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Using Sequential Mixed Methods to Evaluate the Contribution of Absorptive Capacity (ACAP)

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Abstract: How might Absorptive Capacity (ACAP) (Cohen & Levinthal 1990, Song *et al.* 2018) contribute to indigenous firm innovation and growth and how might the effects of this construct be evaluated at both firm and policy level? This paper demonstrates how a mixed methods research design and data analysis strategy can address the research question outlined above. Within the 'mixed methods' research genre, the design approach argued for here is for a 'sequential mixed methods research' approach. This is where one methodology is followed sequentially by another to add robustness to the overall findings from a study. The approach can also be described as a multi-phase research design depending on the number and type of research techniques utilised. Adopting this methodology however allows for data triangulation possibilities as the combination of archival data (secondary) and interview data (primary) gives complementary perspectives on the same proprietary dataset of cases (n=20)(Eisenhardt1989). Combining this triangulation of data with the proposed methodological triangulation can further strengthen the internal validity of the overall findings in the study. The data analysis strategy suggested here employs firstly an exploratory cross – case analysis (Yin 2018), using thematic coding (Saldana 2013) to identify the underlying ACAP mechanisms at play. This is then followed sequentially by a Qualitative Comparative Analysis (Rihoux and Ragin 2009). QCA is a data analysis technique which is used for determining which logical conclusions a data set supports. This proposed research design is applicable to complex research settings where a study can deliver findings on the 'contribution' of mechanisms underpinning ACAP (Cordero & Ferreira 2019), to the innovation and growth performance of the firm rather than assigning precise 'attribution' or impact measures to individual factors or variables.

Keywords: Mixed methods, Absorptive capacity, QCA, Innovation, SME.

1. Introduction and background to Absorptive Capacity

Grant (1996) in his knowledge based view of the firm, argued that the primary role of the firm is in integrating the specialist knowledge resident in individuals into goods and services. He also indicated that the primary task of management is establishing the necessary coordination for this knowledge integration. Many authors have recognized that this knowledge is not always resident within the firm (Chesbrough & Appleyard 2007). Having a stock of previous knowledge will complement certain external knowledge and lead to a competitive advantage and sustainability of the firm in new products and services. Cohen and Levinthal (1990), in their seminal paper, proposed that the ability of a firm to recognize, assimilate and exploit external knowledge is described as a firm's Absorptive Capacity (ACAP). This ACAP construct has been evolving and studied by many academics in the last thirty years but it still remains an evolving construct warranting further study. Song *et al* (2018) outlined the continual challenge for academics and practitioners with this construct.

There are two fundamental problems in the absorptive capacity literature, conceptual ambiguity on what absorptive capacity is and a lack of synthesized empirical findings showing how absorptive capacity matters for firm outcomes. Song *et al* (2018) pg. 2343

Despite being studied, applied and amended over the last thirty years, consecutive bibliometric analyses of ACAP (Apriliyanti & Alon 2017, Volberda, Foss and Lyles 2010, Lane, Koka & Pathak, 2006, Jansen, Van Den Bosch & Volberda, 2005, Zahra and George 2002, Todorova and Durisin 2007) all emphasize the multidimensionality of this construct. In the commercial world, knowledge management - whether internal or external - is dependent on the individuals within the firm. However Cohen and Levinthal (1990) state the ACAP of the firm is not simply the sum of the ACAP of its employees. It is also important to consider the organizational aspects of the construct. The developments of an organization's ACAP will depend upon and build on prior knowledge investments. However, it was not until the work of Volberda, Foss and Lyles (2010) that the *operationalization* of the construct was advanced. Volberda *et al* (2010) remind us that Cohen &

Levinthal placed R&D at the centre of the firm’s innovation processes by linking learning and innovation. They also remind us that ACAP overlaps with themes and fields of management practice such as cognition, knowledge and the important dynamic capabilities at work in a firm. Learnings underpin the early efforts of R&D and innovation. These learnings are created at both the individual and organisational levels. Cordero and Ferreira (2019) state that organizational mechanisms can be interpreted as the ‘design actions’ or ‘structural arrangements’ that will lead a firm to achieve its objectives.

Based on the previous thirty years of extant literature and empirical research, the authors of this paper conceptualised the five Loop framework, Figure 1, to describe the multidimensional interrelationships underpinned by ACAP In the innovation process. This visual representation captures the broader aspects of the multidimensionality of the ACAP construct. Song *et al.* (2018) suggest that:

Opportunities exist for rich theoretical development and empirical research by simultaneously considering the impact of different AC dimensions and their theorized mechanisms with external knowledge conditions. The explicit attempt to capture external knowledge conditions, their interactions with AC dimensions, and how such interactions influence firm outcomes would help develop a richer theory of AC. Pg. 2371

The five loop framework is the conceptualisation of the External, Organization, Individual, and Outputs as the key mechanisms driving the ACAP process loop. The hashed line indicates the knowledge flow (Jones, 2006) that takes place between the underlying ACAP process and the four mechanisms-driving knowledge exchange for value creation in the firm.

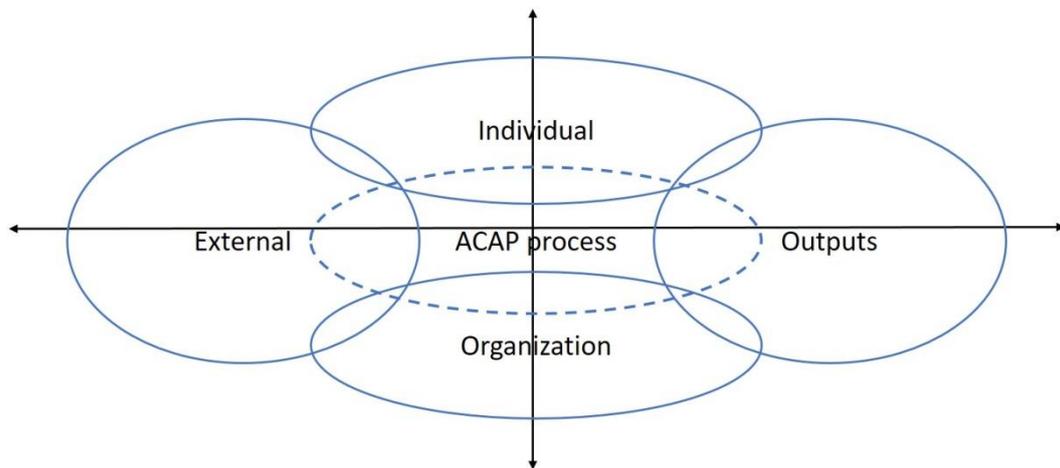


Figure 1: The 5 loop framework describing ACAP’s multidimensional interrelations. Source: Authors

2. External Environment

Within an Irish context, small to medium enterprises, SMEs, are those companies with less than 250 employees, make up 99.8% of the total enterprises in the Republic of Ireland according to the Central Statistics Office (CSO), See: Table 1. These figures are consistent across the EU in terms of the percentage of SMEs to total number of enterprises. However the contribution of SME’s in Ireland to value added in the economy is significantly below the EU average due to the presence of a vibrant FDI sector. See:Table 2.

Table 1: Number of persons engaged in SMEs by sector, 2013 – 2018

Year	Industry	Construction	Distribution	Services	Financial & Insurance	Total Business Economy
2013	109,688	86,494	239,689	419,112	30,653	885,636
2014	114,642	92,289	243,303	438,666	31,084	919,984
2015	118,376	102,690	251,059	463,991	32,765	968,881

2016	121,921	113,558	257,718	484,187	33,621	1,011,005
2017	125,596	128,303	264,684	509,914	35,116	1,063,613
2018	128,787	133,932	267,160	519,068	36,289	1,085,236

Source: CSO Business Demography (2019)

Table 2: SME's Basic Figures

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: SBA Fact sheet Ireland (2019)

The geo-demographic distribution of the selected firms in the study is linked to the Nomenclature of Territorial Units for statistics (NUTS) subdivision for regions in Ireland. See Table 3.

Table 3 Nomenclature of Territorial Units for Statistics (NUTS) subdivisions of Ireland

NUTS 2	NUTS Region	Code	Local Government areas
North & Western	Border	IE041	Cavan, Leitrim, Donegal, Monaghan, Sligo
	Western	IE042	Mayo, Roscommon, Galway, Galway City
Southern	Mid-West	IE051	Clare, Tipperary, Limerick City & county
	South East	IE052	Calow, Kilkenny, Wexford, Waterford City & county
	South West	IE053	Kerry, Cork & Cork city
Eastern	Dublin	IE061	Dublin City, Dun Laoghaire-Rathdown, Fingal and South Dublin
	Mid-East	IE062	Kildare, Meath, Wicklow, Louth
	Midlands	IE063	Loais, Longford, Offaly, Westmeath

Source: CSO website (2020)

Innovation is both contextual in terms of where the case firm is located geographically and the access to their chosen markets which is dependent on the organizational choices of the firm. Glückler (2013) outlined that the existence of relations, memberships and positions in external networks all contribute to the firm innovativeness through the flow of knowledge and knowledge production in these networks. The case firms in the study were therefore selected based on their geodemographic profiles using purposive sampling methodology.

3. Organization selection

It was important to choose case firms that were diverse in their product/technology offerings (but within the B2B sector). For this reason a purposive sample of firms were chosen which represented the knowledge – driven sectors of the Irish economy. The reference definition used by the CSO which links to the Eurostat documentation “Nomenclature générale des Activités économiques dans les Communautés Européennes” (NACE 2.0) which in translated as “statistical classification of economic activities in the European Community” was used.

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

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.”

The individual organizations may differ in their strategic decision making but open innovation research (Chesbrough and Appleyard 2007, Lichtenthaler 2011) indicates that the innovative approach taken by the firm – whether based on internal knowledge and/or on leveraged external relationships - will influence the sustainability and commercial success of the firm. It is not just the availability of external relationships and networks *per se* but it is the intensity of how firms engage with these entities that matters (Ferreras-Méndez, Fernández-Mesa & Alegre 2016). The processes and routines (Daud 2012) put in place by different firms will affect how each firm uses this knowledge in the achievement of sustainable growth. The semi-structured interview approach is deemed to be an effective way to engage with a broad cross section of different case firms. The founder/entrepreneur will be interviewed in each firm. This primary data will then be added to the secondary data gathered on each case firm to allow the researchers to produce a descriptive case analysis on each firm in the study (n=20).

4. Individual characteristics

As noted above the firm’s ACAP is not just the sum of the individual ACAP levels. The individual traits and educational background that founders and employees bring to the firm will affect the levels of innovativeness of the firm (Kato 2020). To promote ACAP within the firm, ACAP must be promoted at an individual or personal level (pACAP) (Yu and Washida 2019). How managers and founders encourage information sharing and engagement across individuals have been highlighted as key leadership traits within the firm (Akgün *et al* 2019, Darwish *et al* 2018). Individual ACAP is a micro foundational trait of the organization (Lowik, Kraaijenbrink & Groen 2017) indicating that heterogeneity of individuals is important and brings three different differentiation possibilities to the firm in terms of prior knowledge, diversity of experience and networks, and bisociative cognitive styles. Lowik, Kraaijenbrink and Groen (2016) further indicate the differences between an individual’s associative cognitive style and a bisociative cognitive style and they demonstrate how these styles impact on how teams and firms can assimilate and interpret data. This makes the case for leaders to pay particular attention to how they design their organisations, on who they recruit and on how they construct and task teams for innovation output.

5. Outputs

Lichtenthaler (2016) suggests that developing higher levels of ACAP can be costly to the firm. This cost can be particularly onerous for the small and growing firm as it can divert much needed resources from other more pressing short term needs. It therefore requires a significant commitment from the entrepreneur to keep committing resources to developing ACAP and the innovation process – particularly in increasingly VUCAH environments. Schweisfurth and Raasch (2018) further indicate that an enhanced ability to explore new markets must become a core part of the knowledge base of the firm – this exploration ability coalescing around the development of a deep understanding of the needs of the addressable market. It is therefore important that the firm develops a balanced scorecard of metrics (hard & Soft/short term/long term) for evaluating the output of their innovation process and their investment in ACAP.

6. ACAP operationalization

A large number of published papers (9,119 - based on Mendeley search, January 2021) have been generated since the seminal paper by Cohen and Levinthal, (1990). What is apparent from this literature review and the empirical evidence gathered to date is that this concept continues to evolve with major revisions to the construct appearing each decade, emphasizing the multidimensional nature of the construct. Attempts to operationalize the ACAP process have been developing since Cohen and Levinthal (1990). The concept evolved from a three step process – i.e. Recognize, Assimilate and Apply to a five stage process (currently). Researchers have generated a broad array of process models which attempt to capture the key drivers, antecedents and outcomes from ACAP (Zahra & George 2002, Lane, Koka & Pathak 2006, Todorova & Durisin 2007, Marabelli & Newell 2014) and most recently Song *et al* (2018). See Table 3 below.

Table 4: Development of ACAP process components since its inception in 1990

ACAP Process	Recognition	Acquisition	Assimilation	Transformation	Exploitation
Cohen & Levinthal 1990	Recognition		Assimilation		Exploitation
Zahra & George 2002		Acquisition	Assimilation	Transformation	Exploitation
Lane 2006	Recognition		Assimilation		Exploitation
Todorova & Durisin 2007	Recognition	Acquisition	Assimilation	Transformation	Exploitation
Marabelli & Newell 2014	Recognition		Assimilation	Transformation	Exploitation

Source: Authors

The authors in the domain have broadly agreed on the stages above in the ACAP conceptualisation. Zahra and George (2002) introduced two further refinements to the concept - *Potential ACAP (PACAP)* and *Realized ACAP (RACAP)*. 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. They hypothesized that Potential ACAP provides the firm with the flexibility to react in VUCAH environments whereas Realized ACAP is more aligned with performance metrics. .

7. Research Design

This paper argues for the use of a mixed methods research design as the most appropriate research design to answer the underlying research question. The use of mixed methods as an approach to research combines both qualitative and quantitative methodologies. This has become increasingly common to the point of being unexceptional and unremarkable in recent years (Bryman, 2006).

Figure 2 outlines the approach adopted in this paper.

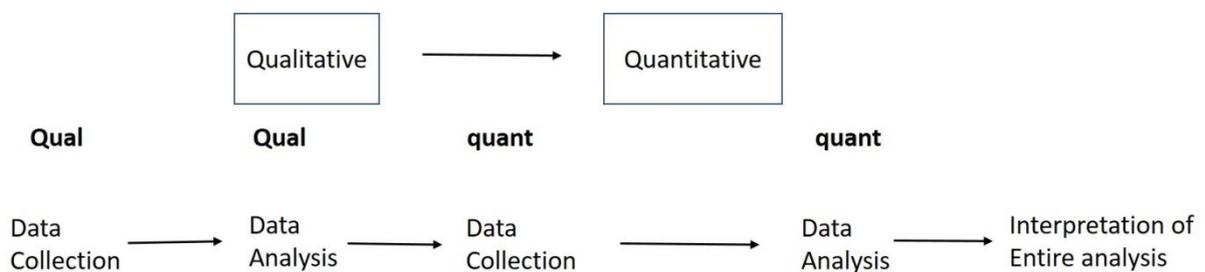


Figure 2: Sequential Exploratory mixed methods research design. Source: Adapted from Creswell et al. 2003

8. Stage 1 of Mixed Methods Study - Exploratory Cross Case Analysis (Qualitative)

Case study research has been used effectively to support evolving theories in the past (Eisenhardt, 1989) but while ACAP is not a new construct, certain aspects of the construct are still at the exploratory research stage. This research focuses on multiple SME cases (n=20). In planning the research a multiple case study approach was adopted following the process outlined by Yin (2002) which is illustrated in Figure 3.

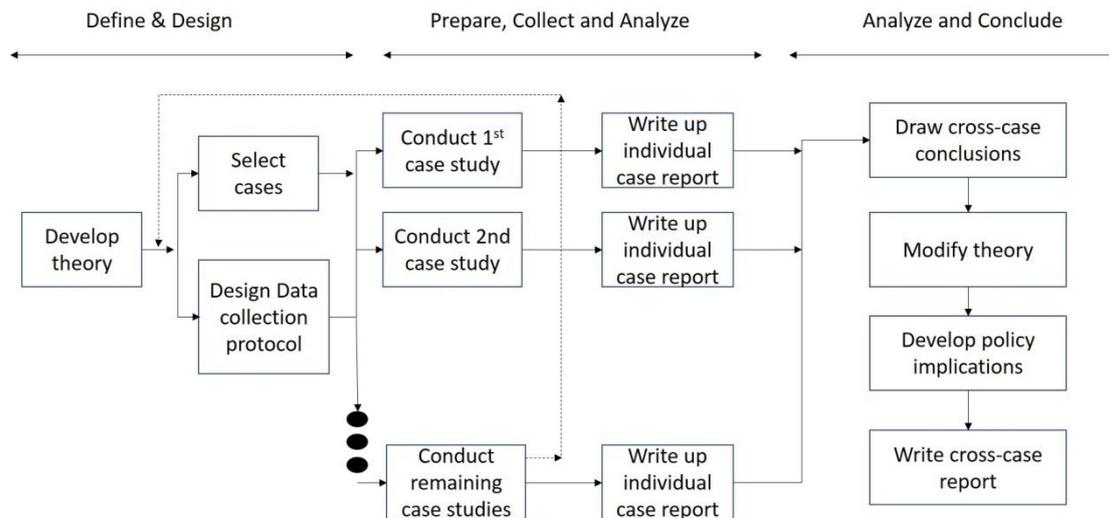


Figure 3 Multiple Case study procedure. Source COSMOS – Corporation

The case studies allow for the possibility of the identification and replication of the mechanisms driving levels of potential and realised ACAP. This is the first stage in the two stage process and can be described as the qualitative part of the research design (Creswell 2009). Following extensive archival research on each SME using the FAME database (Bureau de Djik, 2020) as the base secondary data source, the founding entrepreneur from each of the 20 firms in the study will be interviewed using a semi-structured interview protocol. The interviews will then be coded (Saldana 2013) and analysed using NVivo software to identify the presence or otherwise of the mechanisms driving varying levels of ACAP within the firms.

The cohort of firms have been carefully selected using purposive sampling (from a sectoral & geodemographic perspective) to be representative of the overall firm population under study.

9. Stage 2 of Mixed Methods study – Qualitative Comparative Analysis (QCA)(Quantitative)

The inclusion of a quantitative analysis technique QCA, allows for data and methodological triangulation possibilities, particularly as both the qualitative and quantitative techniques will be applied to the same dataset. Qualitative Comparative Analysis, QCA (Rihoux and Ragin 2009) is a comparative methodology based on set-theoretic theory which is mainly used in the social sciences for the assessment of cause-effect relations in case research. QCA can be used for the analysis of cases on all levels: macro (e.g. countries), meso (e.g. organizations) and micro (e.g. individuals). QCA is typically used for research in the 'no-man's land' of 5-30 cases, but it can also be used for larger samples and populations. This study utilises 20 cases and so QCA is a highly appropriate data analysis technique.

QCA differentiates itself as a research technique in a number of ways: QCA aims for causal interpretation and also makes use of truth tables to allow visualization and for analysis of the central features of causal complexity such as equifinality, conjunctural causation or the presence of insufficient but necessary INUS or SUIN conditions. Equifinality allows for different mutually non-exclusive explanations of the same phenomenon. Whereas conjunctural causation foresees the effect of a single condition unfolding only in combination with other precisely specified conditions. It is also noteworthy to mention the use of INUS as the condition that is 'insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result'. Equally the condition of SUIN stands for "sufficient but unnecessary part of a factor that is insufficient but necessary for the result"(Mahoney, Kimball and Koivu 2009) and finally, QCA makes use of the principles of logical minimizations, a process by which the empirical information is expressed in a more parsimonious yet logically equivalent manner than other techniques. It is thus an ideal complementary technique to cross-case analysis and helps provide the requisite rigor for an exploratory study of this nature.

10. Conclusion

ACAP is an evolving construct that is influential but often overlooked in business and management studies due to the lack of visibility of the concept.

This paper discusses the appropriate methodological approach for answering the research question in this study of ACAP. It also covers the justification for employing a two phase sequential mixed methods research design *in this* research study. In addition, the paper explains the cross-case approach employed, the selection process for the firm case-studies and the phase 2 Qualitative Comparative analysis (QCA) strategy. The findings of this study will be compared to the extant knowledge in the domain literature. The resulting gap analysis will allow recommendations to be made for future development in the domain and it will also highlight research opportunities in the field. Mixed research methods designs are particularly appropriate in non-experimental situations such as those described in this paper. Using mixed methods does however demand a wider skill set from the researcher. The mixed methods researcher must therefore stay abreast of methodological developments in the quantitative and qualitative domains and commit to a process of continuous up-skilling and competence building. Indeed Tashakkori and Teddlie (2010) refer to the need for mixed methods researchers to become 'methodological connoisseurs', just as Cameron (2011) calls for their appreciation of 'methodological trilingualism'. At the very least, mixed method researchers need to adopt a 'methodologically agnostic' stance to ensure that their own research heritage does not unduly influence their methodological and analytical choices. The combining of research methodologies in MMR studies should ultimately depend on the appropriateness of each method to helping answer the research question and reaching the research objectives set. This is the essence of a pragmatic approach (Cameron 2011).

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