature firm being any firm older than 20 years and still in operation.

It is now possible to generate new and unique insights by comparing the 5-Loop framework across the three cohorts for both High and Low Performers. In the Table 5.29 below, it demonstrates the common mechanisms for each component in the 5-Loop frameworks while also indicating the typical levels of the High Performer ACAP in each cohort.

Table 5.29 – Cross cohort observations – The 5-Loop framework insights and summary

	Cohort 1 (5 – 10 years) Young (2 firms) High Performer	Cohort 1 (5 – 10 years) Young (2 firms) Low Performer	Cohort 2 (10 – 20 years) Adolescent (1 firm) High Performer	Cohort 2 (10 – 20 years) Adolescent (5 firms) Low Performer	Cohort 3 (20 years or greater) Mature (2 firms) High Performer	Cohort 3 (20 years or greater) Mature (7 firms) Low Performer
5-Loop Framework	High PACAP High RACAP	A mix of High & Low PACAP and RACAP	High PACAP High RACAP	A mix of High & Low PACAP and RACAP	High PACAP High RACAP	A mix of High & Low PACAP and RACAP
External	Market choice Customer engagement Funding	Academic engagement Niche markets	Single customer focused (crystalizing) Expanded to other markets	Single customer/market drove learning or pivot Limited market growth	Multiple markets Multiple customers Market growth Exploring and enter new markets	Multiple markets Multiple customers Limited market growth Explore new markets
Organisation	Flat structure Flexible Process	Flat structure	Nurture Harvest Lean & unit processing Inclusion of external leadership. Exec Board	Harvest Operational	Structures in place Operational and Exploration IT tools and KM processes ERP systems Exec. board R&D investment	Structures in place Operational Affordability of IT tools and processes ERP systems Motivation for continuity (founder)
Individual	Commercial strength Medium staff level or Large staff level	Academic Research Low staff level Homogenous staff Lack of commercial skills	Investment in staff Training SIMs	Homogenous staff Limited staff Lacking external experience	Generational experience Higher Education Investment in Training New calibre of returning local Staff highly educated	Generational experience Education Investment in Training Staff development
Output	Shareholder value Revenue	Grants Funding	Sustained Revenue	Incremental revenue Limited market growth	Increasing revenue Reinvestment Pool of returning educated local staff	Stable or low revenue based on market choices

Source: Author

5.7 Summary of this chapter

The firms in the dataset were divided into three different cohorts separated by age and performance being geodemographically dispersed to represent the innovative clusters in Ireland. Two levels of coding and a thematic analysis were applied to generate themes with constant comparison from each of the three cohorts. This process adheres to the Eisenhardt method, Eisenhardt (1989) for theory generation which relies on (Yin, 2002) multiple cases (and replication logic) and iterative process of constant comparison of data and where the method allows for theory building from multiple cases.

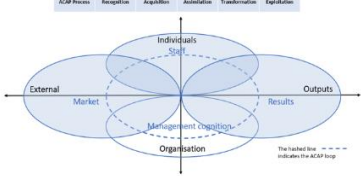
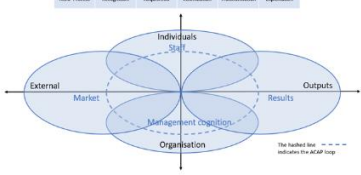
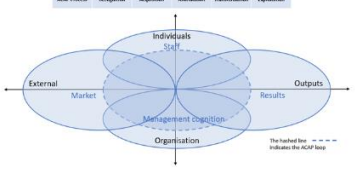
The 5-Loop framework was used to assess the four dimensions of ACAP, *Acquire*, *Assimilate*, *Transform* and *Exploit*, based on the Dynamic Capability definition of ACAP proposed by Zahra and George (2002). The combination of the 5-Loop framework and the ACAP dimensions seem to identify those organisational mechanisms as well as managerial cognition levels in the firms necessary to indicate levels of firm performance. The 5-Loop framework differentiated High Performers from Low Performers in this dataset for ACAP based on age (Young, Adolescent, Mature) of the firm in an Irish SME context. The 5-Loop framework would tend to suggest for SMEs that typically suffer from a lack of resources, in small state contexts, that it offers insights into areas for improvement in performance.

The 5-Loop framework and the application of the Dynamic Capability representation of ACAP by Zahra and George (2002) has provided an assessment of the levels of ACAP for SMEs in a small state, Irish exemplar, at any stage of the firm's organisational lifecycle. ACAP has been presented as an antecedent to firm performance, recognising that different levels of ACAP exist within the firm.

What is evident across the three cohorts is that there is a variation in application of the different dimensions of ACAP as the firm progresses through the organisational lifecycle of the firm. These findings have been characterised by a purposeful selection of SMEs geodemographically dispersed across the country using a cross-case analysis (Yin, 2002). As the participating firms varied by age, size and performance, a cross-case comparison of High Performers and Low Performers in each of the three cohorts of firms was possible. The cohorts were subsequently defined as the Young firm, the Adolescent firm and the Mature firm.

Table 5.30 below indicates a visual representation of the different ACAP levels possible when using the 5-Loop framework in addressing the necessary actions for future SME sustainability. The implications of the findings from this chapter will be discussed in detail in Chapter 6 following this table.

Table 5.30 –The Findings and visualisation across all the three cohorts

Cohort	Findings from cross-case analysis using the 5-Loop framework	5-Loop framework emphasis by Cohort	Visual representation of findings by Cohort using the 5-Loop framework
<p>Cohort 1</p> <p>Young Firms</p> <p>SMEs < 10 years</p>	<p>For Young firms having high PACAP alone, in itself, would appear to be an insufficient indicator of high-level performance of the firm.</p> <p>For Young firms it would appear that for a firm to have a growth imperative, management should demonstrate an equal focus on commercialisation as well as the provision of a differentiated solution to enable value creation for the firm.</p>	<p>External Loop (Commercial focus)</p> <p>Individual Loop (Founder)</p> <p>Outputs Loop (Revenue)</p>	 <p>Notes to the figure: Cohort 1 emphasise the External engagement, the Individual mainly driven by the founder and an Output generating shareholder value.</p>
<p>Cohort 2</p> <p>Adolescent firms</p> <p>SMEs >10 years < 20 years</p>	<p>For adolescent firms, the need to formalise and systematise organisational innovation processes are a significant value adding process that underpins sustainable growth.</p> <p>For adolescent firm growth must be managed through proactive managerial cognition and action for learning and innovation in this phase of the organisation lifecycle.</p>	<p>External Loop (Engagement)</p> <p>Organisation Loop (Management Structures)</p> <p>Individual Loop (Diversity)</p> <p>Outputs Loop (Recurring revenue)</p>	 <p>Notes to the figure: Cohort 2 External engagement routines, Organisational management structures evolve, Staff diversity, Outputs are recurring generating shareholder value</p>
<p>Cohort 3</p> <p>Mature firms</p> <p>SMEs >20 years</p>	<p>For mature firms, the importance of strategic planning including succession planning for sustainable value creation in multigenerational firms.</p> <p>For mature firms, the requirement for continual management investment and reinvestment in innovation regardless of the external environment for long term sustainability of the firm.</p>	<p>External Loop (Multiple Markets)</p> <p>Organisation Loop (Managed RD&I)</p> <p>Individual Loop (Diversity & Growth)</p> <p>Outputs Loop (Reinvestment & Growth)</p>	 <p>Notes to the figure: Cohort 3 Multiple External engagements, Organisational structures systemised, Diverse and ongoing Staff hires, Outputs reinvested for exploratory and exploitation returns</p>

Source: Author

Chapter 6 Discussion of Research Findings

In this chapter, a further discussion of the findings is warranted for each of the cohorts to extract the variation in ACAP levels by age, in providing linkages back to Chapter 5. Table 6.1 was presented in Chapter 5 but a discussion below highlights the differences between the High Performers and Low Performers for each of the three cohorts.

There is evidence of variations of ACAP levels, across all three Cohorts. Firstly, there is a variation in the application of the ACAP components based on the age and the organisational life cycle demands of the firm. This is demonstrated with a market focus requirement of Young firms, emphasising revenue generation with flexible management processes, Table 5.12. The High Performers for the young firms were both located in Dublin.

Secondly, as firms cross the ‘threshold’ from young firm to adolescent firm, a sense of professionalism and managerial engagement in routines and processes are evident in the High Performer. This High Performer for the Adolescent cohort is located in Cork, the second most populated city in Ireland. Professionalism can be a challenge for some firms lacking resources and training. The importance of networks in addressing capability gaps is evident in the Adolescent firm, Table 5.17.

Finally, as firms evolve into Mature firms, the firm needs to address the ambidexterity (O’Reilly & Tushman, 2013) of sustaining the business generating revenue while also exploring opportunities for new growth and wealth creation. Professionalism was evident in both Mature High Performer firms across all the ACAP dimensions particularly the individual, and skills training. Both of the mature High Performers were located the south East and South West, not Dublin. Investment in training of individuals/staff generally with processes for knowledge sharing was evident. Mature

firms tend to invest in R&D beyond the cognitive rigidity of the young and adolescent firms. Mature firms would appear to demonstrate acceptance of risk as a necessary challenge for wealth creation Table 5.26.

Table 6.1 – Cross cohort observations – The 5-Loop framework insights and summary

	Cohort 1 (5 – 10 years) Young (2 firms) High Performer	Cohort 1 (5 – 10 years) Young (2 firms) Low Performer	Cohort 2 (10 – 20 years) Adolescent (1 firm) High Performer	Cohort 2 (10 – 20 years) Adolescent (5 firms) Low Performer	Cohort 3 (20 years or greater) Mature (2 firms) High Performer	Cohort 3 (20 years or greater) Mature (7 firms) Low Performer
5-Loop Framework	High PACAP High RACAP	A mix of High & Low PACAP and RACAP	High PACAP High RACAP	A mix of High & Low PACAP and RACAP	High PACAP High RACAP	A mix of High & Low PACAP and RACAP
External	Market choice Customer engagement Funding	Academic engagement Niche markets	Single customer focused (crystalizing) Expanded to other markets	Single customer/market drove learning or pivot Limited market growth	Multiple markets Multiple customers Market growth Exploring and enter new markets	Multiple markets Multiple customers Limited market growth Explore new markets
Organisation	Flat structure Flexible Process	Flat structure	Nurture Harvest Lean & unit processing Inclusion of external leadership. Exec Board	Harvest Operational	Structures in place Operational and Exploration IT tools and KM processes ERP systems Exec. board R&D investment	Structures in place Operational Affordability of IT tools and processes ERP systems Motivation for continuity (founder)
Individual	Commercial strength Medium staff level or Large staff level	Academic Research Low staff level Homogenous staff Lack of commercial skills	Investment in staff Training SIMs	Homogenous staff Limited staff Lacking external experience	Generational experience Higher Education Investment in Training New calibre of returning local Staff highly educated	Generational experience Education Investment in Training Staff development
Output	Shareholder value Revenue	Grants Funding	Sustained Revenue	Incremental revenue Limited market growth	Increasing revenue Reinvestment Pool of returning educated local staff	Stable or low revenue based on market choices

Source: Author

A detailed discussion of each of the three cohorts is now provided to emphasise the findings.

6.1 The Young firms (<10 years) Survive or Die!

For young High Performing firms, the role of the founder was an important factor in driving sustainability. In one case the founder added skills to compliment his own skills to deliver commercial outputs. The founder demonstrated high *acquisition* and *assimilation* dimensions of ACAP. Resources, particularly the number of individuals, were quickly increasing to address the market Problem with a Solution. High *Assimilation* and *Transformation* dimensions of ACAP. Revenue was reinvested to increase resources which included systems and training. High *Exploitation* dimensions of ACAP. This investment enabled customer engagement and an increased level of business activity. Early strategic planning and gap analysis were evolving.

In the second case the Founder drove deep exploration of the Problem to be solved and iterating a Solution. High *acquisition* dimension. The founder demonstrated that Individual numbers were low during early years. Individuals were contingent on their contributions to adding value. High *assimilation* dimension. Organisational structure and process were purposely “ill defined” to allow flexibility. High *transformation* dimension. A funding focus to allow long term exploration of a competitive solution. High *Assimilation* dimension. Low Revenue was evident with many different customer engagements. Multiple prototype solutions engaging customer feedback. High *Transformation* dimensions

In both Young firms scenarios, the founder would appear to play a key driving role. High Entrepreneurial Orientation seem to dominate the founder mindset in both scenarios.

ACAP Challenges to be explored and identified as a Young firm

Have the founders verified their assumptions and explored options for supply?

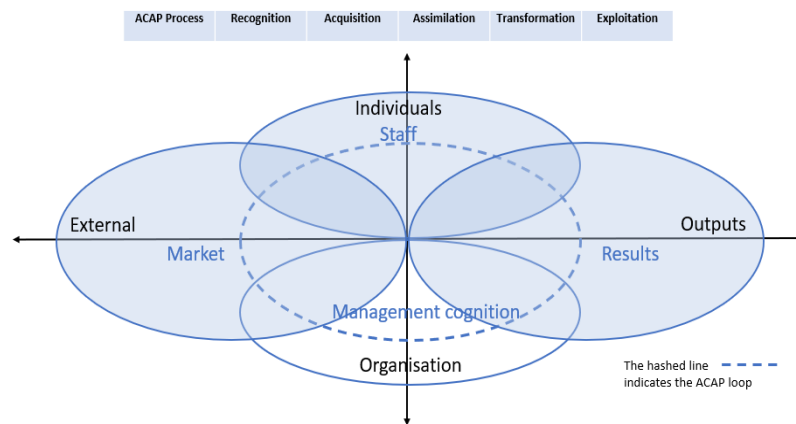
Have the founders leveraged available training and early funding for marketing?

Have the founders engaged available networks to provide path to shareholder value that will sustain the young firm?

Have the individuals (staff) been engaged and motivated to generate value?

Have the results been articulated based on known risks identifying what success looks like?

Figure 6.1 – The 5-Loop Framework for the Young firm



Note to figure: The individual (founder) intersects with the external environment for Exploratory learning. The Individual (Founder) intersect with Outputs for Exploitation learning. Organisation rules and processes are flexible if no solution is in place, otherwise early structures are in place

6.2 The Adolescent firm (>10 <20 years) Transitioning

For the adolescent High Performer firm, it was found that Problem ACAP and Solution

ACAP were well defined with a single large customer. High *transformation* and

exploitation dimensions. Operational processes were well defined, and structures allocated

to meeting requirements. Knowledge management systems were in place. High *assimilation*

and *transformation* dimensions. Knowledge transfer within the organisation was codified

and SIMs in place to allow sharing of information. Promotion from within the organisation.

High *assimilation* and *transformation* dimensions. Management networks were in place for

commercial and mentoring of the founder. High *assimilation* dimension. Strategic processes for market and business were evolving. High *transformation* and *exploitation* dimensions. Broader market engagement was evident based on learnings from a single customer. Recurring revenue was available for reinvestment for growth. Investment in individuals, training and growth opportunities available to staff. High *exploitation* dimensions.

ACAP Challenges to be explored and identified as an Adolescent firm

Has management grown its networks with the external environment?

Has management increased its skills diversity, for example with a mentor or board?

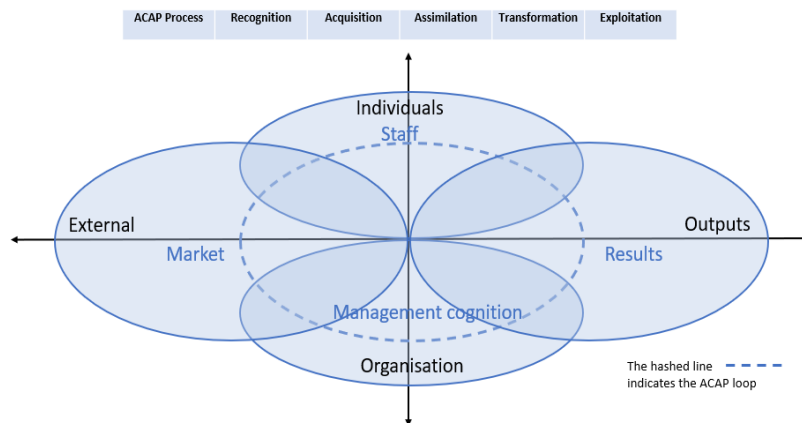
How is the organisation building structures for operational and organisational efficiencies?

What systems and processes are being put in place to capture, store and transfer knowledge?

Are Dynamic Capabilities evident and practiced? Is there a move from substantive to Dynamic Capabilities with a higher level of strategic thinking?

Is there a focus of Transformative learning and Exploitive learning? How much Exploratory learning is being practiced?

Figure 6.2 – The 5-Loop Framework for the Adolescent firm



Note to Figure: The development of organisational structure, tools and processes. The increased in the diversity of individuals. The stable generation of outputs based on superior external environmental understanding

6.3 The Mature firms (>20 years) – Reinvestment

For the Mature, High Performers firms, it was found that Problem ACAP and Solution ACAP were well defined with multiple large customers and multiple markets were in place. High *exploitation* dimensions. Networks were established throughout the value chain. Networks established in adjacent markets and technology. Customer engagement in risk taking and shared growth opportunities. High *acquisition* and *assimilation* dimensions. Operational structures were well defined with investment in knowledge capture, creation and sharing. Investment in IT hardware, software and new skills. Diversified individuals. High *assimilation* and *transformation* dimensions. Training leveraged both with academic and practical (apprenticeships) skills. Individuals' quality of life was a focus for the firm. Mentoring to retain staff. High *assimilation* and *transformation* dimensions. Dynamic Capability and higher levels of adaption were evident in the history of the firms. High *assimilation*, *transformation* and *exploitation* dimensions supported processes for *Acquisition* dimensions. Succession planning was evident in existence for multi-generational leadership. R&D initiatives were evident, or evolving. High *acquisition* dimensions.

ACAP Challenges to be explored and identified for the Mature firm

How are the revenues and shareholder value leveraged for growth?

Does a diversity of markets exist?

Are individuals operating in a structured format within the firm?

Is there a dichotomy of founder motivation and entrepreneurial orientation leading to succession planning?

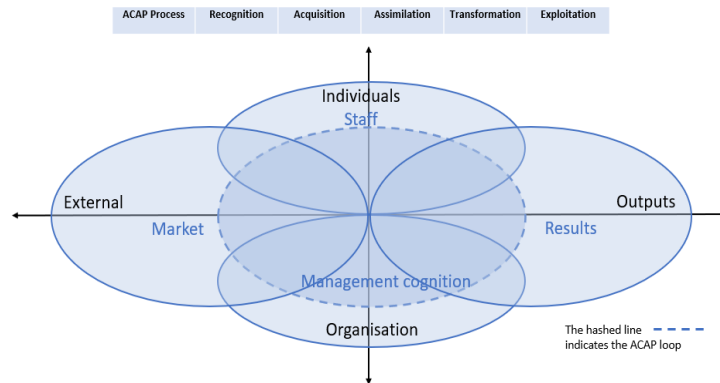
How are organisational structures being developed to generate new Problem ACAP and Solution ACAP?

How are new organisational knowledge stocks being developed internally or externally?

What evidence of dynamic capabilities exist and how is it generating new knowledge either internally or externally?

What evidence is there of higher order strategic modes of adaption encouraging exploration and execution learning?

Figure 6.3 – The 5-Loop Framework for the Mature firm



Note to Figure: The organisational structure, tools or processes drive for efficiencies. The increased in the diversity of new markets. Repeating revenue invested for new capabilities and assets.

6.4 Summary discussion of the findings

Commercial and technical investment in the processes for learning and innovation clearly needs to be managed in SMEs, to result in commercialisation activities which leads to shareholder value creation. Management, as an antecedent to ACAP, needs to bring valid experience and training to facilitate the sustainability of the firm. This adds support to the extant literature that Management is an antecedent to ACAP (Volberda et al., 2010).

In the Table 6.2 below, the findings for each cohort are mapped to some of the critical literature as well as linkage to the Zahra and George (2002) dimensions of ACAP. The

importance of this mapping is that it links the extant literature to the activities associated with the firm, based on age of the firm, a finding from this research.

This representation also shows the impact of recent publications on the ACAP construct and how they are focused on either different organisational mechanisms or orientations of the firm. This mapping indicates that research is not a chronological building over time, but that research areas shift, ebb and flow as focus research areas come into view.

This also confirms what Lane et al. (2006) indicated that ACAP is one of the most important constructs to emerge in Organisational research in recent decades.

Table 6.2 –ACAP Maturity model – Literature informed representation

	Findings	Literature references	ACAP dimensions Zahra & George (2002)
Young Firms	Problem ACAP and Solution ACAP Transformational learning & Exploitation learning Founder Entrepreneurial orientation Organisational flexibility	Scheisfurth & Raasch (2017) Lane (2006) Engelen (2014) Ries (2011), Zahra & George (2002)	Acquisition Transformation Exploitation
Adolescent Firms	Organisation tools processes. members Individuals diversity (Members) Networks Exploration, Transformation, Exploitations learning Dynamic Capabilities Synchronisation of processes Higher levels of adaption	Argote & Fahrenkopf (2016) Tsai 2001 Zahra et al. (2009) Lane (2006) Teece 2007, Helfat et al. 2007 Sirmon et al. 2007 Birkinshaw et al. 2016	Acquisition Assimilation Transformation Exploitation
Mature firms	Leadership cognition Organisational structure Individuals diversification Dynamic Capabilities Ambidexterity Diversity of markets (Arenas) Succession	Jones 2006, Helfat & Peteraf (2015) Argote & Fahrenkopf (2016) Teece 2007, Helfat et al. 2007 O'Reilly & Tushman(2021), Teece (2019) Gunther McGrath (2013)	Acquisition Assimilation Transformation Exploitation

Source: Author

In Table 6.3 linkages are made to the extant literature and the ACAP challenges that exist in each of the three cohorts as presented in Chapter 5.

Table 6.3 – Concise representation of theoretical and practical contributions

ACAP	Recognise	Acquire	Assimilate	Transform	Exploit
Learning Lane et al., 2006	Exploratory Learning		Transformative learning		Exploitive learning
Dimensions/ Components Zahra & George (2002)	Prior Investments Prior Knowledge Intensity Speed Direction	Intensity Speed Direction	Understanding	Internalization Conversion	Use Implementation
5-Loop Framework Individuals	Founder Individual Organisation	Founder Individual Organisation	Founder Individual (Staff) Organisation	Individual (Staff) Organisation	Individual (Staff) Organisation
Roles of individuals	Networks Search	Networks Search New connections Learning Speed of learning	Interpretation Comprehension Learning	Synergy Recodification Bisociation	Practice Core Competencies Harvesting Resources
Resources	Universities Firms (Value Chains) Consortia Enterprise Ireland SFI	Universities Incubators Enterprise Ireland SFI Prior employment Training	Single customer Prototype Supply chains Mentors Experts	Single customer Prototypes Supply chains Mentors Experts Codification	Single & multiple customers LEAN Operational efficiency
Young firm	Prior experience Founder training	Individuals Fast learning HPSU client Long learning cycles	Customer engagements Multiple customers Prototypes Multiple supply chains	Multiple business models Evolving business models	Growing revenue, Reinvestment Investment resources
Adolescent firm	Prior experience (founder) HPSU Client Current customers, Competitive benchmarking	HPSU client EY networks, Marketing, International markets	Multiple products Multiple markets, Mentors SIMs	IT, Technology Business processes Board members Organisation processes	Increasing revenue International expansion Recruitment Investment, Strategy,
Mature firm	Multi-generational, Current customers, Search systems, Competitive benchmarking	Collaboration with customers Marketing, Globalisation	New staff, Apprenticeships, Tools, Processes, Training, Staff experience	R&D, Customers collaboration, Investment, reinvestment, Structures	Multiple markets, Succession planning, Dynamic capabilities

Source: Author

What can be viewed in Table 6.3 are the overlaps and multidimensionality of ACAP with other constructs confirming the difficulty in the appropriate application of the ACAP construct from a managerial perspective, a finding from this research. This table indicates overlaps in Learning constructs, the importance of the Individual, and how Networks play a role in providing external knowledge through engagements with external entities including universities and government bodies. What this research has suggested is that Management teams need an ‘awareness’ of the various overlapping constructs at the different stages of a firm’s evolution and for the management team to apply a dynamic capability mindset or ambidexterity (O’Reilly & Tushman, 2013) in how they manage the firm. Within Table 6.3 as a concise representation of the theoretical and practical contributions of this research findings is articulated. Chapter 7 will now conclude this research in detail in the following chapter.

Chapter 7 Conclusions and Recommendations

7.1 Introduction

This chapter brings the research to a conclusion. The purpose of the research is revisited to indicate how the research question is addressed through the findings in each of the objectives. Each objective is presented with reference to the literature and findings from this research. The contributions made through this research are articulated separately. This chapter indicates the limitations of the research before providing future research directions and concluding remarks.

For over thirty years the ACAP construct has attracted many researchers who have explored and analysed its many different dimensions. The Cohen and Levinthal (1990) publication was rich, in content and broad in its application. This broadness of the construct, while attractive in its distillation of competing theories at the time, provided some difficulty in interpretation and application. This was demonstrated by multiple literature reviews during each decade in an attempt to consolidate the most recent perspectives of the construct (Apriliyanti et al., 2017; Cunha Filho et al., 2021; Lane et al., 2006; Van den Bosch et al., 1999; Volberda et al. 2010).

This research set out to provide an updated perspective of the ACAP literature while providing a pragmatic framework to address the identified gap in application of the construct to SMEs, in a small state context.

The research question addressed in this endeavour through the stated objectives is restated here

What role and contribution do levels of absorptive capacity play in the commercialisation of knowledge in knowledge intensive SMEs?

7.2 Research Objectives

Four objectives were defined to enable the research question to be answered. A multiple case study design was chosen for this exploratory research by engaging SMEs in an Irish context representing small state conditions.

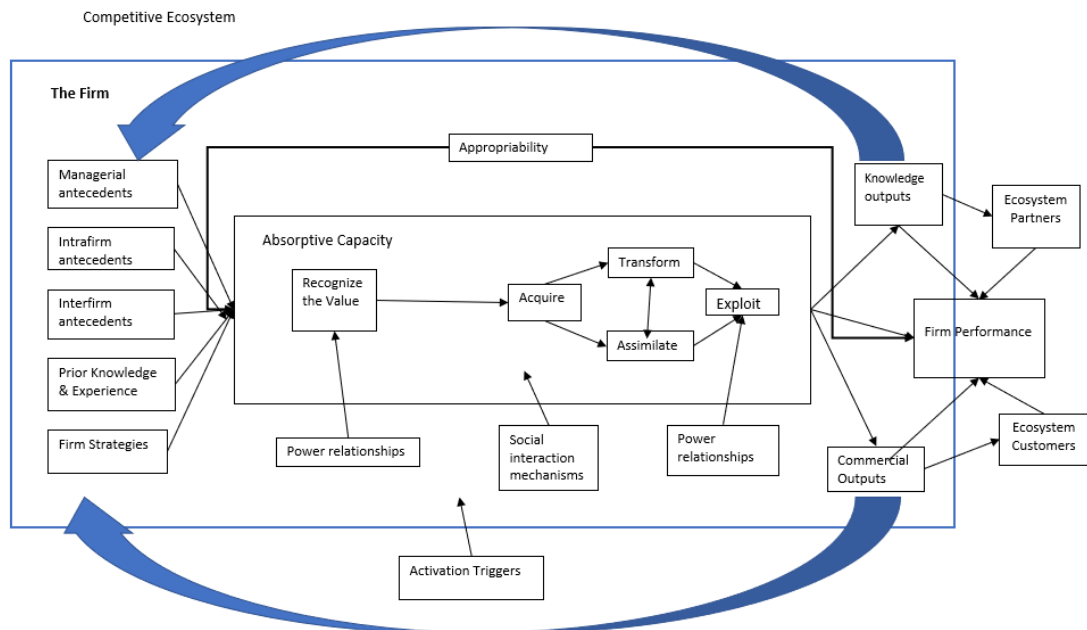
7.2.1 Research Objective 1

To critically evaluate the ACAP construct and its role in firms' performance

In Chapter 2, a chronological review of the literature was presented covering over three decades of evolution of the ACAP construct. Over 270 publications representing the 'waves of ACAP literature' up to the year 2022 were reviewed as part this research in Section 2.3. These 'waves of ACAP literature' showed the progression of the ACAP construct to a process approach by Lane et al. (2006) that was later represented as an operationalised flow model proposed by Volberda et al. (2010). These representations were further developed as part of this research, into a progressive integrated ACAP process, shown in Figure 7.1. This integrated ACAP process view positioned the firm in a dynamic ecosystem and recognised that firms exist in value chains where competitive advantage comes from understanding of 'arenas' of influence (McGrath, 2013). The integrated ACAP process was discussed in

detail in section 2.4. This view also recognised that firm performance has Ecosystem customers and partners that were referenced by Leal-Rodríguez et al. (2014, p. 895) as “relational learning” benefits.

Figure 7.1 – A progressive integrative ACAP process

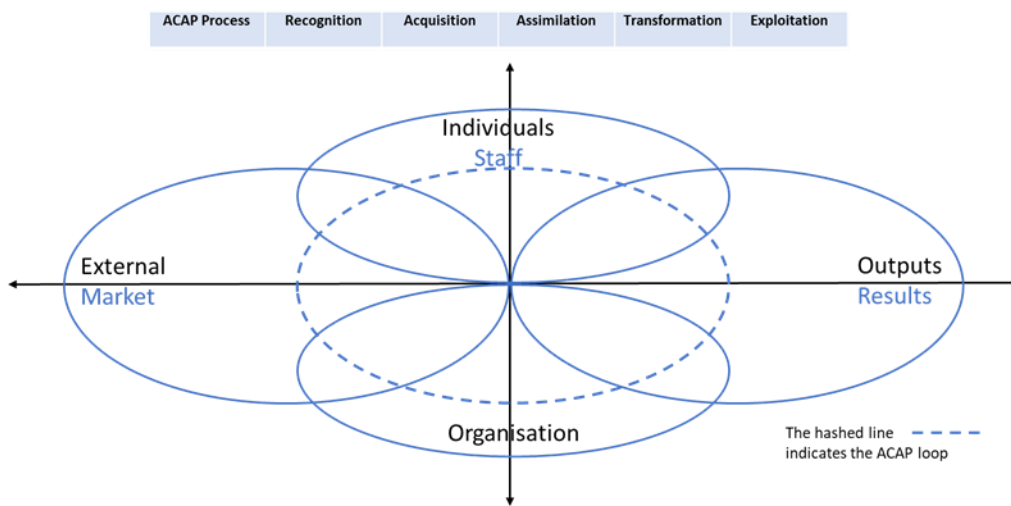


Source: Author

The progressive integrated view presented in section 2.4 visually links the cyclic learning that also benefits firms in expectation management for future innovation, through organisational and managerial learning. It recognised that firm’s strategies play a crucial role in management practices and a firm’s processes to develop the necessary Dynamic Capabilities of ACAP. The ‘strategic variety’ (Miller, 1993) that a firm develops over time helps focus the firm on its own ability to ‘craft the future performance’, given changes in its environment, by applying organisational processes that can be updated and flexed to meet firm performance.

An additional perspective was critically required to allow ACAP engagement with SMEs for this research. Interpretation of the ACAP construct has been highlighted as being challenging for researchers and practitioners. A novel representation of the ACAP construct was proposed for SMEs engagement, in evaluating a firm's performance, which is indicated in Figure 7.2, the 5 – Loop framework.

Figure 7.2 – A 5 – Loop framework artifact – ACAP multidimensional interrelations



Source: Author

The 5-Loop framework was articulated in section 2.5. It indicated how the combination of the firm's interactions between the External, Organisation, Individual, and Outputs loops combine to indicate different levels of ACAP, shown here, as a permeable loop interconnecting all other loops. The loops represent how knowledge flows within the firm, and it is rooted in the decisions by management regarding knowledge effort, the creation of knowledge bases and internal knowledge process as proposed by Song et al. (2018). The four capability dimensions of the ACAP construct defined by Zahra and George (2002) and Todorova and Durisin (2007) are leveraged to emphasise different points of engagement in

the 5-Loop framework. The loops configuration was based on extant literature reviews and a categorisation of the extant literature are presented in Appendix 1. This 5-Loop framework is a novel representation of the literature and it was leveraged in addressing the second Objective of this research.

7.2.2 Research Objective 2

To explore the contribution that different ACAP levels make on firms' innovation performance

This research demonstrates that ACAP is a multidimensional construct and a Dynamic Capability of the firm. As has been shown in this research, the dimensions of the ACAP construct can vary for each individual firm. ACAP can vary depending on the age, size and the external environment in which the firm operates. The various ACAP levels for each of the firms derived in the three cohorts analysed in section 5.5 are shown in the tables below. These tables demonstrate, that ACAP levels have varied in this research with a corresponding varying level of performance. The ACAP levels are indicated for both PACAP and RACAP in each of the 19 cases.

Table 7.1 – Cohort 1 ACAP levels and performance

	Case 14	Case 16	Case 10	Case 04
Performer	High	High	Low	Low
PACAP	High	High	High	High
RACAP	High	High	Low	Low

Source: Author

Table 7.2 – Cohort 2 ACAP levels and performance

	Case 11	Case 02	Case 04	Case 07	Case 20	Case 17
Performer	High	Low	Low	Low	Low	Low
PACAP	High	Low	High	High	Low	Low
RACAP	High	High	Low	Low	High	Low

Source: Author

Table 7.3 – Cohort 3 ACAP levels and performance

	Case 09	Case 12	Case 15	Case 13	Case 06	Case 08	Case 01	Case 05	Case 19
Performer	High	High	Low	Low	Low	Low	Low	Low	Low
PACAP	High	High	Low	High	Low	Low	Low	High	Low
RACAP	High	High	High	Low	Low	Low	Low	High	High

Source: Author

ACAP has been articulated as an antecedent to innovation performance in different iterations of the construct (Cohen & Levinthal, 2002; Todorova & Durisin 2007; Volberda et al., 2010; Zahra & George, 2002). It has been shown in this research, that as a Dynamic Capability, PACAP and RACAP result in different innovative performances of the firm. As can be seen in the tables above, PACAP is different to RACAP and having one does not imply high performance of the firm. Having High PACAP does not necessarily indicate High RACAP and sustainable performance of the firm. PACAP has been shown to build knowledge stocks for the firm with long term benefits for the firm, while RACAP provides the process and execution for current knowledge stocks necessary for immediate financial performance (Zahra & George, 2002).

It has been shown that due to the dynamic environments in which firms exist, management cognition can affect the innovativeness of the firm (Bedford, 2022; Helfat and Peteraf, 2015). This was evident in all three cohorts as discussed in section 5.7. Other researchers have indicated that firm performance is driven by the strategic choices of management, i.e., based on the management ability to sense, seize and importantly reconfigure resources as

necessary (Teece, 2007). The challenge for SMEs is the limited availability of resources for multiple activities, as was seen in Cohort 1, for Young firms. As a result, ACAP can mediate the Entrepreneurial Orientation of the firm as demonstrated by Engelen et al. (2014) in section 2.3.2 and was evident in all three cohorts. Wang et al. (2007) proposed that firms differ in the adaptive, absorptive and innovative capabilities of the firm resulting in different Dynamic Capabilities, which can affect firm performance. This was evident in the Adolescent and Mature, Case 11, Case 08, Case 09 firms and they highlighted the opportunity to explore alternative markets based on stable revenue in at least one market.

7.2.3 Research Objective 3

As ACAP levels are important, to recommend how firms can improve their levels of ACAP.

It has been shown that prior learning is recognised as an antecedent of the ACAP construct. As previously indicated, ACAP is path dependent, and requires routines and process within the organisation to allow for knowledge creation, storage and flow. Lubatkin et al. (2006, p. 665) indicated that no other group, including the board of directors, has a greater potential for affecting the form and fate of an organisation as the small group of senior executives, top management team (TMT), residing at the top of the SME organisation.

Recognising that firms evolve in organisational structures and routines for learning, as they age and grow. Being able to determine the level of structure within the organisation to capture this learning, is critical. This evolution was evident in the changes in organisational structures between the different cohorts in this research. The ‘transition firms’ from Young firms to Adolescent firms, emphasised the professionalism necessary and the need for

organisational mechanisms in Case 11, Case 17. The dichotomy for SMEs is the resources applied to explore or exploit activities will typically be dependent on factors within view of the TMT.

The ability of the TMT to monitor substantive capabilities versus the need to develop routines to generate new capabilities will be a reflection of the environment the SME operates in and also on many of the antecedents to ACAP. This is particularly important in changing environments, where modes of adaption proposed by Birkinshaw et al. (2016) emphasise the higher capability necessary in reconfiguring resources for sensing or seizing activities. The impact of non-Exec board was evident in helping firms grow through the Adolescent phases by adding this capability to the firm. Examples of these influences were evident in Case 11. Having these resources in place for the Mature firms was also evident Case 09, Case 15. This indicates that improved management and training in sub-capabilities of ACAP, being PACAP and RACAP as well as the individual dimensions of ACAP, are necessary for sustainability.

This exploratory research has demonstrated that different capabilities are evident, but vary in priority, depending on whether the firm is a Young firm, an Adolescent firm or a firm in a mature phase of its evolution. What this study of ACAP shows, is that there are many organisational and management implications for *recognising* the state of development (knowledge banks) of the firm. This recognition points to the need for management of the innovation process to navigate an appropriate balance between exploration and exploitation learning activities (Helfat & Peteraf 2015; Teece, 2007).

This research has documented many constructs that emphasise the learning organisation and the need for continual learning, regardless of the growth of the firm. Thereby

recognising some of the challenges and traps that comes with ‘learning myopia’ (Levinthal & March (1993). While the mature organisations may strive for more stable routinisation and stable revenue, this may lead to an inability to experiment or take risks with new capabilities. Ultimately being myopic of the need to change and need to invest in PACAP, thus threatening the firm with becoming unsustainable. This indicates a continued focus of learning within the organisation is necessary to refill the knowledge stocks of the firm (Sun & Anderson 2010).

Limited resources constraining a young firm may require flexibility and learning modes more akin to improvisation and trial and error learning (Miner et al., 2001). This was demonstrated with the High Performers, Young Cohort firms. This may result in faster learning and provision of solutions to customer problems enabling early revenue and survival. Both High Performers demonstrated different approaches to this need in the Young cohort. This indicates organisational flexibility may also be necessary for the Young and Adolescent firms.

Having an awareness of the greater environment in which the firm operates is a key recommendation of this research. This was captured initially in the progressive integrative ACAP process view proposed in Figure 6.1. From this research, it is recommended that firms could leverage a Diagnostic Instrument based on the 5-Loop framework, Figure 6.2, to address the ‘awareness gap’ of ACAP levels, evident in SMEs. These gaps can be described as the need of the firm to assess the following knowledge gaps.

- Assess the external environment
- Assess the internal skills and capabilities
- Assess the levels of individuals skills within the organisation
- Assess managerial routines and actions (dynamic capabilities)
- Assess knowledge networks internally and externally

Outline of a Diagnostic Instrument - Recommendation

The format for the proposed Diagnostic Instrument could take the form of a series of questions scored on a Likert scale, addressing the key loops of the 5-Loop framework. This would then lead to a visual representation of the ACAP levels of the firm. See Appendix 5 including an Excel® version of such a diagnostic instrument.

Table 7.4 – A 5-point Likert scale – Diagnostic Instrument

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
1	2	3	4	5

Source: Author. Note to table: - Strongly agree, Agree, Unsure, Disagree, Strongly disagree

Targeted questions addressing the 4 ACAP dimensions

Acquisition Questions: Ext: 2,3,4,5,6 Org: 1, (6)

Assimilation Questions: Org: 2,3,5,6 Ind: 2 (5)

Transformation: Questions: Org: 4, Ind: 1,3,4,5 (5)

Exploitation: Questions: Out: 1,2,3,4,5,6, Ext: 1, Ind: 6 (8)

External

1. The market we operate in, is stable
2. The firm interacts with a limited number of external entities in the market
3. The marketing effort only communicates outwards
4. The marketing effort does not source external information
5. There are no independent marketing sources
6. Universities provide no technological inputs

Organisation

1. Searching for external information is discouraged
2. The organisation does not document procedures
3. The organisation does not invest in storing information
4. Cross company interactions is not encouraged
5. External competition is not discussed
6. Internal knowledge is used for new product or process innovation

Individuals (Staff)

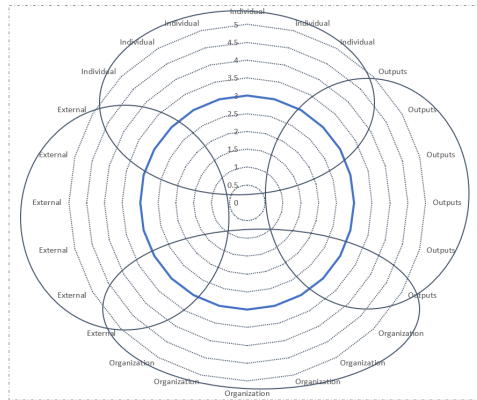
1. Employees are all educated to the same level
2. Employees have the same skills

3. Training for new skills is not encouraged
4. Employees are approximately the same age
5. Employees stay in the same role, do not rotate
6. Employee attrition (loss) is not a problem

Outputs

1. The organisation makes the same product every year
2. New products and services are not encouraged
3. We measure revenue for performance
4. Employee numbers do not change
5. We know our market share
6. We know the customer satisfaction levels

Figure 7.3 – Excel® Visual for 5- Loop Framework diagnostic instrument



Source: Author Note to Table: The Blue line refers to the ACAP levels across the firm within the 5-Loop framework

7.2.4 Research Objective 4

To make policy recommendations that may facilitate ACAP practices in firms deemed to be high potential growth firms (HPGF)

What has been shown in this study is that fast growth of firms is unusual and not representative of SME growth, in general (Brown & Mawson, 2013; Davidsson et al., 2009). High growth firms are not necessarily high-tech firms, they are more likely to be service firms or using technology to enhance their firm's performance. Different periods of

growth was evident in this research, e.g., Case 17 in the Adolescent cohort, and Case 19 in the Mature cohort. A constant emphasis in this research has been the prior knowledge of the firm. The Young firm leverages prior knowledge from the entrepreneur and experience gained in the early period of operation as demonstrated by Cases 14 Case 16. The ability to absorb new knowledge despite the availability provided by the state must be matched by the 'motivation' of the firm to absorb it. This motivation is a combination of the investment by the firm in its 'willingness or readiness' to make changes, being flexible in its processes to absorb new knowledge and act on it, through regimes of appropriability (Todorova & Durisin, 2007). This is affected by both the level of growth of the firm and the learning capabilities of the firm. Both of these will be affected by the individual firms, particularly the top management team (TMT) experience and training.

What this research has shown is that firms grow through learning cycles and that learning takes different paths in different firms. This was evident in the Young firms and how each of the High Performers learned differently. The Young firms availed of different learning resources in their provision of a solution, University access or bringing in a TMT early.

This research shows that SMEs in Ireland are risk averse as demonstrated by Case 09 comment that the firm was built, 'brick on brick'. It was noted crises tend to drive firms to make changes in their processes, Case 20 in the Adolescent cohort with the responsive culture and Case 19 with the 2nd generation management buyout. This risk averse culture was evident in the Adolescent firms based on the Individual experience of the Celtic tiger, noted in the transcripts for Case 02 and Case 04 decision to fund growth through local banks rather than access external funding.

PACAP affects a firm's innovativeness more in dynamic environments than stable ones (Jansen, 2005). There seems to be a slow adoption of IT and databases for knowledge creation and storage in the SME cases presented. Case 08 delayed an ERP purchase because of lack of skills to operate the system. This delay would appear to be driven by the lack of skillset of the firms, but also a lack of the TMTs to leverage efficiencies that can be gained from these investments.

In Appendix 4, Ireland SME fact sheet 2021, it emphasises the strengths of Irish SMEs as consistently above the EU average in terms of its share of high growth firms (HGF) and employment in HGFs. It also notes that a relatively high percentage of HGF engage in innovation. This factsheet also indicates the key challenges in a post COVID19 environment, are a need to stimulate growth in exports. Irish productivity is lower than the EU average and also that the cash flow generation from Irish SMEs is challenging.

Policy recommendations based on this research

In reviewing the research, certain policy actions have been highlighted as providing incentives to enable SMEs to increase the ACAP and subsequently their performance. The recommendations proposed are referenced from a cross section of all the cases in this research.

Networks. Emphasise the need to generate awareness of networks to enable knowledge sharing at a local SME level. Link participation in knowledge networks with export opportunities. Create knowledge networks based on SMEs clusters, e.g., biotech, agri-tech, fintech. Encourage participation in technology events from

managerial levels at SMEs. Create an SME focused national network for mentoring, knowledge sharing and financing and the provision of non-Exec. boards.

Education. Educate management on routines for increasing knowledge sharing within the firm during stable environments, in preparation for the arrival of market turbulence. Educating SMEs on the benefit of knowledge systems and knowledge sharing networks. Encourage University collaboration with SME level participation in new technologies thus encouraging a Quadruple Helix perspective. Leverage Universities as training locations specifically focusing on multigenerational firms preparing advanced succession planning opportunities where these firms already have market access and trading history. Encourage University interns to participate in work experience at SMEs as a path to employment bringing new technologies into the indigenous firm.

Infrastructure. Enable national high speeds internet access for SMEs to locate outside high density populations. Leverage ICT technologies for knowledge storage while encouraging rural employment for SME clustering in remote regions potentially increasing Irish productivity.

Investment & Management. Mature family firms may offer opportunities for intervention or investment when succession planning is not in place or capable for the new technology era. Ongoing market access with external triggers of investment could be beneficial in reviving local generational SMEs with increased TMTs skills and networks. Regenerating Entrepreneurial orientation and driving increased Irish productivity.

7.3 Findings

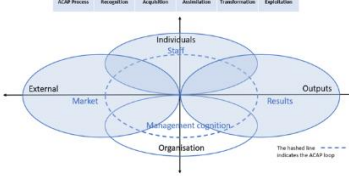
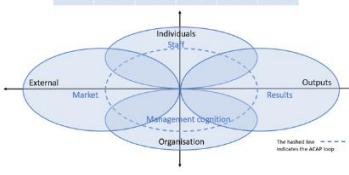
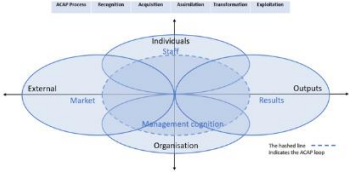
The findings have been presented in Chapter 5 and discussed in Chapter 6. Table 7.5 is repeated here from Chapter 5 and presents the summarised findings for the three different cohorts of the SMEs engaged in this research.

In the Young firms (1-10 years), the role of the founder and the experience of the founder were critical. The role of the founder was to provide activity on both the PACAP and the RACAP sub capacities. Flexibility of the organisation in generating shareholder value was found to differentiate the High Performers from the Low Performers. A challenge for the Low Performers was obtaining a commercial emphasis while balancing the solution and technology development. These findings are captured in the top section of Table 6.5.

In the Adolescent (10-20 years) firm, it was shown that as the ‘transition period’ from young firms occurs, the importance of organisational structure and routines were evident. The High Performer demonstrated, that once an initial market was secured with one customer, this allowed the firm to develop organisational processes that were repeatable and sustainable, providing new market exploration opportunities. Individual activity and employee numbers subsequently increased. There was a recognition by the founder that additional resources and expertise were needed leading to increased networks. It was proposed these networks allowed the inclusion of a non-exec board bringing additional external knowledge, professionalism and experience into the top management team.

For Mature firms (> 20 years) where offerings become more stable, it was shown that there is a need to continually search for new opportunities recognising that markets can be turbulent. The High Performers demonstrated the need to have processes for collaboration with current customers, allowing for a shared exploration of new opportunities. An understanding of the broader ecosystem as part of the strategic flexibility of the firm was demonstrated. An awareness of the changing skills requirement over time, as well as a realisation that the core skills are a key capability for the sustainability of the firm, was evident. It was demonstrated that Mature firms were more likely to invest in R&D indicating the path dependency of older firms and the risk averse culture that exists. Multigenerational firms demonstrated the opportunity to train and educate the next generation by building on the founder knowledge, as a path to early succession planning and renewed growth.

Table 7.5 – Findings across all the three cohorts

Cohort	Findings from cross-case analysis using the 5-Loop framework	5-Loop framework emphasis by Cohort	Visual representation of findings by Cohort using the 5-Loop framework
<p>Cohort 1</p> <p>Young Firms</p> <p>SMEs < 10 years</p>	<p>For Young firms having high PACAP alone, in itself, would appear to be an insufficient indicator of high-level performance of the firm.</p> <p>For Young firms it would appear that for a firm to have a growth imperative, management should demonstrate an equal focus on commercialisation as well as the provision of a differentiated solution to enable value creation for the firm.</p>	<p>External Loop (Commercial focus)</p> <p>Individual Loop (Founder)</p> <p>Outputs Loop (Revenue)</p>	 <p>Notes to the figure: Cohort 1 emphasise the External engagement, the Individual mainly driven by the founder and an Output generating shareholder value.</p>
<p>Cohort 2</p> <p>Adolescent firms</p> <p>SMEs >10 years < 20 years</p>	<p>For adolescent firms, the need to formalise and systematise organisational innovation processes are a significant value adding process that underpins sustainable growth.</p> <p>For adolescent firm growth must be managed through proactive managerial cognition and action for learning and innovation in this phase of the organisation lifecycle.</p>	<p>External Loop (Engagement)</p> <p>Organisation Loop (Management Structures)</p> <p>Individual Loop (Diversity)</p> <p>Outputs Loop (Recurring revenue)</p>	 <p>Notes to the figure: Cohort 2 External engagement routines, Organisational management structures evolve, Staff diversity, Outputs are recurring generating shareholder value</p>
<p>Cohort 3</p> <p>Mature firms</p> <p>SMEs >20 years</p>	<p>For mature firms, the importance of strategic planning including succession planning for sustainable value creation in multigenerational firms.</p> <p>For mature firms, the requirement for continual management investment and reinvestment in innovation regardless of the external environment for long term sustainability of the firm.</p>	<p>External Loop (Multiple Markets)</p> <p>Organisation Loop (Managed RD&I)</p> <p>Individual Loop (Diversity & Growth)</p> <p>Outputs Loop (Reinvestment & Growth)</p>	 <p>Notes to the figure: Cohort 3 Multiple External engagements, , Organisational structures systemised, Diverse and ongoing Staff hires, Outputs reinvested for exploratory and exploitation returns</p>

Source: Author

7.4 Contributions

7.4.1 Contribution to Theory

Through the review of the ACAP literature covering over 30 years, as outlined in Chapter 2.4, it was observed that further development of the Integrative framework proposed by Volberda et al. (2010) was necessary. This resulted in the generation of a progressive integrative ACAP process model, Figure 2.30, being developed. This process view expanded on the extant integrative typology model of ACAP, with the inclusion of additional antecedents and outcomes which can affect expectation formation within a firm. This integrative process view allows for an ecosystem perspective of both current customers and suppliers as sources of ecosystem knowledge and input as referenced by Adner and Kapoor (2006) and Schweisfurth et al. (2018) and others presented in Chapter 2. This progressive integrative process view represents the author's learnings on the variables and the additional contributions these antecedents and outputs can provide in a more holistic view and contribution to the ACAP construct.

Whilst Figure 2.30 in its current format added to theory of the ACAP construct, the author further contributed to theory by developing a *working process model* to facilitate addressing the identified gap of empirical managerial engagement with SMEs in the application of the ACAP construct. This *working process model* was provided via the 5-Loop Framework, Figure 2.31. Each of the 5 Loops were a distillation of the literature as outlined in Appendix 1. This allowed for the representation of the External, Organisation, Individual and Output loops with a superimposed permeable ACAP loop, which represents the operationalisation of the ACAP process, connecting all loops and indicating the knowledge flows necessary within the firm. Through the use of the 5-

Loop framework in practice, in this research, the development of a Diagnostic Instrument was conceived which can contribute to the management need for *recognition* of ACAP levels within the firm. This Diagnostic Instrument is further described in the second of the contributions from this research, contribution to management practice described in the next section.

7.4.2 Contribution to Management Practice

As was outlined in section 2.1, Grant (1996) proposed that the role of the firm is to integrate the specialist knowledge resident in individuals into goods and services, while the primary task of management is to establish the coordination necessary for this knowledge integration. This premise is based upon management being *aware* of the knowledge available and its management possessing the ability to *recognise* the gaps in knowledge required to generate these goods and services, to create value for the customer and value for the firm. It is this ‘awareness’ that allows the firms and particularly the top management team (TMT) to act, demonstrating the *capability* to act.

If the knowledge is not within the firm, the ACAP construct can provide management with a path to understanding the process of acquiring, assimilating and/or transformation of the knowledge leading to the potential to exploit new knowledge. Criticism during the evolution of ACAP has been ‘how to interpret ACAP’ in such a way as to apply it to the firm, as was evident in the Forfás (2005, p.11) report. Marabelli & Newell (2014) demonstrated the difference in possession and practice of knowledge resident in the firm.

It is with a pragmatic worldview, after Creswell (2009), of management practice that an ACAP Diagnostic Instrument based on the 5-Loop framework was made available for future research. The Diagnostic Instrument, outlined in Objective 3, and its application should be considered for engagement at any of the different stages of growth of the firm defined in this research. Awareness is the first step in taking action at a managerial level. This Diagnostic Instrument can be considered as a method to calibrate firm strategy to the market dynamism, driving better management decision making. Table 7.6 indicates the approach.

Table 7.6 – ACAP template for firm engagement

	Young Firm	Transition	Adolescent Firm	Transition	Mature Firm
Age	<10 years.		>10 <20 years		>20 years.
Shareholder Value	€1M Euros		€5M Euros		€10M Euros
Employee #	< 10		<30		>50
Assessment Type	A	B ⇒	B	C ⇒	C
Assessment Characteristics	PACAP RACAP Exploration, Execution	A ⇐	Networks, Mgt. Cognition Organisation, Process. Transformation, Execution	B ⇐	Functions, Markets, Succession Investment Exploration, Transformation, Exploitation
PACAP (ideal)	High	↑	High	↑	High ↑
RACAP (ideal)	High	↑	High	↑	High ↑

Source: Author

Table 7.6 can be considered as a series of steps. Initially, secondary information could be collected prior to interviewing the firm including data on Age of the firm, Shareholder value and Employees numbers. Based on an assessment of the secondary firm data, the performance of the firm as a Young firm, an Adolescent firm or a Mature

firm, could indicate an expected level of the firm's ACAP which could be benchmarked by an interviewer in the middle section of the Table 7.6. The firm may fall into three distinct categories of A, B, C, in Table 7.6, it allows for higher or lower measures depending on the secondary data.

Once the firm levels have been estimated, an interviewer could then pose a series of questions using the 5-Loop framework addressing the challenges articulated in the research findings as discussed in Chapter 6.0, for the different maturity levels of the firm. Based on the interviewee responses, the Diagnostic Instrument might then indicate different levels of ACAP for the firm based on the growth trajectory of the firm.

It is proposed that a 5-point Likert scale could be used to assess the responses to the questions posed to the firm. With each series of questions informing different dimensions of the ACAP construct, an overall level of ACAP could be presented in the form of the 5-Loop framework visual. This would then create awareness of ACAP shortfalls and inform possible actions for management to take based on the responses. A proposed version of the Diagnostic Instrument is outlined in Appendix 5. It is anticipated that engagement with a Diagnostic Instrument in the future could be part of an Innovation audit conducted with the firm.

ACAP has been shown to be a dynamic and multidimensional organisational construct. It has been shown that knowledge flows within firms are not linear, but fluid. This requires that management continually assesses the locus of knowledge and how this might be leveraged as a strategic advantage. Zahra and George (2002) indicated that the role of management should be broad and cover both exogenous and endogenous contingencies in the firm. The management role is not just search activities or

operationalisation of the firm, but a holistic view of knowledge reservoirs and processes to generate, retrieve and share information internally as well as with the external environment. These skill-sets are not all resident with the founder or leader in an SME. Recognising that prior experience is beneficial but that it can also be a barrier for future growth, because of bounded rationality of an individual, unless it is combined with additional players with complimentary skills. Awareness of the need for management to learn and grow beyond their current capabilities would seem beneficial for SMEs. SMEs would benefit from participating in networks for all forms of learning within the organisation. This was highlighted particularly with the Young cohort as being technically skilled, but lacking in commercial experience and not participating in networks. Commercial skills were noted by Adams et al. (2006) as being critical to shareholder value creation.

SFI have invested heavily in knowledge centres and attracting knowledgeable workers to Ireland. It is recommended that these skilled employees or founders acquire additional management skills, required specifically for innovation and market growth, recognising this commercial gap. The processes required for different stages of growth emphasise different ranges of focus by management i.e., Sensing, Seizing and Reconfiguration. With Management being made aware of where the firm is located in its development cycle would benefit firms this would indicate firms are better prepared to apply the appropriate process or skills at the right time. The use of the Diagnostic Instrument would facilitate this awareness.

To influence firm performance, a broader managerial level of cognitive capabilities would enable these capabilities to be applied whether they are focused on exploration or exploitation (Helfat & Peteraf, 2015; Wang et al., 2007). The ability to develop this

higher level of strategic assessment and reconfigure routines and resources as needed, would benefit the firm at different stages of growth.

7.4.3 Contribution to Methodology

The context for this research was small state, late developer economies. While the location chosen was the Republic of Ireland, the research contributes to the broader entrepreneurial research on SMEs and the growth imperative emphasised by small state policies. The Irish context provided important insights into the entrepreneurship and entrepreneurial practices in SMEs. As was covered in Chapter 3, successive Irish policies have relied on attracting export orientated, inward, foreign direct investment for economic growth.

By selecting indigenous Irish SMEs that were geographically dispersed and varied in age and size but were export orientated, this methodology and subject would appear to be unique in entrepreneurial research in small states. In choosing a cross-case methodology for this exploratory research (Eisenhardt, 1989; Yin, 2018), it will contribute to the small but growing body of existing research on entrepreneurship based on the ‘peculiar’ Irish model of small state economies.

This research methodology responds to Goffin et al. (2019) request for examples of improved quality case study design in innovation management with focused research topics, to be initiated. This research will help address the call for an increase in Irish research in Entrepreneurship made by O’Gorman (2015) to provide contextual exemplars reflecting the changing nature of entrepreneurship and the new emerging frameworks and theories.

7.5 Limitations

This research was extensive and it explored a broad construct from an SME and small state perspective. However, it did have limitations based on time and the potential to engage with a diverse number of SMEs. The selection of cases for this exploratory research was purposive and representative of export orientated Irish SMEs. As a small state, Ireland is representative of other small state economies promoting indigenous firms as a path to knowledge creation and export focused firms. While it is anticipated that many of the variables may be representative or adapted to other small states, the data originates uniquely from Irish SMEs and may pose limitations to generalisability to other small states.

7.5.1 Data Issues

While the number of SMEs was sufficient in terms of the Eisenhardt Method (1989) for theory building, and it followed the Yin (2002) multiple case study, it was indicated in Chapter 5 that one NUTS 3 regions, the Midlands, was not represented. Time did not allow for additional efforts to explore other firms, as a 40/40/20 representation of firms was achieved at a NUTS 2 level designation. All secondary data was provided via the Fame database. This data is consistent in this research but it does provide limitations to the overall data that can be obtained in advance of selection of candidate firms. A limitation of the data is dependent on that accuracy of the data available in the Fame database.

7.5.2 Methodological Issues

The research design planned for a mix of Founders or Managing Directors both male and female with a range of academic levels, as single informants. The firms represented

variations in the age of the firms in a small state context. For SMEs, the mental model of the founder is seen to drive the strategy of the firm, where Lane et al. (2006) indicated the characteristics of the members are an antecedent of the firm's ACAP levels. Since SMEs tend to maintain their founder or they evolve into a top management team (TMT) as indicated by Volberda et al. (2010), the interview of the Founder or Managing Director was deemed to be sufficient to represent innovation levels and firm performance within the firm. This single informant view may however contribute to a bias limitation based on the past experience of the founder. As an approach to remedy this limitation, future research may endeavour to include different TMT inputs for each firm. A mix of native and immigrant founders were identified as part of the research design. Given the number of possible variables in this research, diversity of input was mostly achieved, but it was noted that the participation of female founders was underrepresented, despite a significant number of female founders being identified in the pre-selection stage. Future research should ensure a more representative female founder or TMT participation level particularly by the Young and Adolescent firms.

7.6 Future research

This research was exploratory in design. What has been presented here provides opportunities for future researchers to build on the methodology and findings as a template. The creation of a Diagnostic Instrument lends itself immediately to descriptive research in other small state applications, including further research in Ireland. This research allows the findings and recommendations outlined in the Objectives to be explored potentially leveraging further more quantitative methodologies. Small states are emphasising the importance of female entrepreneurs, therefore, it is proposed that

expanding representation of female founders in the Young and Adolescent cohorts would be beneficial in future research. This research has provided a methodology to increase case-based research, where Ireland can provide a useful entrepreneurial lens for other small state economies.

7.7 Concluding remarks

This journey of exploring a management construct has highlighted the benefit of developing new skills and understanding for this researcher. What was initially proposed as a simple three step construct by Cohen and Levinthal in 1990, to address a path to innovation and sustainability, has led to a rich exploration of academic articles and publications based on multiple cases studies in a global aspect covering over 30 years. This increased level of thought and learning has allowed the researcher time to reflect on managerial practices, that might seem sometimes as automatic and routine but are grounded in theory and practice across many different economic locations. As a pragmatic international manager in the realm of technology and innovation, this journey has led to great insights and provided the opportunity to contribute to the extensive research that has gone before.

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Appendices

Appendix 1 – Categorisation of research from 2010 to 2020

Year published	Authors	Category	Methodology	Findings
2010	Volberda et al	ACAP process Revised ACAP model	Literature reviews	ACAP is a multidimensional construct. The implication is that theories that make use of AC as an <i>independent</i> variable cannot explain crucial (microlevel) links between AC and organisation level outcomes (e.g., differential innovativeness). Thus, we identify a gap in the current research and call for additional research that integrates the microfoundations of individual learning and intraorganisational level constructs in the hope that understanding these components of AC will enhance our understanding of AC.
2011	Lewin et al(Lewin et al., 2011)	Organisation	Literature reviews	We conceptualize metaroutines as the foundations of practiced routines. Proposed model for Managing adaptive technology while balancing and transferring knowledge back into the organisation.
2011	Lichtenthaler. U	External	Literature reviews	Open innovation practices concern the inter-organisational exchange of knowledge and the inflow of external knowledge into an organisation. However, these activities do not take place either automatically or easily (Szulanski, 1996) and require ACAP

2012	Daud. (Daud, 2012)	External	Cross sectional survey	New knowledge wherever it comes from, customer or supply demand, the information is processed and thus generates new knowledge or refreshes existing knowledge and helps increase a firm's effectiveness and efficiency.
2012	Cepeda-Carrion et al (Cepeda-Carrion et al., 2012)	ACAP process	Case studies Spain large firms	We propose that an unlearning context and an information systems (IS) capability are required to maintain an appropriate balance between potential absorptive capacity and realized absorptive capacity. Cepeda-Carrion et al 2012
2013	Glückler (Glückler, 2013)	External	Literature reviews	The existence of relations, membership and positions in networks all make a difference for firm innovativeness and the direction of information flows and knowledge production. While collaborative learning is based on interactions and active cooperation, this paper has also emphasised the role of non-relational and often rival learning. P890
2014	Marabelli et al (Marabelli & Newell, 2014)	ACAP process Revised ACAP model	Literature reviews	The model that was developed describes how the interaction between knowledge and knowing involving human and material actors (and power-over and power-to), produces capacity to absorb external knowledge
2014	Leal-Rodriguez (Leal-Rodríguez et al., 2014)	Individual	Case study Spanish Manufacturers	This author argues that the social relationships between the project team members enable the learning process of sense making, and, therefore, contribute to socializing the individuals' tacit knowledge.
2015	(Helfat & Peteraf, 2015)	Individual	Literature reviews	Identified specific types of cognitive capabilities that underpin dynamic managerial capabilities for sensing, seizing, and reconfiguring, and explained their potential impact on strategic change of organisation. Sensing, Seizing, Reconfiguring
2016	Valentim et al. (Valentim et al., 2016)	Knowledge	Case study Portuguese SMEs	Knowledge management practices in SMEs – focused on learning processes through collaboration with business partners favouring learning processes based on experience, knowledge transfer to employees and knowledge absorption by employees

2016	Argote et al (Argote & Fahrenkopf, 2016)	Knowledge	Literature reviews	Knowledge transfer depends on motivation, ability, and opportunity
2016	Lichtenthaler. U (Lichtenthaler, 2016a)	Results	Literature reviews	The cost of ACAP (benefits and downsides) to implement and its negative effects on firm performance. Future research needs to be sensitive to the potential trade-offs needed to address the contradictory contingencies that influence the functioning of absorptive capacity at the firm and other levels.
2016	Lichtenthaler. U (Lichtenthaler, 2016b)	External	Literature reviews	The distinction of technology and market orientations goes beyond earlier research into organisational learning and knowledge-based theory
2106	Lowik et al (Lowik et al., 2016)	Individual	Case study	Bisociative cognitive style have a positive relationship with exploitation activities, Associative cognitive style are better at assimilation activities.
2106	Lowik et al (Lowik et al., 2016)	Individual	Case study The Netherlands	Knowledge-intensive teams are characterized by highly qualified individuals who use creativity, ideas and concepts to solve complex tasks
2016	Ferreras-Mendez et al (Ferreras-Méndez et al., 2016)	External	Case Study Spanish SMEs	Breadth refers to the diversity of the firm's relationships with different types of external partners. Depth of external knowledge search represents the intensity of relationships with external partners. This study presents broad and deep connections with external agents as antecedents of AC learning processes
2016	Martinkenaite et al (Martinkenaite	Organisation	Literature reviews	The primary role of a firm is to mobilize its employees across different functional domains and to facilitate their interactions rather than increase the stock of relevant knowledge through R&D

	& Breunig, 2016)			investments. A 2 dimensional framework, Coleman 1990 “bathtub” model for better understanding of how a firm-level absorptive capacity emerges as an organisational capability
2017	Duarte Alonso (Duarte Alonso & Austin, 2017)	Organisation	Case study Australia	Key elements of the KBT of the firm, such as socialisation processes, tacit knowledge accumulated over extensive experiential learning, with direct implications for solution discovery and value creation are clearly associated and in unison with stakeholder theory ST. The validated applicability of this second theoretical framework confirms its usefulness to examine organisational learning OL orientated enterprises
2017	Lowik et al (Lowik et al., 2017)	Individual	Case studies Dutch industrial firm	Because individual ACAP is a key micro-foundational factor of organisational ACAP (Cohen and Levinthal, 1990; Lowik et al., 2016), and ACAP is a core capability for open innovation (Lichtenthaler and Lichtenthaler, 2009), we suggest that heterogeneity at the individual level can explain differences in open innovation practices across firms. Three antecedents, are that prior knowledge diversity, external network diversity and a bisociative cognitive style explain differences in individual absorptive capacity
2017	Zobel (Zobel, 2017)	Organisation	Case studies International	Firms need to intervene at the organisational level to ensure a successful integration of externally accessed knowledge resources. Zobel proposed a set of higher-order components of AC (recognition, assimilation and exploitation capacity) and their respective lower-order organisational processes (external scanning, strategic assessment; coordinating, integrating, knowledge management; resource cognition, recombining) to enhance the innovation effectiveness through absorptive capacity
2017	Saemundsson et al (Saemundsson & Candi, 2017)	ACAP process	Case studies Europe	Potential ACAP was divided into Problem ACAP and Solution ACAP positively related to identification of opportunities.

2018	Roper et al (Roper & Love, 2018)	External	Literature reviews. Conceptual framework	Firm specific characteristics - Innovation ambition, encoding capacity and strategy lead to heterogeneity in innovation outcomes within any knowledge context Firms' innovation ambition may also shape the type of search partners with which they engage as different partners provide very different types of knowledge
2018	Song et al (Song et al., 2018)	ACAP process revision	Literature reviews (1990-2016)	ACAP Multidimensional construct - Three dimensions of ACAP - ACAP effort (knowledge building), ACAP knowledge base (knowledge stock) ACAP process (internal procedures and practices related to knowledge diffusion). Defines three quantifiable outcomes of ACAP Knowledge acquisition, innovation generation, firm performance
2018	Schweisfurth et al (Schweisfurth & Raasch, 2018)	External & Results	Case studies Globally	Innovation occurs when knowledge about unmet customer needs intersects with knowledge about technological solutions. Both knowledge types are often located outside the firm and need to be absorbed in order for innovation to occur. To absorb knowledge from new customer segments, a firm's need absorptive capacity must be sufficient to support search breadth, while the absorption of knowledge from existing customers seems to require greater depth of absorptive capacity
2018	Darwish et al (Darwish et al., 2018)	Individual	Case Studies UAE	Our results revealed that leaders differ in their abilities to manage different learning processes of absorptive capacity and differ in their ability to create value from their absorptive capacity, therefore they have different impact on firm's innovation performance.
2019	Cordero P. et al (Cordero P & Ferreira, 2019)	Organisation	Literature review	Identification of 4 main strategies from literature review that would be applied to promote the AC, these strategies would be: 3.5.1External Search Strategy, 3.5.2Organisational knowledge management, 3.5.3Reverse Knowledge and 3.5.4Mechanisms not orientated to knowledge management.
2019	Marabelli et al. (Marabelli & Newell, 2019)	Organisation	Case study Boston	Power relations have the ability to constrain as well as promote knowledge absorption. Where power is used to control, it tends to lead to knowledge exploitation at the expense of the creation of new (prior) knowledge. Where power is used to empower individuals (in a performative way), it can better promote knowledge exploration

2019	Akgun al. (Akgün et al., 2019)	Individual	Case studies Turkey	Engineering managers should ensure that process related storytelling that engineers use can convey a more complicated message with far greater penetration than other methods of communication, and thus create a participatory platform for organisational learning as well as greater dialogue
2019	Tarifa-Fernandez et al (Tarifa-Fernández et al., 2019)	External	Case studies Spanish SMEs	In a context of growing uncertainty, firms have to integrate customers, key suppliers and partners into their internal supply chain business processes. Both external integration and ACAP are necessary to gain a competitive advantage
2019	Yu et al	Individual	Case Studies Japan	To promote ACAP a team first needs to promote ACAP at the individual level, Personal (pACAP). 7 factors that influence a team's ACAP, Networks and External sources, Personal prior knowledge, Personal motivation, Intra-team knowledge sharing, Team gatekeepers, Company's organisational structure

Appendix 2 – Forfás (2005) Technopolis report 2005 Questionnaire

Company/respondent identifier. (Forfás, 2005, pp. 113-117)

Survey for Forfás on Company Capabilities and Support Needs

1. About your company

a. Your Name

b. Company Name

c. Is the company owner-managed?

d. Is it part of an enterprise group?

If so, where is the head office?

e. How many employees do you have at your location (please estimate)

No of employees in 2001

Plan/expectations for 2007, do you plan to have more, the same or fewer employees.

g. What are your main products and services?

h. What is the approximate percentage of sales your company exports

2. ABOUT PRODUCTS AND PROCESSES

2.1 Concerning products

a. Have you introduced any new or significantly improved products or services on to the market in the last 3 years?

Please select

b. If yes, were the products or services developed (Tick one)

Mainly internally (within your company or group)

By your company in cooperation with other companies or institutions

Mainly externally (by other companies or institutions)

c. Roughly what proportion of your sales comes from products introduced in the last 3 years? ⁷² %

2.2 Concerning processes

a. Have you introduced any new or significantly improved production processes⁷³ in the last 3 years? Please select

72 This means a product or service, which is either new or significantly improved in its design, technical specifications, software, intended uses, or user friendliness. It should be new to your company; it does not necessarily have to be new to the market. It does not matter whether the new or improved product was developed by your company or by someone else. Do not include simple changes in appearance or pure selling of products of other companies

73 This means new and significantly improved: production technology, methods of supplying services or of delivering products. It should have a significant effect on the level of output, quality of products (goods/services) or costs of production and distribution. It should be new to your company; but your company is not necessarily the first to introduce this process. It does not matter whether the improved process was developed by your company or by another one. Purely organisational or managerial changes should not be included.

b. (If yes) and were the processes developed (read all three out and only tick one)

Mainly internally, (within your company or group)

By your company in cooperation with other companies or institutions

Mainly externally (by other companies or institutions)

2.3 What were the main factors behind your decision to undertake these innovations?

3. SUCCESS FACTORS FOR YOUR BUSINESS

3.1 How important is each of the following factors to the success of your business.

a. Introducing new or improved products/services aimed at existing customers Please select

b. Introducing new or improved products/services to attract new customers Please select

c. Expanding customer base for existing products. Please select

d. Complying with new regulation or legislative obligations. Please select

e. Regularly introducing new processes. Please select

f. Introducing new organisational and management techniques. Please select

g. Finding or using new technologies. Please select

h. Improving the productivity of personnel. Please select

i. Improving the efficiency of machinery and equipment. Please select

j. Protecting your knowledge. Please select

k. Co-operating with others (customers, suppliers, colleges, etc) in innovation projects. Please select

l. Accessing sources of finance Please select

m. Improving your technological understanding of your products and processes Please select

n. Quality certification (eg ISO 9000, supplier approval, ISO 14000) Please select

3.2 Compared to your international competitors, how well does your company perform in the following areas?

a. Introducing new or improved products/services aimed at existing customers. Please select

b. Introducing new or improved products/services to attract new customers Please select

c. Expanding customer base for existing products. Please select

d. Complying with new regulation or legislative obligations. Please select

e. Regularly introducing new processes. Please select

f. Introducing new organisational and management techniques. Please select

g. Finding or using new technologies. Please select

h. Improving the productivity of personnel. Please select

i. Improving the efficiency of machinery and equipment. Please select

j. Protecting your knowledge. Please select

k. Co-operating with others (customers, suppliers, colleges, etc) in innovation projects. Please select

l. Accessing sources of finance. Please select

m. Improving your technological understanding of your products and processes. Please select

n. Quality certification (eg ISO 9000, supplier approval, ISO 14000). Please select

4. ABOUT HUMAN RESOURCES

4.1 Please estimate the number of people in the company with.. No. of people

a. A higher degree (master's or doctorate)

b. A BSc or BA in science or engineering but not a higher degree

c. A non-scientific or technical BSc or BA degree but not a higher degree

d. Qualifications as technicians, but not a degree (A National Diploma or Certificate)

e. A National Craft Certificate qualification, but not a degree

f. No formal qualifications

4.2 Do you have any dedicated in-house R&D personnel? Y/n

If yes, how many people are employed in this capacity?

Number of Full Time Equivalents

If no, what proportion of company employees contribute to your innovation activity %

4.3 How many people in your firm have experience of working in a major foreign or multinational firm in your industry. Don't know.

If yes, do they bring any significant benefit to your company as a specific result of their 'large company' experience?

4.4 Does your company do any kind of training either in-house (on-the-job) or formal (off-the-job)?

4.5 At the following levels approximately how many days per person per year does your company devote to formal (off the job) training

- a. Shop floor
- b. Middle management
- c. Technical staff/graduates
- d. Top management

5. COOPERATING WITH OTHERS

5.1 Does your company belong to any of the following types of industry association or network

a A trade or industry association a. (eg IBEC, ISME, etc) Please select

b A formal business network with other companies. e.g., (Shannon Supply Network; a Plato network – a network where other businesses in the sector get together in order to share information for example)

c. A technology network with other companies (eg a network that is supporting technological developments or innovation within your sector e.g., Ceramnet Ireland, Bioengineering Network)

d If you are a member of a technology network, is a university or college involved?

5.2 Have you bought or used services from any of the following in the last three years? If they answer yes, ask whether this was inside or outside of Ireland.

Yes, In Ireland, Yes, In other countries

- a. University or college
- b. Research institute

c. Dedicated test facility/lab (not covered above)

d. Technical/scientific consultant

e. Business/Management consultant

5.3 Has your enterprise had any co-operation arrangements (for example a joint project) on innovation activities with other enterprises or institutions in the last 3 years?

5.4 If yes, from the following list what types of organisations were involved in these projects and what was their importance to your business?

a. Other enterprises within your enterprise group

b. Suppliers of equipment, materials, components or software

c. Clients or customers

d. Competitors and other firms from the same industry

e. Consultants

f. Commercial laboratories /R&D enterprises

g. Universities or other higher education institutes

h. Government or private non-profit research institutes

i. Other

5.5 Have you hosted students or new graduates from colleges to do placements or projects in the past three years?

If yes, how important has their work been to your innovation activities

6. IDENTIFYING TECHNOLOGICAL OPPORTUNITIES

6.1 Is someone in your company specifically responsible for monitoring opportunities for technical innovation (eg via trade press, new products by competitors, patents, licences)? Please select

a. (If yes) What is their job title?

b. What qualifications do they have?

6.2 How do you identify opportunities “out there” that can be applied to your business?

a. We use the Internet for research Please select

b. We get information from suppliers Please select

c. We get information from customers Please select

- d. We attend exhibitions / fairs Please select
- e. We use professional bodies / trade associations Please select
- f. We use technology network(s) Please select
- g. We have links with universities or colleges Please select
- h. We subscribe to a monitoring service Please select
- i. Others

6.3 Which of the following statements is applicable to your company

- a. Formal mechanisms, such as quality systems, are used to help the workforce to improve processes or products. Please select
- b. We have a suggestions scheme for product and process improvements
- c. Suggestions are regularly considered by management for implementation
- d. Those whose suggestions are taken up receive a financial reward Please select
- e. Management meets regularly to discuss our company strategy Please select
- f. The company documents its strategy in a business plan each year Please select
- g. New products or processes form part of the business plan Please select
- h. The plan includes detailed plans for employing people with specific qualifications (eg x graduates, y technicians, z craftsmen, etc) Please select

7. SUPPORT

7.1 Concerning public support

- a. Has your company received any public financial support for product or process development activities in the last 3 years? Please select

(If yes) From which sources? From the County Enterprise Board or another local agency

From Enterprise Ireland , From Shannon Development From the EU From other sources, please specify

7.2 For which of the following options would your company need external help (e.g from suppliers, consultants or colleges)?

- a. Adopting new ‘turn-key’ technologies Please select Please select
- b. Minor modification of technologies already used in- house. Please select
- c. Major modification of technologies already used in- house. Please select
- d. Making radical changes in technology Please select Please select

7.3 Do you have any further comments on your company's ability to innovate and the kind of support you think state agencies could provide? Please select

Thank-you for your participation.

We will e-mail you a link to our report to Forfás once the work is complete.

Appendix 3 – Topic list – Single informant

Interview topic guide

Introduction

This study is part of requirements for a PhD in management at Technological University Dublin (TU Dublin) supervised by Dr. Anthony Buckley

- The aim is to increase understanding of the components of innovation for internationally trading Irish firms and the influences on and determinants of that growth.
- Interviews with firms in knowledge and technology intensive sectors (.....) will be undertaken to examine the drivers of and constraints on the respective firms growth trajectories.
- In the final report your company and you can remain anonymous if you so desire.
- You do not have to answer any questions that you do not want to.

I would like your permission to record the interview. This will only be listened to by me, possibly my Supervisors and a professional transcriber. You will have the opportunity to review the transcript to provide any corrections or additional comments. I also plan to take notes during the interview.

- Have you any questions at this stage?
- Will you please sign the consent form?

Interviewee information:

Name				
Current position				
Gender	M/F	Age range	Founder	Y/N
Time with firm				
Previous positions with firm				
Prior experience/employment				
Highest level of educational attainment				

In this interview I will ask questions about four major areas of the firm, the external environment, the organisation, the personnel and your results that all contribute to the success of the firm

Interview questions:

Section 1: The external environment

- Why have you chosen to focus on your primary market?
- What motivates you to stay in this market?
- How do you keep track of changes in the market?
- Does any single customer or geographic market account for more than 30% of total turnover?
- How stable would you describe your main markets?
- How do you explore new market opportunities?

Section 2: The organisation

- How does the organisation set priorities for entering markets?
- How are decisions made on key organisational issues?
- How are external views integrated into decision making?
- Do you have a process for innovation?
- Do you have a product launch roadmap?
- How do you plan for success in the organisation in the next five years?

Section 3: Your personnel

- What is the makeup of your staff?
- How do you recruit new employees?
- What characteristics do you look for in new hires?
- Within the firm, how do you share information?
- How are work practices standardized?
- How would you describe the individual's working environment?

Section 4: Results

- How successful are you with product launches in the market?
- How do you protect your customer base?
- How do you measure the success of your solutions?
- What does internal success mean to you?
- Are there ever any non-financial reasons to launch a new solution?
- What percentage of sales do you reinvest in Research and Development?

Final questions!

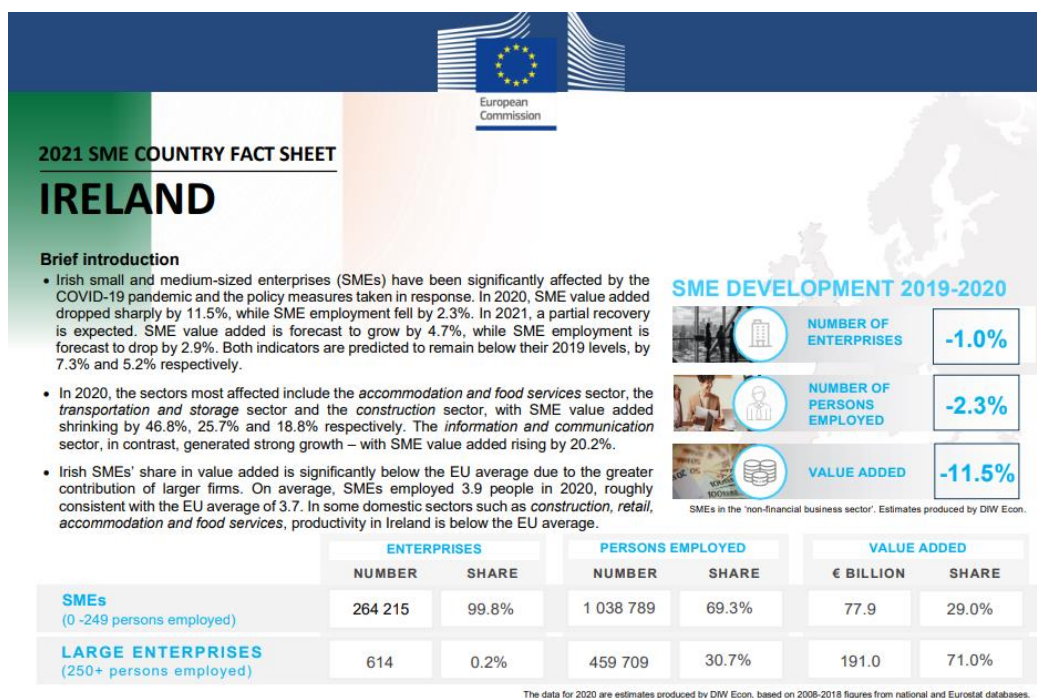
- Is there anything else you would like to add or anything important on the subject of innovation in your organisation that we have not covered?
- Would you like to receive a transcript – by e-mail or post?

Many thanks for your input and co-operation – the information provided will enhance the findings in the study.

Appendix 4 – Ireland SME fact sheet 2021

Source: [DocsRoom - European Commission \(europa.eu\)](https://docsroom.ec.europa.eu/)

European Commission



The data for 2020 are estimates produced by DW Econ, based on 2008-2018 figures from national and Eurostat databases.

SME-RELATED STRENGTHS AND CHALLENGES

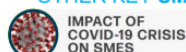
KEY STRENGTHS

- According to Eurostat, Ireland consistently performs above the EU average in terms of its share of high-growth enterprises and the employment share of high-growth enterprises.
- According to the World Bank, Ireland's regulatory environment is favourable to business. Ireland scores particularly well on regulatory ease of starting a business, paying taxes and resolving insolvencies.
- Ireland offers a favourable tax environment for business, including a corporation tax rate of 12.5%. However, SMEs need to increase their take-up of tax incentives and participation in foreign direct investment value chains that are hosted domestically, as reported by the OECD.
- A relatively high proportion of Irish SMEs engage in innovation activities (34.5%), although that proportion is down by 7 percentage points since 2014 (European Innovation Scoreboard 2020).
- Ireland provides good SME skills development support, although skills gaps persist.

KEY CHALLENGES

- The COVID-19 crisis poses very acute challenges to SME business continuity and recovery, with over half facing severe losses in revenue, according to the National Competitiveness Council.
- There is a need to stimulate growth in Irish SME exports - relatively low by international comparison. This challenge is made all the more urgent by the UK's decision to leave the EU.
- Irish SME productivity has declined over the last decade and is lower than the EU average in a number of domestic sectors such as *construction, retail, accommodation and food services*, all of which are labour intensive, according to the Irish Government.
- Cash flow irregularities – related to late payments and difficulties in accessing financial support – are a major challenge for Irish SMEs, as reported by the National Competitiveness Council.
- According to an OECD report, Ireland only introduced the 'SME Test' in 2019 and taxation measures are excluded from its application.

OTHER KEY SME-RELATED BRIEF INSIGHTS



IMPACT OF COVID-19 CRISIS ON SMES

The COVID-19 pandemic has had a significant impact on SMEs in Ireland. It contributed to a sharp fall of 11.5% in SME value added in 2020, as well as a 2.3% fall in SME employment.



GREEN TRANSITION OF SMES

The vast majority of Irish SMEs (93%) have introduced resource efficiency measures according to the Eurobarometer survey of SMEs and the environment; however, SME turnover from green product/service sales is very low by international standards, at less than half the EU average.



SOCIAL ASPECTS OF SUSTAINABILITY

Insolvency resolutions are faster in Ireland than in any other EU Member State, as reported by the World Bank. Ireland is also one of the Member States where giving entrepreneurs a second chance is more widely supported. In addition, Ireland is working to provide for a stand-alone restructuring process for the rescue of small companies.



MARKET ACCESS

Irish SMEs are not very active in external markets by international comparison, according to the OECD. Supports are available, including a new Trade Finance product, but more are needed.



REGULATORY BURDEN

Irish SMEs are less affected by the burden of regulation, administrative procedures and changing legislation than their counterparts in many other EU Member States.



START-UP ENVIRONMENT

The number of new start-ups reached a high point in 2019, with over 3 000 started per month. 2020 saw a noticeable decline in new business creation, 4% down on 2019 with the lowest figures recorded since 2016.



DIGITALISATION OF SMES

37% of Irish companies that responded to the Flash Eurobarometer 486 survey in 2020 view the lack of skills (including managerial skills) as a barrier to digitalisation, against an average of 20% in the EU.

The SME Performance Review monitors SME-related developments across the EU. For more information, please see: https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en

Appendix 5 – Proposed ACAP instrument for firm engagement

5-point Likert scale - Strongly agree, Agree, Unsure, Disagree, Strongly disagree

Strongly agree	Agree	Unsure	Disagree	Strongly disagree
1	2	3	4	5

Targeted questions addressing the 4 ACAP dimensions

Acquisition Questions: Ext: 2,3,4,5,6 Org: 1, (6)

Assimilation Questions: Org: 2,3,5,6 Ind: 2 (5)

Transformation: Questions: Org: 4, Ind: 1,3,4,5 (5)

Exploitation: Questions: Out: 1,2,3,4,5,6, Ext: 1, Ind: 6 (8)

External

7. The market we operate in, is stable
8. The firm interacts with a limited number of external entities in the market
9. The marketing effort only communicates outwards
10. The marketing effort does not source external information
11. There are no independent marketing sources
12. Universities provide no technological inputs

Organisation

7. Searching for external information is discouraged
8. The organisation does not document procedures
9. The organisation does not invest in storing information
10. Cross company interactions is not encouraged
11. External competition is not discussed
12. Internal knowledge is used for new product or process innovation

Individuals (Staff)

7. Employees are all educated to the same level
8. Employees have the same skills
9. Training for new skills is not encouraged
10. Employees are approximately the same age
11. Employees stay in the same role, do not rotate
12. Employee attrition (loss) is not a problem

Outputs

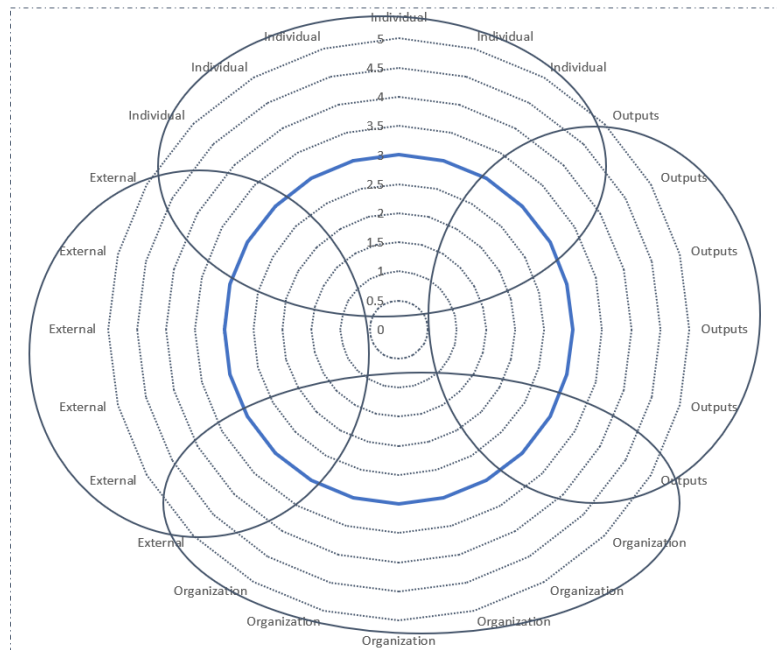
7. The organisation makes the same product every year
8. New products and services are not encouraged
9. We measure revenue for performance
10. Employee numbers do not change

- 11. We know our market share
- 12. We know the customer satisfaction levels

EXCEL based format

Point	Sections	Questions	Strongly agree 1	Agree 2	Unsure 3	Disagree 4	Strongly disagree 5		
1	Individual	Employees are approximately the same age			3			3	
2	Individual	Employees stay in the same role, do not rotate			3			3	
3	Individual	Employees attrition (loss) is not a problem			3			3	
4	Outputs	The organization makes the same product every year			3			3	
5	Outputs	New products and services are not encouraged			3			3	
6	Outputs	We measure revenue for performance			3			3	
7	Outputs	Employee numbers do not change			3			3	
8	Outputs	We know our market share			3			3	
9	Outputs	We know the customer satisfaction			3			3	
10	Organization	Searching for external information is discouraged			3			3	
11	Organization	The organization does not document procedures			3			3	
12	Organization	The organization does not invest in storing information			3			3	
13	Organization	Cross company interactions is not encouraged			3			3	
14	Organization	External competition is not discussed			3			3	
15	Organization	Internal knowledge is used for new product or process innovation			3			3	
16	External	The market we operate in is stable			3			3	
17	External	The firm has limited interactions with external market entities			3			3	
18	External	The marketing effort only communicates outwards			3			3	
19	External	The marketing effort does not source external information			3			3	
20	External	There are no independent marketing sources			3			3	
21	External	Universities provide no technological inputs			3			3	
22	Individual	Employees are all educated to the same level			3			3	
23	Individual	Employees have the same skills			3			3	
24	Individual	Training for new skills is not encouraged			3			3	
							Firm	Total	72

Visual output for neutral responses



The Blue line refers to the ACAP levels across the firm within the 5-Loop framework

List of Publications

2021 – ECRM21

Behan, FM & Buckley AP (2021). Using Sequential Mixed Methods to Evaluate the Contribution of Absorptive Capacity (ACAP). *20th European Conference in Research Methods in Business and Management (ECRM21)*. University of Aveiro, Portugal (Virtual), 17-18th June, ACI.

2021 – ECRM21

Using Mixed Methods to Evaluate the Role and Contribution of Disciplined Innovation Processes (DIPs) for Start-Up Growth and Development Saad Ahmed , Dr Anthony Paul Buckley and Francis Behan 1Technological University of Dublin, Dublin, Ireland 2Corning Inc. Corning, New York, U.S. saad.ahmed@tudublin.ie anthony.buckley@tudublin.ie, behanFM@Corning.com

2019 – ETHAC

TITLE: Evaluating the role and contribution of State-Funded Disciplined Innovation Processes (DIPs) in entrepreneurial success.

AP Buckley¹, Saad Ahmed², Francis Behan³

Discipline Specific Skills Training

Module	Title	Date	Location	ECTS
RESM 1953	Research Integrity	23-Jan-2019	TU Dublin	5
	Developing Breakthrough Innovation	20-Jan-2018	Dartmouth Tuck University	5
MECH 9002	Innovation & Knowledge	27-June- 2021	TU Dublin	5
GRSO 1002	Research Ethics RPL	14-May- 2021	Corning, NY	5
GRSO 1009	Career Planning RPL	14-May- 2021	CV	5
	Qualitative Comparative Analysis	22-May 2020	Erasmus University Rotterdam	5

Additional course Trinity College Dublin

Qualitative research tools -Qdaytraining January & March 2021

- Day 1 – Introduction to NVivo - Setting up your Qualitative Database
- Day 2 - NVivo Underway - analysing your data