Technische Universität München
TUM School of Computation, Information and Technology

Overcoming the Challenges of Digital Innovation

Qualitative Research on the Absorptive Capacity of Digital Innovation Knowledge in Israeli and German Traditional Manufacturing Small and Medium-sized Enterprises

Efrat Pan

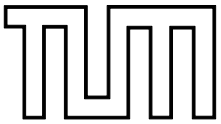
Vollständiger Abdruck der von der TUM School of Computation, Information and Technology der Technischen Universität München zur Erlangung einer Doktorin der Naturwissenschaften (Dr. rer.nat) genehmigten Dissertation.

Vorsitz: Prof. Dr. Hans-Joachim Bungartz

Prüfende der Dissertation:

1. Prof. Dr. Helmut Krcmar
2. Prof. Dr. Gerhard Schwabe

Die Dissertation wurde am 25.09.2023 bei der Technischen Universität München eingereicht und durch die TUM School of Computation, Information and Technology am 17.06.2024 angenommen.

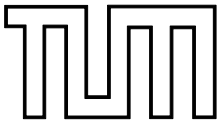


FAKULTÄT FÜR INFORMATIK
DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Dissertation in Wirtschaftsinformatik

Overcoming the Challenges of Digital Innovation

Qualitative Research on the Absorptive Capacity of Digital Innovation Knowledge in Israeli and German Traditional Manufacturing Small and Medium-sized Enterprises



FAKULTÄT FÜR INFORMATIK
DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Dissertation in Wirtschaftsinformatik

Die Herausforderungen der digitalen Innovation meistern

Qualitative Forschung zur Absorptive Capacity von digitalem Innovationswissen in israelischen und deutschen kleinen und mittleren Unternehmen des traditionellen verarbeitenden Gewerbes

Overcoming the Challenges of Digital Innovation

Qualitative Research on the Absorptive Capacity of Digital Innovation Knowledge in Israeli and German Traditional Manufacturing Small and Medium-sized Enterprises

Bearbeiterin: Efrat Pan
Aufgabensteller: Prof. Dr. Helmut Krcmar

Ich versichere, dass ich diese Dissertation selbständig verfasst und nur die angegebenen Quellen und Hilfsmittel verwendet habe.

Garching b. München, den 21.09.2023

Ort, Datum Unterschrift

I certify that I wrote this dissertation independently and only used the sources and aids indicated

Garching b. München, den 21.09.2023

Ort, Datum Unterschrift

Unless the Lord builds the house, those who build it labor in vain.

(Psalm 127, 1)

Foreword

This dissertation was written during the period between 2020-2023 at the Chair for Information Systems and Business Process Management at the Technical University Munich, under the supervision of Prof. Dr. Helmut Krcmar. It deals with a pressing topic: the challenges of digital innovation of small and medium-sized traditional manufacturing enterprises and it suggests best practices to overcome them. This topic has always been close to my heart, especially as personal experience gives me insights into two innovative but very different markets: Israel and Germany. This work represents a fascinating story of how these two markets deal with their digital innovation challenges differently. These differences are rooted in culture which in turn shapes entrepreneurial personalities. This work explores these differences emphasizing that there is no one truth, one leading market, but that by orchestrating learning, leadership defines the success of firms, especially of small and medium-sized, which manufacture traditional products in novel ways. I was honored to share the sense of urgency and interest in this topic with my supervisor Prof. Dr. Helmut Krcmar. I would like to deeply thank Prof. Dr. Krcmar for his confidence, interest in the topic, and the great opportunity he offered me. It is a huge honor to have worked with you. I learned a lot and I felt that I belonged.

A profound thank you to Prof. Dr. Axel Lamprecht for his consistent support, direction, and valuable contribution. An immense and sincere thank you to Christiane Trojan, for reviewing, discussing, and contributing to this work. I learned a lot from you and I enjoyed our exchange very much. Thank you for sharing this journey with me. A warm thank you to Helen, for asserting the urgency and relevancy of this topic. A deep thank you to Thomas, for his attention to detail. A tremendous thank you to all of the managers in Israel and Germany for your candidness, trust, and interest in this work. A deep thank you to Prof. Dr. Gerhard Schwabe for reviewing and supporting this work. I thank my family, Joachim and Jilai, for their support and endless understanding, and for accompanying my efforts with encouragement and patience.

Efrat Pan, Memmingen, 21.09.2023

Summary

Motivation

Digital Innovation (DI) refers to novel ideas that are enabled by the application of digital technologies in products and processes, to create new opportunities for firms, in other words, to help firms innovate (Yoo, Lyytinen, Boland, and Berente, 2010; Carlo, Lyytinen, and Rose 2012). Innovation through DI is crucial for long-term sustainability, especially in a changing and competitive environment. Some researchers define the changes firms undergo, whether in business models, products, or processes, as digital transformation. These changes rely on the combination of digital technologies in a way that transforms organizations and drives the innovation of firms (Levkovskyi, Betzwieser, Löffler, and Wittges, 2020).

In contemporary times, digital transformation in firms is necessary but challenging. This fact is evident in both the literature and the practice. In the digital era, this knowledge is mostly about DI which has to be integrated into the firm's offerings, whether the result is digital or not.

To thrive through these challenging times, firms must acquire DI knowledge. However, knowledge about DI is complex and in abundance. This creates opportunities but also overwhelms firms. Indeed, some firms are more successful in innovating through DI knowledge than others. Moreover, some geographical places are more innovative than others (Shane, 1992). The questions leading this work are, therefore, how do firms foster the absorption of DI knowledge and how can they increase their absorption?

Knowledge is the fundament of innovation creation (Zahra and George, 2002; Volberda, Foss, and Lyles 2010). Innovation capability depends on absorbing knowledge (Wuryaningrat, 2013; Chandrashekar and Subrahmanya, 2017). Since the 1990s, scholars have identified knowledge absorption, as a predictor, facilitator, and accelerator of innovation. This absorption capability was named Absorptive Capacity (ACAP) (Kedia and Bhagat, 1988; Cohen and Levinthal, 1990). Later scholars, describe ACAP as a process of absorption, assimilation, transformation, and exploitation of knowledge (Zahra and George, 2002).

Although DI knowledge is acquired as any other type of knowledge (Roberts, Galluch, Dinger, and Grover, 2012), its complexity makes it harder for firms (Kiefer, van Dinther, and Spitzmüller, 2021). Firms do not thrive in the market merely through acquiring technologically

innovative knowledge. In other words, exposure to knowledge and possessing a deep understanding of technologies are not enough. Firms must forecast the environmental shift, accurately adapt to the market, and manage their knowledge according to the firms' needs (Krcmar, 2015). Digitalization, therefore, requires the development of new capabilities to create new value. Since firms cannot do it by themselves, they must cooperate with the environment (Siachou, Vrontis, and Trichina, 2020).

Representing more than 95% of the world economy, SMEs are the backbone of every economy in every country (OECD, 2020). Their relatively smaller size allows them to remain flexible, however, a lack of manpower and resources limits their digital transformation progress. SMEs are especially challenged by the constant demand to integrate DI knowledge into their offerings, mainly due to their subjection to strict industry regulations demanding to maintain safety standards. These kinds of organizations need to change their business way of thinking and gain external knowledge (Siachou et al. 2020). Specifically, manufacturers of traditional products. However, "the literature still lacks attention to the digital transformation of traditional organizations" (Siachou et al. 2020, p. 4). Recent scholars stated that there is a need for more research on SMEs (Trenkle, 2019; Zhang, Xu, and Ma, 2022), especially through the perspective of ACAP (Avalos-Quispe and Hernández-Simón, 2019).

Method

This work focuses on how SMEs can overcome their digital innovation challenges and continue to prosper by using a cross-cultural comparison of ACAP practices in Israel and Germany. In the past three decades, this construct has been linked to innovation creation (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen, Van den Bosch and Volberda, 2005; Volberda et al. 2010, Roberts et al. 2012). The higher the ACAP of a firm is, the more innovative and successful is the firm. High ACAP means understanding the required external knowledge and implementing it in the firm. Moreover, the firm must identify opportunities and cooperate with other firms to create value (Jansen et al. 2005). In other words, the level of ACAP determines whether a firm would successfully transform what was acquired (Siachou et al. 2020).

There is a vast literature on the topic of ACAP dating back to 1989. But, to date, four gaps have been identified: (1) The first is the lack of understanding of what exact factors influence the

ACAP (Jansen et al. 2005; Volberda et al. 2010; Chandrashekar and Subrahmanya, 2017); (2) The second is concerned with the lack of a direct examination of this construct (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016); (3) The third is concerned with the under-representativity of research focusing in SMEs (Trenkle, 2019; Zhang et al. 2022); and (4) The fourth states a lack in cross-cultural analysis of the ACAP construct (Avalos-Quispe and Hernández-Simón, 2019; Dahlin et al. 2019). These gaps were answered in this work as described below.

The first gap was closed by conducting an extended literature review, covering 75 articles published between 1989-2020. These articles were elevated in a matrix (Webster and Watson, 2002), and analyzed using grounded theory (Wolfswinkel, Furtmueller, and Wilderom, 2011). The second gap was closed by favoring qualitative methods both in the literature review and in the empirical investigation (Flick, von Kardoff, and Steinke 2004, Gey and Zinke, 2014; Yin, 2009), from which direct proxies could be revealed (Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012). The third gap was closed by focusing on traditional manufacturing SMEs (Trenkle, 2019; Zhang et al. 2022). The fourth gap was closed by conducting a cross-case analysis (Eisenhardt, 1989; Yin, 1994) comparing two innovative countries, Israel and Germany (Avalos-Quispe and Hernández-Simón, 2019; Dahlin, Moilanen, Østbye, and Pesämaa, 2019).

Israel and Germany were selected since both countries share a similar baseline: They are well-developed, stable, democratic, and extremely innovative. However, they differ in their level of DI. Despite its innovation, Germany still lacks DI capabilities, especially amongst the SMEs, usually family-owned and regional-based (Gick et al. 2019). Moreover, research focused specifically on Israeli and German SME comparisons is scarce.

Since DI knowledge is needed for the innovation creation of firms, this work explores whether the SME firms selected for this research demonstrate different levels of ACAP. The purpose is to understand the role of national culture in their ACAP and innovation creation. Finally, through Design Science Research (DSR) (Hevner, Salvatore, Park, and Ram 2004; Peffers, Rothenberger, Tuunanen, and Chatterjee 2007; Sonnenberg and vom Brocke, 2012), an artifact was created. This artifact guides managers on how they could change their mindset and

behavior to overcome their digitalization challenges, by absorbing more DI knowledge, based on the collected best practices.

In sum, this work compares traditional manufacturing SMEs in two innovative markets: Israel and Germany. These firms' products are by definition non-digital, but, they need DI knowledge to produce those products. This work covers how SMEs access and use knowledge about DI for their commercial success, and how they may increase their absorption and implementation ability of this knowledge. The goal is to reveal how successful SMEs behave and operate and what best practices can help firms make a change. This work supports researchers suggesting that entrepreneurial orientation is required for innovation (Peeters, Massini, and Lewin 2014; Aljanabi, 2017; Stelmaszczyk, 2020) and that firms rely on cooperation with their environment to tackle the digitalization change (Krcmar, 2015; Siachou et al. 2020). By collecting the responses from the Israeli and German approaches, transferable best practices could be derived. An analysis of the differences between them helped trace possible causes that hinder firms, as well as best practices that helped real firms in the practice. Based on these findings, an artifact was designed, offering guidelines that managers can apply in their firms, regardless of the industry or the country. These guidelines were later evaluated in a workshop in two cycles (Mijač, 2019). The evaluation served as a basis for guidelines, on how to increase the absorption of DI knowledge.

Results

The results could be summarized as follows: Managers must practice an entrepreneurial mindset, and involve flexible and multidisciplinary teams to work on existing problems, but also to look for opportunities created by digital technologies. Increasing cooperation with the external environment, specifically with clients and government programs, helps achieve innovation but also commercialize it. Whether by using clients already at the start to decide what to acquire, involving them in the transformation phase for proof-of-concept, or receiving accompaniment and funds from government programs to support the firms throughout their digital transformation.

Implications

This dissertation is relevant to any function in a firm, namely managers, IT, and R&D, involved with the acquisition and assimilation of new external knowledge who need to optimize activities to process and utilize new knowledge and communicate this knowledge throughout the firm. Specifically in the transformation phase, the guidelines outline behaviors that distinguish the firm from incremental to disruptive results, helping them later to exploit it for their advantage. It is also relevant to researchers in the fields of ACAP, innovation, and more specifically, DI, who could regard the findings as a groundwork for further investigation into the value of ACAP to firms.

Limitations

This work has two types of limitations, theoretical and practical. The theoretical limitation has to do with the frameworks chosen for this work: ACAP and national culture. By focusing on these frameworks, it may be that other frameworks were overlooked. The practical limitation has to do with the transferability of the guidelines, which is subject to the willingness of managers and teams to undergo the required change, certain regulations in each industry in each country, which may limit the implementation of some guidelines; and finally, the dependency on the public sector to change to some degree, so firms may derive the same benefits and opportunities as their counterparts may do in other countries.

Table of Contents

1 Introduction 13

1.1 Motivation and Relevance 13

1.2 The Goal of this Work 17

1.3 Research Questions and Methodology 18

1.4 Structure of the Work 24

2 Conceptual Framework 27

2.1 Absorptive Capacity 27

2.2 Innovation 32

2.3 Digital Innovation 33

2.4 SMEs 36

2.5 Culture 37

2.5.1 National Culture 37

2.5.2 National Culture in the Context of Entrepreneurial Orientation 40

2.5.3 Applying Kiefer's Organizational Cultural Values to Hofstede's Dimensions. 42

2.5.4 Culture, Mindset, and Innovation 46

2.5.5 Individual Culture and Innovation 46

2.5.6 Organizational Culture and Innovation 48

3 Theoretical Framework: A Literature Review 50

3.1 Design of the Literature Review 51

3.2 Results: The Influencing Factors of ACAP 54

3.3 Individual Influencing Factors 58

3.3.1 Knowledge Base 58

3.3.2 Team 62

3.3.3 Coordination Capabilities 66

3.3.4 Managers 69

3.3.5 Inter-Organizational Collaboration 71
3.3.6 Environmental Features 74
3.3.7 Mediating Institutions 77
3.3.8 Influencing Factors: Summary 78

3.4 The Formation of Categories and Sub-categories 80
3.4.1 Inter-Organizational Collaboration 81
3.4.2 Intra-Firm Relations 82
3.4.3 The Influence of the Factors on the ACAP Phases 84

3.5 The Hierarchy and Interaction of the Influencing Factors 86

3.6 ACAP of DI Knowledge: Summary 89

3.7 The Empirical Implications of the Theoretical Results 92

4 Innovation in Traditional Manufacturing SMEs 98

4.1 Digitalization in Israel and Germany SMEs 100

4.2 Research Methodology and Design 111
4.2.1 Qualitative Research 111
4.2.2 Case Studies 112
4.2.3 Semi-structured Expert Interviews 113
4.2.4 The Cases 113
4.2.5 Interview Partners and Interview Setup 114
4.2.6 Design of the Questionnaire 114
4.2.7 Case Presentation 120
4.2.8 Data Analysis: Within - and Cross-Case Analysis 122
4.2.9 Limitations 123

4.3 Case 1: Israeli and German Industrial Furnaces SMEs 124
4.3.1 Summary of the Interviews: Case of Industrial Furnaces 125
4.3.2 Within-Case Analysis 129
4.3.3 ACAP and Innovation Creation in the two Industrial Furnace Firms 134
4.3.4 Interim Conclusion 135

4.4 Case 2: Israeli and German Food Packaging SMEs 137
4.4.1 Summary of the Interviews: Case of Food Packaging 138
4.4.2 Within-Case Analysis 143
4.4.3 ACAP and Innovation Creation in the two Firms 149

4.4.4 Interim Conclusion: The Case of Food Packaging 151

4.5 Case 3: Israeli and German Dental Implants SMEs 152
4.5.1 Summary of the Interviews 153
4.5.2 Within-Case Analysis 157
4.5.3 ACAP and Innovation in Israeli and German Firms 160
4.5.4 Interim Conclusion: The Case of Dental Implants 161

4.6 Case 4: Israeli and German Pipe Fittings SMEs 163
4.6.1 Summary of Interviews 164
4.6.2 Within Case Analysis: Case of Pipe Fittings 171
4.6.3 ACAP and Innovation in the two Firms 174
4.6.4 Interim conclusion: The Case of Pipe Fittings SMEs 176

4.7 Cross-Case Analysis 177
4.7.1 Similarities 177
4.7.2 Differences 181
4.7.3 ACAP of DI knowledge in Israeli and German Traditional Manufacturing SMEs 185
4.7.4 Implications: Culture as a Cause for Difference in ACAP of Israeli and German SMEs 195

5 Artifact: Design and Methodology 205

5.1 Guidelines for Conducting Design Science Research: Review 206

5.2 Methodology: Design and Evaluation of Management Guidelines 207

5.3 Analysis: Understanding of the Problem 211
5.3.1 Summary of the Influencing Factors for Effective ACAP 211
5.3.2 Summary of Best Practices according to the Phases of ACAP 216

5.4 Design of the Artifact: Framework, Guidelines, and Operating Conditions 219
5.4.1 Deriving Guidelines 220
5.4.2 Development of the Artifact 227
5.4.3 Operating Conditions 231

5.5 Evaluation of the Managerial Guidelines: Workshop 233
5.5.1 First Evaluation 236
5.5.2 Final Evaluation 237

5.6 The Final Artifact 239
5.6.1 Diffusion 242

6 Summary 243

6.1 Review of Theoretical Findings 245

6.2 Review of Empirical Findings 246

6.3 Contribution and Practical Implications 249

6.3.1 Theoretical Contribution 250

6.3.2 Practical Implications 252

6.4 Limitations 253

6.5 Avenues for Further Research 255

7 References 256

8 Annex A: Methodology of Pretest 281

List of Figures

Figure 1: The structure of this work. Own illustration. 26

Figure 2: The framework of the ACAP construct, divided into consecutive phases which lead to innovation. Own illustration. 30

Figure 3: The relationship between ACAP and innovation. Own illustration. 31

Figure 4: Including and excluding criteria. Own illustration. 53

Figure 5: The flow of knowledge in the ACAP process. Own illustration. 85

Figure 6: The framework of culture, ACAP, and innovation. Own illustration. 197

Figure 7: The five Cultural Dimensions of Israel and Germany. PD: Power Distance, IND: Individuality, MAS: Masculinity, UAI: Uncertainty Avoidance, LTO: Long Term Orientation. (Hofstede Insights, n.d.) 199

Figure 8: The ACAP of DI knowledge framework. Own illustration. 225

Figure 9: The influencing factors active in each ACAP phase. Own illustration. 225

Figure 10: The full environmental context of the ACAP process. Own illustration. 226

Figure 11: The initial artifact. Own illustration. 233

Figure 12: The final artifact. Own illustration. 241

List of Tables

Table 1: A comparison between the organizational values of Kiefer and the cultural dimensions of Hofstede. (+) Long/high (-) short/low (~) middle (balanced). 45

Table 2: Concept Matrix: The influencing Factors of ACAP. (+) having a positive influence on ACAP, (-) having a negative influence on ACAP, and (~) the position of the article is indecisive. 56

Table 3: Concept Matrix, Part 2: The influencing factors of ACAP. Quantitative studies. The article describes a (+) positive influence, (-) a negative influence on ACAP, or (~) the position of the article is indecisive 57

Table 3: Differences between the Israeli and the German Furnace SMEs. 132

Table 4: Differences between the Israeli and German Food Packaging SMEs. 147

Table 5: Differences between the Case of Israeli and German dental implants SMEs. 159

Table 6: Differences between The Case of Israeli and German Pipe Fittings SMEs. 174

Table 7: Cross-case analysis of the ACAP of DI knowledge in Israeli and German traditional manufacturing SMEs. Own illustration according to Miles and Huberman, 1984. 192

Table 8: Frequencies. Own illustration according to Vogelsang et al. (2013). (*) with clients (**) with universities. 194

List of Abbreviations

ACAP: Absorptive Capacity

DI: Digital Innovation

SME: Small and Medium-sized Enterprises

1 Introduction

1.1 Motivation and Relevance

"Digital innovation refers to novel ideas that are enabled by digital technology" (Carlo et al. 2012, p. 867). Digital Innovation (DI) is the driving force behind innovation and is crucial for long-term sustainability in the industry (Cavillier and Wieser, 2018; Ciriello, Richter, and Schwabe, 2018). Firms that will successfully overcome their digital challenges will maintain their competitive advantage (Faro et al. 2019, in Levkovskyi et al. 2020). Similarly, those that fail, will cease to exist (Griffiths et al. 2018, in Levkovskyi et al. 2020). In 2018, less than 20% of companies were focusing on DI knowledge (Manyika et al. 2016; Cavillier and Wieser, 2018). In 2021, 67% of the surveyed companies stated that "they have accelerated their digital transformation strategy, making it their top priority" (KPMG Global Report, 2021, p. 9).

The term DI knowledge is distinguished from digital technologies since it refers to new ways of using digital technologies to create novel concepts and ideas, and new processes that are enabled by digital technology and their application is original and new. DI can manifest in digital processes, digital manufacturing technology, digital products, or new digital business models. This also holds true if the product itself is not digital and if DI knowledge is not at the center of the knowledge base of the firm. In such firms, the DI knowledge will have to be acquired externally. To do so, firms invest much effort in finding and understanding digital technologies and integrating them into the firm and/or its products (Fichman, Dos Santos, and Zheng, 2014).

All firms struggle with DI knowledge (Kammerlander, Matzler, and Prügl, 2017; Bitkom Research, 2020; OECD, 2020; Avalos-Quispe and Hernández-Simón, 2019; Kiefer et al. 2021). The increased competition, technological complexity, and changing market needs increase the pressure to innovate. Since innovation is linked to the sustainability of firms, they must strive to innovate in a digital environment, despite the challenges (Kiefer et al. 2021). The first aspect is to gain knowledge.

Knowledge is the fundament of innovation creation and is therefore essential for firms to compete in the market (Zahra and George, 2002; Volberda et al. 2010; Wuryaningrat, 2013;

Chandrashekar and Subrahmanya, 2017). However, firms do not thrive in the market merely through acquiring technologically innovative knowledge but by forecasting the environmental shift, accurately adapting to the market, and managing the knowledge according to the firms' needs (Krcmar, 2015). In light of the increasing importance of DI knowledge for the innovation capability of firms, researchers seek to understand: What hinders firms from acquiring DI knowledge and how can firms enhance their absorption of DI knowledge.

On one hand, „the capability of a firm to create innovation depends on its knowledge resources" (Wuryaningrat et al. 2013, p. 62). On the other hand, the success of this process depends on the integration of such knowledge through a different organizational mechanism (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen et al. 2005; Volberda et al. 2010, Roberts et al. 2012; Krcmar, 2015). It is, therefore, important to get a holistic view of how firms absorb DI knowledge to adapt to their changing environment. This work begins by reviewing the challenges that surface due to the changing environment and then attends to reviewing how firms may overcome the challenges by accessing and integrating knowledge.

The main obstacles to acquiring and integrating knowledge can be divided into two perspectives: cultural and industrial. The cultural perspective claims that knowledge is hard to acquire due to learning barriers, cultural differences, and the need for mental change (Attewell, 1992; Darwish, Zeng, Rezaei Zadeh, and Haak-Saheem, 2020). The cross-cultural framework indicates that some cultures are more innovative than others (Shane, 1992). This fact found support also in recent literature comparing German and US firms (Krcmar, 2015).

The industrial perspective relates mainly to the segment in which the firm operates, its size, and the establishment age of the firm (Ohlert, Giering, and Kirchner, 2020). These factors determine different levels of safety in the end product (for example in automotive) or in the production processes (Ohlert et al. 2020). Moreover, different industries require different digital technologies. For example, manufacturing requires automation of production (Lerch, Jäger, and Maloca, 2017; Ohlert et al. 2020). Consulting firms rely on knowledge. They require big data, cloud computing, and online platforms (Arntz, Gregory, Jansen, and Zierahn, 2016; Ohlert et al. 2020). Service sectors require mobile devices. The healthcare segment requires monitoring. Finally, especially traditional firms whose product is not digital, need to transfer their organizational culture to accommodate the changes imposed by DI (Kiefer et al. 2021).

In terms of size and age: „The use of digital technology increases gradually with the size of the company„ (Ohlert et al. 2020, p. 5). Older organizations are less flexible, a fact which hinders them from adjusting to the required change. While there is no standard for achieving digital transformation, three dimensions of change were identified over decades of research. A change in the business model, technological capability, and organization. For example, using DI knowledge for production and operations is one of the top indicators that there is a change in the business model, technical capability, and organization (Zhang and Chen, 2021).

Lack of will and resources alongside limited IT systems, are the main reasons why digital transformation fails. This could be solved by improving the open communication between IT and management, regardless of the industry (Fitzgerald, 2013). Moreover, the success of digital transformation depends on the full integration of the change in the overall firm, and not on individual projects (Krcmar, 2015). This includes changes in value creation such as the usage of digital technologies in R&D, production, operations, human resources, marketing, finance, and customer service. But also in the communication, documentation, and standardization of processes. Finally, digital technologies enhance the response time to the market (Zhang and Chen, 2021).

Different types of firms face different challenges depending on their size, structure, and value creation. However, this work focuses on small and medium-sized enterprises (later: SMEs), that would have to change their business model, product, or processes due to DI. SMEs represent more than 95% of the firms worldwide (OECD, 2020). And yet scholars argue that there is still a lack of research focused on SMEs (Trenkle, 2019; Zhang et al. 2022), especially under an ACAP approach (Avalos-Quispe and Hernández-Simón, 2019). Like larger firms, SMEs must remain innovative to answer customer demand and remain competitive in their markets (Abernathy et al. 1985, in Kammerlander et al. 2017). This work, therefore, reviews the special challenges that SMEs encounter in their digital transformation.

Depending on the size, firms face different challenges when it comes to digitalization. While large firms stumble upon long processes and rigid structures, smaller firms enjoy flat hierarchies and faster decision-making, however, they lack the resources to purchase the necessary IT and the new employees' talent which is required (Becker and Schmid, 2020). Despite the less rigid structure, SMEs have fewer resources for investment in technologies, human resources,

training, and maintenance. Moreover, they must individualize their products according to client's demands, which makes the implementation of digital technologies more difficult. Moreover, legal issues also hinder firms from succeeding in their digitalization (Ohlert et al. 2020).

SMEs cope with the challenges of financing the high costs of learning, lack of technical competence, fewer skilled employees, high prices of raw materials, and inefficient supply chains. They also lack business confidence, which prevents them from undertaking innovation (Chandrashekar and Subrahmanya, 2017). SMEs are forced to pursue both exploration and exploitation (both testing and utilizing) since they cannot afford ambidexterity (Jansen et al. 2005; Broersma et al. 2016). In terms of leadership, this manifests in contradicting strategic decisions, such as solving the tension or prioritizing between protecting the core business and creating innovation (Broersma et al. 2016). Moreover, their cognitive ability is limited due to the smaller number of employees (Liao et al. 2003, in Roberts et al. 2012). Finally, SMEs evolve in an uncertain environment, where their lack of DI knowledge and resources prevents them from starting their digital transformation (Cavillier and Wieser, 2018). But what kind of knowledge is missing?

In sum, digitalization is understood as using digital technologies such as electronic devices, processes, and tools, to generate, store, or analyze data (European Commission, 2021). In the last two decades, customer needs have changed according to the possibilities following digitalization. Emerging new digital technologies have impacted almost every business, including manufacturing firms (Becker and Schmid, 2020). Firms had to evolve in the direction of customization and digitalization of production, and products, but first, to reevaluate and conceive the business models and the concept of value creation anew (Becker and Schmid, 2020).

Knowledge is the basis for overcoming digitalization challenges. Because DI knowledge is processed by the same mechanisms as other types of knowledge (Melville et al. 2004, in Roberts et al. 2012), the theoretical construct of Absorptive Capacity (ACAP) is used to take a closer look at how firms acquire external knowledge and turn it into innovation. Most important is that the success of this process depends on the integration of knowledge through organizational

mechanisms (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012).

Absorptive Capacity (ACAP) is defined as "the ability of a firm to recognize the value of new, external information, assimilate, and apply it to commercial ends" (Cohen and Levinthal 1990, p. 128). This theoretical construct predicts innovation because the underlying mechanisms catalyze innovative behavior (Cohen and Levinthal, 1990; Attewell, 1992; Zahra and George, 2002; Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012; Darwish et al. 2020). Therefore it is identified with a higher market value (Harrington and Guimaraes, 2005).

Over three decades, researchers have shown that firms enhance their innovation input (activities that help increase innovation) and innovation output (the result of their activities) by strengthening their capability of accessing and processing knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012). This requires external and internal activities. External activities include the constant search for new knowledge. Internally, this knowledge needs to be successfully integrated into the firm (Carlo et al. 2012; Nambisan, Lyytinen, Majchrzak, and Song, 2017).

1.2 The Goal of this Work

To address the main research question: 'How can SMEs improve their ACAP to harness more DI knowledge to their advantage?' It is important to understand first what mechanisms are crucial for the absorption of external knowledge and how they interact with each other. This was achieved by conducting an extensive literature review. Initially, the search was defined for articles about ACAP and DI knowledge specifically. However, the search yielded very few results. Since DI knowledge is similar to any other type of knowledge (Roberts et al. 2012), the terms ACAP and innovation were used. Deliberately, the search was not restricted to certain journals or to recent timeframes, since the motivation was to win an overall historic view of a wide range of articles covering this topic.

The working assumption was, that knowledge and access to it are not lacking. This holds true, especially in technologically advanced countries with high levels of resources and education, where companies operate internationally. It was assumed that when all the aforementioned

variables are held constant, there must be another explanation as to why some firms succeed while others fail (Shane, 1992).

To date, most research on digital transformation focuses on two aspects: technological and economic. These approaches fail to consider the aspect of culture, responsible for most failures in any kind of transformation (Kiefer et al. 2021). Especially smaller firms are more strongly rooted in cultural habits than their large international counterparts are (Gick et al. 2019).

Shane (1992) claims that different cultures show different levels of innovation (Shane, 1992). Dahlin et al. argue that no studies have yet tested ACAP in a cross-cultural context (Dahlin et al. 2019). Therefore, a cross-cultural examination was added. This allows comparing how firms absorb DI knowledge in different cultures. Similar countries in terms of their innovativeness: Germany and Israel were chosen to illustrate the illusive nature of DI specifically. The status of both countries with regard to DI is discussed in further detail in chapter four.

1.3 Research Questions and Methodology

Part 1: Enhancing ACAP

To fully understand how to enhance ACAP, researchers must seek first to understand the construct itself (Volberda et al. 2010). ACAP was originally defined by three dimensions: (1) Knowledge acquisition; (2) Knowledge assimilation; and (3) Knowledge application (Cohen and Levinthal, 1990; Zhai et al. 2018). Zahra and George (2002) reconceptualized and extended ACAP by grouping the phases into two levels and four dimensions: (1) *Potential ACAP* refers to the acquisition and assimilation of new knowledge, and (2) *Realized ACAP* refers to the transformation and exploitation of knowledge. The distinction between Potential and Realized ACAP illustrates that a company can have a high capacity for acquiring or assimilating knowledge while having a weak capacity for transferring and exploiting it (Volberda et al. 2010; Leal-Rodriguez, Ariza-Montes, Roldán, and Leal-Millán, 2014; Ciriello et al. 2018). However, the other way around this is not the case: Without Potential ACAP, Realized ACAP cannot be achieved (Zahra and George, 2002; Leal-Rodriguez et al. 2014).

Jansen et al. (2005) stated that it remains unclear what mechanism in the organization affects the ACAP. Based on a comprehensive bibliometric analysis of 1,213 papers, Volberda et al.

(2010) show that the mechanisms that enable organizations to identify, assimilate, transform, and exploit new knowledge to enhance their innovation are not yet fully understood (Volberda et al. 2010). In their view, a thorough examination of the factors that form and enhance ACAP is lacking. Chandrashekar and Subrahmanya (2017) also stated that there is a lack of consensus about the influencing factors of ACAP (Chandrashekar and Subrahmanya, 2017).

This work's arguments are built on these premises which were already accepted in research: ACAP directly leads to innovation (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane Koka, and Pathak, 2006; Roberts et al. 2012; Maes and Sels, 2014; Zapata-Cantu, Rialp, and Rodríguez, 2020). Due to the special features of DI, namely the complexity, accessibility, and programmability (which will be discussed in further detail in Chapter Two), the ACAP of DI knowledge is faster and more intense. The work relies mainly on the four dimensions of Zahra and George (2002) and traces which factors are relevant for each phase, and in what hierarchy.

Since the survival of firms depends on their ability to innovate and harness DI knowledge to improve their processes, business models, and offerings, firms need to first understand the ACAP construct before they can improve. The ACAP construct will become more tangible by supplementing it with factors and explaining how these enhance or hinder ACAP. The first research question is formalized as follows:

RQ1: **What are the influencing factors that enhance the ACAP of new knowledge?**

In the words of Yin: "A literature review is a means to an end. It is a preparation to understand a topic. Experienced researchers review previous research to develop sharper and more insightful questions about a topic" (Yin, 2009, p. 14). An extensive review covering the literature from 1989 to 2020 was therefore conducted. The purpose was to aggregate and re-clustered individual factors and their direction of influence on ACAP. 29 factors were identified as having a positive or a negative influence on ACAP.

By using grounded theory (Wolfswinkel et al. 2011), these influencing factors were clustered into 7 sub-categories that focus on either internal or external activities. These were: Knowledge-base, Team, Coordination Capabilities, Managers, Cooperation & Co-creation, Environmental Features, and Mediating Institutions. The sub-categories were later prioritized according to their level of influence and discussed in relation to DI knowledge. This review contributes to the

understanding of which influencing factors strengthen ACAP and how they relate to each other. The connection to DI knowledge was achieved by explaining how the special traits of DI knowledge may challenge the ACAP.

To answer the first research question, what are the influencing factors that enhance the ACAP of new knowledge, a systematic literature review based on the guidelines of Webster and Watson (2002) was conducted. Eventually, the five steps of grounded theory for literature review (Wolfswinkel et al. 2011) were applied. These methods helped determine what are the influencing factors that could enhance the ACAP of external knowledge, how they interact with each other, and what is their hierarchy in relation to DI knowledge.

The main goals of the literature review were (1) To aggregate existing knowledge by recombining the existing concepts of ACAP (Cohen and Levinthal, 1990; Lane et al. 2006) and entrepreneurial orientation (Peeters et al. 2014; Aljanabi, 2017; Stelmaszczyk, 2020); (2) To classify the factors into clusters and discuss their interaction with each other, and finally; (3) To identify research gaps.

Part 2: SMEs in their struggle with DI knowledge

"Firms reach different levels of innovation, due to different levels of ACAP" (Chandrashekar and Subrahmanya, 2017, p. 290). Different types of companies face different challenges depending on their size, structure, and value creation. More than 95% of the firms worldwide (OECD, 2020) are smaller manufacturing firms (SMEs), and yet scholars argue that there is still a lack of research focused on small and medium enterprises (Trenkle, 2019; Zhang et al. 2022), especially under an ACAP approach (Avalos-Quispe and Hernández-Simón, 2019). Moreover, most of the research on ACAP is done quantitatively, restricting the findings to indirect proxies (Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012). Qualitative methods hold a better chance to trace the reasons for the challenges and elevate best practices as solutions (Cohen and Levinthal, 1990; Robinson and Stubberud, 2010; Volberda et al. 2010). Finally, SMEs operate mostly locally (OECD, 2000).

Based on these gaps, this work focused on SMEs' ACAP of DI knowledge by analyzing dyad firms in similar countries in terms of their innovativeness: Israel and Germany. While both countries share a similar baseline, both countries are well-developed and benefit from a stable

economy, democratic government, and rich ecosystems. Ranked 9th and 13th of 131 economies, German and Israeli firms respectively, represent high innovation capabilities (WIPO, 2020). They both have a high level of education and similar access to digital knowledge and technologies (Sommerland and David, 2021). In the digital competitive ranking, Germany scores number 18th, and Israel is number 19th among 64 countries (IMD World Competitiveness Center, 2020). However, the two differ in DI.

Although ranked as one of the most innovative economies globally (WIPO Report, 2019), "Germany is not among the digital leaders in the EU" (European Commission Report 2020b, p. 54). German SMEs still struggle in the field of DI, they create fewer new technologies (Bhawa and Zahra, 2017, in Böhm et al. 2019), but also have less usage of DI technology for their offering (Levkovskyi et al. 2020). In their white paper from 2017, the German federal government has set a goal to place Germany as a leader in digital growth in Europe. They called to attend to the DI challenges by (1) Strengthening the SMEs, especially manufacturing firms, by providing access and training to digital platforms; and (2) Enhancing the startup ecosystem (BMWi, 2016). Despite its sovereignty in production (EFI, 2022), "Germany shows considerable weaknesses in the development of digital technologies" (EFI, 2022, p. 6). The Commission of Experts for Research and Innovation, also known as EFI, recommends using programs and strategies to promote the use of innovation and digital infrastructure, implementing startup strategies, making the transfer from universities available, and accessing venture capital funding. These programs should be initiated by the federal government to offer training and pilot projects in the field of digital technologies and the correct application of them in the industry (EFI, 2022).

The Israeli economy in contrast is dominated by high-technological companies, mostly startups but also growth companies that are internationally successful by being knowledge-intensive. In 2019, Israel was amongst the top 10 of the Global Innovation Index (GII), in a variety of innovation inputs and outputs, especially in the following parameters: R&D spending, innovation linkages, business sophistication, and ICT services (Komani and Bobek, 2020). Compared to the OECD countries, including Germany, Israel is leading in almost every aspect of innovation and digitalization (OECD, 2020). In measurements that specifically point to DI knowledge like research, R&D intensity, and ICT, "Israel scored 1st while Germany scored 15th" (WIPO, 2019, p. 21). The second research question is, therefore:

RQ2: **How do Israeli and German traditional manufacturing SMEs absorb new DI knowledge?**

Due to the explorative nature of the inquiry, qualitative research methods were chosen. Specifically for the following reasons: (1) They help discover something new to reflect on and better understand the phenomenon of innovation potential (Flick et al. 2004, Gey and Zinke, 2014); (2) They facilitate the purpose of this research, namely, exploration and description (Flick et al. 2004); and (3) They allow remaining flexible and cover new areas of investigation (Yin, 2009). Furthermore, by using qualitative methods, this work also answers scholars' call to measure ACAP directly and not through quantitative methods (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016).

Within the qualitative approach, case studies were chosen for the comparison of firms. A case study design is typically used when the research seeks to answer "how" and "why" questions about a real-life phenomenon that requires an "extensive description" (Yin, 2009, p. 4). A case study helps trace the reasons for decisions and their implementation results (Schramm 1971, in Yin 2009). This work demonstrates multiple case comparisons (Yin, 2017). The cases in this work were selected according to their representativeness of this research phenomenon (Lewis-Beck, Bryman, and Liao, 2003; Gerring, 2008). The firms in each case were sampled according to their similarity (Gerring, 2008). Through 4 cases of 8 SMEs, 16 expert interviews were conducted comparing two different cultures. Each case compares two SMEs from the same industry and elevates meaningful differences between them. The segments are furnaces, food packaging, dental implants, and compression fitting pipes.

Based on the findings from the literature review about the importance of managers, the interview starts with the CEOs. For additional informants, the purposive sampling technique was used. „The purposive sampling technique is a type of non-probability sampling that is most effective when one needs to study a certain cultural domain with experts within" (Tongco, 2007, p. 147). It can be applied in both qualitative and quantitative research (Bernard, 2002; Tongco, 2007), and it is especially fitting when there is information abundance (Patton, 2001). Moreover, there is no specification regarding the number of participants (Bernard, 2002). As qualitative methods place primary emphasis on saturation, the researcher may stop once the

latter is achieved (Miles and Huberman, 1994). The purposive sampling technique is also called judgment sampling since the expertise level of the informants is judged and decided by the researcher (Tongo, 2007).

To ensure the quality of the data collection, it is imperative to select informants who can contribute their expertise to the research topic. Within the purposive sampling, expert sampling was used. This sort of sampling is especially required when either the research is likely to take a long time, or when the research topic lacks knowledge. The experts are selected based on the researcher's expectation that they may provide valuable insights into the study (lker et al. 2016).

For the analysis of the interviews, within – and – cross-case analyses were used (Eisenhardt, 1989; Yin, 1994). This approach allows for deriving more conclusions from a vast perspective and strong data sources (Yin, 1994). Finally, to comply with anonymity issues, all firms and managers were handled anonymously.

Part 3: Transferable best practices

This work examines the ACAP of external DI knowledge behavior and practices of dyad SME firms in Germany and discusses how successfully they apply it. The empirical findings are then compared to the literature findings, and finally, possible reasons for differences are discussed. Best practices that could be transferred are elevated into guidelines. These guidelines are validated in two workshop cycles (Mijač, 2019). The final guidelines are incorporated into an artifact, for other firms to use and to serve as a basis for further research. The third research question is formalized as follows:

RQ3: **Which guidelines can help SMEs enhance the ACAP of DI knowledge?**

Most information system (IS) research is dominated by two paradigms: Behavioral Science and Design Science. While the behavioral approach focuses on the prediction of human and organizational behaviors by testing theories, the design science approach is designed to solve problems. "Solving a problem simply means representing it (…) to make the solution transparent" (Simon, 1996, in Hevner et al. 2004, p. 83). This solution is achieved by gathering relevant knowledge and building artifacts (Hevner et al. 2004).

Artifacts refer to creating products, models, methods, processes, or instantiations (objects or concepts) by implementing prototypes and guidelines (Walls et al. 1992, in Hevner et al. 2004),

on how to search for solutions in the given firm's space to create innovative change. The solution must join people, organizations, and technology into a single framework. In this framework, scientists seek to first understand the problem they need to solve and come up with a novel approach and guidelines to create an artifact. While the guidelines of the artifact could be amended over time, an artifact must be well thought through and based on analysis methods and an explanation of how to use it (Hevner et al. 2004).

The purpose behind design science is to further knowledge, which promotes the application of technologies and information systems in firms to help managers improve their firms' competitiveness and effectiveness. These guidelines or artifacts should help managers design decisions and strategies to achieve this goal (Hevner et al. 2004). However, the solutions designed by this approach are derived from established theories and practices that were analyzed in science and then modified and extended through their application in real life (Hevner et al. 2004).

This work's artifact is presented in the form of guidelines that may help managers of traditional manufacturing SMEs enhance their ACAP of DI knowledge based on best practices found in the theoretical and empirical parts of this work. To determine which guidelines are applicable, industry specificities were considered and two evaluation cycles (Mijač, 2019) were conducted. The artifact is presented both as guidelines for each ACAP phase and graphically.

1.4 Structure of the Work

This work comprises three distinct sections that build on each other. As the questions addressed in the sections require different research approaches each section is introduced by a related work section and a chapter describing the methodology before presenting the findings and discussing them.

Chapter One presents the motivation and relevance of this work. Research gaps detected in the literature ignited this work's research questions. Furthermore, the research goals are also discussed in this chapter. In the concluding chapter, a summary of this work is presented. This includes the practical implications, avenues for further research, and finally, limitations of this work.

Chapter Two captures the conceptual framework of this work, namely the ACAP in traditional manufacturing SMEs. Specifically, the ACAP construct is discussed in relation to innovation creation through the acquisition and processing of DI knowledge. The special situation of SMEs is also discussed and national culture as a framework that advances or limits innovation creation is presented.

Chapter Three presents the literature review (Webster and Watson, 2002) conducted on ACAP and innovation covering the time spectrum between 1989 and 2020. This work deliberately does not restrict the type of literature used, nor does it focus solely on recent publications, to ensure a wide perspective and a thorough examination of the influencing factors that surface. First, the four consecutive phases of knowledge absorption in the ACAP construct are outlined. Followed by definitions of innovation and DI and their connection to the ACAP framework. A detailed presentation of the influencing factors that help increase the ACAP, especially of DI knowledge, is offered. The analysis leading to the way these influencing factors interact with each other is discussed (Wolfswinkel et al. 2011), concluding with mapping the hierarchies of these factors. Finally, the chapter infers empirical implications that help form the empirical investigation conducted in this work. Specifically, a qualitative and cross-cultural examination of dyad SMEs in their quest for DI knowledge, with a focus on ACAP practices under the framework of national culture and entrepreneurial mindset.

Chapter Four compares four cases of dyad SMEs coping with the acquisition of DI knowledge to succeed in their digital transformation. This empirical section examines the continuity of its predecessor capital, by verifying whether the factors found in the literature surface. Each case focuses on a different industry with unique demands. By comparing two cultures in two innovative markets, this work examines how these differences manifest in the ACAP practices and innovation creation as detected in the interviews of dyad Israeli and German manufacturing SMEs. The methodology used in the analysis is within and cross-analysis by Eisenhardt (1989).

Chapter Five uses a design science approach (Hevner et al. 2004; Peffers et al. 2007; Österle et al. 2010; Sonnenberg and Brocke, 2012; Thoring, Mueller, and Badke-Schaub, 2020) to gather insights from the analysis of the cases. An artifact in the form of guidelines was drafted to serve as practical implementations resulting from the theoretical and empirical study. Drafting the guidelines takes into consideration which guidelines could be transferred and

implemented in other cultures. The goal is to use the insights from the case studies to frame guidelines on how to improve the ACAP of DI knowledge. In the third section, these guidelines were evaluated twice in a workshop (Mijač, 2019) with the participating firms who helped formulate the final guidelines on how to transfer these best practices to firms in other lines of business, and eventually, in other cultures.

Chapter Six summarizes the work done in the form of discussion, contribution, and limitations as well as presents avenues for further research. The below figure demonstrates the aforesaid structure of the work.

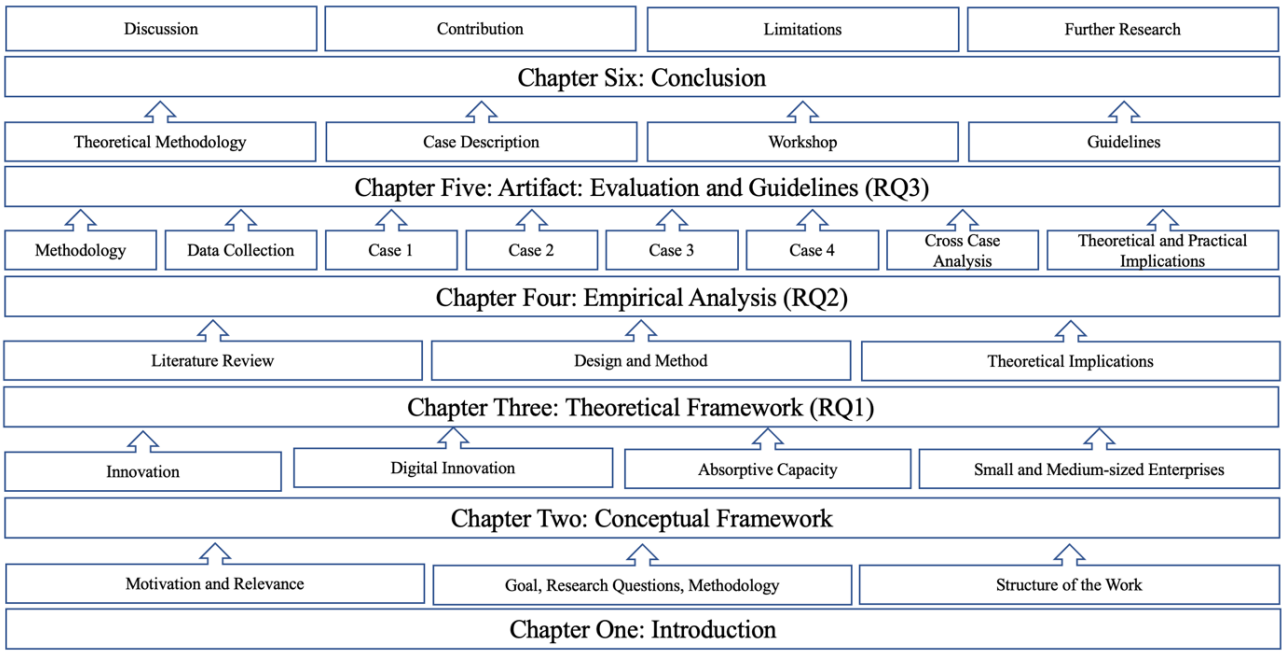


Figure 1: The structure of this work. Own illustration.

2 Conceptual Framework

The following sections are dedicated to defining the main terms used in this work. Starting with the ACAP construct, which directly leads to innovation and serves as a framework and an indicator of innovation success (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al. 2006; Roberts et al. 2012; Maes and Sels, 2014; Zapata-Cantu et al. 2020). Thereafter, innovation is discussed, as it is the goal of all firms since firms must innovate to maintain (Levkovskyi et al. 2020). Subsequently, a short examination of DI knowledge versus other types of innovative knowledge is discussed to illustrate the challenges of absorbing such knowledge and implementing it in firms. Later on, the definitions of small and medium-sized enterprises (SMEs), are presented, as this work is dedicated to them. Finally, culture as the framework of ACAP and innovation creation is introduced.

2.1 Absorptive Capacity

The term ACAP was first coined by Kedia and Bhagat (1988) in their study on international technology transfer. However, Cohen and Levinthal are recognized as the founders of this construct. In their seminal article, they define ACAP as "the ability of a firm to recognize the value of new, external information, assimilate, and apply it to commercial ends" (Cohen and Levinthal 1990, p. 128). Since then, more than 9,000 articles have referred to this formative work by Cohen and Levinthal (Zou, Ertug, and George, 2018).

ACAP is a lens through which firms should assess their processes to gain knowledge and re-invent or create new processes and solutions that could help them remain competitive. It is an inherently endogenous feature, which is enhanced by both internal and external factors (Ritala and Hurmelinna-Laukkanen, 2013; Maes and Sels, 2014). ACAP is unique to a firm. It cannot be bought. Moreover, it takes time to develop (Cohen and Levinthal, 1990). Furthermore, no single department is responsible for a strong ACAP, it is rather a joint effort of different departments and levels in the firm (Cooper, 1995, in Drejer, Christensen, and Ulhoi, 2004).

ACAP was originally defined by three dimensions: (1) Knowledge acquisition; (2) Knowledge assimilation; and (3) Knowledge application (Cohen and Levinthal, 1990; Zhai et al. 2018). Zahra and George (2002) reconceptualized and extended ACAP by grouping the phases into

two levels and four dimensions: (1) *Potential ACAP* refers to the acquisition and assimilation of new knowledge, and (2) *Realized ACAP* refers to the transformation and exploitation of knowledge. By this distinction, Zahra and George stress the importance of routines that enable the sense-making and transformation of new knowledge (Zahra and George, 2002). The distinction between Potential and Realized ACAP indicates that a company can have a high capacity for acquiring or assimilating knowledge while having a weak capacity for transferring and exploiting it (Volberda et al. 2010; Leal-Rodriguez, Ariza-Montes, Roldán, and Leal-Millán, 2013; Ciriello et al. 2018). However, the other way around this is not the case: Without Potential ACAP, Realized ACAP cannot be achieved (Zahra and George, 2002; Leal-Rodriguez et al. 2014).

Acquisition capacity describes a firm's ability to identify and acquire external knowledge (Zahra and George, 2002). It is acquired through interaction between the internal and external environments of the firm (Jansen et al. 2005). *Assimilation capacity* refers to the firm's routines and processes that allow it to analyze and understand the external knowledge and integrate it within its existing knowledge base. *Transformation* describes the firm integrating newly acquired and assimilated knowledge with existing knowledge. *Exploitation capacity* is the ability of firms to incorporate and utilize the acquired, assimilated, and transformed knowledge into their operations and routines and to add it to their knowledge base (Zahra and George, 2002; Flor et al. 2018). In this work, these dimensions are examined as consecutive phases, through which knowledge passes until it is incorporated into the firm and put to use.

To translate the potential ACAP into realized ACAP, all phases have to be managed successfully. In a fast-changing environment, such as the digital one, keeping knowledge up to date is especially difficult and it is determined by the quality of communication within the firm, in the teams and between team and managers, and externally with cooperation partners (Maes and Sels, 2014). However, it begins with making sense of new external knowledge and combining it with existing knowledge (Cohen and Levinthal, 1990). Success relies on the depth of the prior knowledge base (Attewell, 1992; Zahra and George, 2002; Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012; Carlo et al. 2012; Flor et al. 2018).

Scholars still debate whether to regard ACAP as an asset or as a dynamic capability (Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012). As an asset, ACAP is a "tangible

or intangible property that a firm owns or has access to" (Helfat and Peteraf, 2003, in Roberts et al. 2012, p. 628) and is measured by proxies that quantify R&D intensity and patents (Mowery et al. 1996, in Roberts et al. 2012). In contrast, as a dynamic capability, ACAP is described as a management and working attitude, that enables a firm to reconfigure its capabilities to enlarge its knowledge base (Lichtenthaler and Lichtenthaler, 2009; Alves et al. 2016). In this work, ACAP is regarded as a construct that covers both views. The knowledge base is an asset that serves as a platform upon which the firm can build, and the dynamic capabilities refer to the activities by which the firm utilizes this knowledge. Firms must excel in both segments to use ACAP efficiently. Both terms are explained as consecutive steps in which the dynamic capabilities build on the assets.

Relevant prior knowledge is an asset that serves as a precondition for the acquisition of knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen et al. 2005; Lane et al. 2006; Leal-Rodriguez et al. 2014; Savin and Abiodum, 2016; Lucena and Roper, 2016; Zou et al. 2018; Flor et al. 2018). However, it does not guarantee a high ACAP. In a further process, newly acquired knowledge has to be assimilated, transformed, and exploited. The underlying capabilities can be regarded as dynamic because they enable a firm to extend its knowledge base by adopting certain abilities (Helfat, 2007, in Roberts et al. 2012).

Mason, Rincon-Anzar, and Venturini (2020) call such abilities skills. In each phase, different skills are required. In the acquisition and assimilation phases (which correspond with the Potential ACAP), high-level professionals are required, both R&D (engineers, scientists) and non-R&D (strategic business managers). This group can identify the value of the new external knowledge and decide accordingly what knowledge is worth acquiring. In the application phase (which corresponds with Realized ACAP) the processes involve mediating employees (such as technicians, product designers, craft-skilled, and production) in addition to highly skilled employees (Mason et al. 2020). Also, Mowery and Oxley (1995) recognized the importance of the skill set within a firm. They regard ACAP as the broad spectrum of skills required to alter the tacit or implicit components of imported knowledge (Mowery and Oxley, 1995, in Roberts et al. 2012). In other words, although ACAP depends on the sum of knowledge and the skills of all professionals, the organizational ACAP level depends on the transformation of such knowledge through communication and coordination capabilities (Cohen and Levinthal, 1990; Zahra and George, 2002; Roberts et al. 2012; Leal-Rodriguez et al. 2014; Ciriello et al. 2018;

Zapata-Cantu et al. 2020). “Collective knowledge is the most secure and strategically significant kind of organizational knowledge” (Nahapiet and Ghoshal, 1998, p. 247).

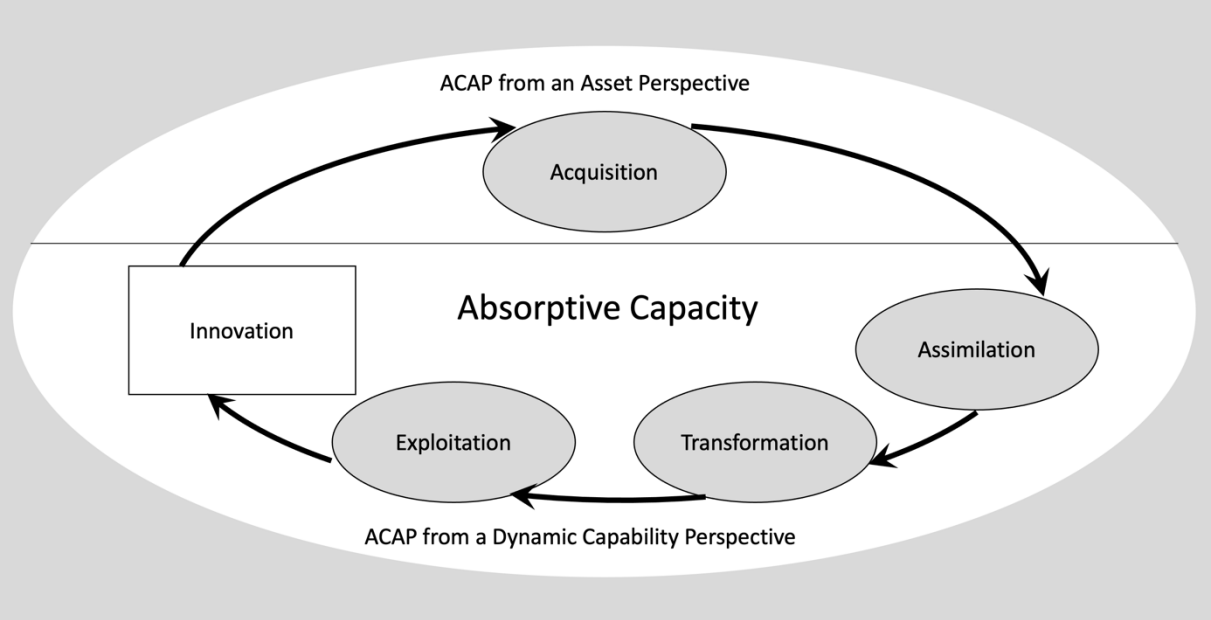


Figure 2: The framework of the ACAP construct, divided into consecutive phases which lead to innovation. Own illustration.

The extent to which a firm can acquire external knowledge depends on its ACAP (Cohen and Levinthal, 1990; Leal-Rodriguez et al. 2014; Moilanen, Østbye, and Woll, 2014; Maldonado Vera, and Keller, 2015; Lucena and Roper, 2016; Zou et al. 2018). According to Cooper (1995), there is no single department that is solely responsible for innovation output. Thus, to understand innovation creation in firms, one must evaluate how departments create innovations together (Cooper, 1995, in Drejer et al. 2004). Knowledge flows from the external environment to the firm and is processed there until it is realized in innovations (Zahra and George, 2002; Maes and Sels, 2014). Through this realization, new knowledge is created and spills back into the environment (Zahra and George, 2002; Roberts et al. 2012; Zapata-Cantu, et al. 2020). Therefore, the relationship between ACAP and innovation is recursive: ACAP enables innovation; innovation, in turn, enhances the knowledge and the firm's ACAP thanks to the newly gained technological understanding (Lane et al. 2006; Roberts et al. 2012). Figure 2 illustrates the different phases of ACAP and the recursive relationship between ACAP and innovation as the knowledge that returns to the external environment:

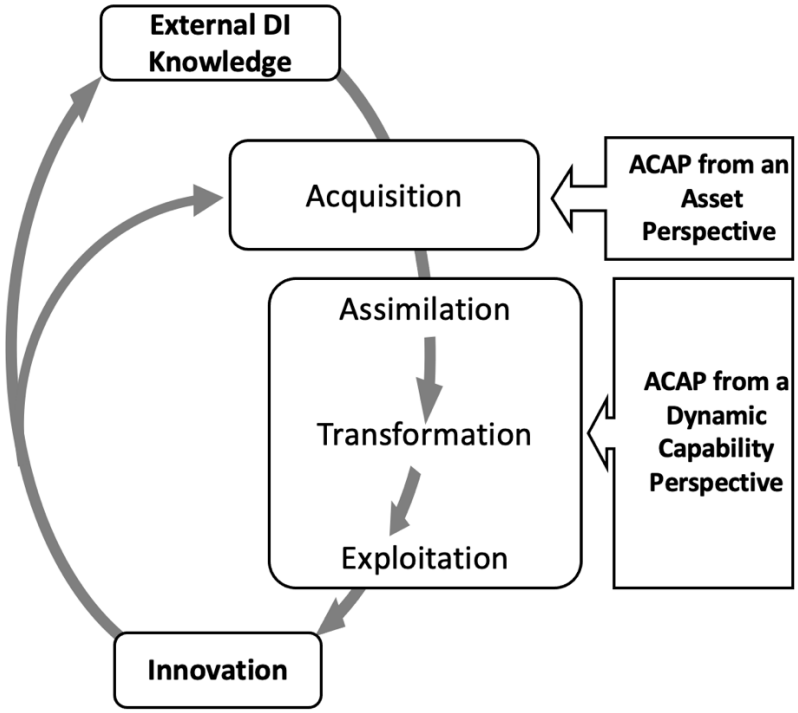


Figure 3: The relationship between ACAP and innovation. Own illustration.

Roberts et al. (2012) found that IT capabilities lead to ACAP capabilities through the mediating role of coordination and socialization capabilities and that they correspond with all the phases of ACAP. Following this logic, collecting IT knowledge from the environment and bringing it to the company correlates with the acquisition phase of ACAP. Processing this IT knowledge within the firm correlates with the assimilation phase, in which the IT serves as a tool to manage, document, and share knowledge, designed to change processes, models, or products.

Overall, it is suggested that "firms have a greater propensity to innovate when they have (1) A deeper, more diverse knowledge base, with (2) Intense linkages to its environment, which are (3) Combined with robust and extensive sensing and experimentation routines" (Carlo et al. 2012, p. 867). However, several questions remain under investigated to date. These questions are summarized in Chapter 2 as gaps and motivation for the literature review. The aim of conducting the literature review was twofold. First, to better understand the ACAP construct, what influences it, and how to enhance it. Second, to help firms develop and harness their ACAP to enhance their innovation creation, capability, and performance.

The literature review is built on these premises: It is accepted that ACAP directly leads to innovation (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al. 2006; Roberts et

al. 2012; Maes and Sels, 2014; Zapata-Cantu et al. 2020); because DI knowledge is acquired through the same mechanism as any other type of knowledge (Roberts et al. 2012), it also depends on ACAP. However, due to the special features of DI, the complexity, accessibility, and programmability, the ACAP of DI knowledge is faster and more intense (Carlo et al. 2012).

2.2 Innovation

Schumpeter claimed in 1934, that innovation is the driving force of the economy and propounded that innovation takes five forms: the introduction of new methods of production, new products, the opening of new markets, new sources of supply, and new forms of organization (Chandrashekar and Subrahmanya, 2017). The purpose of innovation according to Schumpeter, is to obtain profits (Zhai et al. 2018). In this respect, innovation goes beyond invention because it is a process in which „ideas are put into practice“ (Drejer et al. 2004, p. 106). According to the OECD, „innovation is defined with high levels of uncertainty, systematization, pluralism, accumulation, high investment, high income, and high risk“ (Zahi et al. 2018, p. 2).

Technological innovation is based on novel ideas and new combinations of existing knowledge (Zhai et al. 2018). Nambisan et al. refer to the development of knowledge as the “memory of early coupling” (Nambisan et al. 2017, p. 228). Firms often acquire this knowledge through collaboration with actors in their ecosystem (Alberti and Pizzurno, 2015, in Zapata-Cantu et al. 2020). Despite many definitions, there is a consensus that innovation is an iterative process, which initially unfolds by a market need, a problem, or an opportunity. These trigger the development and finally the commercialization of new inventions (Drejer et al. 2004).

Innovation creation generates new products, new markets, new production methods, or new business capabilities. It requires a combination of managerial competencies, business, and a strategic vision alongside a technological understanding and abilities (Drejer et al. 2004). The tension between the need to manage a firm effectively to protect its present, while searching for new information to ensure its future, is defined in the literature as an exchange between *exploitation* and *exploration* respectively (Zahra and George, 2002; Drejer et al. 2004). Both exploitation and exploration require managerial skills and involvement to sustain the company.

Innovation capability refers to using and combining procedures and knowledge, through which new developments of products, as well as the improvement of existing products, are reached (Wang et al. 2017, in Stelmaszczyk, 2020). In other words, it is the ability to create and implement new ideas that result in innovation, and through it, achieve a competitive advantage for the company (Jain, 2013, in Stelmaszczyk, 2020).

Innovation performance measures the level of a firm's technology innovation activities or outcomes. The literature mentions archival indicators such as the number of patents, patent citations, and the number of new products produced by a firm. The level of technological innovation of firms according to the literature is also measured by archival proxies such as R&D expenditure in relation to the total revenues of a firm (Zhai et al. 2018). However, archival measurements are often indirect and present bias (Stelmaszczyk, 2020).

2.3 Digital Innovation

"Digital innovation refers to novel ideas that are enabled by digital technology" (Carlo et al. 2012, p. 867). Digital technologies can (1) Be incorporated or entirely change physical products, their production, and marketing; (2) Replace physical products, or (3) Produce novel products and solutions (Yoo et al. 2010). DI is not restricted to digital end-products but comprises digital processes, tools, artifacts, and business models, that foster innovation, no matter whether the product itself is digital or not (Carlo et al. 2012). Digital technologies organize knowledge, making it more accessible, and easier to exchange and communicate (Barrett et al. 2012, in Hund, Drechsler, and Reibenspiess, 2019). Therefore, innovation in this field can profoundly change management strategies and cooperation, production, or marketing processes (Jansen, 2005; Peeters et al. 2014; Aljanabi, 2017).

The unique properties of digital technologies are that they are flexible and compact. They combine different data and technologies which leads to broader opportunities. The digitally stored information can be amended, transmitted, and reprogrammed and it allows the interaction of several systems. It has high governance capability, hence it can combine different features that were separated in the past, into one product. Furthermore, the reprogramming feature allows products to be extended, maintained, and updated (Ciriello et al. 2018). As a result, firms innovate faster on a digital platform rather than developing separate products (Gawer, 2011, in

Ciriello et al. 2018). However, Digital technology is complex due to its self-referential attribute: „Digital technology is needed to create digital technology“ (Ciriello et al. 2018, p. 565).

Digitalizing companies means using DI beyond introducing a digital product portfolio because it comprises major restructuring and counts as a transformation. This digital transformation radically changes value creation and operations due to the emergence of DI (Libert, Beck, and Wind, 2016). Digitalization leads to fundamental changes in the firm: (1) Products and production change, starting with new production methods allowing for customized products, inserting digital components in the products, and advancing to new products that include not only the physical object sold but services around this product; (2) Digitalization facilitates close collaboration with customers, partners, and suppliers. This collaboration is crucial for the innovation capability and through it, the sustainability, of firms. Moreover, digital platforms open entirely new markets; (3) Digitalization enables seamless data management and better control of internal workflows and work processes, enabling faster decision-making, time efficiency, and cost reduction. In sum, the novelty of digital innovation knowledge requires significant changes on behalf of the adopters (Fichman et al. 2014).

Industrial organizations are transformed by DI. The managers are more under pressure to become radical and they depend on acquiring external knowledge to enrich their firms' knowledge base. This is accomplished by increasing the cooperation with external parties (Hund et al. 2019) and by ensuring the flow of communication that was also made easier and more immediate thanks to DI (Barrett et al. 2012, in Hund et al. 2019). Additionally, managers have to focus at the same time on both process innovation and product innovation, since the boundaries between them are more blurry and elusive in DI knowledge (Nambisan et al. 2017). They must possess more expertise and invest more attention to market trends and technological developments.

Especially, when the end product is non-digital, firms struggle to obtain knowledge about digital technologies, tools, and artifacts, that could be added to or support their innovation creation, because their center of knowledge so far is not in the digital field. Traditional firms have to venture into unknown territory to add digital components to products for tracking or analyzing purposes, to add AI to automate processes or IoT to better the human/machine interface. Even more challenging, by innovating the management or production processes,

supply chain, and capabilities, DI changes fundamentally the way firms operate. Therefore, DI requires knowledge, attention, and investment in learning to further develop and utilize it (Ciriello et al. 2018).

Acquiring and assimilating DI knowledge, whether for internal use or to facilitate digital capability in products, requires unique digital practices. These practices might be new to a firm, including its engineers. Moreover, they require an entrepreneurial way of thinking by the managers as well as the team. These self-motivated employees must be supported by the company by being provided knowledge, an open communication culture, an external network, and finally, digital tools and artifacts (Ciriello et al. 2018).

As a result of the above, DI blurs the boundaries between product and process innovation (Nambisan et al. 2017). The process of creating and utilizing digital innovations is less structured and organized than in innovation (Ciriello et al. 2018). Therefore, DI has the potential to be far more radical than any innovation process before (Ciriello et al. 2018). This complexity raises uncertainty and requires creativity to organize the data (Hund et al. 2019). Moreover, digitalization extends the firm's boundary and forces firms to cooperate (Barrett et al. 2012, in Hund et al. 2019). In sum, digitalization brings about a lot of new knowledge that needs to be understood and integrated, in other words, to be acquired and assimilated. This transition is a burden for firms (Carlo et al. 2012; Nambisan et al. 2017) as well as for their clients, and thus forces firms to mobilize and share knowledge or know-how (Attewell 1992; Carlo et al. 2012).

Measurability is also different in DI. Whereas innovation success can be measured by revenues, DI is more elusive. Hence, it is hard to define its value. Managers, therefore, are forced to focus on both process and outcome at the same time. As a result, their dependency on external knowledge grows. This forces them to collaborate and involve external heterogeneous actors, and they might face resistance to the new structures within their firms (Hund et al. 2019).

In sum, innovation today happens in a digital context. In other words: "Innovating in a digitized environment" (Hund et al. 2019, p.2). To innovate, firms must apply digital capabilities (Kiefer et al. 2021). They have first to understand and acquire DI knowledge, and then integrate it into their firm. Firms must rely more on external cooperation to access knowledge (Hund et al. 2019; Kiefer et al. 2021) and intensify their communication skills within and outside the firm's boundaries (Barrett et al. 2012, in Hund et al. 2019). Therefore, scholars call for a further

investigation into how to cope with the burden of obtaining knowledge about DI (Yoo et al. 2010; Nambisan et al. 2017; Ciriello et al. 2018).

2.4 SMEs

The ACAP framework is used in this work to explain how firms can innovate by absorbing DI knowledge. While knowledge is accessible in abundance, it is overloading firms. Different firms have different capabilities to absorb DI knowledge and they, therefore, achieve different levels of innovation (Chandrashekar and Subrahmanya, 2017). This research explicitly focuses on exploring smaller firms (SMEs), usually, family-owned. These types of firms have especially difficulties in overcoming digital transformation (Kiefer et al. 2021). However, they are very important to the world's economy (BMWi, 2016; Gick et al. 2019; European Commission, 2021).

Representing 95% of all firms worldwide (OECD, 2020), SMEs must remain innovative to increase their likelihood of sustaining, offer greater diversity to answer customer demands, and remain competitive in their markets. However, innovation is challenging for SMEs (Kammerlander et al. 2017; Avalos-Quispe and Hernández-Simón, 2019; Bitkom Research, 2020; OECD, 2020). Despite their central role in the world's economy, there is still a lack of research focused on SMEs (Trenkle, 2019; Zhang et al. 2022), especially under an ACAP approach (Avalos-Quispe and Hernández-Simón, 2019). The research questions guiding this work are: How do SMEs absorb DI knowledge to reach their innovation creation? How and why do they differ in their absorption capability from each other? And, what can explain the differences? This comparison is done in a cross-cultural framework. The next paragraphs define SMEs in these respective markets.

Small and medium-sized firms are defined as "non-subsidiary independent firms which employ fewer than a given number of employees. This number varies across national statistical systems" (OECD, 2000, p. 2). According to the European Commission, the upper limit of small-sized firms is 10-49 while medium-sized firms are 50-250 employees. Moreover, European SMEs have between 10 and 50 Million euros in gross revenues (10-43 Million euros in the balance sheet total) (Eurostat, n.d.). Israeli SMEs are defined as between 20 and 99 employees with 23 Million euros in revenues/per annum (OECD, 2018). In this work, the definition of

SME is according to the OECD and the European Commission: SMEs have between 10 and 250 employees (OECD, 2000; Eurostat, n.d.).

“SMEs also account for a high percentage of manufacturing firms in many OECD countries and provide at least half of OECD manufacturing employment“ (OECD, 2000, p. 3). In Germany, SMEs represent 99% of the economy and are a major economic pillar employing almost 60% of the German market (BMWi, 2020). Most of Germany’s SME firms rely on the production of products for the industry (BMWi, 2020). Despite the high level of startups, the Israeli economy also relies on SMEs, representing 99.5% of total firms in the market (OECD, 2020). Moreover, Israeli SMEs employ 66% of the workforce (Bianchini and Kwon, 2020). This work, therefore, focuses on SMEs to discover, how they cope with their innovation creation in light of digitalization challenges.

2.5 Culture

As this work deals with a comparison between two cultures, this section explores the meaning of culture, whether national, organizational, or individual, and connects it to innovation creation. It begins with an overview of Hofstede’s work from 1983, explaining his well-established cultural values, and connecting them to the recent work of Kiefer et al. (2021), which focuses on organizational culture and entrepreneurial orientation, as a framework for innovation in firms (Kiefer et al. 2021).

2.5.1 National Culture

Different taxonomies are used to specify the framework of national culture. Some researchers frame national culture as shared ideology beliefs, assumptions, and collective values. Others divide national culture into polychronic versus monochronic approaches, context, and time orientation (Leidner and Kayworth, 2006). In all cases, these taxonomies exist in all countries to some extent, but they vary in magnitude (Leidner and Kayworth, 2006). Despite the wide selection of theories, „to date, the most popular conceptualization of national culture has been Hofstede’s (1983) original taxonomy describing culture along the dimensions of power distance, uncertainty avoidance, individualism-collectivism, and masculinity-femininity“ (Leidner and Kayworth, 2006, p. 360).

Hofstede was chosen also for this work due to the following reasons: (1) His focus on values versus beliefs, which are more observable features; (2) Available data on designated cultures, which made the cross-cultural comparison easy and clear; and (3) His focus on knowledge exchange. The exchange of knowledge corresponds with ACAP. Hofstede's approach will be reviewed in the next segments, starting with a definition of culture and continuing with a discussion of culture as a framework in connection to ACAP.

Geert Hofstede conducted his research about the organizational culture of IBM in the 1960s. His goal was to elevate national and regional differences which could influence organizations' operations and success. He developed the Hofstede Cultural Dimensions which could help bridge differences and make work more fluent (Van Vliet, 2009). Important to note, that the values in Hofstede Cultural Dimensions run throughout a scale and are to be interpreted as a comparison. Absolute values do not represent societies, but in comparison to other societies, one may derive an understanding of which values are more dominant. According to the tendency of dominance, researchers interpret the behavior of individuals in this society (Hofstede Insights, n.d.).

Hofstede's work serves today the following segments and purposes: consumer analysis, strategic decision-making, organizational culture change, value transformation for government programs, customized education according to gender and region, and more. However, the original work on national culture was especially serving this work, since it allows for the consideration of inherent differences between Israel and Germany which could explain the differences found in the empirical results of the investigation. The goal of this work was to elevate transferable best practices that could serve other firms to help them increase their ACAP of DI knowledge. Therefore, understanding the source of differences could serve for an efficient transformation of best practices.

The earlier work of Hofstede refers to four dimensions. These dimensions seem to manifest differently in different cultures (Leidner and Kayworth, 2006). The initial dimensions are power distance (PD), individualism (IDV), masculinity (MAS), and uncertainty avoidance index (UAI). Later Hofstede added two additional dimensions: long-term orientation (LTO) and indulgence (IN). The next paragraphs will elaborate on each dimension.

Power distance (PD) refers to the extent to which members of a society accept that power is distributed unequally. If the PD is low, people believe that change in power structures is possible and that non-senior members should be consulted in decisions and the generation of new ideas. If the power distance is high, the status quo is to be maintained (Hofstede Insights, n.d.). High PD can also be indicated by a high level of written communication and a top-down decision approach (Zahed, Van Pelt, and Song, 2001).

The individualism (IND) scale focuses on independence. This can be seen by the use of either first-body singular or third-body plural, i.e. "I" versus "we" (Hofstede Insights, n.d.). It indicates to what extent the individual needs are more important than the group's harmony. The more collective the society, the more harmony is valued. However, entrepreneurship and through it innovation are more likely to manifest in individual societies (Zahed et al. 2001).

The masculinity (MAS) scale indicates the extent to which the emotional and practical gender roles are set and clear. In feminine societies, equality is stronger, while masculine societies put a higher value on competition and achievement, success, and a solid educational system (Hofstede Insights, n.d.). A high score in MAS describes "societies in which the social gender roles are distinct (…) and men are required to be assertive (…) and women tender" (Zahed et al. 2001, p. 88).

The uncertainty avoidance index (UAI) is the extent to which members of a society feel threatened by the unknown. People in high UAI societies tend to keep busy by working very hard. They are motivated by the need for security. The culture tends to be more expressive (Zahed et al. 2001). Societies differ in their anxiety about what the future may bring. Some look for strategies to avoid uncertainty by acting directly upon it, while others accept uncertainty more (Hofstede Insights, n.d.). This score should not be mixed with risk avoidance. It is rather the extent to which uncertainty is perceived as something good or bad. Societies that score high in UAI favor structures, rules, and learning. They give attention to detail to avoid misunderstandings (Zahed et al. 2001).

Long-term orientation (LTO) measures, to which extend society's value the links to its tradition and past while dealing with the future. Societies differ in how they prioritize their tendency in this aspect (Hofstede Insights, n.d.). Longer-term societies favor saving and the reward of hard work. Shorter-term societies have respect for tradition and are more flexible and adaptable to

change, brought for example, by innovative technologies (Zahed et al. 2001). This means that long-term societies invest for the long run, also at the cost of complexity and high investment, while shorter-orientation societies favor an immediate solution to a problem and are less concerned about the far future (Hofstede Insights, n.d.). Management style in shorter-term societies is pragmatic. They favor what works rather than a perfect solution (Zahed et al. 2001).

Indulgence (IN) captures the extent to which socialization is established in society. This manifests already at a young age and is indicated to which extent individuals restrain their desires to comply with social rules and expected limitations. The level of confirming describes the extent of indulgence versus restraint (Hofstede Insights, n.d.). This scale was developed later, and no data was provided about Israel.

Since organizational culture is a reflection of the national culture (Hofstede, 1983; Gerhart, 2008), national culture is used as a general framework to help understand organizations led by individual managers, who guide and orchestrate the absorption of DI knowledge. In other words, examine how certain traits of national culture may enhance or hinder the absorption of DI knowledge by influencing individuals and organizations. To add rigor to how cultural differences influence innovation, the cultural dimensions theory of Hofstede (1983) is compared to a more recent approach by Kiefer et al. (2021). This allows a view of culture in the context of entrepreneurial orientation.

2.5.2 National Culture in the Context of Entrepreneurial Orientation

Culture seems to modulate the ability to innovate. As claimed by Shane, there is a relationship between cultural values, innovativeness, and inventiveness, and different cultures show different levels of innovation (Shane, 1992). This is mostly because some cultures are more knowledge-friendly than others (Harrington and Guimaraes, 2005) and have a higher degree of freedom (Shane, 1992).

Societies that have fewer hierarchies and a higher exchange of knowledge are considered more free. They are also frequently found to be more inventive and innovative (Shane, 1992). Cultural values such as freedom and knowledge exchange change from culture to culture and they influence the approach to the complexity of technologies and the acquisition of technological knowledge (Leidner and Kayworth, 2006).

Although Hofstede did not specifically address entrepreneurship and innovation, his dimensions can be used to explain entrepreneurial activity (Rarick and Han, 2015). According to Hofstede, differences in innovativeness develop because some societies are more focused than others on finding immediate solutions to help them prepare for the unknown future. Finally, the speed of finding such solutions is based on cooperation between individuals within or outside their organization (Hofstede Insights, n.d.).

Also according to more recent work focused on DI knowledge, most research that deals with innovation creation through digital strategies must focus more on cultural aspects (Kiefer et al. 2021). According to Kiefer et al. (2021), nine characteristics of organizational culture foster DI. These are: "corporate entrepreneurship, digital awareness and necessity of innovations, digital skills and resources, ecosystem orientation, employee participation, agility, and organizational structures, error culture and risk-taking, internal knowledge sharing and collaboration, customer and market orientation as well as open-mindedness and willingness to learn" (Kiefer et al. 2021, p. 1). In the following paragraph, each value is elaborated on.

1. *Corporate entrepreneurship:* employees are considered entrepreneurs, they should, therefore, be given responsibility and freedom. They must share with the management the responsibility to identify opportunities and the mindset of being first in the market.

2. *Digital awareness and the necessity of innovations* begin at the top management and are measured in the commitment and seriousness in which the digital transformation and the need for increasing digitalization are perceived.

3. *Digital skills and resources* refer to the willingness of the firm to foster technological opportunities and incorporate activities to support them: facilitate training for employees, allocate resources, and look for external partners.

4. *Ecosystem orientation* refers to the actual collaboration with external consultants, IT firms as service and knowledge providers, customers, and the practice of open innovation, to bridge the gap of missing technological knowledge.

5. *Employee participation, agility, and organizational structures* refer to involving employees from different ranks in decision-making, giving them freedom and

empowerment, and avoiding a silo mentality. This usually comes with flat hierarchies and agile structures.

6. *Error culture and risk-taking* allow the exploration of new opportunities, tolerating failure, and closing of projects in a relatively short time when they are not developing correctly.

7. *Internal knowledge sharing and collaboration* refer to enhancing knowledge exchange through the activation of multidisciplinary teams across the firm's subunits, allowing each employee to contribute from their unique expertise and share their knowledge with other employees.

8. *Customer and market orientation* refers to the creation of value by orientating to customers' needs and demands, all while monitoring trends and shifts in the market.

9. *Open-mindedness and willingness to learn* allow questioning the business model and being open to learning, developing, and amending existing status to facilitate DI.

In sum, some organizational behaviors and structures are more supportive of innovation creation than others. These can be supported or hindered by the dominant national culture (Hofstede 1983, Kiefer et al. 2021). Therefore, these two approaches were compared, to show how national cultural traits influence organizational characteristics. The next paragraph presents the connection between Hofstede (1983) and Kiefer et al. (2021).

2.5.3 Applying Kiefer's Organizational Cultural Values to Hofstede's Dimensions.

The Corporate entrepreneurship value is realized with *a lower PD where e*mployees from all levels are involved and their opinion and experience are considered in the overall decisions. This value also indicates a high IND dimension, since, in such an organizational structure, the employees are valued for their input and their entrepreneurial skills. However, when collective aspects exist, there is much more harmony in the teams, which helps create innovation (Zahed et al. 2001). A balance between the IND and collectivism scales indicates entrepreneurship combined with sharing knowledge (with clients or within the team) for innovation. Similarly, a

balance between MAS and the femininity scale is important since the femininity scale indicates knowledge sharing through communication (Zahed et al. 2001).

Digital awareness indicates how seriously digital transformation is perceived. There is a positive connection between a low PD and a high IND since such awareness occurs overall and throughout the entire firm to be successful. As digital awareness is intended to make an enterprise fit for the future, this focus goes hand in hand with a high UAI and a low LTO which both are concerned with future developments. A high UAI indicates the urge to innovate, as a strategy to avoid the uncertainty digitalization brings. Similarly, a low LTO indicates that this innovation process must take place immediately. In sum, a high UAI and a low LTO help the task be achieved in time and push managers to search for novel combinations and innovate (Zahed et al. 2001).

Digital skills and resources guarantee the allocation of needed funds for the realization of digital transformation. A low PD can support this by keeping the management open to hearing what is needed, respecting the individual opinion (high IND), and sharing information with the external environment (evident in a balanced MAS).

Low PD also supports *Ecosystem orientation* by being open to involving consultants and external input from the environment and gaining technological knowledge. A balance between IND and collectivism helps, in this case, to be open to engaging these partners for the good of the firm, and a balanced MAS helps exchange the information A high UAI and a low LTO help to expedite the process. *Employee participation, agility, and organizational structures* refer to involving employees and avoiding a silo mentality. To achieve this, a firm should practice a low PD and empower the IND.

A balanced MAS helps lower the barriers to information exchange and a high UAI and a low LTO help reach fast decisions. *Error culture and risk-taking* can take place only in a low PD and a high IND by empowering the entrepreneurial aspects of the employees and a balanced MAS ensures that there is open-mindedness and daring to take the risk and endure failure. A high UAI and a low LTO can be seen as the motivation to practice risk and tolerate failure. *Internal knowledge sharing and collaboration* can be strengthened by identifying the strengths of individuals and harnessing them into the digitalization transformation. In such a way, multi-

disciplinary units within the firm are managing the process of transformation by adding their unique knowledge and experience and representing the firm's considerations and priorities, which could otherwise not be represented. Such behavior is possible when PD is kept low and IND high.

A balanced MAS ensures the flow of communication and a high UAI and a low LTO help to implement decisions. *Customer and market orientation* indicates the importance of customers in the creation of value. Similar to ecosystem orientation, the focus is on involving external players in the firm's production focus and priority. However, this time, the focus is on reacting to specific demands. A low PD supports this by remaining open to input from all the employees who are in touch with the customers and monitor competitors.

A high IND empowers the individual to pursue ideas to strengthen the firm. A balanced MAS helps remain open to collecting information by maintaining a close relationship and information exchange with the customers. A high UAI and a low LTO help the process take place fast. *Open-mindedness and willingness to learn* also correspond with a low PD since it allows questioning the business model and being open to learning, and development. A high IND helps employees take ownership of this process. MAS is not applicable and a high UAI and a low LTO help to accept the urgency in learning and applying digital technologies and amend the business models as the needs of the firm change and move toward digitalization.

A comparison between the organizational values of Kiefer and the cultural dimensions of Hofstede is presented in the table below.

Characteristics of organizational culture that support innovation (Kiefer et al. 2021)	**Cultural Dimensions (Hofstede, 1983)**				
	PD	**IND**	**MAS**	**UAI**	**LTO**
Corporate entrepreneurship	(-)	(+)	~	(+)	(-)
Digital awareness	(-)	(+)	~	(+)	(-)
Digital skills and resources	(-)	(+)	~	(+)	(-)
Ecosystem orientation	(-)	~	~	(+)	(-)
Employees' participation	(-)	~	~		
The agility of organizational structure	(-)				(-)
Culture of risk-taking and failure tolerance	(-)	(+)	~	(+)	(-)
Internal knowledge sharing and collaboration	(-)		~	(+)	(-)
Customer and market orientation		(-)	~	(+)	(-)
Open-mindedness and willingness to learn	(-)			(+)	(-)

Table 1: A comparison between the organizational values of Kiefer and the cultural dimensions of Hofstede. (+) Long/high (-) short/low (~) middle (balanced).

By comparing Hofstede's cultural dimensions to the organizational values of Kiefer et al. (2021), it becomes evident that national cultural behaviors correspond with the characteristics of organizational culture that foster innovation through digitalization. The organization values mirror the low PD, high IND, balanced MAS, lower UAI, and lower LTO dimensions of Hofstede. A behavior that supports digital transformation corresponds with a high entrepreneurial mindset of managers, taking a risk, involving multidisciplinary employees, sharing information fast within the firm's subunits as well as with customers and partners, and focusing on changing the present threats by inventing fast solutions and thereby, lowering the uncertainty which comes with the complex, fast and ever-changing digital change.

2.5.4 Culture, Mindset, and Innovation

Firms reach different levels of innovation creation and innovation performance due to the different decisions and activities throughout the phases of ACAP. The success of the ACAP phases is influenced by the entrepreneurial orientation of their managers which surfaces from their mindset. This includes the goals they set, the risks they are willing to take, and the failure they endure. Moreover, their vision of the market trends, their positioning in their markets, and their level of disruptiveness make a difference. For example, being first versus being the best or doing the right things right away versus doing things right. But what influences mindset?

In searching for the influence factor on the mindset, the mindset needs to be examined within the larger framework of culture. „Culture is defined as the collective mental programming of the human mind which distinguishes one group of people from another" (Hofstede, 1991, p. 5). Culture reflects people's values, beliefs, and assumptions and also shapes the exchange of knowledge and communication (Hofstede, 1983). Smaller firms (SMEs) are more strongly rooted in (national) cultural habits than their large international counterparts. Therefore, culture in SMEs is a factor to recognize and study regarding digital innovation (Kiefer et al. 2021).

In the next sections, individual, organizational, and national cultures are reviewed in connection to innovation. In chapter five the cultural framework is used again to build an artifact to enhance the ACAP of DI knowledge, based on best practices found in this research.

2.5.5 Individual Culture and Innovation

Managers are central to absorbing DI knowledge, whether by implementing new digital processes, inserting digital technologies into a product, or, implementing a new business model based on newly available platforms (Nambisan et al. 2017). Higher levels of entrepreneurial orientation can be viewed by taking more risks and thinking more disruptively (Drejer et al. 2004; Peeters et al. 2014; Aljanabi, 2017; Stelmaszczyk, 2020; Lynch and Corbett, 2021).

„The predominant theoretical approach to culture has been to conceptualize it, at any level, in terms of values" (Leidner and Kayworth, 2006, p. 363). Cultural values influence innovativeness and inventiveness. Therefore different cultures show different levels of innovation (Shane, 1992). Innovation depends directly on the cultural values and norms

regarding technology and change since change is the result of new knowledge being shared throughout an organization (Harrington and Guimaraes, 2005).

Researchers state that innovation creation is not only a function of technology but also, of people (Hevner et al. 2004; Krcmar, 2015; Nambisan et al. 2017). With the entry of DI, the innovation processes ceased being structural and linear, and methods like stage gates were unable to capture the complexity DI brought (Nambisan et al. 2017). To illustrate this complexity, the following points were discussed already in chapter two. DI has made the boundaries between innovation outcomes and processes more blurry (Nambisan et al. 2017). Moreover, the ability to determine when a process had finished became unclear, due to the dynamic characteristic of DI, being editable, ever-changing, and transferable (Carlo et al. 2012; Libert, Beck, and Wind, 2016; Nambisan et al. 2017; Ciriello et al. 2018). Therefore, the organization of the innovation creation process demanded more flexibility and collaboration to solve a problem.

A possible way to cope with this new demand for flexibility and collaboration was to activate a *distributed innovation agency*. This is a combination of dynamic and open actors from different sections and departments who engage together and share knowledge to drive the innovation creation process. The idea is to match a solution to a problem, or in other words, a *problem-solution pairing* that is based on an individual narrative (Nambisan et al. 2017). While the orchestrator of such an agency could be individuals, such as managers, digital technologies also play a role. The scheme's existence of digital platforms makes knowledge sharing easier. However, for this process to reach its highest potential, the actors must have a shared language (Nahapiet and Ghoshal, 1998; Maes and Sels, 2014; Nambisan et al. 2017).

A shared language is therefore important since the *problem-solution pairing* happens in the context of individuals and collectives. The sensemaking of knowledge and technology, in this case, DI knowledge, is being interpreted differently according to the narrative of individuals and collectives. This narrative is based on their life experiences and defines how they grasp opportunities (Nambisan et al. 2017).

Since personal narrative manifests also in a more general circumstances context, such as national culture (Hofstede, 1983), then the sense-making of DI knowledge with regards to the possibilities it holds, can also be regarded as a reflection of cultural narrative. In this sense,

cultural settings evoke a different view of potential and urgency, when encountering the same input or knowledge. Following this logic, different approaches to solutions and problems are derived from individual narratives (Nambisan et al. 2017), and these individual narratives are formed in one's national culture (Hofstede, 1983). In sum, individuals must organize themselves to support innovation-creation activities and enhance ACAP of DI knowledge by scaling on the socio-cognitive sensemaking (Nambisan et al. 2017).

At the organizational level, there are numerous theories explaining the rejection or acceptance of technology in firms as a subject to national culture (Leidner and Kayworth, 2006). On the subunit level, the emphasis is on the concrete process routines, documentation, and rewards that are specific to individuals within the subunit (Leidner and Kayworth, 2006). Since the subunit level is specific and harder to compare, the remaining levels are discussed from the smaller to the larger: organizational and national.

2.5.6 Organizational Culture and Innovation

Culture manifest also in the affinity for technology and business. In their literature review about culture in IS research, Leidner and Kayworth state that IS researchers are interested in the relationship between culture and IT outcomes and technology (Leidner and Kayworth, 2006). They quote the following topics and researchers supporting this statement.

Culture theories have been used to explain an extensive range of social behaviors and outcomes in organizational settings, including "firm effectiveness, firm performance, corporate strategy, job attitudes, administrative practices, merger and acquisition, technology transfer practices, and conflict resolution strategies in product innovation settings" (Leidner and Kayworth, 2006, p. 358).

Organizational culture consists of explicit and latent features. Explicit artifacts such as structure and processes can be viewed, while beliefs and values are latent. The latent features manifest in strategies, goals, norms, and principles. They are mostly unconscious and are accepted inherently (Schein, 2010). This fact makes them dominant in influencing the organizational culture, although they are harder to trace. Moreover, numerous theories and approaches deal with the value aspect of the culture at different levels: national, organizational, and subunit (Leidner and Kayworth, 2006).

Organizational culture manifests in collective assumptions and practices that were adapted to efficiently exchange knowledge internally and externally and to solve problems (Kiefer et al. 2021). In an organization, knowledge affinity is determined by communication and the mindset toward change. By mindset to change, we mean acceptance or resistance to change (Harrington and Guimaraes, 2005). In sum, some organizational cultures are more supportive of fostering innovation than others. Innovation culture is the platform on which managers can run the digital transformation, in other words, there are cultural values for digital transformation. However, these are not yet specified in the literature (Kiefer et al. 2021).

3 Theoretical Framework: A Literature Review

Since the survival of firms depends on their ability to innovate and harness DI knowledge to improve their processes, business models, and products (Cavillier and Wieser, 2018; Ciriello, et al. 2018; Levkovskyi et al. 2020), firms need to first understand the ACAP construct before they can improve. The ACAP construct can become more tangible by supplementing it with factors and explaining how these enhance or hinder ACAP.

To understand the ACAP construct in detail, the research question for the initial part of this work was: **What are the influencing factors that enhance the ACAP of new knowledge?** The question was added more layers, to define how to increase the ACAP, specifically DI knowledge. It is formalized as follows:

1. What are the factors that enhance or hinder the different dimensions of the ACAP?

2. Who is the driving force in each stage of ACAP and how do they act?

3. How is the hierarchy between the factors organized in the ACAP of DI knowledge?

To cope with these questions, a literature review was conducted. A literature review is a scientific method to structurally capture the increasing information on a discipline as a building block for future investigations which will contribute to the cumulative knowledge of the scientific community. “By integrating findings and perspectives from many empirical findings, a literature review can address research questions with a power that no single study has” (Snyder, 2019, p. 333). A literature review contributes to the understanding of concepts while reporting them in a structured way and making new contributions (Hart, 1998).

There are three main approaches to literature review: systematic, semi-systematic, and integrative. Each one has its unique purpose according to the creativity and freedom that is demanded by the research design or purpose. A literature review is an appropriate research method when the researcher wants to evaluate a theory, provide an overview of the state of knowledge in a specific discipline or topic, generate gaps, or create a new theory (Snyder, 2019).

A semi-systematic literature review was chosen for this research. This approach is mainly used when researchers wish to understand how research on a different topic progressed and to understand vast relevant areas that connect to it. Moreover, through its transparency, it allows readers to decide whether the conclusions are reasonably argued. Finally, this approach is used usually when it is followed by qualitative research (Snyder, 2019). This helps detect themes, perspectives, and similarities within a specific theme and helps form a theoretical concept (Ward, House, and Hamer, 2009).

3.1 Design of the Literature Review

„The literature review is the most important step in the research process in all empirical studies (…) because, without it, the researcher(s) would not have an up-to-date awareness about what is known regarding the phenomenon of interest and, subsequently, where the gaps in the knowledge are“ (Onwuegbuzie and Weinbaum, 2016, p. 266).

The literature review was conducted according to the guidelines of Webster and Watson (2002) and analyzed according to the five steps of grounded theory for literature review (Wolfswinkel et al. 2011). This was added to increase the rigor of the review, give it structure, and allow transparency in a systematic way leading to the findings. The grounded theory was chosen for the following reasons: (1) The grounded theory emerges from the data through connections of different variables which are rooted in the findings. It is especially appropriate when data is missing, in this case, about the focus on ACAP of DI knowledge; (2) The different levels of codes allow a transparent trail of how the conclusion was developed; and finally, (3) The current method used specializes in literature reviews and contains examples from the IS research (Wolfswinkel et al. 2011).

According to the grounded theory guidelines, there are five steps in analyzing literature: define, search, select, analyze, and present (Wolfswinkel et al. 2011). *Define* refers to defining the field, the database, and the criteria for the inclusion or exclusion of papers (Wolfswinkel et al. 2011). ACAP corresponds with several segments, such as psychology, behavior, and learning reflecting on three levels: individual, firm, or country. Due to the large spectrum of articles, it was narrowed down by focusing on ACAP which leads to innovation and remains on the organizational level.

Since the relationship between ACAP and innovation stands at the core of this research, the terms “Absorptive Capacity” AND “Innovation” were searched in the title and abstract, on the databases Ebscohost and Scopus, known to be general and rich databases. The search yielded 212 results on Ebscohost and 349 results on Scopus (561 in total). In these papers, some factors surfaced more often than others. Nonetheless, they were treated equally, as one of the goals of this work was to aggregate existing knowledge by locating as many factors as possible and recombining existing concepts. Before reaching saturation, a third database was reviewed for quality assurance, IEEE. Using the same query, 199 hits were retrieved. By reviewing the title and abstract, the papers were narrowed down to 25. However, since no new influencing factors emerged, it was decided to focus on the results of the first two databases and not add additional papers.

The total literature review was conducted between January 2020 and April 2021. 75 articles dating back as far as 1989 were analyzed. This produced a wide spectrum of influencing factors. A complete list of all the influencing factors is elaborated on later in this chapter. First, the search was limited to published articles in English, focused mainly, but not restrictively, on peer-reviewed articles from journals and conference proceedings. No time restriction was added, covering publications from 1989 to 2020. The search was also not restricted to specific journals since the approach was to gain a vast overview from different sources to make sure that the results were not subject to bias. However, due to the interest in technological knowledge, the search was focused mainly on publications that deal with technological innovation in knowledge-intensive industries. The exclusions mentioned above reduced the number of articles to 181 on Ebscohost and 102 on Scopus (283 in total). To refine the sample of hits, the title and abstract of the papers were reviewed (Webster and Watson, 2002), this corresponds with the second phase of the *search* in the grounded theory (Wolfswinkel et al. 2011).

After reviewing the title and abstract, it was decided to keep only empirical articles that deal with influencing factors. This was reflected in 37 and 32 articles respectively (69 in total). After clearing the duplicates (9), 60 articles remained. Forward/backward (Webster and Watson, 2002) produced 15 additional articles including 4 meta-analyses (a total of 75 articles). This also corresponds to the third phase: *select* in the grounded theory (Wolfswinkel et al. 2011). The meta-analyses helped gain an overview of the current state of the research on the topic of

ACAP and helped detect gaps. Finally, four meta-analyses were reviewed as quality assurance, to check whether the findings are accurately represented and whether most of the important authors associated with the topic of ACAP are included. In Figure 4, the including and excluding process leading to the selection of articles is illustrated.

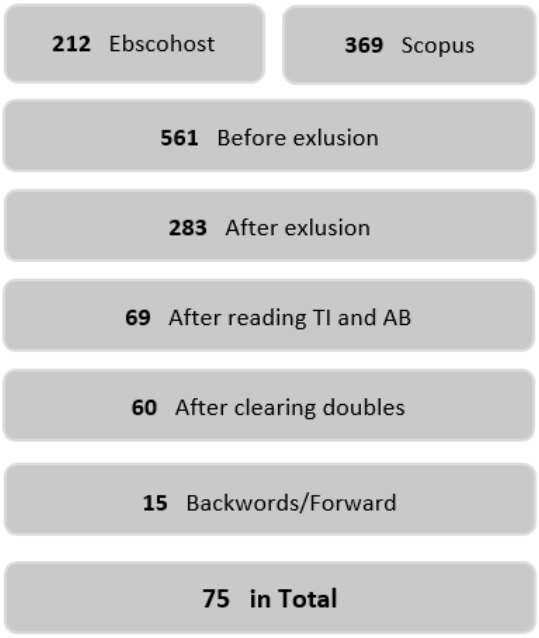


Figure 4: Including and excluding criteria. Own illustration.

The fourth step according to the grounded theory is to *analyze*. In this stage, the researcher condenses all relevant insights found in the reviewed papers into excerpts and examines them repeatedly, also in connection to other excerpts. The related concepts must be defined from other concepts. In this phase, researchers may also add their comments and insights (abstraction). Researchers must use creativity to understand the topic and identify the categories (Wolfswinkel et al. 2011).

Each article in the theoretical sampling was read and the factors were noted. First, they were listed individually and insights were written to better understand the topic. Then the factors were abstracted and clustered according to the relations they formed with one another. Each factor was given the same weight of importance. However, some factors manifested more often than others and the number was marked in the matrix. These factors were marked as more instrumental to the ACAP process. Such a presentation shows the "conceptual overlaps

resulting from the various categories" (Wolfswinkel et al. 2011, p. 8), and the number of publications stating a certain factor or a cluster of factors (Wolfswinkel et al. 2011).

Similar concepts were clustered together, forming the basis for the emerging codes in three phases: open coding, axial coding, and selective coding. The coding phases were conducted systematically (Wolfswinkel et al. 2011). First, categories were formed and related topics were clustered into sub-categories. During axial coding, the interrelations between the categories were identified. During selective coding, the relationship between the categories evolves into a story (Wolfswinkel et al. 2011). Since this story is about acquiring DI knowledge, it had to be evaluated whether the same hierarchies formed in the axial coding, remain.

Discrepancies were noted separately in memos and emerging gaps were written down. These insights represented pieces of information that were either contradicting or presented a new perspective on the factors that were naturally formed within the categories. These are discussed in further detail in avenues for further research.

The fifth step according to the grounded theory is to *present*. In addition to the concept matrix (Webster and Watson, 2002), the graphic presentation of the findings is presented, according to Wolfwinkel et al. (2011). This illustrates the hierarchy and the touching points between the influencing factors on ACAP of DI knowledge.

A literature review must be rigorous, accurate, deep, and replicable (Snyder, 2019). To ensure these requirements the same method was used several times returning to the theoretical sampling to re-evaluate the data and consider changes in the categories and sub-categories (triangulation). Moreover, to strengthen the internal validity, each factor and insight, which emerged from the theoretical sampling was granted the same weight, regardless of the frequency in which it was mentioned. This achieved a deeper understanding of the phenomenon. Finally, to ensure replicability, each step of the review process was documented (Palmatier, Houston, and Hulland, 2018).

3.2 Results: The Influencing Factors of ACAP

In the following section, the result of the literature review is presented and discussed. The concept matrix created according to Webster and Watson's (2002) guidelines presents the

influencing factors that emerged from the literature review and the categories and sub-categories they were grouped into. Followed by an elaborate description of these individual influencing factors. Finally, the sub-categories and the hierarchies between them are explained. This reveals how firms organize their ACAP process, which roles are leading that process, and how the different sub-categories interact. This section concludes with avenues for further research which elevate gaps and open questions resulting from the literature review. Part of the topics presented in these avenues served as motivation for this work as will be addressed in the empirical part, in chapter four.

In the 75 articles reviewed, Communication and Knowledge Exchange Efficiency is the most prominently mentioned aspect to influence ACAP (mentioned 54 times). Next is Cooperation & Co-creation with clients, partners, and suppliers (mentioned 54 times), followed by Routines (48), Level of Prior Knowledge and Deep Knowledge (mentioned 43 times), CEO and Leadership Involvement (mentioned 41 times), and R&D (mentioned 35 times). Some of these factors are mentioned frequently, as their impact is obvious throughout the whole ACAP process. Others are mentioned less often, as they tackle more specific qualities of the entities involved. Moreover, not all factors impact all ACAP phases to the same extent and in the same way.

The influencing factors in the form of a concept matrix according to Webster and Watson (2002) are presented next. The factors are marked with (+) for having a positive influence on ACAP, with (-) for having a negative influence on ACAP, and with (~), when the position of the article is indecisive. Finally, colors were assigned to distinguish the external from the internal factors and to emphasize that these are two separate qualities that must take place. Throughout the figures in the work, the colors of the factor clusters (blueish for internal and yellowish for external) will correspond with the colors of the ACAP phases (blueish for phases that happen internally, yellowish with the exploitation, that shares the result with the external environment). Due to the data volume, the matrix was divided into two tables: qualitative and quantitative research, and sorted by publication year to show how factors were covered over the years.

Table 2: Concept Matrix: The influencing Factors of ACAP. (+) having a positive influence on ACAP, (-) having a negative influence on ACAP, and (~) the position of the article is indecisive.

Author	Method: Meta-Analysis/ Qualitative/ Quantitative	Intra-firm relations																		Inter-organizational collaboration								
		Knowledge base						Team Culture						Coor-dination capa-bilities			Managers				Coopera-tion and co-creation			Environmental features				Mediating institu-tions		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Maldonado et al. (2015)	MA			+	+					+		+		+			+				+		+					+		
Apriliyantia/Alon (2017)	MA				+			+		+	+	+		+			+				+	+		+	-					
Tengjian et al. (2018)	MA	-		+	+					+	+	+		+	+	+	+				+		+					+		
Levitt/March (1988)	Qual			+										+							+									
Attewell (1992)	Qual	+		+	+					+				+							+		+		-			+		
Nahapiet/Ghoshal (1998)	Qual		+	+				+		+	+	+		+								+								
Zahra/George (2002)	Qual		+	+	+					+		+		+			+					+	+	+	-	+		+		
Todorova/Durisin (2007)	Qual			+				~		~				+							~					-				
Lichtenthaler/Lichtenthaler (2009)	Qual			+										+			+				+	+								
Petraite/Janiunaite (2010)	Qual				+																+		+					+		
Robinson/Stubberud (2010)	Qual	~			+																+		+					+		
Roberts et al. (2012)	Qual		+	+	+									+							+									
Acs et al. (2013)	Qual	~			+					+				+			+				+			+				+	+	
Drejer et al. (2014)	Qual		+	+						+	+			+					+											
Fichman et al.(2014)	Qual		+					+		+	+	+		+			+				+									
Peeters et al. (2014)	Qual							+						+			+				+									
Ducheck (2015)	Qual			+	+					+		+		+	~	+	+				+						+			
Cavillier/Wieser (2018)	Qual																+				+		+		-			+		
Ciriello et al. (2018)	Qual			+						+	+			+			+		+		+		+					+		
Enkel et al. (2018)	Qual									+		+		+							+									
Ruiz et al. (2018)	Qual			+				+		+	+	+	+	+	+	+	+				+	+								
Rodriguez/Da Cunha (2018)	Qual				+					+		+		+							+		+							
Malhotra et al. (2005)	Quan+Qual			+										+			+				+				-					
Chowdhury et al. (2017)	Quan+Qual									+							+				+									
Nambisan et al. (2017)	Quan+Qual		+	+						+	+	+					+				+		+		-					

1	Large firms
2	Diversity of knowledge
3	Level of prior knowledge and deep knowledge
4	The role of R&D
5	Structural ambidexterity
6	Skills and education
7	Entrepreneurial culture and creativity
8	Women in leadership positions
9	Communication and socialization
10	Knowledge transfer efficiency
11	Team commitment to learn and trust
12	Open-mindedness
13	Routines
14	Participation in decision making
15	Job rotation
16	CEO and leadership involvement
17	Young managers
18	Risk-taking and entrepreneurial orientation
19	Vision-sharing

20	Customers, partners and suppliers
21	Personal network
22	Competitors
23	Geographical proximity (clusters)
24	Complexity of the environment and regulation
25	Strong appropriability regime
26	International partners
27	Local universities
28	Innovation programs: incubators and accelerators
29	Government support

Table 3: Concept Matrix, Part 2: The influencing factors of ACAP. Quantitative studies. The article describes a (+) positive influence, (-) a negative influence on ACAP, or (~) the position of the article is indecisive

Method: Quantitative	Intra-firm relations																			Inter-organizational collaboration									
	Knowledge base						Team Culture						Coor-dination capabilities			Managers				Coopera-tion and co-creation			Environmental features				Mediating institutions		
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Cohen/Levinthal (1989)			+	+	+															+		+			-		+		
Cohen/Levinthal (1990)		+	+	+	+				+				+							+		+			-		+		
Fichman/Kemerer (1997)		+	+	+				+	+		+		+			+				+		+					+		
Lane et al. (2001)	~		+						+		+		+			+				+			+			+		+	
Tsai (2001)	~		+	+																	+	+								
Jansen et al. (2005)	~		+						+				+			+								-					
Gray (2006)	+		+			+	+		+				+			+	+	+		+	+		+						
Lane et al. (2006)		+	+				+		+	+	+		+							+									
Gao et al. (2008)			+													+					+	+		-			~	+	+
Wang (2010)	-																												
Carlo et al. (2012)	+	+	+	+					+				+			+				+		+		-			+		
Mukherji/Silberman (2013)		+	+	+			+		+				+			+				+		+					+		
Ritala/Hurmelinna-Laukkanen (2013)			+	+					+				+			+				+		+			+				
Wuryaningrat (2013)	~		+	+					+		+		+			+				+		+	+				+		
Ahlin et al. (2014)	~	+	+				+	+	+												+								
Egbetokun/Savin (2014)				+																+							+		
Leal-Rodríguez et al. (2014)			+				+		+	+			+					+		+									
Maes/Sels (2014)	~	+	+								+		+			+				+				-					
Moilanen et al. (2014)	~			+																+		+					+		
Lambert (2015)		+					+		+		+		+																
Ryzhkova/Pesamaa (2015)													+							+							+		
Broersman et al. (2016)													+		+	-													
Costa/Monteiro (2016)	~			+			+		+		+		+			+				+						+			
Guimaraes et al. (2016)			+	+					+				+			+				+		+		-			+		
Lucena/Roper (2016)		+	+	+					+				+							+		+					+		
Ratten (2016)																+													+
Raymond et al. (2016)	~								+				+			+				+		+		-			+		
Savin/Abiodun (2016)			+	+																+		+		-			+		
Strese et al. (2016)							+									+													
Zobel (2016)																				+		+					+		
Alves et al. (2017)	-							+	+				+			+													
Chandrashekar/Hillemane (2017)		+	+	+																			+				+		
Rangus et al. (2017)				+					+		+					+				+							+		
Aljanabi (2018)										+						+		+		+	+								
Badillo/Moreno (2018)	~		+	+												+				+						+	+		
Flor et al. (2018)			+	+		+							+							+				-					
Kim et al. (2018)	~	+	+						+				+							+		+			+				
Ramirez et al. (2018)			+																		+								+
Zhai et al.(2018)									+				+							+		+		-					
Avalos-Quispe et al. (2019)		+	+	+									+			+			+	+		+	+				+		+
Dahlin et al. (2019)				+							+									+									
Galbreath (2019)	~			+				+	+							+													
Presutti et al. (2019)							+																+			+	+		
Banerjee et al. (2020)				+	+								+			+			+			+		-					
Darwish et al. (2020)									+			+	+	~		+			+										+
Mason et al. (2020)			+	+																						+	+		+
Santoro et al. (2020)																				+						+			
Stelmaszczyk (2020)			+	+					+	+	+	+				+			+										
Zapata-Cantu at al. (2020)							+		+				+							+	+		+	+					

3.3 Individual Influencing Factors

In the next paragraphs, the individual factors aggregated by the literature review are presented. Followed by a discussion on how they were grouped into two main categories and 7 sub-categories, to ease processing them into hierarchies and their importance to the ACAP process.

3.3.1 Knowledge Base

Typically, knowledge is defined as the intellectual property of a firm, or in other words, „that which is known“ (Drejer et al. 2004, p. 111). „Knowledge is characterized by an interplay between dichotomies such as explicit and tacit knowledge, individual vs. organizational knowledge, top-down and bottom-up knowledge“ (Drejer et al. 2004, p. 111). There are two dimensions of processing knowledge: *Epistemic and Behavioral* (Lane et al. 2006; Roberts et al. 2012). The *epistemic dimension* denotes what a firm knows and the *behavioral dimension* denotes how a firm acts.

„The firm that has a large knowledge base (or is well connected to varying actors creating new knowledge), is capable of understanding new knowledge and its applicability“ (Ritala and Hurmelinna-Laukkanen, 2013, p. 157). In the epistemic dimension, the knowledge base reflects „both explicit and implicit facts, beliefs, ideas, conceptual structures, and frames that a firm’s members possess“ (Carlo et al. 2012 p. 869). Knowledge is therefore path-dependent and a function of a firm’s prior knowledge investments and experience (Cohen and Levinthal 1990; Todorova and Durisin 2007). The epistemic dimension is critical for absorbing new knowledge because “a firm without a prior technological knowledge-base in a particular field may not be able to acquire one readily” (Cohen and Levinthal 1990, p. 138).

Firm’s Size

Size is one of the most referred to organizational characteristics in the innovation field (Attewell, 1992; Gray, 2006; Carlo et al. 2012; Acs, Audretsch, and Lehmann, 2013; Moilian et al. 2014; Maldonado et al. 2015; Alves et al. 2016; Kim, Lee, and Kang, 2018; Badillo and Moreno, 2018; Zou et al. 2018). Earlier research indicates that organizational size can have a positive or negative influence on innovation (Carlo et al. 2012). Size is an advantage when costs have to be allocated, and learning is costly. Costs may involve pilot projects, training, and

experimenting. Moreover, large firms usually have a better management knowledge base, more structures, more sophisticated routines, and more resources to invest in R&D (Attewell, 1992; Flor, Cooper, and Oltra, 2018; Zou et al. 2018). Large firms are more diversified and hence, more financially resilient against learning costs and risks (Carlo et al. 2012). Therefore, ACAP is strongly linked to a firm's *resources* (Gray, 2006). These resources facilitate both dimensions of ACAP. They support the acquisition (Potential ACAP) by allowing firms to purchase expensive tools or software and are important in the transformation phase by maintaining routines that support the knowledge exchange (Realized ACAP).

SMEs on the other hand, rely mainly on their internal knowledge, network, and skills to develop ACAP (Wang, Wang, and Horng, 2010). Contradicting the advantages of large companies the literature shows that SMEs convert Realized ACAP into innovation performance better than larger firms (Alves et al. 2016; Zou et al. 2018). This indicates that flexibility and agility can outweigh a lack of access to resources (Alves et al. 2016). Due to their smaller size, SMEs have fewer costs of coordination and can rely on tacit knowledge. SMEs convert Realized ACAP into innovation performance 30% more efficiently than large firms (Alves et al. 2016).

To sum up, large firms absorb new information faster than SMEs. Large firms have greater access to the market, they benefit from a vast network of external industrial sources (customers, partners, vendors, and competitors), and public sources (governments and universities) (Attewell, 1992; Malhotra, Gosain, and El Sawy, 2005; Zobel, 2016; Ciriello et al. 2018). Due to fewer resources, SMEs generally engage less in training and management development (Gray, 2006) but SMEs are more efficient and flexible. Since the size of the firm determines both its epistemic and behavioral dimensions on how to process knowledge, it is covered in this sub-category of knowledge base, however, the size of the firm cannot be influenced and therefore, is not the focus of this work.

Knowledge Diversity

Knowledge diversity is defined as the „range of knowledge possessed by the firm concerning the focal innovation" (Fichman, 2001, in Roberts et al. 2012, p. 636). The range of knowledge is measured by the level of heterogeneity of technologies (Cohen and Levinthal 1990; Carlo et al. 2012). In other words, it describes the extent to which a firm's knowledge base covers distinct and unique knowledge elements (Fichman and Kemerer, 1997). Knowledge diversity

enhances the level of innovation because it facilitates the incorporation of new knowledge. A more diverse background of individuals results in a higher ACAP (Lucena and Roper, 2016; Avalos-Quispe and Hernández-Simón, 2019). Therefore, this diversity supports a firm's ability to acquire and transform new knowledge (Zahra and George, 2002).

Level of Prior Knowledge and Knowledge Depth

Prior related knowledge describes the know-how and skills a firm possesses in areas that are relevant to its innovation (Carlo et al. 2012). Knowledge depth is defined by the quality of the available expertise compared to "typical" expertise found in the marketplace (Carlo et al. 2012). The deeper the knowledge, the deeper the understanding of the potential of new knowledge. This fact signifies that the ACAP of a firm is domain-specific (Attewell, 1992).

In their conceptualization of ACAP, Zahra and George (2002) claim that a firm can only apply the knowledge that has been previously assimilated. Accordingly, a firm can develop its ACAP once it has recognized the value of the knowledge and identified a potential source of knowledge. However, to facilitate absorption, the new knowledge must be connectable to the focal knowledge base and comply with the firm's strategy, organizational culture, and routines (Zahra and George, 2002; Lane et al. 2006; Volberda et al. 2010; Leal-Rodriguez et al. 2014; Moilian et al. 2014; Maldonado et al. 2015; Savin and Abiodum, 2016; Lucena and Roper, 2016; Zapata-Cantu et al. 2020).

As ACAP is bound to individuals, it is path-dependent (Leal-Rodriguez et al. 2014). A firm, or more precisely, its employees, that successfully accumulated ACAP in the past, will be more efficient in accumulating information in the future (Attewell, 1992). The literature proposes that a firm will be able to acquire knowledge despite knowledge barriers if: (1) It possesses prior-related knowledge or, if: (2) The new knowledge can be acquired economically and integrated easily through activities that facilitate the learning (Attewell, 1992).

The Role of R&D

Through its R&D, a firm develops collective technological and scientific knowledge (Cohen and Levinthal, 1989; Moilian et al. 2014; Maldonado et al. 2015; Lucena and Roper, 2016; Zou et al. 2018). Firms are able to exploit external knowledge mainly through their R&D as they act as an important source of knowledge and technological capacity (Cohen and Levinthal, 1990;

Gao, Xu, and Yang, 2008; Roberts et al. 2012). At the same time, R&D secures the stability of the products by incrementally improving them (Cohen and Levinthal, 1989). R&D facilitates the creation of new knowledge through its complementary and accumulative knowledge assets and connection with external partners (Ruiz, Brion, and Parmentier, 2018; Avalos-Quispe and Hernández-Simón, 2019).

Some companies separate their exploration and exploitation activities, leaving R&D in charge of incremental innovation while allocating other teams for new and disruptive innovation. This is called *Structural Ambidexterity.* Allowing for contradicting behavior, such as explorative and exploitative, is a strategy to split the technological trajectories by separating organizational units (Broersma, Van Gild, and De Grip, 2016). Each unit works on a mandate, for either exploration or exploitation (Banerjee, Lampel, and Bhalla, 2020). Structural ambidexterity solutions for R&D allow the unit to separate two activities: Innovating via existing technological knowledge to improve products in the firm's portfolio, or creating new products, by accessing new technological knowledge (Banerjee et al. 2020).

As a central influencing factor for the knowledge base of the firms and through it, the success of the ACAP process, R&D should be further investigated. To date, scholars measure the relevance of R&D mostly indirectly, through archival proxies such as investment in R&D, number of patents, patent citation, and number of university graduates (Cohen and Levinthal, 1990; Zahra and George, 2002; Volberda et al. 2010). Moreover, there is not enough knowledge about structural ambidexterity in SMEs. This work, therefore, is set to explore qualitatively, how should R&D be positioned in the acquisition, assimilation, transformation, and exploitation of new external knowledge, specifically DI knowledge, in SMEs.

Skills and Education

The level of education refers to the years of study and training as well as the skills and experience of both the team and the managers. It contributes to their ability to sense and recognize the value of new external knowledge (Mason et al. 2020; Stelmaszczyk, 2020). Highly educated individuals possess a higher capability to make sense of new knowledge (Roberts et al. 2012). Individuals without qualifications (formal and informal education) are less likely to innovate (Gray, 2006). Therefore, education affects the development of ACAP. Moreover, the educational level has been positively linked to entrepreneurial orientation,

growth, and development of internal practices that support ACAP. However, ACAP and innovation performance are not confined solely to formal education, although they are easier to measure and therefore dominate the discourse, but are also linked to technical and professional competencies (Gray, 2006).

3.3.2 Team

The team becomes important when individuals share knowledge across the firm for the sake of further development. The behavioral dimension of ACAP describes how individuals act, what their set of beliefs is, and how they share knowledge (Lane et al. 2006; Roberts et al. 2012; Maldonado et al. 2015; Zou et al. 2018). In other words, „a firm's ACAP is formed from an overlap in individual members' knowledge coordination as well as the transfers of knowledge across and within organizational subunits" (Roberts et al. 2012, p. 627). These overlaps imply that ACAP is specific and relies on the intensity with which individuals communicate knowledge across the firm (Roberts et al. 2012). By definition, ACAP is a capability that takes time and cannot be bought (Cohen and Levinthal, 1990; Roberts et al. 2012). In this section, it is therefore explored, which attributes of the team enable, support, and advance knowledge-sharing across the firm's subunits. Amongst these are (1) Entrepreneurial Culture & Creativity; (2) Women in Leadership Positions; (3) Communication & Socialization; (4) Knowledge Exchange Efficiency (5) Team Commitment to Learning, Motivation, and Trust, and finally, (6) Open-Mindedness.

Entrepreneurial Culture & Creativity

Culture steers knowledge exchange. The literature groups culture into four main aspects: (1) A culture of sharing knowledge (Nahapiet and Ghoshal, 1998; Leal-Rodriguez et al. 2014; Costa and Monteiro, 2016); (2) A culture of entrepreneurship (Mukherji and Silberman, 2013); (3) Cultural diversity & creativity (Ahlin, Drnoversek, and Hisrich, 2014; Lambert, 2016); and (4) A shared language (Nahapiet and Ghoshal, 1998; Maes and Sels, 2014).

Costa and Monteiro (2016) regard culture as the *act of sharing knowledge*, which „significantly reinforces knowledge creation" (Costa and Monteiro, 2016, p. 215). To share knowledge, perspectives, and values, a firm must have a connected team with cross-functional interfaces

that help to overcome differences and construct a shared understanding of the new external knowledge (Leal-Rodriguez et al. 2014; Costa and Monteiro, 2016).

According to Mukherji and Silberman (2013), sharing knowledge is enabled by a *culture of entrepreneurship*, which leads to a „realm of economic development and growth“ (Mukherji and Silberman, 2013, p. 400). Entrepreneurial culture facilitates the development and pursuit of new opportunities. However, not all leadership styles enable this culture to the same extent. Power relationships seem to be adversarial because, in a rigid hierarchy and a clear structure, employees are less likely to express their opinions openly or to think critically. This seems to hinder ACAP and innovation (Todorova and Durisin, 2007).

C*ultural diversity* is instrumental to innovation, since „most successful commercialized innovation is an outgrowth of making new associations and/or recombining existing ideas“ (Dahlander and Gann, 2010, in Ahlin et al. 2014, p. 218). Moreover, “diversity is seen as the facilitator of creativity which supports the innovation performance of firms” (Lambert, 2016, p. 7). However, the diversity of ideas must be communicated in one clear form of language that ensures similar understanding.

Maes and Sels refer to a language that helps form a common understanding and thus aids collaboration as a „shared language“ (Maes and Sels, 2014, p. 146). *A shared language* raises the probability that the recipient will understand the knowledge or the artifacts in the way the sender of the knowledge intended (Nahapiet and Ghoshal, 1998; Roberts et al. 2012). Jansen et al. call it a common language for products and services (Jansen et al. 2005). A shared language facilitates knowledge exchange and its further development in the form of concepts and ideas. These may include well-established behavior norms and an understanding of the vision of the firm (Roberts et al. 2012).

Women in Leadership Positions

Women in leadership positions (Galbreath, 2019) and gender diversity in general (Ahlin et al. 2014) positively influence the level of absorption of new information. Galbreath discovered that women in leadership positions excel in knowledge sharing and implementation. In doing so, Galbreath has connected a high rate of women in leadership roles to a high level of ACAP (Galbreath, 2019).

Communication & Socialization

Communication and *social relations* are essential to matching new knowledge with existing knowledge and successfully absorbing it (Cohen and Levinthal 1990; Zahra and George, 2002; Jansen, 2005; Leal-Rodriguez et al. 2014; Wuryaningrat, 2013; Lucena and Roper, 2016; Ciriello et al. 2018). Absorptive capacity, therefore, depends on communicating the knowledge among the organizational members (Cohen and Levinthal 1990; Roberts et al. 2012), and within the management when aligning IT possibilities and business strategy (Roberts et al. 2012).

Knowledge-sharing is a social activity to acquire and transfer knowledge (Dalkir, 2005, in Wuryaningrat, 2013). It describes the communication of information, skills and experiences, ideas, and advice from internal and external sources (Srivastava et al. 2006, in Wuryaningrat, 2013). Both tacit and explicit knowledge must be shared (Kamasak and Bulutlar, 2010, in Wuryaningrat, 2013). Knowledge sharing takes place within the company, but also outside of it. Knowledge-sharing is the key to transferring individual knowledge to organizational capabilities, and therefore, knowledge-sharing is connected to the core of ACAP (Wuryaningrat, 2013).

Socialization is a form of personal communication that also aids the collective development and transfer of complex knowledge. Cousins and Menguc (2006) define socialization as an individual but also organizational interaction between different functions, which creates personal acquaintance and improves communication and problem-solving (Cousins and Menguc, 2006, in Chowdhury, Jayaram, and Prajogo, 2017). Chowdhury et al. offer an alternative definition of socialization, as „the process by which individuals acquire knowledge of the other enterprise's social values and norms" (Chowdhury et al. 2017, p. 7022).

Socialization is beneficial for the creation of innovation (Uzzi and Lancaster 2003, in Enkel et al. 2018). It is required during the entire ACAP process, „to transform internal actors' cognitive schemes to facilitate acceptance of the knowledge" (Ruiz et al. 2018, p. 71). Zahra and George (2002) argue that socialization supports the shift from Potential ACAP to Realized ACAP. "Social capabilities create the necessary platform for the exchange of knowledge, they include cohesion, shared goals, a consistent set of beliefs and values, a common language, and well-established behavior norms" (Roberts et al. 2012, p. 641). Socialization produces a shared

ideology that allows the members to identify and interpret the reality of the firm in the same way (Jansen et al. 2005).

Shared values, time, and norms build connectedness among members of an organization but also among collaborating partners that are not part of the same organization (Jansen et al. 2005; Enkel, Groemminger, and Heil, 2018; Ruiz et al. 2018). Inside the firm, socialization helps newcomers to understand the background of the information and interact with others. Outside the firm, it helps create a common understanding of what knowledge is needed by the other (Enkel et al. 2018).

Examples of social interactions include organized social events, knowing suppliers at a personal level, and maintaining relationships outside of the working environment (Chowdhury et al. 2017). Social relations help embrace new knowledge (Rindfleisch and Moorman, 2001, in Jansen et al. 2005). However, they can also limit the acceptance of alternatives, by generating an unspoken commitment to old policies. In this sense, socialization can result in a group rejection of new ideas (Nahapiet and Ghoshal, 1998; Wuryaningrat, 2013). In the phases of Potential ACAP, socialization increases the commitment to past policies and thereby leads to less new knowledge being acquired. During the realization of ACAP, socialization enhances transformation and exploitation by creating strong social norms (Jansen et al. 2005; Todorova and Durisin, 2007).

Knowledge Exchange Efficiency

Knowledge Exchange Efficiency is defined as the firm's capability to integrate newly acquired knowledge with prior knowledge. Creating new knowledge relies on procedures that accelerate the use of integrated knowledge (Strese, Adams, Flatten, and Brettel, 2016) and profits from the efficiency with which individuals exchange information and are complementary to each other (Kamasak and Bulutlar, 2010, in Strese et al. 2016). Moreover, the transformation of knowledge from tacit to implicit reflects the level and quality of interaction between individuals and groups (Drejer et al. 2004).

Explicit knowledge is more easily obtained and coded, whereas tacit knowledge is not observable and therefore, can not be easily coded (Nahapiet and Ghoshal, 1998). Tacit knowledge, therefore, can be utilized and processed only by experts (Dreyfuss and Dreyfuss,

1986, in Drejer et al. 2004). Complex knowledge has many tacit elements, and its absorption depends on the team's ability to communicate in formal and informal ways. The diffusion of knowledge happens on a need-to-know basis when a certain individual needs certain knowledge. However, the more knowledge is diffused the better it could be used in the organization (Drejer et al. 2004).

Team Commitment, Motivation, and Trust

Learning requires *commitment* (Ahlin et al. 2014). Because organizational learning is burdensome, management actively needs to reduce resistance and motivate the team to acquire and communicate new knowledge within the subunits of the firm (Fichman and Kremerer, 1997; Nahapiet and Ghoshal, 1998). Otherwise, the firm cannot utilize the knowledge of competent individuals if they lack the *motivation and trust* to share it (Ahlin et al. 2014).

„*Trust* in the vision and direction of the managers and cooperation in the team encourages communication and improves the efficiency of knowledge exchange across organizational units" (Roberts et al. 2012, p. 643). High cohesion within a team facilitates trust and cooperation and improves knowledge exchange across the organizational units (Burt, 1987, in Roberts et al. 2012, p. 643). To sum up, team commitment is measured by the level at which team members communicate and cooperate to achieve the firm's goals.

Open-Mindedness

Open-mindedness enhances learning, by developing new skills to replace old knowledge (Banerjee et al. 2020). Therefore, open-mindedness supports the ACAP of a firm, by lowering the learning barriers and by accommodating a willingness to learn (Ruiz et al. 2018; Mason et al. 2020; Stelmaszczyk, 2020; Darwish et al. 2020). Open-mindedness can also be seen as the necessary cognitive flexibility that helps amend and transform new knowledge even when it does not fit the existing schemas (Zahra and George, 2002; Todorova and Durisin, 2007).

3.3.3 Coordination Capabilities

Coordination capabilities refer to the firm's ability to manage the activities that are essential to its operations (Malone and Crownstone, 1994, in Roberts et al. 2012). As mentioned before, although an organization's ACAP depends on the absorptive capacities of its members, it is not

simply the sum of members' absorptive capacities. „A firm may identify valuable external knowledge and yet have significant difficulty assimilating that knowledge" (Roberts et al. 2012, p. 641). The knowledge base of a firm facilitates associative connections and linkages required to develop novel ideas, by incorporating these ideas into existing structures (Todorova and Dursin, 2007). Coordination capabilities support successful assimilation by enhancing the transfer of knowledge across the firm's subunits (Cohen and Levinthal 1990; Roberts et al. 2012). Certain activities facilitate the absorption of external knowledge in different phases of the ACAP process. These can be (1) Routines; (2) Participation in Decision Making; and (3) Job Rotation.

Routines

Routines are defined as procedures, beliefs, strategies, and use of technological tools, and other frameworks, that are independent of the individual (Cohen and Levinthal, 1990; Attewell, 1992; Levitt, 1998; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Malhotra et al. 2005; Maldonado et al. 2015; Lucena and Roper, 2016). In this context, routines are to be seen as procedures, activities, and strategies that are undertaken regularly, for example, meetings, visits to other branches, informal means (lunches or use of personal network), speaking to customers, seeking consultancy (Jansen et al. 2005; Gao et al. 2008), monitoring the market, attending fairs or seminars, field trials, piloting or prototyping, training, formalization, and documentation (Carlo et al. 2012).

Routines are repetitive behaviors with visible patterns that involve several participants (Carlo et al. 2012). The repetition of routines reduces the effort of managing knowledge (Jansen et al. 2005) and ensures that inputs are indeed transformed into outputs (Jansen et al. 2005). Routines, therefore, bridge the knowledge base and the innovation outcomes (Roberts et al. 2012; Carlo et al. 2012). Successful routines enable a firm to „identify, acquire, integrate and exploit knowledge in relation to its current knowledge base " (Carlo et al. 2012, p. 870). ACAP consists of several routines (Zahra and George, 2002; Lane et al. 2006**;** Volberda et al. 2010; Chowdhury et al. 2017).

There are two types of routines: *Internal routines* focus on internal sources of innovation and regulate activities and processes that develop novel ideas (Flor et al. 2018). They include (1) Compensation policies; (2) Creating and sharing new combinations of knowledge; (3)

Evaluating and amending existing practices, thereby improving competencies, and finally, (4) Experimentation (Roberts et al. 2012, p. 628). *External routines* focus on external sources and include (1) Regular screening of the environment for relevant knowledge; and (2) Management of the strategic acquisition and assimilation of such knowledge (Chowdhury et al. 2017).

The efficiency of routines is measured by several factors: (1) The level of effort; (2) The utility; and (3) The diversity of responses to stimuli (Cohen and Levinthal, 1990; Kim et al. 1998). The efficiency of routines is reflected by the time and effort needed to achieve a satisfactory outcome. Some companies develop their ACAP routines quickly and with less difficulty than others, and, therefore, they manage to enhance the absorption process (Peeters et al. 2014).

Participation in Decision-Making

Participation in decision-making and planning increases the range of prospective "receptors" to the environment (Cohen and Levinthal, 1990, p. 135). These receptors serve as „structures of interaction among individuals" in the firm (Roberts et al. 2012, p. 635). They later filter the relevant external knowledge and share it in their internal network (Jansen et al. 2005). Participation in decision-making supports the efficient coordination of different expertise throughout the subunits (Jansen et al. 2005). However, too intensive participation may also slow down the transformation and exploitation of knowledge, due to the time and effort they demand (Jansen et al. 2005). The literature does not provide clear guidelines about who should take part and to which extent should a firm perform this activity.

Job Rotation

Job rotation refers to rotating employees from different fields throughout the company. It is a mechanism that enhances the transformation of knowledge within the firm and supports the coordination of different subunits. The rotation enhances the ability to make novel linkages (Cohen and Levinthal, 1990; Volberda et al. 2010; Roberts et al. 2012; Zou et al. 2018). Due to the diversity of backgrounds of the individuals, problem-solving skills develop further when employees rotate (Cohen and Levinthal, 1990). However, the costs could eventually prove to be too high (Jansen et al. 2005). The literature is still not clear on how to implement job rotation in a way that the benefits outweigh the costs. Which departments or employees should take part and to which extent?

3.3.4 Managers

Managers act as internal change agents. They are crucial for the innovation performance of a firm (Peeters et al. 2014; Maldonado et al. 2015; Zou et al. 2018). Therefore, managerial factors are more important for ACAP than technological ones (Peeters et al. 2014). However, both technological and business knowledge „is instrumental to the efficient absorption of new external knowledge“ (Roberts et al. 2012, p. 676). Business managers use technical knowledge to lead the firm in the right technological direction. On the other hand, IT managers use business knowledge to understand the business opportunities of new technologies. Innovative managers improve the innovation performance of the firm through (1) The introduction of new management regulations and methods (Enkel et al. 2018); and (2) Increasing the commitment to learning and collecting information, analyzing, and sharing it with the employees (Banerjee et al. 2020).

In the sub-category of *Managers*, the following are mentioned in the literature (1) CEO & Leadership Involvement; (2) Age; (3) Risk-Taking and Entrepreneurial Mindset; and (4) Vision-Sharing.

CEO & Leadership Involvement

The CEO, as well as the senior leadership, are crucial for the acquisition and assimilation of information (Gao et al. 2008; Broersma et al. 2016). The ACAP of the leadership level is defined by their ability to recognize valuable information, both in business and in IT, and guide the firm’s further development according to the application of such information (Cohen and Levinthal, 1990; Roberts et al. 2012, p. 632). CEOs are instrumental in the search, acquisition, and assimilation of information due to (1) Their deep influence on complex decisions (Broersma et al. 2016; Ciriello et al. 2018); (2) Their influence on innovation policy (Broersma et al. 2016); and (3) Their involvement in the strategic process and guidance on relevant external knowledge (Broersma et al. 2016).

Additional leaders like Chief Innovation Officers (CIOs) also shape the direction and intensity of the search for new external knowledge and determine its acceptance and legitimatization (Duchek, 2015). To build trust and legitimacy, managers increase the involvement of the

employees, and they allocate resources for the implementation of the acquisition through routines (Egbetokun and Savin, 2014).

The nature of a firm is shaped by the characteristics of its managers (Broersma et al. 2016). Managers who share information regularly and who involve the employees support the ACAP process. However, identifying new knowledge is a difficult task for employees. Too much involvement could overburden employees and „could affect innovation, creativity, and productivity“ in a negative way (Hemp, 2009, in Broersma et al. 2016, p. 5).

Young Managers

According to Gray (2006), younger managers (under 40) are less concerned about preserving their internal knowledge. They are more open to cooperating with other firms and working closely with their network to exchange business and technological knowledge. This suggests that younger managers are pre-positioned to have a higher level of ACAP through their cooperation with the environment and search for external knowledge. Additionally, older managers usually have a lower technological affinity. However, studies have not found that age is a barrier to the adoption of technology (Gray, 2006).

Risk-Taking and Entrepreneurial Mindset

Innovation is considered highly uncertain and risky, wrong decisions tend to have expensive consequences (Aljanabi, 2017; Ciriello et al. 2018). However, taking risks is crucial to innovativeness (Avalos-Quispe and Hernández-Simón, 2019; Darwish et al. 2020). Following this logic, innovative managers are characterized by a mindset higher level of entrepreneurial orientation. Their entrepreneurial orientation increases the level of innovation by shaping the firm’s behavior, and risk tolerance (Aljanabi, 2017). Accordingly, a mindset with a high level of entrepreneurial orientation in managers enhances the firm’s ACAP (Peeters et al. 2014; Aljanabi, 2017).

Vision-Sharing

It is the task of management to sense new opportunities in the market. Pursuing these opportunities reflects their strategic vision for the firm. This vision needs to be communicated clearly and positively to the employees (Guimaraes, Thielman, Guimaraes, and Cornick, 2016;

Stelmaszczyk, 2020). By sharing their vision, managers raise the commitment and motivation of the team to learn and seek new solutions (Banerjee et al. 2020). „Trust in the vision and direction of the managers, and cooperation in the team, encourages communication and improves the efficiency of knowledge exchange across organizational units“ (Roberts et al. 2012, p. 643).

3.3.5 Inter-Organizational Collaboration

“Companies cannot rely solely on internal knowledge development for innovation” (Maes and Sels, 2014, p. 142). Firms, therefore, collaborate with external players (Petraite and Janiunaite, 2010). C*ollaboration* is defined as a deep exchange that involves activities like (1) Sharing and transferring new technological knowledge and production know-how; (2) Co-creation of new products; and (3) Sharing of financial information and environmental changes (Petraite and Janiunaite, 2010; Chowdhury et al. 2017).

Knowledge evolves by recombining expertise available in an ecosystem. To achieve this, stakeholders need to bridge people, technologies, and organizations (Carlo et al. 2012). Among these are firms providing technology, institutes offering financing or research results, customers, competitors, and regulatory agencies (Ciriello et al. 2018).

The positive relationship between ACAP and knowledge transfer has, therefore, been vastly investigated at the inter-organizational level (Cohen and Levinthal, 1990; Zahra and George, 2002; Roberts et al. 2012; Acs et al. 2013; Badillo and Moreno, 2018; Cavillier and Wieser, 2018; Ciriello et al. 2018; Zou et al. 2018). Organizations increase their ACAP by engaging in joint processes and by building joint infrastructures (Malhotra et al. 2005; Flor et al. 2018). Given that knowledge for innovation is multidisciplinary and situation-specific, no single actor (whether an individual or a company) has holistic knowledge. But „the more the actors in the environment are heterogeneous, the more sense they could derive from available knowledge“ (Nambisan et al. 2017, p. 228). In this sense, the greater the ACAP of a firm is, the more a firm can learn from the external environment about customer preferences, technological innovation, and trends in emerging markets, to gain a competitive advantage (Zahra and George 2002; Chowdhury et al. 2017; Zou et al. 2018). The category of Inter-Organizational Collaboration

includes the following sub-categories: (1) Cooperation & Co-creation; (2) Environmental Features; and (3) Mediating Institutions.

Cooperation & Co-creation

Cohen and Levinthal (1990) argue that knowledge transfer depends on the level, quality, and intensity of communication between the firm and its external environment (Cohen and Levinthal, 1990). The external environment, namely customers, partners, suppliers, and competitors, is linked to the firm either through (1) Its business ties (Savin and Abiodun, 2016); or (2) Networks of individuals (Van den Bosch et al. 1999, in Jansen, 2005). These knowledge linkages are „prospective receptors to the environment" (Cohen and Levinthal, 1990, p. 132). Carlo defines them as the „knowing-who" element of a firm's knowledge base (Carlo et al. 2012, p. 870). Socialization, joint decision-making, and knowledge exchange between partners increase the ACAP, especially in a knowledge-intensive environment (Malhotra et al. 2005; Ruiz et al. 2018).

Cooperation is therefore essential for fostering innovation (Moilian et al. 2014; Guimaraes et al. 2016). The more sources there are for cooperation, the broader the exposure to relevant knowledge and eventually the better the chances to identify changes in the environment (Robinson and Stubberud, 2010; Maldonado et al. 2015). However, companies are trying to manage their knowledge and use it exclusively. In each market, there is an appropriability regime that regulates the sharing of knowledge and controls, which participants may benefit from the exchange of knowledge. Appropriability regimes can have a positive or negative impact on firms (Cohen and Levinthal, 1989; Zahra and George, 2002; Todorova and Durisin, 2007; Ritala and Hurmelinna-Laukkanen, 2013). This will be discussed separately in the paragraph on environmental features.

Co-creation with external partners comprises interactive activities of innovative processes (Dahlin et al. 2019). By collecting and transforming customer input, the ACAP increases, and through it also the innovation performance (Dahlin et al. 2019). Co-creation can be seen as attending to customers' needs and therefore securing a competitive edge (Chowdhury et al. 2017). Finally, co-creation reduces costs and unnecessary routines (Dahlin et al. 2019) because it shares the risk and uncertainty (Egbetokun and Savin, 2014). Therefore, co-creation supports the commercialization of innovation in the form of new products (Dahlin et al. 2019).

Customers, Partners, and Suppliers

Customers are the most commonly cited source of information and are said to be more important for successful innovation than technology (Robinson and Stubberud, 2010; Lucena and Roper, 2016; Zobel, 2016). This is because the development of new products focused on customers' needs is more successful than products that are developed based on pure technological abilities (Fichman and Kremerer, 1997). Moreover, firms also learn from the mistakes of early adopters and make amendments to the technology and therefore profit from the economy of scale (Attewell, 1992; Fichman and Kremerer, 1997). This knowledge then enhances future designs (Robinson and Stubberud, 2010; Maldonado et al. 2015).

Customers' roles in the innovation process differ. Previous works suggest three main roles: (1) Customer as a resource; (2) Customer as a co-producer; and (3) Customer as a user (Ryzhkova and Pesamaa, 2015). Relying on the input and suggestions of the users is more valuable for innovation than traditional marketing techniques. If this cooperation is intensified, customers can become co-producers. Once customers jointly create products they identify strongly with the product (Ryzhkova and Pesamaa, 2015).

Knowledge sharing between *partners* is the mutual exchange of knowledge and technical abilities (Zahra and George, 2002; Egbetokun and Savin, 2014; Zou et al. 2018; Ruiz et al. 2018; Flor et al. 2018). "Enterprises recognize, that their competitive advantage is derived from knowledge resources embedded in social relationships with other enterprises" (Malhotra et al. 2005, p. 151). Therefore, they engage in intensive collaboration and communication and use IS tools for the coordination, retrieval, and exchange of knowledge (Malhotra et al. 2005; Ciriello et al. 2018). Good experience and trust in the partner elevate the chances of cooperation. These are achieved through socialization, shared values, and norms (Ruiz et al. 2018).

Firms gain from close relationships with *suppliers* who possess novel technology, a better understanding of new markets, or new capabilities for product development (Cohen and Levinthal, 1990). By maintaining a network of key suppliers, firms gain valuable knowledge about their unique competencies. Such collaborations increase the spectrum of their knowledge base and improve their internal competence and skills (Cohen and Levinthal, 1990; Ryzhkova and Pesamaa, 2015).

Personal Network

According to Gao et al. (2008), the complexity of the technological environment "leads firms to rely on informal or private solutions" (Gao et al. 2008, p. 396). The most successful companies develop their strategies by interacting with the external environment through networks, both professional (Egbetokun and Savin, 2014), and mainly personal (Jansen et al. 2005; Gao et al. 2008). Personal networks, mainly friends or acquaintances of the entrepreneurs, are used to establish connections with potential clients and partners. They facilitate innovation by providing a source of knowledge and novel information (Ahlin, et al. 2014). Ahlin et al. (2014) explain that „because mainly entrepreneurs are involved in the innovation creation, especially in smaller firms, understanding the role of personal networks is important" (Ahlin et al. 2014, p, 214). To sum up, networks, especially personal ones, support organizational learning and the exchange of knowledge, and in turn enhance the innovation performance of a firm (Tsai, 2001; Guimaraes et al. 2016; Dahlin et al. 2019).

Competitors

"Competitors are generally perceived as the riskiest partner type in collaborative innovation" (Ritala and Hurmelinna-Laukkanen, 2013, p. 154), and still, firms must gain new knowledge by monitoring and cooperating with their competitors (Cohen and Levinthal, 1990; Zahra and George, 2002; Todorova and Durisin, 2007; Ritala and Hurmelinna-Laukkanen, 2013; Lucena and Roper, 2016; Maldonado et al; Moilanen et al. 2014; Abiodum and Savin 2016; Zobel 2016; Zou et al. 2018). Imitation of products and technologies that originated from competitors is one way firms improve their product offerings (Carlo et al. 2012). The knowledge that results from technological spillovers from competitors helps focus on what knowledge is needed and how to use it (Cohen and Levinthal, 1990; Gao et al. 2008). This aspect is widely covered under the term *appropriability regime*, which will be discussed below.

3.3.6 Environmental Features

Under environmental features are gathered factors that influence the firm's ability to take certain actions, the speed of these actions, and the circumstances such as location and proximity that may influence the decisions with whom to cooperate and the quality of the knowledge retrieved.

Geographical Proximity (Clusters)

Geographical proximity seems to enhance and even be the source of the competitiveness and innovativeness of firms (Presutti, Boari, Majocchi, and Molina-Morales, 2019). To improve their innovation, firms rely on inter-organizational collaboration as a significant source of external knowledge, especially in highly dynamic and competitive sectors (Zapata-Cantu et al. 2020). When firms are clustered in geographic proximity, the exchange of knowledge increases, thus, allowing them to better develop strategies to sustain the competition (Zapata-Cantu et al. 2020). Innovation through ACAP occurs through networks where actors are geographically closer (Avalos-Quispe and Hernández-Simón, 2019; Presutti et al. 2019; Zapata-Cantu et al. 2020; Darwish et al. 2020). Geographical proximity facilitates technological spillover, especially among firms that devote fewer resources to developing their R&D. Such firms are less able to absorb knowledge from distant partners (Cavillier and Wieser, 2018; Guimaraes et al. 2016; Lambert, 2016; Chandrashekar and Subrahmanya, 2017; Presutti et al. 2019) or hot spots (Presutti et al. 2019). The positive effect of geographical proximity or clusters on a firm depends on how efficiently the firm taps into external sources of knowledge (Chandrashekar and Subrahmanya, 2017).

International Partners

Although the literature points out that geographical proximity (clusters) supports the efficient exchange and flow of knowledge between companies, other scholars argue that gaining a knowledge base is not tied exclusively to local networks because other characteristics (of the ACAP) moderate the level of geographical proximity has an advantage for the firm (Lane, Salk, and Lyles, 2001; Badillo and Moreno, 2018). Lane et al. (2001) add the importance of international partners. In such a relationship, a *parent company* teaches a *student company* new knowledge to gain a competitive edge in their market. According to Lane, the more distant the partner is, the more valuable and novel the knowledge (Lane et al. 2001). Similarly, Badillo and Moreno (2018), indicate that firms „stand to profit more from collaboration with international partners“ than with local ones (Badillo and Moreno 2018, p. 2) because foreign partners provide access to unique resources and new creative ideas (Badillo and Moreno, 2018).

The Complexity of the Technological Environment

The constant appearance of new technologies increases a firm's cognitive burden (Attewell, 1992; Carlo et al. 2012; Savin and Abiodum, 2016; Zhai et al. 2018). „From a technological perspective, these complexities refer to new tools, platforms, and IT standards. From a product perspective, it refers to embedding new functionality, application concepts, and design patterns into software artifacts. From a process perspective, introducing changes in how software is implemented and designed" (Carlo et al. 2012, p. 866).

„Knowledge barriers arise due to the complexity of the technologies and the required experience and abilities of the managers for its implementation" (Fichman and Kremerer 1999, in Roberts et al. 2012, p. 636). Firms that possess related knowledge and knowledge diversity overcome the transfer barriers faster and with less difficulty and are more inclined to innovate and maintain a competitive advantage (Attewell, 1992; Malhotra et al. 2005; Carlo et al. 2012). Moreover, this difference can be explained by the ACAP ability of a firm because ACAP helps to predict the nature of the new technology and its commercial potential (Roberts et al. 2012).

Strong Appropriability Regime

The appropriability regime is a term that describes the attempt of firms to keep their competitive advantage by retaining a knowledge edge seclusive and protected (Cohen and Levinthal, 1989, 1990). The effect of a strong appropriability regime is twofold. On one hand, it helps the firm that holds a competitive advantage through novel knowledge to maintain it. Also, rival firms who enjoy an exchange with the last, secure their uniqueness over others who cannot access this knowledge (Zahra and George, 2002; Ritala and Hurmelinna-Laukkanen, 2013; Kim et al. 2018). However, a strong appropriability regime hinders firms that try to access knowledge and reduce spillover into the ecosystem. In other words, a strong appropriability regime benefits the strong players but reduces the ACAP of the overall ecosystem (Cohen and Levinthal, 1989; Todorova and Durisin, 2007). This results in tensions between and within firms on how to share and protect knowledge at the same time (Ritala and Hurmelinna-Laukkanen, 2013).

3.3.7 Mediating Institutions

Firms can also acquire knowledge from *mediating institutions.* Especially when new knowledge is complex, firms tend to engage external institutions or consultants (Attewell, 1992; Cohen and Levinthal, 1989; Robinson and Stubberud, 2010; Carlo et al. 2012). Such mediating institutions could be research and development centers, patent offices, university labs, governments, and trade associations (Attewell, 1992; Gao et al. 2008). One possibility is *the Triple Helix*[1] network of university-industry-government relations (Etzkowitz and Leydesdorff 2000, in Presutti et al. 2019), which works especially well for geographically close partners. Innovation between these partners needs this proximity because is not a single or discrete process but rather emerges through interactions. High-level individuals possessing skills, expertise, or creative capabilities need to meet and interact to facilitate the spillover of necessary knowledge (Presutti et al. 2019). However, the firm's assimilation of such output is constrained by its level of ACAP (Cohen and Levinthal, 1989).

Local Universities

Research institutions transfer scientific knowledge to the industry (Carlo et al. 2012; Moilian et al. 2014; Maldonado et al. 2015). By collaborating with local universities or research centers firms get access to the latest research (Carlo et al. 2012; Lucena and Roper, 2016; Savin and Abiodum, 2016). Geographical proximity is instrumental in obtaining direct assistance in problem-solving since it enables the exchange of tacit and context-specific knowledge through human resources (Avalos-Quispe and Hernández-Simón, 2019). As an embodiment of this connection university spin-offs have higher innovation potential than traditional firms and they contribute to a higher innovation rate in businesses (Attewell, 1992), especially because they stay connected to the university networks (Carlo et al. 2012; Ciriello et al. 2018).

[1] A term describing the cooperation of three social actors—the university, the private sector, and the government with the aim of generating regional development in the area of innovation.

Government Support

Governments can support innovation in businesses on the one hand directly and on the other hand by providing a reliable and supportive environment. Among the first are funding, training (for example to increase sales or technological training), or facilitating resources for research and development. The latter comprises regulations, which facilitate cooperation between companies, lowering taxes for innovation (Attewell, 1992; Ratten, 2016), and finally, enabling infrastructures such as a fast internet (Ratten, 2016). These are especially important for the use of digital knowledge in knowledge-intensive industries (Gao et al. 2008; Ratten, 2016).

Innovation Programs

„Knowledge has positive consequences for innovation only when it is absorbed" (Mukherji and Silberman, 2013, p. 392). However, a firm cannot successfully absorb knowledge merely by being subjected to it. Different institutions can help a firm successfully absorb knowledge and to foster innovation (Gao et al. 2008; Mukherji and Silberman, 2013). *Innovation Programs* such as incubators provide mentoring and coaching as well as infrastructure and access to their network for a specific amount of time in a protected environment (Ramirez, Flores, Borbon, del Rio, and Ramirez, 2018). These innovation mediators link startups and existing companies so they can mutually benefit from each other, especially in digital technologies (Lichtenthaler and Lichtenthaler, 2013, in Ramirez et al. 2018). „Incubators help firms by advising about the development, helping form a structure, and improving their knowledge through training in different areas including management, marketing, financial, innovation, and accounting" (Ramirez et al. 2018, p. 13).

3.3.8 Influencing Factors: Summary

After reviewing the 7 sub-categories with their 29 individual influencing factors, the following can be stated. Knowledge, explicit and more so, tacit, remains the objective challenge firms deal with in their digitalization race. Firms are often overloaded by the abundance of DI knowledge and by the complexity and dynamic nature of this DI knowledge. DI knowledge must be screened before the decision to acquire it and then, it must be understood, documented, communicated, and transformed in a way that would ensure its exploitation, in the form of profitability and further development of the business. To add to the challenge, firms must search

for diverse DI knowledge. They, therefore, rely on diverse experts, invest resources, and take risks.

Bringing DI knowledge and skills into a firm and employing them to the benefit and future of the enterprise is a team effort. Therefore the team holds a special role in the success of the firm to deal with challenges presented by DI knowledge. An ideal team must be diverse in background, strengths, and styles. However, it must be managed smoothly to ensure an effective knowledge transfer through communication and socialization, members must share the corporate vision and follow the corporate culture. They must be empowered to act as intrapreneurs[2], take responsibility, act free to be creative, and suggest outside-the-box strategies and business directions. They must seek and embrace novelty and avoid working in silos. Their work must be focused, documentation limited to essentials, wide enough to create combinations but accurate and restricted enough to be retrieved easily. But what orchestrates the team?

The type of leadership managers implement is decisive. Managers act as an internal compass of the firm, they are agents of change (Peeters et al. 2014; Maldonado et al. 2015; Zou et al. 2018). They directly influence the innovation creation in their firms by orchestrating the acquisition and transformation of new external knowledge, whether digital or otherwise. They must be deeply involved, and responsible to facilitate a working culture of creativity, freedom, intrapreneurship, and empowerment and to enroll the team in their vision. This management style is a combination of national culture and personality. For example, traits such as risk-taking, entrepreneurial mindset, and growing a vast personal network to support the firm, can manifest naturally or be learned.

But managers serve as double agents. While they are essential for smooth operations and teamwork internally, they must also serve as a bridge to the external environment. This environment opens a world of opportunities and limitations alike, much dependent on geographic and political circumstances. External players can share knowledge, cooperate, and become new clients or partners; mediating institutions such as universities or government

[2] The term intrapreneurs describes individuals acting as entrepreneurs in established firm, being innovative and searching for novel opportunities. For more information see https://intrapreneur.com/gifford-pinchot-iii/

agencies can assist with funding, tests, research, or training. On the other hand, regulations, restrictions, and environmental conditions limit possibilities.

All the internal and external factors listed above in some way affect teams and managers and determine the ACAP of a firm. Different types of firms have different coping strategies at their disposal, therefore the factors have to be evaluated regarding the type of firm. Especially for SMEs, the discussion on ACAP must be enhanced, not only on the level of knowledge absorption, but also to regard leadership, culture, and entrepreneurial mindset, of both managers and team.

3.4 The Formation of Categories and Sub-categories

The individual factors went through the five steps of grounded theory analysis, emerging into two main categories and 7 sub-categories. According to grounded theory, they were evaluated and organized. The abstraction relies a great deal on the researcher's understanding and creativity, as stated in the guidelines of the grounded theory used (Wolfswinkel et al. 2011).

Since knowledge flows from the external environment into the firm, this discussion begins with *Inter-firm* relations and the sub-categories it entails. Moving to the *Intra-firm* section. In the first step of the analysis, the sub-categories are revisited and positioned in the ACAP process, according to the role and importance they play in the ACAP process. By arguing the hierarchies of the sub-categories, the second research question of the first part could be answered, shedding light on how the influencing factors interact.

Discrepancies were noted separately in memos and emerging gaps were written down. These insights represented pieces of information that were either contradicting or presented a new perspective on the factors that were naturally formed within the categories. These are discussed in further detail in the empirical implication of the theoretical results. In this sub-chapter, it is explained how the results of the literature review served as a motivation for the empirical part of this work.

3.4.1 Inter-Organizational Collaboration

"Companies cannot rely solely on internal knowledge development for innovation" (Maes and Sels, 2014, p. 142). Firms, therefore, collaborate with external players (Petraite and Janiunaite, 2010). C*ollaboration* is defined as a deep exchange that involves activities like (1) Sharing and transferring new technological knowledge and production know-how; (2) Co-creation of new products; And (3) Sharing of financial information and environment changes (Petraite and Janiunaite, 2010; Chowdhury et al. 2017). The category of inter-organizational collaboration includes the following sub-categories: (1) Cooperation & Co-creation; (2) Environmental Features; and (3) Mediating Institutions.

Firms can cooperate with local customers, partners, suppliers, and competitors or within personal networks (Malhotra et al. 2005; Ciriello et al. 2018, Cohen and Levinthal, 1990, Ryzhkova and Pesamaa, 2015, Gao et al. 2008, Carlo, et al. 2012; Egbetokun and Savin, 2014, Ahlin et al. 2014, Ritala and Hurmelinna-Laukkanen, 2013, Lucena and Roper, 2016; Maldonado et al; Moilan; Abiodum and Savin 2016; Zobel 2016; Zou et al. 2018). However, firms "stand to profit more from collaboration with international partners" than with local ones (Badillo and Moreno, 2018, p. 2), because foreign partners provide access to unique resources and new creative ideas (Badillo and Moreno, 2018). However, it remains unclear what type of partners are ideal (Apriliyanti and Alon, 2017).

Every environment has different features that impact the ACAP. "Knowledge barriers arise due to the complexity of the technologies and the required experience and abilities of the managers for its implementation" (Fichman and Kremerer 1999, in Roberts et al. 2012, p. 636). Moreover, in each market, there is an appropriability regime that regulates the sharing of knowledge and controls which participants may benefit from the exchange of knowledge. A strong regime helps firms maintain their competitive advantage by not sharing their novel knowledge, thereby reducing the ACAP of the overall ecosystem (Cohen and Levinthal, 1989; Todorova and Durisin, 2007).

Mediating institutions are instrumental when knowledge is complex or not available (Cohen and Levinthal, 1989; Attewell, 1992; Robinson and Stubberud, 2010; Carlo et al. 2012). Such institutions could be research and development centers, patent offices, university labs, trade associations, and governments (Attewell, 1992; Gao et al. 2008). Governments can additionally

support innovation by providing a reliable and supportive environment (Attewell, 1992; Ratten, 2016).

3.4.2 Intra-Firm Relations

Intra-firm relations describe all the activities that take place within the firm and contribute to the ACAP. The transfer of knowledge across intra-organizational structures is crucial for the usage of the acquired information. In this category, factors that form an internal framework specific to each firm are clustered together. This intra-firm framework supports or hinders the absorption of new external knowledge. The category of intra-firm relations includes the following sub-categories: Knowledge Base, Team, Coordination Capability, and Managers.

Each firm has a certain knowledge base. But to be of use for innovation, it needs to be broad (diversity) and deep (depth of knowledge). Diversity enhances the level of innovation because it facilitates the incorporation of new knowledge (Lucena and Roper, 2016; Avalos et al. 2019). Depth helps to understand the potential of new knowledge (Zahra and George, 2002; Lane et al. 2006; Volberda et al. 2010; Leal-Rodriguez et al. 2014; Moilian et al. 2014; Maldonado et al. 2015; Savin and Abiodum, 2016; Lucena and Roper, 2016; Zapata-Cantu et al. 2020).

Firms are able to exploit external knowledge mainly through their R&D (Cohen and Levinthal, 1990; Gao et al. 2008; Roberts et al. 2012). The R&D has to secure the stability of the existing products by incrementally improving them and should at the same time create something entirely new and innovative (Ruiz et al. 2018; Avalos-Quispe and Hernández-Simón, 2019). To overcome the tension between these contradicting demands, some authors suggest practicing structural ambidexterity, so each unit works on a mandate, for either exploitation or exploration (Jansen et al. 2005; Gray, 2006; Volberda et al. 2010; Mukherji et al. 2013; Egbetokun and Savin, 2014; Savin and Abiodum, 2016; Broersma et al. 2016; Chowdhury et al. 2017; Banerjee et al. 2020). While most scholars are clear about the importance of R&D, others believe in ambidexterity (Broersma et al. 2016; Banerjee et al. 2020). In other words, ambiguity remains as to which department controls the DI knowledge.

The sub-category of Teams comprises the way the team communicates, creates, and socializes. Also, its open-mindedness, and commitment to learning. These aspects as a part of organizational culture. The literature groups culture into four main aspects: (1) A culture of

sharing knowledge (Nahapiet and Ghoshal, 1998; Leal-Rodriguez et al. 2014; Costa and Monteiro, 2016); (2) A culture of entrepreneurship (Mukherji and Silberman, 2013); (3) A cultural diversity & creativity (Ahlin et al. 2014; Lambert, 2016); and (4) A shared language (Nahapiet and Ghoshal, 1998; Maes and Sels, 2014). Gender diversity was also found to support ACAP, especially by having women in leadership positions (Galbreath, 2019). However, more coherency is needed in how to motivate the team.

Firms differ in the way they coordinate their activities (Malone and Crownstone, 1994, in Roberts et al. 2012). The absorption and processing of the knowledge depend on mechanisms including policies, routines, and procedures that enhance the ACAP of the firm (Lampert, 2015; Flor et al. 2018). Therefore, ACAP is path-dependent and firm-specific. In other words, this ability cannot be bought; and it takes time to develop (Cohen and Levinthal, 1990). Coordination capabilities support successful assimilation by enhancing the transfer of knowledge across the firm's subunits (Cohen and Levinthal 1990; Roberts et al. 2012). Certain activities facilitate the absorption of external knowledge in different phases of the ACAP process. These can be (1) Routines; (2) Participation in Decision-Making; and (3) Job Rotation. However, it remains unclear to what extent these activities should take place.

Managers engage in regular and intensive observation and monitoring of the environment in the search for new trends. By observing the external environment carefully and accurately, managers can increase the ACAP of the firm (Aljanabi, 2017). Managers motivate, generate trust and commitment to learning, all of which are necessary for ACAP to take place, by keeping the team open-minded (Fichman and Kremerer, 1997; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Todorova and Durisin, 2007; Roberts et al. 2012; Ahlin et al. 2014; Banerjee et al. 2020; Ruiz et al. 2018; Mason et al. 2020; Stelmaszczyk, 2020; Darwish et al. 2020). Therefore, "ACAP is no longer restricted only to the prior related knowledge but is also largely influenced by different leadership styles" (Darwish et al. 2020, p. 86). Managers also facilitate a specific culture, which could support or hinder the ACAP of the firm. There are three parameters concerning managers that were linked to ACAP: young age (Gray, 2006), entrepreneurial orientation (Peeters et al. 2014; Aljanabi, 2017; Ciriello et al. 2018, Avalos et al. 2019; Darwish et al. 2020), and their level of involvement and sharing (Roberts et al. 2012; Guimaraes, 2016; Stelmaszczyk, 2020, Banerjee et al. 2020). Concrete guidelines are required

about how managers should behave, make decisions, and lead the firm, especially in a complex and ever-changing digital environment.

3.4.3 The Influence of the Factors on the ACAP Phases

External influences are crucial in the **acquisition** phase because only through contact with the environment knowledge can enter the firm. While the sub-category of knowledge base remains valuable throughout the entire ACAP process, in the phase of acquisition specifically, factors that describe the environment and the firm's connection to its surroundings shape this phase. The acquisition initially relies on the agents (mainly CEOs and other leaders) and is facilitated by their network. The decision of what to acquire relies on the existing prior related knowledge (typically in the R&D, but not exclusively). Prior knowledge helps make sense of the new external knowledge and create linkages. In sum, for the acquisition phase, the following categories are instrumental: Knowledge Base, Cooperation & Co-creation, Managers, Environmental Features, and Mediating Institutions.

The following steps of assimilation and transformation have to be mastered within the firm:

The **assimilation** depends on the efficiency of the team's knowledge exchange. This depends on the level, intensity, and quality of routines, communication, a culture of entrepreneurship, creativity, trust, and motivation to learn). These factors depend again on the managers and their managing skills. Therefore, the following sub-categories are influential: Managers, Knowledge Base, Team, and Coordination Capabilities.

Afterward, the coordination capabilities and the quality of communication between the team members determine the efficiency with which the newly acquired knowledge will be used by the firm to create innovation. This **transformation** is influenced mainly by the team and depends on their culture & creativity for recombination and further development of ideas. Managers are also required to oversee the process and facilitate the right approach and spirit. Clients are at times also involved in the transformation for tests or pilots. The category of Cooperation & Co-creation is therefore also added to this phase.

The **exploitation** phase refers to commercializing the acquired, assimilated, and transferred knowledge. For this phase to succeed, external mechanisms are needed such as screening and

locating valuable knowledge about who the right customer is (existing or new) is necessary. The manager orchestrates this activity through their network and vision. Therefore, for this phase, managers and clients surface again.

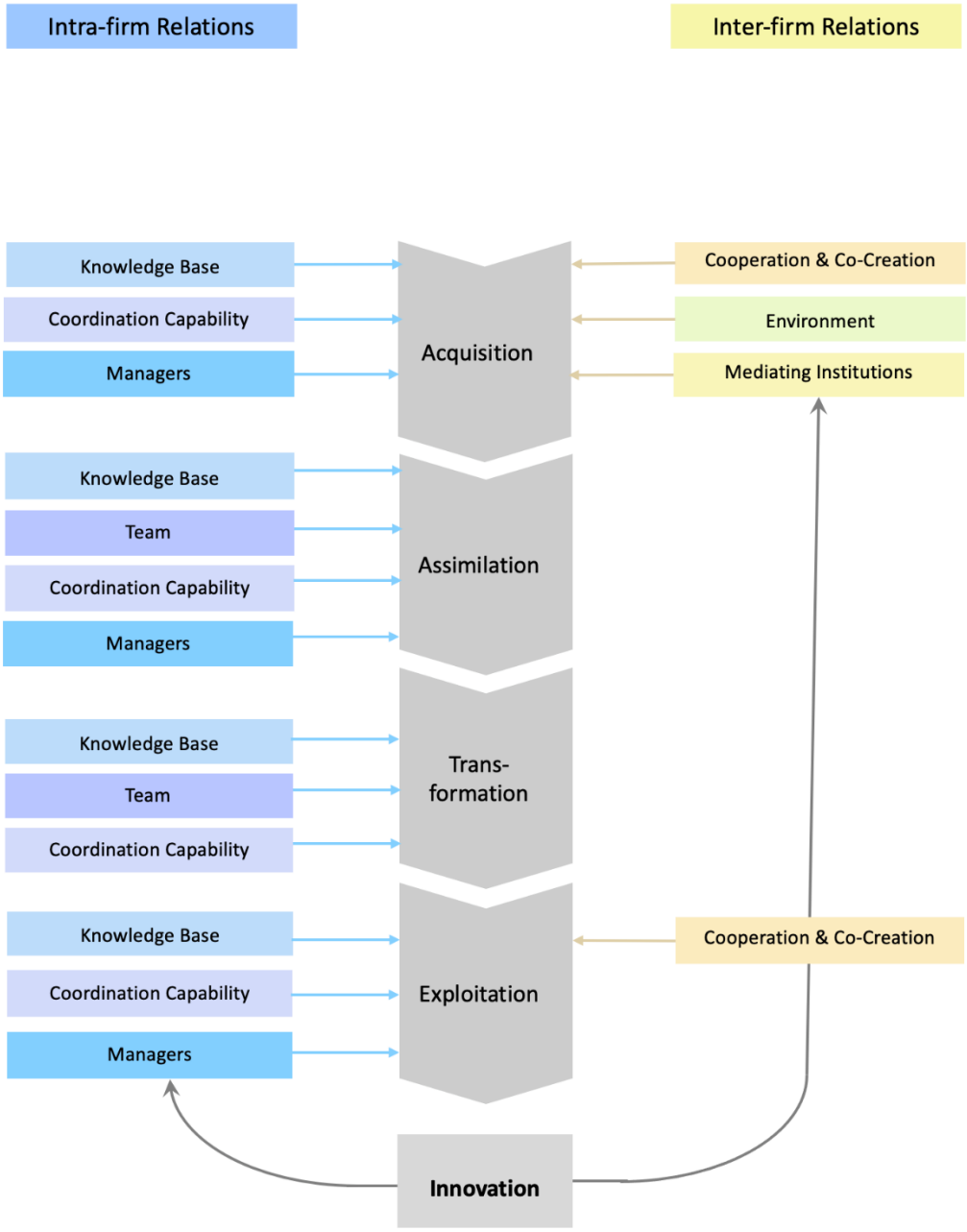


Figure 5: The flow of knowledge in the ACAP process. Own illustration.

Figure 5 presents an overview of the ACAP phases and their influencing factors. In contrast to the clear impact structure of external factors, internal factors shape the whole process. The

knowledge base must be consulted in all phases, and the company has to coordinate itself to make this process productive.

By summarizing the relations and the intensity of influence the sub-categories resonate in the ACAP process, it is concluded that the sub-categories could be divided into main and secondary levels. At the main level, Managers are the most important factor, relying on and conditioned by the Knowledge Base, and Cooperation & Co-creation. Secondary are Team and Coordination Capabilities that follow the directions of the Managers. It is, therefore, concluded that managers, knowledge base, and cooperation & co-creation are the leading factors in the ACAP of knowledge, but they are required more intensely with DI knowledge. Moreover, the literature indicates that managers orchestrate the remaining factors, elevating them to the higher priority influencing factor. The hierarchy is discussed in the following section.

3.5 The Hierarchy and Interaction of the Influencing Factors

Leadership enables a firm to generate a competitive edge by converting external knowledge into strategic innovations or letting it fail (Peeters et al. 2014; Darwish et al. 2020). Innovation is, therefore, the outcome of a systematical entrepreneurial orientation (Aljanabi, 2017). By mapping the different sub-categories and individual factors, it became evident that one factor, managers, influences all the other factors, in both main categories (intra- and inter-firm relations) due to the unique areas of responsibility that they hold. To add to the special tasks managers hold, they usually come with a professional background in management and often than not, in technology. Their job is to monitor the market and influence the team and the coordination within the firm as well as gather market trends and make decisions about the future strategic direction of the firm. These points are elaborated in the following paragraphs to illustrate the connection and the direction of influence managers hold on the other main factors: knowledge base, cooperation, and also the secondary factors: team and coordination capabilities.

Managers and Cooperation & Co-creation

Without cooperation & co-creation with the external environment (namely clients), the added value and the possible application of new knowledge are limited. Cooperation allows the

acquisition of new external knowledge. Such acquisition may serve existing or new markets. Additionally, through co-creation (also testing), experimenting is made possible. This increases the probability of these offerings being exploited. However, it is the managers who rely on their network to add partners, and on their business vision to add new market segments to their offering. They instruct their teams (for example sales or engineers) to partner with specific functions or conduct pilots. The sub-category of Cooperation & Co-creation is, therefore, influenced by the managers, their decisions, and their strategies. Managerial decisions orchestrate the ACAP process because managers control the main factors that ACAP depends on. This starts with identifying which knowledge, is relevant and how to incorporate it into the firm to create and commercialize the innovation.

Managers also instruct with which institutes to cooperate to receive help in accessing the relevant knowledge. Especially in a complex digital environment, managers can decide to rely on institutions that mediate knowledge and give support, whether universities, government aid, or other innovation programs. Managers also determine what kind of partners are sought after (international or local) and whether to cooperate with them. In sum, managers orchestrate the intensity, spectrum, and quality of the sub-category Cooperation & Co-creation.

The sub-category of environmental features, specifically the appropriability regime, is outside the control of firms. Firms can, to some extent, influence their local ecosystem but cannot expect to change the culture of their whole branch. Therefore, these features need to be considered but can hardly be influenced.

Managers and Knowledge Base

The firm's dependence on the existing knowledge base forms the second category, parallel to their cooperation with the environment, namely the knowledge base. The literature emphasizes the strong influence leadership has on learning and innovation (Peeters et al. 2014; Aljanabi, 2017; Stelmaszczyk, 2020). Managers support learning at every level of the organization by constantly gathering information and making sense of it to create value. Their contribution is defined as the ability to recognize the value in external knowledge, develop learning within the firm, and guide the innovation activity (Roberts et al. 2012). Through its managers, firms engage in regular and intensive observation and monitoring of the environment in the search for new trends. By observing the external environment carefully and accurately, managers can

increase the ACAP of the firm (Aljanabi, 2017). Managers also decide how to position the R&D to draw value to the firm while securing its resources.

Managers and Team

Managers influence how the team is organized to receive knowledge, how they communicate, and how the firm coordinates the routine activities that support the processing of knowledge. The sub-category team receives a secondary position because they are directly influenced by managers. Knowledge is exchanged through communication, socialization, open-mindedness, and the team's willingness to learn. Although these factors appear in the sub-category of the team, they are also a derivative of the managers, whose role is to facilitate the right culture, spirit, and openness to support ACAP. Therefore, "ACAP is no longer restricted only to the prior related knowledge but is also largely influenced by different leadership styles" (Darwish et al. 2020, p. 86). Leadership styles include decision-making styles, working methods, and other managerial practices on which the commercialization of knowledge depends (Aljanabi, 2017; Zou et al. 2018).

Managers and Coordination Capabilities

Coordination capabilities help sort, save, and retrieve the knowledge that the firm can use for its operation. They mirror the efficiency of knowledge exchange among the teams, and through it, the leadership of managers. Coordination capabilities help process the acquired knowledge through two main activities: (1) The assimilation of this knowledge within the knowledge base; And (2) Facilitating an exchange of it through routines. These routines create the connection between new and existing knowledge, linking different departments and ensuring that all relevant teams are informed and trained. Managers decide which coordination capabilities are necessary and how to implement them. For example, how many meetings are required and who should be involved in those meetings, whether or not to participate employees in decision making, and how to benefit from job rotation without overloading the teams. Coordination capabilities are, therefore, also dependent on managerial decisions.

3.6 ACAP of DI Knowledge: Summary

The ACAP of external knowledge was discussed with a focus on the influencing sub-categories that must be activated so the process is successful. The ACAP construct may also be used to explain how DI knowledge is acquired (Robert et al. 2012), however, the unique features of DI knowledge make the ACAP more complex (Jansen, 2005; Peeters et al. 2014; Aljanabi, 2017). In the next paragraphs, this complexity will be discussed with the same focus on the influencing sub-categories.

DI knowledge is complex and ever-changing. It requires an understanding and a prioritization of what knowledge is relevant and how it could relate to existing prior knowledge, the core business. This can be done by the managers themselves, or by hiring experts that can help make the decisions. Managers must embrace fundamental changes brought by digital technologies. These vary from a change in products, for example adding digital features to existing products, creating new products and services, or customizing products. Also, production is changing, becoming faster, more accurate, and fully automated. Managers, therefore, face a complex task first by keeping a view of the overload of digital possibilities, making sense of them, and through them, forming a new vision for the firm. Finally, managers must cooperate with external parties much more to achieve this vision.

This complexity of DI knowledge burdens firms, requiring creativity (Hund et al. 2019) and support. Collaboration with customers, partners, and suppliers becomes crucial for the innovation capability of firms (Hund et al. 2019). First, firms cannot tackle the abundance of DI knowledge alone, but moreover, DI knowledge opens new markets for firms. Experts are sought and cooperation for pilots and experimentations is required (Cohen and Levinthal, 1990; Zahra and George, 2002; Roberts et al. 2012; Acs et al. 2013; Badillo and Moreno, 2018; Cavillier and Wieser, 2018; Ciriello et al. 2018; Zou et al. 2018).

New knowledge is integrated into the firm's knowledge base and must be managed. The digital platforms help organize and retrieve knowledge, make new combinations, and help manage internal workflows (Hund et al. 2019). Moreover, DI demands speed (Nambisan et al. 2017). Although managers can hire people with specific knowledge or buy a company for its knowledge, this knowledge still needs to be integrated properly so the firm can draw benefits from it. Therefore, the knowledge base is subject also to managerial decisions and management

mindset. These would facilitate risk-taking, needed at times to steer and further develop the firm.

Especially due to the complexity of DI knowledge, the team must be open to learning, communicating, and taking responsibility for their tasks. Communication must be fluent and clear, exchanged regularly and amongst several subunits. This demands a change of the team to become intrapreneurs, commit, and identify with the firm's goals and managerial vision. In traditional firms whose products are non-digital, teams' understanding of DI knowledge is scarce (Ciriello et al. 2018). The novelty of DI knowledge requires significant changes on behalf of the adopters (Fichman et al. 2014). Team members might express antagonism or take a long time and resources to be trained. The flow of communication, although made easier through digital technologies, is also demanding and made much more crucial for the success of the ACAP process. In addition to the understanding of DI knowledge, the team must also be willing to engage. Entrepreneurial ways of thinking, self-motivation, and an open communication culture must be practiced (Ciriello et al. 2018). Such a change can start only when managers treat their teams as intrapreneurs. Giving them more freedom and responsibilities (Leidner and Kayworth, 2006; Nambisan et al. 2017; Ciriello et al. 2018).

Digital technologies present new possibilities and enhance coordination capabilities by making them more fluent and efficient. Routines and meetings are being taken online, making communication flow easier. Employees spend more time at the office, participating in creating value rather than transporting across the globe. Job rotation activities are also made easier when done digitally. Managers orchestrate how routines are conducted in the firm and allocate the resources for it whether by providing a strong infrastructure or by instructing priorities.

The analysis of the influencing factors indicates that the ACAP practices remain similar, whether the knowledge is about DI or any other type of knowledge, concluding that it's rather the managers' mindset that determines the effectiveness and intensity of the ACAP process, and through it, the different results in digitalization. The complexity of DI knowledge indicates that the inter-relations between the sub-categories leading to innovation in the digital era are more intense, making the role of the managers even more decisive. The findings from this section helped crystalize the central and crucial role of managers, as the main character that orchestrates the ACAP of DI knowledge, throughout the different phases. In sum, there is a

clear hierarchy when it comes to the ACAP of DI knowledge. This positions the manager as the main coordinator of the different phases of ACAP and the orchestrator of the other influencing factors.

This conclusion is situated also in the literature. The way managers lead their companies is a direct result of their mindset (Lynch and Corbett, 2021). A firm's entrepreneurial attitude relies on individual managers who set the goals, define strategies, and facilitate the risk (Drejer et al. 2004). One of the most important features of an entrepreneurial mindset is the persistence to pursue a market opportunity or a venture and continue evolving it until it is executed (Lynch and Corbett, 2021). Entrepreneurs must possess both abilities: searching and executing opportunities. This duality moves across a timeline and must repeat itself (Lynch and Corbett, 2021). Additionally, entrepreneurs need to be flexible to shift their direction when it is evident that an opportunity does not fit. Finally, they must tolerate risk and failure in doing so (Chen et al. 2020, in Lynch and Corbett, 2021).

The entrepreneurial way of thinking and behaving differs from business managers mostly in their decision-making processes (Mitchell et al. 2020 in Lynch and Corbett, 2021). Entrepreneurs' decision-making is fast and heuristic. It is difficult to teach because the processes leading to a decision are mostly unconscious (Gollwitzer and Bayer, 1999, in Lynch and Corbett, 2021) and are tied to cognitive processes designed to solve problems. They affect how information is perceived (Nenkov, 2012, in Lynch and Corbett, 2021), interpreted, and how the individual behaves (Gollwitzer, 2012, in Lynch and Corbett, 2021). Following this logic, managers need to be entrepreneurs, regardless of the size of the company if they want to be innovative. But, to understand the leader as an entrepreneur who contributes to the innovative culture in their organization, is not enough. It is important to elicit what influences the entrepreneurial mindset of the managers, and whether the attributes which lead to innovation creation could be transferred and learned.

3.7 The Empirical Implications of the Theoretical Results

The following paragraphs will focus on gaps that surfaced in the literature review. Some have to do with specific factors, internal and external, influencing the ACAP of the firm. Others have to do with the scientific approach taken in the existing literature to explore the ACAP construct. The detection of these avenues serves two purposes. On one hand, these gaps serve as a motivation for this work, and most of them are addressed in the empirical investigation conducted in this research. On the other hand, these gaps can inform other researchers of avenues for further research.

The empirical implications begin with gaps concerning the ACAP process, in all phases, but especially in the transformation phase. Moving to examine the gap dealing with the role of R&D in the ACAP of DI knowledge. Afterward, the gap in the influence of external mechanisms on the ACAP is discussed, concluding with the lack of a cross-cultural examination of the ACAP of firms. Finally, gaps in the methodology are addressed, namely, the claim that not enough qualitative research was conducted in the field of ACAP, resulting in mostly indirect measurements, failing to touch the influencing factors directly.

Realized ACAP: Transformation

Studying the factors that enhance the different dimensions of the ACAP, the actors in each phase, and their interaction, it was found that the literature satisfactorily covers the acquisition and assimilation phase (Potential ACAP). However, research gaps concerning the Realized ACAP were identified, specifically in the transformation phase. A firm can possess a high capability to acquire or assimilate knowledge (Potential ACAP) and still be weak in transforming and exploiting knowledge, therefore not realizing its ACAP (Zahra and George, 2002; Volberda et al. 2010). The transformation phase is elaborated on to discuss the research gaps:

Transformation: Since a successful transformation is enabled by coordination capabilities and driven by the team, efforts to improve transformation have to start with factors related to these fields. Coordination capabilities comprise routines, participation in decision-making, and job rotation. Routines facilitate the recombination of existing and newly acquired and assimilated knowledge (Cohen and Levinthal, 1990; Nahapiet and Ghoshal, 1998; Zahra and George, 2002;

Jansen, 2005; Roberts et al. 2012; Kim, 2018) enhancing the Realized ACAP (Jansen, 2005; Leal-Rodriguez et al. 2014; Zou et al. 2018). On the other hand, *routinization* may decrease the ability to acquire and assimilate new external knowledge (Potential ACAP) by imposing rigid structures.

Participation in decision-making and job rotation facilitates knowledge linking and transfer through the firm's units (Jansen et al. 2005; Roberts et al. 2012; Zou et al. 2018) thus fostering alertness to new information (Cohen and Levinthal, 1990, p. 133), and open-mindedness to apply this new knowledge. However, both involve massive effort and costs (Volberda et al. 2010). These controversial factors have one problematic feature in common: Their optimum cannot be reached by an increased effort (Jansen et al. 2005; Zou et al. 2018). Therefore, it is asked how these factors can be optimized to serve the Realized ACAP as well as the Potential ACAP.

The other sub-category essential to transformation is Team. Communication is the core with all factors contributing (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen, 2005; Roberts et al. 2012; Wuryaningrat, 2013; Ciriello et al. 2018). However, communication, specifically from tacit to explicit knowledge, remains under-investigated in the transformation phase. To date, there is a lack of knowledge on what should ideally be communicated, to what extent, and with whom. On one hand, social relations enable knowledge to flow through communication (Rindfleisch and Moorman, 2001, in Jansen, 2005). On the other hand, social structures manifest a status quo, which hinders the consideration of alternative processes (Nahapiet and Ghoshal, 1998). Therefore, it is asked how communication and socialization can enhance the transformation process. This aspect is especially challenging for DI knowledge, because the innovation may not only touch upon the product itself but on the firm culture as a whole, changing communication, and hierarchies. The team must cope and adapt to these innovations to get them successfully implemented in the firm.

The managers' contribution starts in the acquisition phase, as they recognize the value in external knowledge; and continues in the assimilation phase, where they develop learning within the firm and guide the innovation activity (Roberts et al. 2012; Volberda et al. 2010; Broersma et al. 2016; Aljanabi, 2017; Stelmaszczyk, 2020; Darwish et al. 2020). However, "merely determining promising opportunities is not enough. Firms must capitalize on these

opportunities through transformation and exploitation of this information" (Aljanabi, 2017, p. 826). Also, Alves et al. (2016) claim that leadership influences transformation (Alves et al. 2016). However, scholars do not specify how. It is, therefore, asked what is the managers' role in the transformation phase. In this context, it should also be noted that the identification of too much new knowledge could result in an overload and thus negatively affect „innovation, creativity, and productivity" (Hemp, 2009, in Broersma et al. 2016, p. 5). It is, therefore, important to track what is the right balance between sharing and overloading.

The Role of R&D in Incremental and Disruptive Innovations

Past research has regarded the R&D as the focal unit to assimilate new knowledge internally while as a second role being in charge of the incremental development of existing products (Cohen and Levinthal, 1990; Zahra and Geroge, 2002; Gray, 2006; Wang et al. 2010; Carlo et al. 2012; Roberts et al. 2012; Alves et al. 2016; Mason et al. 2020). However, disruptive and incremental innovation (exploration vs. exploitation) could collide and therefore should be separated via ambidexterity (Jansen et al. 2005; Gray, 2006; Volberda et al. 2010; Mukherji and Silberman, 2013; Egbetokun and Savin, 2014; Savin and Abiodum, 2016; Broersma et al. 2016; Chowdhury et al. 2017). Most SMEs have only one engineering department, which they refer to as R&D. This department focuses mainly on protecting and incrementally improving the core business. This department constitutes the core business of the firms but also covers aspects of construction, design, and assembly of new features that could be added to existing products. But as DI touches not only upon the product, and changes but markets, production, and the whole organization, it is unclear if this department is the right one to be entrusted with fundamental digital innovations. DI might call for ambidexterity (Broersma et al. 2016), as it entails fundamental changes for the whole company. In sum, scholars are not clear about the role of R&D in ACAP, especially for SMEs and DI. It is, therefore, asked, how R&D should be positioned in the ACAP process, especially concerning DI knowledge, and in which setting ambidexterity is promising.

Focus on External Mechanisms of ACAP

"The ACAP literature offers a fine-grained description of how internal integration mechanisms affect the ACAP development process but does not address external mechanisms" (Ruiz et al. 2018, p. 66). Customers, partners, and suppliers support the commercialization of innovations

by contributing to their development (Dahlin et al. 2019). Close cooperation with them ensures a higher acceptance and exploitation possibility of innovation (Fichman and Kremerer, 1997) because it ties companies together. Egbetokun and Savin (2014) argue for partners who possess novel and relevant knowledge, and who invest much in their own ACAP. On the other hand, intellectual property is more difficult to maintain and control, and some technologies, like blockchain, are designed for trust-free cooperation (Manyika et al. 2016; Cavillier and Wieser, 2018). In the meta-analysis of Apriliyanti and Alon (2017), the question of how to choose partners surfaces again. It is, therefore asked, who are the right partners for a firm and through which strategic activities they can be attracted to cooperate. As cooperation bears risks for both sides, it is also important to inquire: How does digitalization influence cooperation with partners?

A Cross-Cultural Investigation of ACAP

The literature cited in this work mentions several aspects of culture: A culture that facilitates knowledge exchange; entrepreneurial culture; diversity; creativity; and a shared language. These aspects dictate how firms behave and how knowledge is shared (Cohen and Levinthal, 1990; Attewell, 1992; Fichman and Kremerer, 1997; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Jansen et al. 2005; Lane et al. 2006; Todorova and Durisin, 2007; Roberts et al. 2012; Leal-Rodriguez et al. 2014; Mukherji and Silberman, 2013; Ahlin et al. 2014; Lambert, 2016; Lucena and Roper, 2016; Costa and Monteiro, 2016). As all these aspects are imperative to ACAP and innovation, it is inquired: How the difference in the innovation of firms in similar industries is rooted in a difference in their national culture? Dahlin argues that “to the best of our knowledge, no study has tested such a model across different national contexts” (Dahlin et al. 2019, p. 82). It is, therefore, proposed to investigate similar firms in different countries to learn about the influence of culture on the ACAP. In this context, elevating differences in the ACAP practices, starting with the manager and resonating throughout the firm, will be examined in relation to cultural differences.

Measurements and Research Methodology

At the beginning of this section, contradicting perceptions of the nature of ACAP were noted. This problem does not only touch upon definitions but raises the question of how and what to measure in the ACAP construct. Although ACAP is described as a dynamic capability, it is still measured as an asset (Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012; Alves et al. 2016). Instead of using direct measures, ACAP is measured via indirect proxies such as investment in R&D, education of the employees, or patents (Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012). These easy-to-measure factors are widely used in quantitative investigations to evaluate a company. However, they only capture ACAP as an asset and are thus only appropriate for the first stages of ACAP. The complete innovation process has to be measured by the output (Cohen and Levinthal, 1990; Robinson and Stubberud, 2010; Volberda et al. 2010). Furthermore, they give no clue how to achieve ACAP, and therefore, fail to explain the success criteria on which guidelines could be built. Viewing ACAP as a dynamic capability might help to close this gap.

ACAP is domain-specific within a firm (Attewell, 1992). As such, firms could have high ACAP in one area (traditional product), while having low ACAP in other areas (Volberda et al. 2010; Leal-Rodriguez et al. 2014; Ciriello et al. 2018). Traditional firms have acquired knowledge about their specific domain long before they had to deal with digitalization. Their ACAP in this domain might be high and the firm is currently successful. But this alone does not ensure a successful future. In the future, this firm might need a high ACAP concerning DI as well. As digitalization impacts not only the product but the organization as well, not only R&D will have to deal with the process, but all departments. However, they will face different struggles specific to their industry (Roberts et al. 2012). Therefore, their ACAP might differ and should be examined individually. Roberts et al. (2012) call to develop specific measurements for specific knowledge domains. Otherwise, results may not be valid and transferable, especially for IS research since it currently fails to conceptualize how IT impacts ACAP of different domains (Roberts et al. 2012).

Some of the indirect measurements target individual capabilities rather than the ACAP of the organization as a whole (Roberts et al. 2012). This compromises the validity of the multilevel construct since there is a clear distinction between individual ACAP and organizational ACAP.

While the first depends on overlap and coordination of individual knowledge across several individuals, the second is by far the more complex and depends on combinations of several groups, departments, organizations, and institutions (Roberts et al. 2012). According to Roberts et al. (2012), research on ACAP should, therefore, focus on the organizational capability to transfer individual knowledge. It is, therefore, inquired: How does knowledge flow from the individuals to the organizational level? A qualitative investigation would help discover the real- and direct reasons rather than an average that results from a quantitative approach.

Exploring the open questions and combining the insights into one framework will result in a detailed view of ACAP and its ideal process. From this baseline, guidelines can be developed on how firms could improve their ACAP of DI knowledge to sustain in the market. These guidelines should be tested in each industry and firm size separately to avoid bias, which could result from other influencing factors or specific circumstances, such as the size of a firm or market segment (Roberts et al. 2012).

In sum, the empirical implications of the theoretical results have emerged into gaps in all of the main sub-categories influencing the ACAP of DI knowledge. In Managers, more information is missing about their specific role in the transformation phase. This must include inquiries about leadership styles, decision-making, and vision sharing, indicating the level of entrepreneurial mindset a manager possesses. In Cooperation & Co-creation, information is missing about the types of ideal partners that firms should cooperate with. This investigation should be accompanied by examples of successful or non-successful projects and whether digitalization has changed the choice of partners. In the Knowledge Base, the focus should be dedicated to the positioning of R&D in the creation of innovation through DI knowledge. Also, the issue of ambidexterity should be covered here. In Teams, the focus remains on how communication and socialization should be organized to enhance the ACAP process in general and in the transformation phase specifically, to reach a balance between sharing and avoiding overloading. In Coordination Capabilities, the topic of practicing routinization efficiently remains a priority. Also reaching the optimum level of participation of employees in decisions deserves notice. Finally, the need for a qualitative research method to reveal direct measurements of ACAP and shed light on the topic of ACAP of DI knowledge should be used. Further, investigating similar industries in different cultures will help gain a framework for the influence of culture on the ACAP with a focus on the industry.

4 Innovation in Traditional Manufacturing SMEs

Innovation is challenging for all firms (Kammerland et al. 2017; Avalos-Quispe and Hernández-Simón, 2019; Bitkom Research, 2020; OECD, 2020), especially for small firms with traditional products (Yoo et al. 2010; Eller et al. 2020). But it is their only chance to comply with new industry requirements to remain competitive. SMEs lack digitalization per se. This manifests in a lack of IT understanding or digital maturity. In other words, when the firms' performance is not based on digitalization (Eller et al. 2020).

When SMEs produce a physical product, a new value is mostly created by adding features or services to the product (Becker and Schmid, 2020). These may include anomaly detection, big data, human-machine interfaces that coordinate the information between machines and their operators, or support. Digitalization for SMEs additionally includes automatization of their production (BMWi, 2020), for example, Artificial Intelligence (AI), the Internet of Things (IoT), Robot Process Automation (RPA), and Cloud Computing, to develop and promote their products and enhance manufacturing processes or open new markets. Such digital technologies are innovation assets and are crucial to SMEs and large firms alike. Only SMEs are facing more difficulties in implementing these technologies (Bianchini and Kwon, 2020). However, despite SMEs' flat hierarchies and smaller sizes, which allow them to practice agile management styles and make decisions quickly, they lack the resources to realize those (Becker and Schmid, 2020). Moreover, managers are overwhelmed by the richness of available DI knowledge (Zhang et al. 2022).

If an SME does not succeed in digitalization, this can be linked to either of the three groups of challenges SMEs are facing: (1) Lack of awareness and understanding of the available and required digital technologies due to inferior connectivity; (2) Lack of resources to engage in digitalization; and (3) Difficulties in amending existing business models for the new reality (European Commission, 2021). SMEs, therefore, must retain support to define, select, and plan their transformation, fund it, and understand the regulations involving it. Moreover, SMEs must dedicate time to training the digital skills of their workers (European Commission, 2021).

Several factors determine the extent to which SMEs use digital technologies and transform their activities: size, resources, openness, and the existence of support. Innovative firms which grow

rapidly, are more inclined to adopt advanced digital technology for their growth. This requires openness and the allocation of resources. Moreover, firms whose value is global and whose clients are international would need more digital technologies to remain competitive. This requires support in acquiring the DI knowledge in the first place. On the other hand, smaller firms will usually lack the resources to support their digitalization. Also, firms that do not trust the development of digital technologies and the corresponding regulations will neglect to pursue it. And finally, firms that experience barriers from approaching government or other support, will not approach digitalization (European Commission, 2021).

A crisis can also impact the extent and success of the digitalization process in firms. The COVID-19 crisis pushed SMEs in general, including traditional manufacturing firms, to incorporate digital products and processes to maintain their operations (European Commission, 2021). Those who were already inclined to use digital technologies had better chances of survival (OECD, 2021).

In addition to creating a competitive advantage, overcoming crises, and growing, SMEs need digitalization to create added value by increasing the efficiency of the value chain through automation. Automation not only reduces the costs of production but also makes them more accurate, safe, fast-produced, and independent of manpower (Becker and Schmid, 2020). To automate, SMEs may need to combine cross-division departments to facilitate the change, finance the digitalization from revenues and shareholders, at times also through government funds, and refine from implementing an overall and unified solution, and choose rather than automate just parts of their productions processes (Becker and Schmid, 2020). Therefore, similar to other firms, SMEs cannot achieve digital transformation on their own and they depend on cooperation with partners and governments (Tarute, Duobien, Klovien, Vitkauskait, and Varani, 2018).

The German Federal Ministry of Economic Affairs and Climate Action[3] searches for ways to support SMEs in their digitalization transformation (BMWi, 2020). However, according to the annual report on European SMEs, the state of SMEs' digitalization has a long way to go

[3] Bundesministerium für Wirtschaft und Klimaschutz

(Interreg Europe, 2021). Less than 50% of SMEs reported having a digital strategy, however, 71% reported adopting more digital technologies in response to COVID-19 (European Commission, 2021). Although the majority of SMEs do not have a strategy for dealing with digitalization (Becker and Schmid, 2020), very little research has been done on the digital transformation of SMEs (Eller et al. 2020; Zhang et al. 2022).

Potentially, SMEs a more likely than larger firms, to create new products and services to meet the market's demand as well as develop new production techniques to increase sales. While only 25% of SMEs are global, there is a growth opportunity for others to expand internationally as well (OECD, n.d.). This potential is dependent also on the support they may receive, especially from governments. Governments may reduce regulations and support new initiatives, network SMEs with new clients and markets, support them financially, and encourage clusters (OECD, 2000).

4.1 Digitalization in Israel and Germany SMEs

In addition to factors inherent to the firm, the environment influences the degree of the firm's digitalization. The environment includes government structures as well as competing and cooperating companies. A comparison between environments with different characteristics can therefore shed light on individual factors and determine their impact. This is the reason for a comparison between Israel and Germany.

Israel and Germany differ in the way they approach digitalization. While both prioritize digital technologies and agree on which technologies take precedence, they differ in the application of these technologies in the firms. Germany scores relatively low in digitalization (European Commission Report 2020a), but is very advanced in automation, whereas Israel invests more in research and development (International Federation of Robotics, 2020).

The International Federation of Robotics (IFR) measures how many robots are operating worldwide. The robot density is measured versus 10,000 employees. The most automated country in 2020 in this report was South Korea. Germany was placed number four, after

Singapore and Japan, with a robot[4] density rising from 66 in 2015 to 126 in 2020 (International Federation of Robotics, 2020). The market size is estimated to reach 5.6 billion Dollars in 2027. Israel ranks 15th out of 132 countries in innovation (Global Innovation Index, 2021). The Israeli industry invests less in machines than the OECD average. However, they are very high in their investment in research and development, similar to South Korea (Ministry of Economy and Industry of Israel, 2018).

As digitalization remains a challenge for most EU member countries and Germany confides with the average of the members on all scales (Interreg Europe, 2021), government programs have been set up to aid SMEs. A wide range of programs exists to support SMEs with their digitalization challenges. This helps identify and develop digital skills through training, providing networks, encouraging cooperation, and giving financial support on different levels, according to the digital maturity of the targeted firm (European Commission, 2021). However, in comparison to other European members, only 43% of the German SMEs reported using public programs aid, while the European average was 61%, and the highest was 85% (European Commission, 2021). Due to the importance of government-aiding programs, the next sections will discuss the aid Israeli and German government programs provide.

The Israeli government also supports SMEs by opening programs and agencies whose task is to supply networks, training, funding, and expert consulting to overcome the digitalization challenges. For example, the Small and Medium-sized Agency (SMBA[5]) under the Ministry of Economy and Industry provides training and consultation through the Maof business center. The Israeli Small and Medium-sized Enterprises Authority (ISEMA[6]), under the Ministry of Industry and Trade, guides SMEs to become entrepreneurs and helps them promote and coordinate their activities. They also offer exposure to business networks and funds. The

[4] The focus is on Collaborative Robots (CoBots).

[5] https://maoftech.org.il/en/about-the-program/

[6] http://www.israelbusiness.org.il/startingyourbusiness/assistingcenters/smallbusiness

National Digital Israel National Program[7] supports digital adoption for various firms, including SMEs (Ministry of Economy and Industry of Israel, n.d.).

The most known authority for innovation is the Israeli Innovation Authority (IIA[8]). IIA was previously known as the Office of the Chief Scientist (OCS), incepted in 1965. The authority aims to foster industrial R&D as well as amend policies to secure the development of early-stage, or mature firms and academic groups seeking to transfer research, and global corporations interested in Israeli technology. The funding for IIA is granted by the Ministry of Economy. Several programs have been launched to reach this goal. Technological incubator and ideation programs (like Tnufa[9]) and incentive programs (like Magnet[10]) provide grants for R&D collaboration between industry and academia. International programs (like Matimop[11]-Iserd[12]) work together with the EU, USA, Canada, Singapore, and the rest of the world. They secure agreements and partnerships in bilateral support, multinational cooperation, and R&D. Mentoring programs, such as the Israel Business Connection[13], are active in these segments.

The Growth Division at IIA is focused on SMEs. They operate a wide range of incentive programs that assist hi-tech companies in the sales growth stage as well as mature hi-tech companies that utilize growth channels based on technological innovation and/or seek assistance in funding innovative research and development. Incentives and assistance programs for SMEs in Israel include tutorial courses, inception support, and consulting (the service is provided through Maof branches spread throughout the country). Coaching is done on the topics

---

[7]https://www.gov.il/BlobFolder/news/digital_israel_national_plan/en/The%20National%20Digital%20Program%20of%20the%20Government%20of%20Israel.pdf

[8] https://innovationisrael.org.il/en/contentpage/israel-innovation-authority

[9] https://innovationisrael.org.il/en/program/ideation-tnufa-incentive-program

[10] https://innovationisrael.org.il/en/program/magnet-consortiums

[11] https://www.era-learn.eu/network-information/organisations/matimop-israeli-industry-centre-for-r-d

[12] https://innovationisrael.org.il/en/program/bilateral-programs-european-countries

[13] http://www.israelbusiness.org.il/aboutus/ibcprofile

of management, finance, marketing, organization, logistics and operations, standardization, export, import, sales, licensing, design, information systems, computing, innovation, business space, public, and more. But most importantly, the accompaniment is personal, done by a coach dedicated to the firm, visiting its facilities and remaining hands-on.

The Advanced Manufacturing Division (like Mofet[14] or R&D Preparatory Incentive Program[15]) focuses on promoting the implementation of R&D and innovation processes in companies in the manufacturing sector in order to strengthen their competitiveness in the global arena and improve productivity across a variety of industrial sectors. Through the Israel Innovation Agency (IIA) and Mofet, funds were dedicated to supporting R&D. SMEs were then able to increase production efficiency and maintain in the market. Moreover, they secured jobs and the national position of Israel.

Other programs have to do with technological infrastructure: Supporting research and development promoting applied R&D, leveraging R&D for dual application, technology transfer, support for research institutions as well as collaboration between companies on R&D to support their activities. The Societal Challenges Division[16] focuses on improving the effectiveness and quality of public sector services, as well as enhancing social welfare and quality of life through boot camps, training on DI, and technological innovation.

Another organization supporting IIA and the Ministry of Economy and Industry is Startup Nation Central[17], an independent non-profit entity that connects the triple helix (government, industry, and academia) as well as NGO leaders worldwide with Israeli innovation. As a result, Israeli innovators receive access to high-potential markets through highly customized

[14] https://innovationisrael.org.il/en/program/mofet-rd-manufacturing-industry

[15]https://innovationisrael.org.il/en/program/rd-preparatory-incentive-program-companies-manufacturing-industry

[16]https://innovationisrael.org.il/en/contentpage/israel-innovation-authority#:~:text=The%20Societal%20Challenges%20Division%20focuses,Coding%20Bootcamps%20Program

[17] https://startupnationcentral.org/

engagement and free-of-charge platforms connecting all parties, mainly in the sectors of Industry 4.0, Ag- and Food-tech, and health.

To complete the ecosystem, universities, and research centers provide valuable help for SMEs. Whether in research results, testing, or knowledge. Indeed, All the firms interviewed reported having used this government support continuously. Many startups provide Business-to-Business (B2B) solutions especially aimed at SMEs, for example, The Foreign Investment and Industrial Cooperation Authority (Ministry of Economy and Industry of Israel, 2018).

A similar system exists also in Germany. The digital agenda is a white paper presented between the years 2014 and 2017 by the German government. In its digital agenda, the federal government of Germany has defined guidelines for its digital policy and the necessary action items to reach its goals. In this agenda, the German government refers to innovations that will be inserted in learning, society, business, and academia (BMWK, n.d.).

In addition to the digital agenda, there is also the digital strategy document from 2016 which refers to legal policies and measurements that Germany will need to successfully deploy the digital transformation by 2025. One of the main technologies in this strategy is AI. Inserting this technology will secure Germany's competitive position, in the economy and society. Specifically, help SMEs in their industry 4.0. The government provides funds and training to help the integration of the technology but also to lower the resistance of the citizens and employees to it, also by researching and approaching its ethical aspects (BMWK, n.d.).

By recognizing that there is no one size fit for all, the federal government of Germany has taken practical and precise steps to support firms in choosing the right digital technology for their change. Training platforms such as Atingi[18] are helping educate people who seek advice on how to use digital technologies to advance their business or life in general. By establishing development programs such as Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH[19] (GIZ), established by Germany's Federal Ministry for Economic Cooperation and

[18] https://www.atingi.org/

[19] https://www.giz.de/de/html/index.html

Development[20] (BMZ). Digital solutions are tailored in a local context to fit the needs and ecosystems of single firms by matching them to funds, partners, and experts and allowing them to benefit from best practices. Similar programs have been activated in the UK (2012) and Belgium (2016), however, the concept of Digital-by-Default[21] entered into power in Germany in 2018. Since then, firms have been obligated to prefer and advance the use of digital technologies in realizing their different projects, foremost in the industry, but also in other sectors of Germany (OECD, 2022).

In the German Digital Strategy for 2025, steps for the future are defined. These focus on the following: (1) Funding the enlargement of the internet platform via gigabit optical fiber network to store digital documents and allow an uninterrupted transmission of knowledge (10 billion Euros); (2) Launching a new startup era by creating and supporting startups by lowering the bureaucracy and encouraging cooperation between them and established companies to scale their products and sustain. This support includes strengthening the venture capital scene in Germany, which is much smaller in comparison to other European countries, the US, and Israel. This will also involve tax reduction on turnover and services provided by the VC funds; (3) Strengthening the stock exchange as a funding source for ventures and reducing tax on a minority of shares; (4) Competition programs for young ventures in which the winner receives funding support (Digital Strategy, 2025).

The government also plans to create a regulatory framework for digital development to increase investment and innovation while protecting consumers by complying with European laws but still being competitive with international offers. For this, a European Single Market[22] must serve the interests of manufacturing firms, banking, automotive, logistics, trade, energy, and transportation as well as of private individuals and allow safe connectivity in ICT and cloud

[20] https://www.bmz.de/en

[21] https://www.bmz-digital.global/qualitaetsmerkmal-digitalisierung/digital-by-default/

[22] https://european-union.europa.eu/priorities-and-actions/actions-topic/single-market_en

computing. This will be done by developing a digital legal code that secures open and fair competition, provides data security, and is harmonized throughout the EU.

Encouraging smart networks in different infrastructures will allow citizens a higher degree of social and political participation, as well as a higher efficiency and productivity rate. This demands funds, generating a European standard for data protection regulations, and creating synergies of programs. Furthermore, training is necessary for removing technological barriers; finally, these platforms must allow cooperation between individuals, companies, associations, and countries.

Strengthening data security and moving toward informational autonomy. Since data is the raw material in the digital economy, companies must store and analyze data, and data protection must secure individuals and companies from data abuse. IT security and data protection are valuable to maintain Germany's competitiveness in the international arena as well as its national security. This expertise will be developed with other companies and the scientific community to keep up with European standards (BMWi, 2020).

Such support programs enable new business models for SMEs and train craft employees to ignite and maintain their digitalization transformation. Therefore, the government offers a user-friendly guideline for SMEs specifically on how to acquire digital technologies and implement them in their processes and business models. Under the initiative of SMEs 4.0[23], digital production and work processes such as cloud, communication, process management, and commerce are being taught. The program Go-Digital[24] offers financing and IT security, as well as internet training. An additional program called Go-Inno[25] offers 50% financing for consulting services for firms smaller than 100 employees. Additional programs such as the

[23] https://www.sme40.eu/

[24] https://www.bmwk.de/Redaktion/DE/Artikel/Digitale-Welt/foerderprogramm-go-digital.html

[25]https://www.pfif.net/news/innovationsgutschein-go-inno/?gad=1&gclid=Cj0KCQjw1rqkBhCTARIsAAHz7K0atZzQoxnS5V5VGAQNyCWi-ntoDaHO_35C7mSHyr9g1tg3nkNO0i4aAnkgEALw_wcB

Central Innovation Program for SMEs[26] (ZIM: Zentrales Innovationsprogramm Mittelstand) and the Industrial Collective Research Program[27] (IGF: Industrielle Gemeinschaftsforschung) also provide ever-growing funding. Finally matching programs of startups and established firms support SMEs in their challenges for digital production and novel ideas (BMWi, 2020).

Modernizing production through Industry 4.0 is crucial to remain competitive versus the alternatives in the USA and Southeast Asia (Japan, South Korea, and China). The goal is to keep production in Germany by implementing Industry 4.0 and ICT. These will allow to insertion of digital components and technologies in traditional products and ease complex production processes, thereby creating added value in terms of services and customer relations and conserving production resources. However, only 60% of German companies are prepared for the challenges of Industry 4.0 and they are worried that the IT sector will take over their core business. Therefore, the role of government programs for production SMEs must be more active and intense in terms of knowledge and funding. Finally, bilateral cooperation is important in the area of testing and learning from best practices and creating excellent research about digitalization, especially in traditional industries (BMWi, 2020).

Germany currently spends half of the US on such research and therefore cannot advance the traditional SMEs. The use of technology in German firms is outdated, only 5% in comparison to 49% in the US. Research on ICT and digital innovations is also missing, this can also be seen in a lower number of patents in the area of communication. In the manufacturing segment, 3D printing and robotics are taking a huge role, however, there is still work to be done, especially in the health segment. In the area of smart homes, digital technology has revolutionized it through connectivity. However, also here, Germany has to go a long way to reach its potential. Also in cloud technologies, Germany must take steps to close the gap with other countries. Germany must invest in transfer from science to industry, especially in promoting R&D projects and supporting digital technology implementation in manufacturing SMEs, by subsidizing parts

[26] https://www.zim.de/ZIM/Navigation/DE/Infothek/UeberZIM/ueber-zim.html

[27]https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/BMWi/industrielle-gemeinschaftsforschung.html

of their costs and lowering taxes. Specific examples include The technology program Smart Service Worlds[28] (Smart Service Welten) for technologies related to Industry 4.0; For Autonomous Systems: The program Autonomics for Industry 4.0; The PAiCE[29] Program for product engineering, logistics, service robotics, industrial 3D applications, and industrial communication; And Smart Data Program[30] for data-based innovation (BMWi, 2020). There is still a need to expand these programs for IoT and IT security (Digital Strategy, 2025).

An effort was invested in introducing digitalization in education to match the gap of new professional opportunities created by digitalization. Europe lacks millions of data experts and training programs. Despite the availability of the Internet in German schools, their teaching programs do not include digital forms of learning and digital equipment such as tablets. Also, cross-segment in every industry, firms state the need to train their employees in data analytics, social media, programming, data protection, and data security. Information Science must enter each school program by 2025. IT training shall be given at any workplace by 2025, public education institutions will make training available in a larger volume, the public universities will also share their knowledge with the industry, dual education programs that combine a profession with traditional learning have a special role in this and will receive money from the government for this, particularly for these segments: IT systems, electronics technician, IT specialist, IT system support specialist, and IT office. Funding programs for business formation at universities, such as EXIT[31], must be expanded, as well as online offers such as Massive Open Online Courses[32] (MOOCs) should be better integrated into university studies. Finally,

---

[28] https://www.bmwk.de/Redaktion/DE/Artikel/Digitale-Welt/smart-service-welt.html

[29]https://www.digitale-technologien.de/DT/Navigation/DE/ProgrammeProjekte/AbgeschlosseneProgrammeProjekte/PAiCE/paice.html

[30] https://www.bmwk.de/Redaktion/DE/Artikel/Digitale-Welt/smart-data.html

[31] https://www.exist.de/EXIST/Navigation/DE/Home/home.html

[32]https://www.bmwk.de/Redaktion/DE/Publikationen/Digitale-Welt/digitale-bildung-der-schluessel-zu-einer-welt-im-wandel.pdf?__blob=publicationFile&v=8

centers of excellence such as Work 4.0 and Mittelstand 4.0[33] will help support and train employees prepare them for the digital transformation, and educate their media literacy.

Creating a digital agency as a center of excellence to cope with the challenges that digitalization presents to public authorities. These include fair competition, confidentiality, security of the systems used, and consumer protection. Policies must be implemented in order to enforce these challenges. The first step is to interconnect all the federal agencies and help them share data as well as advance and support the other initiatives specified above. Digital analysis should also contribute to educated conclusions and an overview of the activities (BMWi, 2016).

In sum, the German government also offers several programs. The government's priority is the development of digital capabilities (OECD, n.d.). They promote their use in 10 pillars. The first one is in education and the individual lives of the citizens, the focus being on the public, social, academic, and scientific sectors (Digital Skills and Jobs Platform, n.d.). They invest in infrastructure, support startup creation and network them to established firms, regulate innovation, encourage smart networks (human-machine or machine-machine interfaces), strengthen data security, enable new business models for SMEs, and create centers of excellence (BMWi, 2016).

According to the *DZ-Bank Digitalization Survey*, there is a lot to be done to support the digitalization of SMEs, but „while 88% of all companies understand the connection between digitization and commercial success, 51% of the SMEs surveyed said that digitization is not (yet) part of their business strategy" (BMWi, 2016, p. 37).

The assistance offered by the German government to SMEs is focused mainly on centers of excellence to give training on digital production, digital communication, cloud computing, commerce and services, digital finance, IT security, and digital marketing. In addition to the training and information, the Go-Inno program financially supports firms, but only with up to

[33]https://www.mittelstand-digital.de/MD/Redaktion/DE/Artikel/Mittelstand-4-0/mittelstand-40-kompetenzzentren.html

100 employees. This program grants 50% subvention for consulting in the field of innovation management (BMWi, 2016).

The Central Innovation Program for SMEs[34] and the Industrial Collective Research Program[35] will increase their budget substantially to identify the aid programs' deficiencies. These funds are designated to improve the visibility of programs and help new SMEs to join them. They offer consultancy and assistance in the implementation of „personal and organizational development activities, development of target-group-specific technologies, and investment grants for spurring investments and IT implementation projects at SMEs, including assistance in the implementation process" (BMWi, 2016, p. 38).

Additionally, the development of new internet-based platforms is focused on creating pan-European but also some international networks. These are designed to help SMEs access DI knowledge specifically on ICT solutions, as well as non-technical innovation. Finally, funds will be dedicated to the building of a Digitisation House[36] in Berlin for SMEs. This will serve as a meeting point to exchange knowledge, presentations, and exhibitions, and for matching SMEs with startups, and government agencies to manage the support process for SMEs (BMWi, 2016).

For digitalization in production, "only six out of ten companies in Germany are well prepared for Industry 4.0" (BMWi, 2016, p. 42). Therefore, the Ministry of Economic Affairs partners with the business and the scientific community to educate through events firms in IT security, standardization, and legal framework (BMWi, 2016).

[34] ZIM: Zentrales InnovationsProgram Mittelstand.

[35] IGF: Industrielle Gemeinschaftsforschung.

[36] Haus der Digitalisierung.

4.2 Research Methodology and Design

In this sub-chapter, the methodology of this research is presented. First, the research method is introduced, then the case studies are introduced, detailing the research questionnaire, the analysis, and finally, the limitations are discussed.

4.2.1 Qualitative Research

Since the complete innovation process has to be measured by the output (Cohen and Levinthal, 1990; Robinson and Stubberud, 2010; Volberda et al. 2010), researchers recommend capturing the ACAP through direct measurements rather than indirect proxies (Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016). Considering that indirect proxies are mostly quantitative, using qualitative methods is a better fit to measure ACAP directly (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016).

Qualitative research methods are best used when there is a need to discover something new, new ways in the ever-changing digital environment, when we need to reflect to better understand, and when we are dependent on analyzing human interactions, uncertainties, ambiguities, and contradictions. Qualitative research provides new scientific ways of thinking, especially when researching innovation potential, usage, and development of software (Gey and Zinke, 2014).

Qualitative research focuses on exploration, description, and sometimes on generating or constructing theories (Flick et al. 2004). Qualitative methods are flexible. The research treats any kind of information as relevant and important. There are no hierarchies about the information or among the interviewees. Any perspective or point of view is important and is taken under consideration (Flick et al. 2004, p. 5).

In sum, qualitative research methods were selected for this work for the following reasons: (1) The need to discover something new, reflect, and better understand the phenomenon (Flick et al. 2004; Gey and Zinke, 2014); (2) The need for exploration and description (Flick et al. 2004); and (3) The need to remain flexible (Flick et al. 2004).

4.2.2 Case Studies

Within the qualitative approach, multiple case studies were selected to compare dyad firms (Yin, 2017). Case studies are designed to handle the richness of the variables found in the literature review and capture the complexity of the topic: ACAP of DI knowledge. A case study design is typically used when the research seeks to answer "how" and "why" questions about a real-life phenomenon that requires an "extensive description" (Yin, 2009, p. 4). Moreover, these questions have to do with "contemporary events over which the investigator has little or no control" (Yin, 2009, p.13).

Among other attributes, the case study design allows a combination of multiple sources and detects patterns for comparison (Yin, 1994). The strength of case studies research is in its empirical (internal) validity and the allowance of a dialog between the findings (Öz, 2004). This will eventually help create guidelines based on reality. In the words of Eisenhardt: Case studies represent an "intimate interaction with actual evidence" (Eisenhardt, 1989, p. 546). The information provided by a case study is rich, novel, and empirically grounded. These are traits that are not possible to obtain quantitatively, thereby they support an understanding of complex structures that are typical to organization and management (Yin, 1994). Moreover, despite the lack of generalization limitation, it is possible to generate "analytic generalization" (Yin, 1994, p. 10), by relating the results to the propositions made in the theory, rather than to a wide population.

"The sample size should be proper and sufficient for explaining the studied occurrence, irrespective of the sampling method used" (Rusu, 2020, p. 182). Due to the challenges of overload, Eisenhardt suggests limiting the cases to 4 - 10 (Eisenhardt, 1989). Cases are selected according to their likelihood to extend and contribute to the emerging theory (Eisenhardt, 1989). According to Yin, "every case contributes to the overall inquiry. Each case should be synthesized also with the literature and compared to real findings" (Yin, 1994, p. 45).

According to Eisenhardt, there are three approaches to conducting case studies: (1) To select categories and search for similarities within the group and differences between the groups; (2) To select pairs of cases and list similarities and differences between them; or (3) To divide the data by source, using more researchers (Eisenhardt, 1989).

The second strategy was chosen for this work to allow the emergence of unexpected categories while maintaining a standard according to the questions asked. First, each SME is compared to its dyad SME in the same industry, and later, all four cases are compared to each other. This helps eliminate bias that could have emerged by overlooking the reason for the industry-specific differences.

4.2.3 Semi-structured Expert Interviews

Within the case studies, semi-structured expert interviews were conducted. Experts can help with the crystallization of important points. They give opportunities to expand the research by obtaining rapid and unproblematic access to information (Bogner, Littig, and Littig, 2009; Diekmann, 2017). The researcher followed the guidelines of semi-structured expert interviews (Flick et al. 2004; Adams, 2015).

To ensure reliability and comparability, the researcher used a guided interview with open-ended questions. The questions were presented in English, while the managers were free to respond in either English or their respective mother tongue. Answers were later translated into English and the researcher conducted communication validation (Flick et al. 2004) to ensure that the message was captured accurately. The interview questions were not disclosed to the informants before the interview.

In addition, a pretest was conducted to ensure the quality of the questionnaire (Buschle, Reiter, and Bethmann, 2022), which will be discussed later in this chapter. Insights from interviews were also used to formulate new questions to be added to further interviews. For example, the question about values was added after one CEO mentioned this as his motivation. Similarly, some questions yielding similar answers from all informants were dropped. For example, to establish an understanding of the firm's digital maturity, it was inquired about which digital technologies or platforms they currently use. Since all the answers were unanimous, they were later taken out of the protocol, to make room for questions that promised novel insights instead.

4.2.4 The Cases

Four industries were selected from which one Israeli and one German company were compared. From these four cases with eight firms, 16 experts were interviewed. According to Eisenhardt

(1989), each case compares the two SMEs from the same industry to each other (within-case analysis), and then to all of the cases (cross-case analysis). The four cases are:

Case 1: Industrial Furnaces

Case 2: Food Packaging

Case 3: Dental Implants

Case 4: Compression Fitting Pipes (later: Pipe Fittings)

All companies are located in periphery areas. 7 out of 8 CEOs are male, and their education is in engineering, dentistry, and business. While all firms are family-owned, some are led by family members, and some hire an external CEO.

4.2.5 Interview Partners and Interview Setup

Based on the literature review revealing the central role of managers, CEOs were first to be interviewed. For additional informants, following the purposive sampling technique, each CEO was asked to refer the researcher to the next informant, who may contribute to the understanding of the topic (Tongco, 2007). These were identified as experts since they provided valuable insights for the study (lker et al. 2016).

The managers were interviewed between June 2021 and April 2022. The interviews lasted an average of 60 minutes. Due to COVID-19 travel restrictions, the interviews were conducted online via video call in the natural environment of the research subjects (Bryman, 2016). The main parameters in the interview settings: comfort (physical and psychological), privacy, and quiet, were observed (Flick et al. 2004; King et al. 2010; Glaser and Strauss, 2017). Moreover, to avoid any bias, informants whom the researcher did not know were chosen. Interviews were recorded and notes were taken additionally.

4.2.6 Design of the Questionnaire

As the formulation of research questions impacts the answers, the research questionnaire determines the quality of the results. Different formulations of the same question may induce different answers, and thus, in the attempt to move toward scientific work, the researcher must

evaluate how well the questions represent the research goal and the focus of the inquiry (Hess et al. 1999).

The reliability of the questionnaire is demonstrated also by asking questions that require thought and reflection (Hess et al. 1999). Especially in qualitative research, understanding is the key to ensuring the quality of the data collected. However, the process of understanding is influenced by a wide spectrum of possible interpretations. These interpretations must be clarified and agreed upon (Buschle et al. 2022).

The process of answering a question can be divided into three steps. First, interviewees must interpret the question and decide how to form their answers. In the second stage, they rely on their memories and understanding to integrate their knowledge and conclude with a decision on how to answer. At last, they transform their decision into a response to fit the exact question (Krosnick and Presser, 2009).

To validate the questionnaire, the questionnaire design principles of Krosnick and Presser (2009) were followed and a qualitative pretest interview (QPI) (Buschle et al. 2022) was conducted. According to the question and questionnaire designs, the following principles were implemented: (1) Use of simple and familiar words; (2) Avoiding ambiguity and abstract wording; (3) Refining from leading questions; and (4) Inquiring about one thing at a time.

The questions were grouped according to topics and proceeded from general to specific. The first questions were easy to answer and focused on the topic directly. Sensitive questions were kept for the end of each section (Krosnick and Presser, 2009).

The questions were formalized clearly and directly, thereby moving towards objectivity. To strengthen the internal validity, ambiguity was avoided by refraining from using suggestive questions (Diekmann, 2017). To increase reliability, communication validation (Flick et al. 2004) was used. The interviews were held in the natural environment of the informants (Bryman, 2016). Although via digital means (due to COVID-19), in the offices of the informants. Finally, the structure of the questions was built according to the ACAP phases with a focus on the conceptual framework and theoretical base.

4.2.6.1 Pretest

The goal of the pretest was to ensure that the interview questions were formulated in a way that the interviewees could understand. This helped ensure that they were encouraged to answer them fully and in a meaningful way and guaranteed that the questions fully covered the subject. The pretest was conducted with an external expert, who was not a part of the final research. This expert worked in several industrial firms as a CEO, board member, and later as an external consultant. He brought the experience of a CEO together with a deep understanding of how SMEs function and how digitalization is influencing and challenging them.

Following the OPI guidelines (Buschle et al. 2022), the research topic was introduced first. In this section, the pretest expert understood that ACAP is instrumental for innovation creation and thereby, for the survival of firms. He asked how the influencing factors were prioritized and accepted the answer that the priority was based on the literature review analysis, resulting in positioning managers as the main influencing factor to ACAP. Also, he accepted the argumentation about the positioning of the two other main sub-categories: Knowledge Base and Cooperation & Co-creation. These three sub-categories were followed by: Team (communication) and Coordination Capabilities (routines) as the secondary influencing factors. The pretest expert suggested explaining the ACAP framework and the goal of the research at the beginning of the interview. This was implemented thereafter in each interview.

The pretest interview consisted of two parts. First, the expert was interviewed using the interview guide to be tested. In the second part, he was asked to reflect on the interview guide using the following questions:

1. Did you understand all the questions?
2. Are the questions phrased simply and clearly?
3. Do you see the connection between the questions and the research topic?
4. Was any part of a question or a term unknown to the interviewee?
5. Did you understand the meaning of the question in the way the researcher intended?
6. Are questions redundant?
7. Is the sequence of the questions correct?
8. Is it possible to answer the questions within one hour?

9. Are the questions concrete enough?

Using a communication validation (Flick et al. 2004), it was confirmed that the expert understood the questions in the way they were intended. The questions were clear and on the topic. One question was found redundant, and one was moved to another place in the sequence. It was possible to complete the interview in under one hour. And the questions were concrete enough. The detailed responses of the pretest expert can be viewed in Annex A.

4.2.6.2 The Questionnaire

The interview questions are based on the literature review findings and the analysis. The seven sub-categories that are crucial for the ACAP appear in the interview questions according to their chronological appearance in the ACAP processes.

The questionnaire, therefore, begins with the knowledge base of the firm. This illustrates the status quo of the firm at a given moment. In this section, it was especially interesting to gather initial information on how the firm was affected by DI, and how the industry would be affected. The prognosis of the industry's future challenges and the directions the firm might have to take to cope with the changes indicated the complexity and the resources firms are prepared to allocate. In this section, the sub-category of environmental features was included.

Asking for a concrete example was added to make the discussion more effective. Additionally, the positioning of R&D in the digitalization transformation was added to contribute to the literature debate on the double role of R&D versus ambidexterity. As a counterpart to R&D, a question on IT was inserted, and finally, an inquiry about the protection of knowledge, which is also a huge issue concerning the creation of relevant and deep prior knowledge.

As discussed in Chapter One, managers hold a decisive role in the success of their firms, namely by managing and orchestrating the ACAP process (Peeters et al. 2014; Maldonado et al. 2015; Zou et al. 2018). Therefore, placing the inquiry about managers second. In this segment, the focus was on the transformation phase of ACAP, since the literature on this topic is not distinct enough. The next inquiries in this sub-category were about how managers make decisions, their innovation strategies, management styles, and operations in an uncertain and ever-changing environment. Finally, managers were inquired about their values, drive, and motivation. This

question was added to bring to light the philosophy behind innovation. Unlocking what drives managers could help trace the reason for differences in the exploitation phase.

The third sub-category was Cooperation & Co-creation. As explained in Chapter One, without joining forces, no firm could ever overcome the challenges of knowledge overload and lack of expertise in DI knowledge. Therefore, firms cooperate (Maes and Sels, 2014; Hund et al. 2019; Siachou et al. 2020; Kiefer et al. 2021). In this section, it was important to understand with whom firms cooperate, with whom not, and why. In other words, how to choose the right partner (Apriliyanti and Alon, 2017). Managers were asked about a concrete example of a project involving DI knowledge, which either succeeded or failed, and the reasons for that result. By asking about a concrete project, it could be easier to trace decision patterns and best practices about whom to cooperate with. This could give an example of real value which could be extracted by DI knowledge and help its implementation. Finally, it was inquired about their general approach to cooperation versus risk. This was added to indicate the mindset towards risk and the priority of advancing knowledge versus protecting the firm. Moreover, it included the sub-category of Mediating Institutions.

The last two sub-categories which were defined in Chapter One as secondary in their importance to ACAP were added last to give a complete overview of all seven sub-categories identified as influencing the ACAP process. Especially interesting was the way communication is done in the sub-category of Teams and how knowledge is exchanged. Concerning the sub-category Coordination Capabilities, it was inquired about the routines, mostly meetings, and documentation, that are being conducted regularly. This too was based on the findings from the literature review and was designed to illustrate how the daily business is organized, and what could be changed to increase efficiency. In the next paragraph, the interview questions are presented.

<u>Interview Questions:</u>

Knowledge Base (with the inclusion of environmental features)

1. How did DI influence your line of business and what is about to come?
2. Tell me about a project involving DI knowledge. Was it successful or not, and why?

3. How should R&D be positioned in this process, especially in DI knowledge? Is there another unit responsible solely for DI?
4. What role does the IT department (not R&D) have as a driving force in communicating DI knowledge?
5. Think of one leading manager leaving, aside from the documented knowledge, how do you protect tacit knowledge?

The Role of Managers

6. What is your role in the transformation phase of ACAP?
7. How do you go about when you want to implement a new idea about DI in your company? How fast did you decide? And how long does it take until implementation? How much time does it take to cancel a project which is not working? Whose decision is it?
8. How do you deal with the ambiguity and uncertainty of DI knowledge (when you cannot rely on past knowledge or experience)?
9. How do you deal with the tension between the involvement of employees versus overload? What do you share? And what not?
10. What is your motivation to do what you do?

Cooperation & Co-creation (Customers, Partners, Suppliers, Competitors) and Mediating Institutions (universities and other innovation programs)

11. Does digitalization change the way you cooperate and in what way?
12. Tell me about cooperation with an external partner. Was it successful/unsuccessful and why? Why did you choose this partner?
13. How do you estimate the risk of sharing vs. cooperation?

Team

14. How are communication and knowledge exchange within the company organized?

Coordination Capabilities

15. Which routines are essential and who is involved in them?
16. How do digital technologies influence routinization?

4.2.7 Case Presentation

In the next section, the four cases, representing the empirical part of this work, are introduced. Each case handles a dyad of manufacturing SMEs, in different industries. Case 1 Industrial Furnaces; Case 2 Food Packaging; Case 3 Dental Implants; and Case 4 Pipe Fittings. Each case begins with a snapshot of the firm. The information in this part was obtained by allowing CEOs to initiate what they wanted to share, representing their narrative and view of the firm. By avoiding directing the informants, insights could be derived about their focus.

The next section summarises the interview responses given by the CEOs and later the second manager of their choice. To remain consecutive, the Israeli firms are presented first, and then the German firms (following the order in which the interviews were conducted). In the analysis sub-chapter, the within-case analysis describes first the similarities, followed by the differences between each firm in the case.

The similarities are gathered in a text format. To ease the understanding of the differences, they are presented in both a text format and additionally in a table. This way of presentation makes it easier to track and capture fine discrepancies which could elevate possible reasons for it (Eisenhardt, 1989). In the final sub-chapter of each case, the differences found are also summarized as an extraction of the ACAP processes in each firm.

Although the questionnaire referred to five sub-categories: Knowledge Base, Managers, Cooperation & Co-creation, Team, and Coordination Capabilities, the last two are not presented since similar answers were given throughout the cases, leaving no meaningful difference in either the industry or the culture. The next two paragraphs connect the literature findings about these sub-categories with the empirical findings resulting from the interviews, concluding with the decision to focus only on the main three categories in which differences were indicated. These could shed light on the phenomenon of the ACAP of DI knowledge across cultures and industries.

Team

As discussed in Chapter 3, the main aspect referring to the sub-category of the Team in the literature can be summarized as organizational culture. In organizational culture, four main groups are mentioned (1) A culture of sharing knowledge (Nahapiet and Ghoshal, 1998; Leal-Rodriguez et al. 2014; Costa and Monteiro, 2016); (2) A culture of entrepreneurship (Mukherji and Silberman, 2013); (3) A cultural diversity & creativity (Ahlin et al. 2014; Lambert, 2016), and (4) A shared language (Nahapiet and Ghoshal, 1998; Maes and Sels, 2014). Gender diversity was also found to support ACAP, especially the existence of women in leadership positions (Galbreath, 2019).

Since communication facilitates the exchange of knowledge, it is the core of ACAP (Cohen and Levinthal, 1990; Zahra and George, 2002; Jansen, 2005; Roberts et al. 2012; Wuryaningrat, 2013; Ciriello et al. 2018). Researchers call to investigate it further (Jansen et al. 2005). Therefore, in this section, the open-ended question (Flick et al. 2004) inquired about communication and knowledge exchange.

Throughout the 16 interviews, in all 8 firms, all managers reported that the communication and the team are friendly and open. Employees are involved in the innovation process. As a thumb rule, the Israeli firms relied more on inofficial communication, however, all in all, they use the same methods to communicate and the same friendly atmosphere. Mostly, both Israeli and German teams had a culture of entrepreneurship to some extent. Both teams were engaged and informed about the vision and the action plan. In both Israeli and German teams, some resistance evolved about the necessity of DI knowledge and its chances to work. Also, the interviewees raised concerns about the workload were raised. However, in both firms, the CEO managed to convince the resistance. Since no meaningful difference arose in the segment in any of the participating firms, it will not be addressed specifically again.

Coordination Capabilities

The success of the ACAP process depends on the sum of knowledge and the transformation of this knowledge through coordination capabilities (Cohen and Levinthal, 1990; Zahra and George, 2002; Roberts et al. 2012; Leal-Rodriguez et al. 2014; Ciriello et al. 2018; Zapata-Cantu et al. 2020). This segment inquired about the activities that are dedicated to this exchange

of knowledge (Malone and Crownstone, 1994, in Roberts et al. 2012). The sub-category of Coordination Capabilities included (1) Routines; (2) Participation in Decision Making; and (3) Job Rotation. Open-ended questions (Flick, 2004) were used to allow managers to express their views on what was important.

Overall, the Israeli firms tended to let different team members participate in decisions. The German firms were more inclined to rotate team members than include them in decision-making. However, these activities were not central and no meaningful differences in the result of the ACAP process could be linked to them. Therefore, the questionnaire focused on routines such as meetings and documentation. There was a tendency for Israelis to document and meet less. All in all, in each case, the number of meetings was similar between the Israeli and German firms. On average, 3-5 meetings per week. These are important for knowledge exchange, solving problems, and keeping the team spirit. Furthermore, no differences were detected in comparison to other cases. Therefore, this sub-category is also reduced from the interview summary, to save time and concentrate on the main influencing factors.

4.2.8 Data Analysis: Within - and Cross-Case Analysis

The purpose of the within-case analysis is to discover differences between Israeli and German dyads, operating in the same industry. Each case must be treated as a „stand-alone“ allowing all patterns and factors to resonate (Eisenhardt, 1989). The answers of the interviewees were noted according to the influencing factors of ACAP, based on the literature review (Wolfswinkel et al. 2011). Both similarities and differences were noted. Differences that emerged were coded in comparison to one another and presented in a table. These codes cover the following topics:

- Managers: the role of the manager in innovation creation in every phase of ACAP.
- Knowledge Base: what kind of DI knowledge is missing and relevant for the business and which department is organizing this transformation (R&D, IT, ambidexterity)?
- Cooperation & Co-creation: where to look for the missing DI knowledge, with whom to cooperate, and why.
- Team (communication): communication and knowledge exchange culture.

- Coordination Capabilities: routines, meetings, and other behaviors that help coordinate the innovation creation through ACAP.

In the second step, patterns were searched using a cross-case analysis (Eisenhardt, 1989). Following Miles and Huberman (1984), the data was reduced to ease the „conclusion drawing and verification“ (Miles and Huberman, 1984, p. 23). In addition to the four tables of Step 1, a fifth table was created with the reduced data to compare the four industries with each other. This table was added to elevate additional possible influencing variables that were not explained in the first phases of comparison, thereby avoiding bias and allowing the crystalization of the factors according to the ACAP activities of the firms.

The data was sorted according to its relevancy. Relevancy is graded according to the codes' importance, subject to the researcher's interpretation. Finally, the measures to be taken are deducted and communicated to the groups of interest (Vogelsang, Steinhueser, and Hoppe, 2013). The emerging codes are first graded separately from the literature, according to the informants' responses. Topics that were given high importance by the informants are graded higher. High importance was assumed when the topics were mentioned repeatedly or when the informants emphasized them especially. In the end, the rating of the codes serves as a basis for the formulation of guidelines that could serve to increase the ACAP of DI knowledge.

4.2.9 Limitations

Although objectivity is not possible to achieve through qualitative methods (Amstrong, 2010), the researcher may move closer to objectivity by keeping the interpretation, comprehensiveness, and comparability transparent. To come closer to replicability, the research proceedings were documented (Bryman, 2016). External validity and generalization are also not obtainable in qualitative research (Sarantakos, 1994). However "the literature also recommends using tables at this point to have a simplified comparison between the cases" (Miles and Huberman 1994; Yin 2014, in Becker and Schmid, 2020, p. 994). This was solved by choosing a Within – and – Cross-case Analysis (Eisenhardt, 1989; Yin, 1994) and presenting the results in tables. Finally, coming closer to internal validity is possible by controlling possible intervening variables (Diekmann, 2017). This was achieved by avoiding suggestive questions or manipulation and conducting the research according to the scientific approach.

The second bias could have emerged from cultural and language gaps. By comparing dyad firms in two innovative markets, Israeli and German managers were interviewed. Cultural differences in the approach, as well as language barriers, were threatening the accuracy of the answers. To avoid this type of bias, the interview questions were formulated and asked only in English. However, to benefit from the flow and richness of the answers, the informants were allowed to respond in either English or their respective mother tongue.

4.3 Case 1: Israeli and German Industrial Furnaces SMEs

This case focuses on two family-owned furnace manufacturers for the industrial market. Their products serve the aviation, medical, and energy segments. Since gas is scarce in Israel, Israeli firms do not develop gas furnaces and cannot experiment with them. In this case, the Israeli firm produces electric heating systems but sought to operate internationally and therefore needed to expand its knowledge into the gas field. Therefore, they acquired the German firm in 2019. The German firm is 40 years old. The Israeli firm is 80 years old. Both CEOs are external to the family firm and were recruited two years prior to the interview. They are both male and in their 50's. The Israeli CEO studied engineering, while the German CEO was educated in business. Additional informants, in this case, were the Israeli and German VPs of engineering.

The German firm excelled in the field of gas furnaces and was very advanced in implementing digital technologies in its products. Such technologies were Programmable Logic Controllers (PLCs) and Human-Machine Interfaces (HMIs). The PLC enjoys a flexible architecture that can be programmed to each machine separately. They collect and control data, and can also perform actions according to the program instructions. The HMI sits on top of the PLC and allows a human to interact with the machine. Despite the superiority of the knowledge base, the German firm was almost bankrupt due to certain business decisions. The Israeli firm was missing knowledge and experience about gas furnaces which were increasingly in demand on the market. They performed a gap analysis versus the competition to understand their position in the market and decided to acquire knowledge about gas furnaces in response. They then found the German firm and acquired it due to their knowledge base but also as an investment.

4.3.1 Summary of the Interviews: Case of Industrial Furnaces

Israeli Firm

Knowledge Base

The Israeli firm was dealing with electro furnaces and was lacking knowledge in the area of gas furnaces. To acquire this knowledge, the Israeli firm bought a German firm, specializing in this area. In addition to the types of energy, the field of industrial furnaces is also competing over abilities in Industry 4.0. Two main technologies are relevant in this segment: Human-Machine-Interface (HMI) and Overall Equipment Efficiency (OEE). These allow the user to retrieve information from the machine usage through sensors that indicate the condition of the machine or allow an analysis of how much time a process takes. This firm also programmed a Process Control system (PC) that allows for gathering data from the machine. In this program, the HMI is installed to visualize the condition of the machine. The goal is to automate this PC so the system would be more accurate. A fully automated solution is one of the requirements of Industry 4.0. This will allow an analysis of every data retrieved. In sum, firms operating with these digital technologies have an added value over firms that are unable to gather information from the machines. The goal of the Israeli firm is to have these technologies in all certified products of the firm.

In addition to these priorities shared by the entire industry, the Israeli firm has also acquired and transformed other digital technology, seemingly, not connected to their field of activities: Augmented Reality (AR). During the lockdowns of COVID-19, the firm had to reevaluate how to maintain its installation service for overseas clients. Since without installation services, they could not sell the products, they concluded that remote installation could solve their travel restrictions. The solution was presented through AR. Industrial furnaces are sensitive and their installation requires accuracy and care. By using AR, the technical support could not only enter the client's server but also see what the client's technician was seeing, thereby helping them install the software remotely by guiding and supervising the client's action. However, as with any innovation, it involved a great risk of damaging the client's computer system. Despite the risk involved in the remote installation, the Israeli CEO estimated that it would become an industry standard. Simply, as a reaction to the new reality caused by COVID-19.

Industrial furnaces are, by definition, tailor-made products. The R&D in furnace firms builds the products according to clients' demands. Therefore, they are focused mainly on the core business and must dedicate attention to it, especially due to the safety requirements. The challenges in this industry are mainly connected to safety requirements. Products cannot be developed agile or tested later. The trust of the clients is what makes the firm survive. Therefore, the innovation in the Israeli firm is done by the CEO together with the VP of engineering, by having R&D work overtime to build new ideas and innovations. According to the VP of engineering, the DI section of the firm must remain in the hands of R&D since they possess deep knowledge about the product and hold a close connection to the clients. The safety factor is increased when the knowledge is accumulated. Therefore, innovation is done by interdisciplinary teams and R&D must work overtime to facilitate new directions.

To avoid knowledge loss, the CEO consults the human resources department to identify which employees might be crucial to the firm. After this, they make sure that these employees pass their knowledge to other team members while they are in their positions. Every piece of knowledge is computerized in one system. The goal is to become paperless and create a huge database of knowledge combining different platforms.

Although the IT department is external, the CEO strives to make it internal and have them implement an overall Enterprise Resource Planning **(**ERP) system, which will make the work more efficient. Finally, the CEO strives for the firm to own intellectual property. However, the VP of engineering thinks differently. According to him, there is no advantage in having IT internally, as long as they are experts and available. The IT part is to support the R&D by making knowledge and new information available and accessible to other departments as well.

Managers

The manager must know his product and market well. Through a gap analysis versus competitors, the Israeli CEO decided to acquire a German firm to bridge the knowledge base gap in HMI and gas furnaces. The manager must also contemplate what the future will bring and position the unique selling point of the firm accordingly. Finally, the manager must bring the firm to be first-to-market, be disruptive, and create a competitive advantage. In the view of the VP of engineering, the role of the manager is to organize all the phases of the ACAP. He is in charge of deciding what to acquire and how to communicate it throughout the firm's subunits

(assimilation). In the transformation stage, managers must consider also financial and other resource constraints. However, in the end, the idea or the project will be realized. Either by overloading the team or by subcontracting the work.

Cooperation & Co-creation

The firm cooperates with its daughter firm in Germany, with external consultants, such as suppliers and clients for beta testing. The firm does not cooperate with competitors, since they consider the risk of copying too high. Moreover, some cooperations are in obtaining research, for example from universities, or developing novel ideas by responding to government needs and receiving government funding. One office is the Institute for Advanced Manufacturing[37]. Some projects were successfully realized while others have not. For example, there was a demand by the Israeli government (from the chief scientist office/IIA) for firms in the industry to come up with novel ideas in exchange for funding. The firm developed a magnesium recycling system using nanotechnology, based on government funds. However, since this was not in the core business of the firm, it became difficult to follow up on the development, so they had to abandon the project. However, they were successful in producing a fully automated furnace with the German firm. This will define their future and they, therefore, focus on it.

German firm

Knowledge Base

According to the CEO, the emphasis in the industry of furnaces is on the production process. These must become more digital, which means controlled and fully automated. The German firm developed a self-training production line with a university as part of a larger project, issued by the Italian government. They programmed a new user interface that can link different machines together and exchange data between them. The CTO shared that in the future, there will be a fully automated system, involving IoT and intelligent sensors as well as new digital features.

[37] The institute for Advanced Manufacturing is part of the Israeli Ministry of Econmy and Industry.

The firm also uses other digital technologies such as CRM and ERP systems, however, the CEO finds them outdated, so they are currently moving towards cloud computing, as a cooperation with the Israeli firm. Overall, the firm excels in the application of innovative techniques, but they do not create them themselves.

The R&D does construction and less research and development since they must remain focused on the core business. However, they should still search for new ideas for clients through the input they receive from sales. Innovation is done by the CEO and the CTO. The IT is kept external. According to the CEO and CTO, there is no need for internal IT because IT must only maintain the hardware and software and build what the CEO tells them. If they cannot build it, they would be exchanged for a contractor who can.

The firm protects itself against knowledge loss by documenting all the information, according to ISO 9001 requirements. Additionally, they work in groups, so knowledge is not kept by one team member. Processes are documented step-by-step in a system. Once a year, employees from other departments must follow the documentation successfully to see, if they reach the same result. This is a type of quality assurance, however, it is done manually and is very time-consuming. The challenge is the overload of knowledge and the ever-growing knowledge base the firm possesses and the effort to process this knowledge. Large data accumulates and makes the job of sales more complex. "Digitalization must help the work, not hinder it. However, due to the overload of DI knowledge, the struggle exceeds the benefit" [38].

Managers

The manager must understand the new technologies and how to use them. The CEO, therefore, sends different managers to training programs so they can pass knowledge on to their teams. The CEO must lead the team, set the goals, and facilitate the right team culture. Especially in the transformation phase, he must be able to gather them around an idea and control the implementation of this idea in the firm processes. The CEO decides alone but the decision is shared immediately with two additional managers, whose job is to pass it on to their teams. Moreover, the available and required resources must be considered. Decisions usually take three

[38] A citation of the German CEO.

months, unless a client orders something specific and pays for it. In such events, the firm will work on it, without taking a long time to decide. Interdisciplinary teams are allocated to the project and they are responsible for pushing the idea further. To be able to structure the work, the CEO uses the requirements of standards like ISO 9001. These indicate what to do and how to document, so they support the management of the project. 80% of the time and effort must be dedicated to the core business. Due to safety restrictions, the CEO is not in favor of taking any risks. Finally, he does not overload the team. In times of overload, he prefers to prioritize and postpone projects.

Cooperation & Co-creation

The German firm uses students, universities, and other partners in order to bridge gaps in DI knowledge but also other types of knowledge. An example of a field in which the firm needs to go into is hydrogen. They also work with government associations of furnace companies in Germany to take on large-scale projects such as CO2 reduction. The cooperation with the government is done mainly to tackle issues that are too large for one firm alone, and to remain in trustworthy relationships with their clients by being up-to-date with industry trends and engaging in exchange.

Since there are no secrets in this industry, the German CEO stated that he would also be willing to cooperate with competitors, although the firm is not doing so currently. However, in this industry, it is not done often, since other players also reject such cooperation.

As an example for a concrete project, the CTO shared that he searched for expertise about new industry-standard requirements for a specific furnace due to a request of a client. He found a supplier whom he did not know, and he agreed to help them. The cooperation partner, in this case, was elected based on their expertise and prior knowledge.

4.3.2 Within-Case Analysis

In the following paragraphs, the similarities between the Israeli and German firms of Case 1 are discussed in the order of the questions asked: first the sub-category of Knowledge Base, then Managers, followed by Cooperation & Co-creation. After which, the differences are discussed and portrayed in a table. In the section following that, the differences are discussed

from the perspective of ACAP. Finally, a summary is presented in the interim conclusion section.

Similarities between Israeli and German Industrial Furnaces SMEs

Since the firms were merged, they both have a similar knowledge base and a similar focus on the DI knowledge that they need in order to maintain a competitive advantage. This DI knowledge is mainly on integrating Programmable Logic Controllers (PLCs) and Human-Machine Interfaces (HMIs) into their products. Additionally, Overall Efficiency Equipment (OEE), IoT, and Cloud Computing (as the next-generation CRM and ERP systems) are top priorities.

R&D continues to be the main department to build innovations, while neither firm practices ambidexterity. The potential ACAP is done by the CEO together with one technological manager (VP of engineering in Israel and CTO in Germany). They are both convinced that R&D must lead the innovation process, especially when the products of furnaces must comply with a certain level of safety. Moreover, they don't practice ambidexterity due to a lack of budget. Neither of the firms relies on internal IT. They both see IT as contractors, having to serve firms' demands. Finally, both firms must comply with safety regulations and CO_2 reduction, and both compete in the international race for digitalization.

The managers' role is also similar in both firms. Managers are deciding heuristics and fast. They are leading the entire ACAP process from the acquisition through assimilation to transformation and exploitation. Both CEOs see priority in moving their firms toward digitalization and creating a competitive advantage for their firms in the market. They also coordinate with the same types of entities: clients, suppliers, universities, government associations, and programs, and none cooperate with competitors.

In the following section, the differences in the within-case analysis of the case of furnaces are discussed. In sum, it became evident that the reaction of both CEOs to the COVID-19 crisis and their transformation strategies differ, due to their different visions and mindsets. The differences are first summarized in points and then presented in a table below, followed by a short discussion of their effect in the context of ACAP, and finally closing with an interim conclusion.

Differences between The Case of Israeli and German Industrial Industrial Furnaces SMEs

COVID-19 had a strategically disruptive impact, especially on the Israeli firm, while having an incremental impact on the German firm. Technical support and installation are crucial components in selling industrial furnaces. They build trust and allow quality control of the products once they are at the clients. By thinking of a disruptive solution to the installation problem which became relevant during the COVID-19 lockdown, the Israeli firm created innovation. The innovation of remote installation which the Israeli firm risked and succeeded at, helped the Israeli firm to reposition itself as a „market-first", a standard-setter and gained them the support of foreign governments: The government of Italy offered subventions to firms choosing their furnaces solutions. This strengthened their exploitation capabilities. The German team refused to take any risks that could damage the firm's reputation, and therefore, they did not join the remote installation solutions.

Although the German firm enjoyed technological superiority, they were re-directing their efforts to excel in advanced applications and concentrating on current clients' needs. It was mostly the German team who refused any disruptive ideas and focused on incremental development. Two pieces of evidence illustrate this: (1) The topics that the teams discuss in meetings are mostly problems of current clients; and (2) The vision of the CEO, which was successfully realized, is to become the best in their field. While the vision of the Israeli CEO is to be the first. For example, the German firm developed AI software for anomaly detection in HMIs, but it was the Israeli team who transformed it into a product feature. Therefore, it was the Israeli firm that developed the German knowledge base further to fit Industry 4.0 by implementing DI knowledge and translating it into novel capabilities for their products and services. Evidence for that is by (1) Holding steering committee meetings discussing future technological trends; (2) Using a spillover of AR to facilitate remote installation; and (3) Adding AI for anomaly detection in the HMI, although the HMI was developed by the German firm. To cope with the workload, the Israeli demands overtime from R&D while the German firm brings students' support to R&D. Finally, the Israeli CEO would like to have internal IT in the future, as a part of a larger vision to invent and own intellectual property.

In the German firm, processes, and ways of conducting and organizing the firm it more structured. They follow the strict ISO 9001 requirements accurately and invest much effort in

fully documenting knowledge. In the assimilation phase, the Israeli firm tends to document less, a fact that gives them time and energy to focus more intensively on the Realized ACAP (transformation and exploitation) but without a rigid structure. In the words of the Israeli CEO: “Work is an organized chaos”.

The CEOs differ in their management styles. While the Israeli CEO tends to take more risks and overload the R&D with 20% additional time allocation for new ideas, the German CEO prefers to maintain their value for the existing clients and keep the firm stable. Concerning risk-taking, he does not receive support from his team, as they oppose risks that could jeopardize the firm's reputation and future. He also refrains from overloading the team and matches his expectations to their capacity and not the other way around. These differences in management styles could be traced back to their mindset and vision. While the Israeli CEO strives to be disruptive, own intellectual property, and become a market leader, the German CEO seeks to strengthen his technological superiority in the market and positions his firm as a service provider, not as an inventor.

The two firms differ also in the cooperating partners they choose. While the Israeli firm tends to rely more on personal networks, clients, and government programs that give financial support and training, the German firm continues to invest in advancing its knowledge base (acquisition and assimilation) by turning to university research, and associations which give input about general market needs. This positions the German firm as reliable and expert in their fields.

The next table illustrates the above-discussed differences in the order in which the questions were asked.

Table 4: Differences between the Israeli and the German Industrial Furnace SMEs.

Factors	**Israeli Furnaces**	**German Furnaces**
Effect of Crisis	COVID-19 enhanced communication and efficiency by pushing the firm for new solutions that	COVID-19 enhanced the exchange of knowledge with previous clients and the necessity to gain a larger knowledge base.

	could appeal also to new clients	
Documentation	Less documentation, only important things	Complete and accurate documentation
An Example of a Transformation Project	Disruptive: The use of AR (Augmented Reality) was successfully implemented and changed the standard in the industry	Incremental: Reduction of CO2 was done by sharing information and efforts with the association of furnace firms in Germany and cooperating with a university
Knowledge Base	Bought the German firm due to their knowledge base but developed the knowledge further to fit DI and industry 4.0 requirements	More advanced in applying DI knowledge but did not develop it further, due to a decision to focus on clients' current needs
Vision	Disruptive: Become an inventor, tell clients what they will need in the future, become service-oriented, implement digital features that do not exist yet, and integrate IT and own intellectual property	Incremental: Excel in the nascent application of DI knowledge. Become a leader in the market by being a better and more efficient service provider by keeping up with national trends (like emission reduction)
Mindset	Focused on the implementation of ideas and taking large risks, overload the team when necessary	Focused on team acceptance and avoiding risk due to security restrictions. Avoid overloading the team

Cooperation	Personal networks, clients, and government programs	Universities and government associations
Success Criteria of the Firm	Risk-taking and trying new things	Safety and stability and superiority of technology

4.3.3 ACAP and Innovation Creation in the two Industrial Furnace Firms

ACAP in the Israeli firm

Potential ACAP: The Israeli firm conducted a gap analysis to detect areas in which they should invest their efforts. As a result, they acquired a German firm for their superiority in the knowledge base and concluded that they must focus on Industry 4.0 and the implementation of DI knowledge in their traditional products. These actions correspond with the first two phases of ACAP: The search and the decision of what knowledge is relevant demonstrates the acquisition capability while diffusing the understanding of this knowledge throughout the firm's subunits corresponds with the assimilation capability.

Realized ACAP: The reality of COVID-19 motivated the Israeli team to search for a digital solution for their main line of services, namely for the installation of their products at the client. While they could not travel to the South African client, they chose to use AR glasses for the installation and the tech support. This approach was risky, fast, and novel. It was mostly motivated by the situation because there was simply no better choice. This transformation led to successful exploitation. The firm was able to successfully continue to sell and provide support to clients. Through the success of the remote installation project in South Africa, the demand grew and the Italian government gave grants to Italian clients to buy the Israeli firm's product and favor it over others. This decision provided new clients and set the grounds for a new industry standard.

ACAP in the German Firm

Potential ACAP: The German firm decided to focus on DI solutions such as a self-learning production line because they recognized that clients demand and prefer such products over others. Their solution was developed together with a university. The acquisition and

assimilation were done accurately and over years of carefully documenting and making sense of the new DI knowledge.

Realized ACAP: The German firm also went through changes due to digitalization. Some were incremental and some more radical. The German firm programmed a new user interface for its products. They interlinked machines and exchanged data between them, they changed the electronic controls. This made them a target for the acquisition by the Israeli firm. Finally, they moved towards cloud computing and expanded their database techniques to support the continuity of knowledge. However, the exploitation was indistinct. On one hand, it seems that the firm is preparing the infrastructure and is doing everything by the book to tackle the digitalization challenge, also on a national scale of future trends and challenges; On the other hand, these actions have yet to generate immediate exploitation results.

4.3.4 Interim Conclusion

The analysis in the case of industrial furnaces reveals similarities in the way things are organized within the firm (team communication and coordination capabilities) and in the strong involvement of the CEOs. Both CEOs are innovative and they reflect on the market trends, such as digitalization and Industry 4.0, as well as on regulation and direction, for example, the reduction of CO2. They work very closely with their teams, they keep available, and lead the firm in a charismatic way. Information is shared and they both practice a heuristic and fast decision-making process. They also both have a deep understanding of their technologies and the firm's abilities, despite their different academic backgrounds (the Israeli CEO came from engineering, while the German CEO from business).

Both the Israeli and German firms used the crisis of COVID-19 as an opportunity to evolve. However, they saw different opportunities for DI knowledge application. The Israelis used the restriction of travel caused by the COVID-19 crisis to seek a new solution of remote installation. The German firm used the crisis to strengthen its acquisition and assimilation (upgrading its communications and efficiency) and become more efficient, faster, accurate, and reliable.

The German firm was able to structure the information flow in the firms and between the subunits and also secure exposure to external knowledge. These activities indicate a high performance in the potential ACAP. The Israeli firm was also able to acquire knowledge

through the acquisition of the German firm. Moreover, they managed to assimilate, amend, transfer, and apply this knowledge to their products and services. The Israeli firm used external knowledge to reposition the firm by pioneering an „industry standard“[39].

Technologically, the German firm was more advanced. They were acting towards enlarging this knowledge and becoming more accurate and advanced in the application of DI knowledge. The Israeli firm was focused on a fast transformation of the knowledge they have already acquired from the German firm and started to use an industry spill-over by applying AR technology to their field, thereby, coping with the need for remote installations.

In sum, in terms of ACAP, the Israeli firms have shown a stronger realized ACAP (transformation and exploitation), while showing a similar level of potential ACAP to the German firm. These differences could be attributed mostly to the managerial vision and mindset. To fulfill the disruptive vision, the Israeli firm practices a shorter assimilation phase (less documentation) but was also open to experimenting with seemingly unrelated digital technologies, such as AR, to solve a remote installation problem, which was core to his business. Differences were also found in the managerial approach to overload versus not overloading the team, as a way to cope with transformation pressure.

The acquisition and assimilation of the AR technology were also done fast. Here the Israeli CEO was taking a high risk of losing their reputation and clients, should the application of AR prove to cause damage to the client’s system or the quality of the installation. Moreover, their focus on learning fast and applying immediately, rather than perfectly, having less structure or documentation, helped them as well in their focus on realizing ACAP.

Since the two firms were merged, these differences could not be explained by organizational culture or different industry requirements. Therefore, different explanations must be found. The Israeli CEO’s goal is to own IP and become the first in the market. In other words, to initiate an industry standard. He is taking high risks to reach this goal. Despite the know-how and technological superiority of the German firm, the German CEO's goal was to strengthen his

[39] A citation from the Israeli CEO.

firm's knowledge base and avoid risks that could cost their reputation or market share. The question is why?

In the words of the Israeli CEO: “When COVID-19 came into play, we decided we have nothing to lose”. This mindset of having nothing to lose, being hasted, and fighting for survival while taking risks, is more typical for the Israeli culture in general, in comparison to the German one. This fact helps explain the differences in the mindsets of the CEOs as an individual, through national cultural differences between the nations. Individual culture is an indication of national culture (Hofstede, 1991), and national culture explains also organizational behavior (Hofstede, 1983). These differences and their connection to national culture will be reviewed in further detail at the end of this chapter.

4.4 Case 2: Israeli and German Food Packaging SMEs

Both food packaging firms are family-owned. The Israeli firm was founded in 1976, and the German one in 1938. The Israeli CEO is hired and entered his position in 2020, while the German CEO owns the firm, leading the firm with another member of the family. The Israeli CEO came from the field of plastic in infrastructure. He also chairs an association of rubber and plastic under the Manufacturing Association of Israel[40] (MAI), a government entity designed to support the Israeli economy in many industrial sectors. The Israeli firm manages, a US-based daughter company, in addition to its activities in Israel while the German firm manages three production plants, one outside of Germany. The Israeli CEO studied electric engineering, while the German CEO was educated in business. Additional informants, in this case, were the Israeli and German Chief Operations Officers (COOs).

Food safety and recycling are big issues in this field of industry. The two firms have slightly different strategies in approaching the recycling topic. The Israeli firm uses recycled products from other products (such as plastic water bottles) but does not focus on a full recycling cycle[41].

[40] https://eng.industry.org.il/

[41] Full recycling cycle is used to describe creating a recycling product from the same old product. Also known as tray-to-tray recycling.

The German firm has patents for safety closure and has an ISO energy certification. To tackle the recycling issue, the German firm planned long ahead and ensured its competitive advantage by choosing recyclable material only. This restricts them to colorless packing materials but allows them to enter a full recycling cycle from food use to food use, which color material cannot provide.

Business success is measured by the experience and the closeness of the client. Not by the plastic material or knowledge about it. Since plastic materials are common knowledge in the industry, there is less risk in cooperating.

4.4.1 Summary of the Interviews: Case of Food Packaging

Israeli Firm

Knowledge Base

Innovation in this field of production lies in (1) Automation to reduce cost, and (2) Producing recyclable products. Digitalization has changed the process in which plastic sheets are compressed, thereby increasing the potential of automation in production. Innovation in this case is defined by the use of machines. The Israeli firm uses an ERP system for the production floor for two reasons: to reduce manpower and to have an overall system that connects all the firm subunits and standardizes the entire firm's activities and knowledge. This DI system should provide real-time status of all production processes at any given time. The challenges lay in the level of automation that is needed to reach this accuracy. With advanced automatization, the jobs of the remaining workers become more demanding, since using the cobots[42] requires a lot of training.

The R&D in this field consists mainly of chemists, in charge of coloration. The R&D is, therefore, not relevant for DI, since the challenge lies in chemical knowledge about the compatibility of color and material to the food. The chemists are not involved with automatization. Instead, the CEO together with the chief of engineering and the operation

[42] Cobots is a term to describe the collaboration between robot and human work.

manager leads the innovation process by acquiring DI knowledge and implementing new machines gradually. Connected to this team is also the Chief Financial Officer (CFO), to oversees the investment and the return on investment. The IT's responsibility is to monitor innovation globally and give ideas. However, the above-described team is in charge of innovation and overseeing the digital transformation. The goal is not to go with digitalization cross-board, but to evaluate what is needed and what is the return.

A project example is the implementation of the manufacturing execution system (MES) and Overall Equipment Efficiency (OEE). This system allows anomaly detection, analysis of every action in the process, and optimization through digital tools. Thanks to the MES system, managers do not lose time searching for problems. Rather, the problems are detected and brought to their attention. Every machine is connected to the system and the manager can visually track which machine works, and which one does not work, including the reason why it does not work (broken, being repaired) and how fast it is working. This digitalization has shortened the reaction time of managers. The OEE contributes insights about the machines. For example, the time it takes to set up the machine. Setup times were found to be one of the most influencing factors in the success of the firm. If each phase of the machine maintenance and action can be analyzed, these setup times can be controlled and reduced. For example, while the machine stops, other work could be done. Therefore, by giving information about all the machines, it creates an overall view of the firm.

Another project is concerned with recycling for the future or post-consumer recycling. The idea behind it is to purchase recycled material and from it, produce new products. Such a transformation would require a preliminary treatment of the material. Under Israeli regulation, there is no standard-check limitation on re-using recycled material for food, but tests and development are required. To meet clients' demands, the firm cooperates with a European client expert, they chose this partner due to their knowledge and expertise.

This firm is currently advancing towards purchasing a cobot to increase the working time. However, the firm would then need an experienced workforce to operate the cobot. As there is a severe lack of specialized employees, automation of the production floor has not advanced very far yet. In other words, although the technical possibility exists, the workforce must be first trained, before benefits can be drawn. Aside from documenting meeting protocols, there is

no strategy to protect against knowledge loss. The CEO's strategy is to try to keep the employees happy so they remain in the firm.

Managers

The role of the CEO is to define the firm's strategies and accompany the process. Decisions are taken based on a calculation of the return on investment versus the vision. As a strategy, the risk is being diverted by installing the cobots modularly, one machine after another. Each person in the firm is allowed to pitch ideas to the innovation committee. The committee consists of the main managers: CEO, COO, CTO, and CFO. According to the ideas gathered, the manager may react. Decisions are taken usually fast and heuristic. However, the needs must be prioritized according to the needs of the firm and not to the level of digital sophistication, which could result „only in cosmetic upgrade"[43]. Managers decide alone but consult later with other managers or within the team.

The manager does not overload his team. Managers must accept failure and encourage the team to „make it happen[44]". They divide the activities into priorities or allow the team to work alone and allocate time as they see fit. One of the most important traits of a manager is to invest in preparing the employees for the transformation and implementation phase. Without connecting the employees of the different departments to the vision, any project is doomed to fail.

According to the COO, the second interviewee, there are several phases a manager must follow: (1) Define which processes to assimilate and define who is responsible for it. Additionally, form a screening committee to support the team members; (2) The manager must pay attention to the informal managers, whose status and experience within the team position them as non-official leaders. These leaders must be convinced first and help shape the teams' opinions. Moreover, they are a good source of knowledge of what can work; (3) The human resources department must draw attention to any kind of obstacles among the employees that could damage the project.

[43] A citation of the Israeli CEO.

[44] A citation from the Israeli CEO

Cooperation & Co-creation

The Israeli managers work closely with Israeli government offices, for example, the advanced manufacturing division of the Israeli Innovation Authority (IIA). Such government entities facilitate experts who give ideas and help firms understand what digital technologies are required and how to install them, including an accompaniment through the implementation phase including funding and training. The government's support is mainly concerned with automation and the reduction of CO2. Among the programs that have been mentioned are the Israel Innovation Authority, The Manufacturing Association, and The Authority of Advanced Manufacturing.

Cooperation is also done with clients. The firm is required to provide the client with samples of the material, to be tested at the client's production line for appropriability. This co-creation can be shortened by using 3D models. These models are created by Computer-Aided Design (CAD) software.

German Firm

Knowledge Base

„Digitalization is a strategic decision. It is everywhere"[45]. Digitalization influences every department. The firm focuses on IoT and they are planning to implement AI in machines for anomaly detection and maintenance. Additionally, they are using apps for training. Finally, the goal of digitalization is to become paperless. Thanks to digital tools, the firm can monitor all the processes in three production plants and try to optimize them. ERP systems became a standard for monitoring and managing all the departments, planning production digitally, and gathering and analyzing data like clients' behavior. Also, the exchange of knowledge increased.

The R&D is not comprised of innovative people. The innovation creation is done by the CEO, the COO, and one engineer. The IT makes suggestions about what to acquire, but mostly, they

[45] A citation of the German CEO.

are dedicated to maintenance. Keeping IT external saves costs and reduces the pressure of having to become experts in the field.

The competitive edge of this industry is how fast firms can learn. There is no way to protect tacit knowledge. Explicit knowledge is protected by working in teams and documenting. They also count on employees' loyalty by strengthening their identification with the firm. The firm's management teaches the employees how to learn by giving a personal example, encouraging curiosity, and allocating time to learn. Since the firm is managed in a lean and agile way, they use the same people for the core business and the digital transformation. This results in a conflict in dedication. The managers solve it by allocating one day a week on which the team can contemplate transformation and new ideas.

Digitalization poses challenges. These are twofold: (1) Coping with the complexity of DI knowledge overload; but also (2) With regulations. DI knowledge and digital technologies are complex and overloading. The (older) age of the average employees and lack of resources also hinder the firm. Moreover, digitalization requires a change in the management and the team's mindsets. Because the firm is currently profitable, there has been no need to change the mode. However, now the managers have started to think about how plastic production will be done in the future. Moreover, the German government demands to keep digitized documentation also in paper and archive it for 10 years. This is time-consuming and costly. In the words of the CEO: „The government does not allow us to become completely digital and regulations are not communicated clearly".

Managers

Everything begins with the vision and strategy about how to digitalize the work, the products, and the cooperation with partners. Decisions are taken alone and fast, although they are discussed later amongst the other managers. It is important to make stable decisions, not to shy away from a challenge, but to calculate risk. Therefore, managers have to know „ their why[46]". In other words, their vision. Moreover, managers must communicate this vision at face value, as part of the team, not as external advisors. Everyone must be invested in the vision. The

[46] A citation from the German CEO.

employees trust that the manager will lead them correctly. Managers have to trust their employees by giving them respect and freedom to create. „We do not overload. Instead, we teach employees how to become intrapreneurs and prioritize their projects and workload". Finally, managers also have to give value to clients and provide a stable workplace.

Managers have to stay open to technologies, listen to clients, and incorporate this into their vision. The managers' job is to optimize processes and digitalize them. This is a transformation of the firm that involves logistics. They must possess a lot of knowledge including about the niche, core business, markets, products, and clients. Decisions are taken according to the strategy, which defines the short-term firm's needs. This definition may change step by step.

Cooperation & Co-creation

The managers must decide what fits their firm. Digitalization already made the firm more international. The firm is working on a Europe-wide shared database and cooperating on global projects like CO2 reduction, which benefits the firm with insights derived from big data. Partners for cooperation are chosen based on their knowledge and expertise but also based on trust.

The firm cooperates with universities and with clients for research purposes. Through cooperation with a laboratory, they manage to conduct the testing in less time and reduce the costs of the application process thanks to software that enhances the accuracy of production parameters. Furthermore, to fulfill the client's demands to access the firm's production capacity, they integrated an SAP system. They also research market trends such as recycling and removing plastic particles that may be absorbed by the food. Furthermore, they work to reduce CO2. Knowledge is also acquired from startups. For example, a game technology developed by a startup was acquired to improve communication between the teams.

4.4.2 Within-Case Analysis

In the following paragraphs, the similarities between the Israeli and German firms of Case 2 are discussed in the order of the questions asked: first the sub-category of Knowledge Base, then Managers, followed by Cooperation & Co-creation. After which, the differences are discussed and portrayed in a table. In the section following that, the differences are discussed

from the perspective of ACAP. Finally, a summary is presented in the interim conclusion section.

Similarities between Israeli and German Food Packaging SMEs

Automation of the machines is done to analyze processes and make them more efficient, as well as reduce manpower. Both firms digitalize only parts of the chain: semi-automation, and modular automation. Both recognize the importance of installing ERP systems to coordinate the firm's operations. Both firms suffer from a shortage of people, and both firms' employees currently reject the changes brought by DI. Both firms suffer from information overload, and both must cope with reducing CO_2.

The Israeli firm practices more explicit separation between the R&D and the innovation activities since their engineers are not involved in innovation per se, rather they are in charge of the chemistry of colors. However, this is not complete ambidexterity, but rather a joint effort of numerous departments (operations, sales, R&D, and finance). In the German firm, the R&D focuses on the core business, however, they are also involved with digitalization together with interdisciplinary teams. These include the operations manager, the mechanical engineer, and quality assurance.

In both firms, there is no strategy to protect against the loss of tacit know-how. While explicit knowledge is being documented, know-how is lost if one member leaves. Israeli managers treat the risk of losing know-how as an opportunity to gain new perspectives and try new things. They do not practice any strategy to protect knowledge, other than trying to maintain the employees as long as possible. Also, the German firm benefits from long-time employees, however, they invest much effort in trying to trace the knowledge. This is done in two steps. First the collection of information about processes, decisions, and general operations. And second, digitalizing the knowledge and finally automating it. However, so far this approach has not been successful, since it takes too long to interview each employee in detail and employees find it hard to explain what they know in a structured way.

In both firms, the managers are deeply involved in the digitalization process. Managers in both firms map the processes first and then digitalize them. They take the decision and give a role model. They both practice lean management and believe in giving a personal example. The

mindset of the CEOs is also similar in both firms. They both believe in sticking to decisions, communicating clearly, and remaining consistent. They both have a strong and clear vision, take risks and decide fast. In the Israeli team, the CEO leads the next step and engages in every relevant function. The assembled innovation team includes the CEO, COO, CFO, CTO, and engineers. Each of the members may add people they think are relevant. They bring the ideas to the board to decide whether to continue. The German firm behaves similarly, only with fewer functions. The vision regarding DI is to help work accurately and efficiently. However, both firms agree that not every DI needs to be acquired. It depends on the company's needs. For both CEOs, the values are similar, namely to take care of the people working for them and give value to clients. Decisions are taken by both CEOs fast and heuristic, both decide alone based on what is good for the firm.

This industry is defined by both the simplicity of manufacturing and the flexibility of products. Innovation is done based on clients' demands. However, without cooperation with the external environment, DI knowledge cannot be obtained or implemented. Cooperation is done in both firms similarly: (1) Cooperation with suppliers is done based on trust and experience. It is usually triggered by clients' demands; (2) Both firms cooperate with universities; and (3) Both firms are careful about involving competitors. Since materials are common knowledge, most of the intellectual property in the food packaging industry is in the core production processes. Therefore, the risk of copying is relatively low. However, a risk will emerge when formulas are easy to copy. In such a case, neither firm would cooperate.

Differences between the Israeli and the German Food Packaging SMEs

The differences between the Israeli and German food packaging firms are in the raw materials they use. While the Israeli firm uses mostly CPET[47] material, the German firm uses Crystallized polyethylene terephthalate[48] (PP). Although both are plastic commodities, the raw material can

[47] Crystallized polyethylene terephthalate gives the tray ability to be heated in a conventional oven as well as in microwaves.

[48] For more information, visit https://blog.brandmycafe.com/polypropylene-pp-vs-polyethylene-pet-plastic/

have implications on the DI capabilities, regulations, and choice of cooperation partners. For example, according to German regulations, a full recycling cycle is only allowed with PP.

The firms differ in their DI maturity, namely how easily they use data, how they document knowledge and retrieve it, and how easily they can match and build further on existing knowledge to create new possibilities. While documents are kept digitally in Israel, the German firm is instructed by their government to keep all documents both digitally and on paper and to archive the paper documents for 10 years. This regulation leads to enormous effort and investment in filing and keeping those files physically. Finally, the German firm plans to use AI and big data for anomaly detection. This was not mentioned by the Israeli firm.

At the time of the interview, none of the firms have been able to incorporate cobots into their working or production processes. However, they differ in the reason why this was the case. The Israeli firm had mapped possible ways and specific cobots that could fit them. However, they were forced to postpone the implementation until they concluded their acquisition by a larger firm. The German firm decided to map all of its production processes perfectly before it attempted to automate them. This difference in approaches helps draw indications about the different mindsets. The German firm puts the accuracy of the processes first, also at costs of time, effort, and monetary investment. The Israeli firm prefers to advance modularly, gain experience, and learn from mistakes before they commit to a decision for the entire firm.

Another difference between the dyad relates to their products' flexibility. The Israeli products come in three variants: transparent, black, and white. The German firm has only the transparent variant. Using only transparent material has proved to have two main strategic advantages for the German firm. By processing only one raw material, the German firm saves on costs and increases the appropriability of the machines to the material with only one set of machines. To customize the transparent packaging, the German firm offers labeling fitting to clients' requests and corporate identity. A second advantage is the ability to recycle transparent raw material and reuse it for food. German regulations do not allow full-purpose recycling of colored raw material, since poisonous particles can enter the food. Finally, due to the transparent raw material, the German firm is less subjected to competition. They also need fewer machines since they have one material in comparison to the Israeli firm, which must change the production plan for each change in color, thickness, and material.

The firms also differ in their choices of cooperation partners. The Israeli firm relies a great deal on government programs that give financial support but also accompaniment in regulatory matters, as well as coaching on accessing and implementing the right DI knowledge. In contrast, the German government is perceived as a „force that stands in the way of change“[49]. This is due to the government's rigid regulations regarding the requirements of firms, in the field of DI but also to the demands of the vertical industries, in this case, food packaging. Although many different government programs exist, firms feel left alone. The reason for not approaching government programs is the absence of trust and the complexity of accessing these programs, the long waiting time, and the bureaucracy firms must endure before they receive confirmation and funding (on average, up to one year). Moreover, the long and complex demands to maintain the support throughout the project. This lack of efficiency forces firms to concentrate their cooperation with universities for research and testing, to create a competitive advantage, for example, in the field of recycling and CO2 certification.

Table 5: Differences between the Israeli and German Food Packaging SMEs.

Factors	**Israel**	**Germany**
DI Maturity	All documents are kept digitally. Until now, government regulations demanded keeping files for 7 years The firm has a low number of cobots since they will use the system of a company that is planning to acquire them	All documents are kept digitally and additionally, they must be kept on paper for 10 years (due to government regulations) The firm has not been able to install cobots yet, because they want to map the process perfectly first

[49] A citation of the German CEO.

Product Flexibility	Products come in three options (transparent, black, and white)	Product flexibility is ensured by personalization of the labeling for each client. But the material is always transparent due to recycling regulations
Cooperation	Government Institutes for Advanced Manufacturing provide subventions and ease of regulation. Additionally, the firm cooperates with external experts and clients	The German government has a „Culture that hinders change“ Cooperating mainly with universities and clients for research
Market Regulations	There is no limitation on the reuse of plastic trays to repack food	Regulations for full-cycle recycling are still pending As a regulation[50], all project results in Europe are uploaded digitally on the same platform, causing a data overload and time-consuming to enter all the results They need CO2 certification

[50] For more information visit: https://ec.europa.eu/info/about-european-commission/service-standards-and-principles/transparency/funding-recipients_de

Market Conditions	More risk of competition due to the simplicity of the production (plastic foils could be produced by suppliers as well)	Less competition in their field, since the use of transparent plastic, has more business possibilities. Therefore, it is seen as a competitive edge
What slows down DI	Existing machines can process only a specific plastic. Other materials (for example, paper) will demand to change of the entire machines. Therefore, DI is restricted to current raw materials	Long documentation of know-how and improvement of processes is required before automatization can take place

4.4.3 ACAP and Innovation Creation in the two Firms

Israeli firm

Potential ACAP: The acquisition of DI knowledge is done through the CEO and a small team. The focus is on ERP and automation (cobots), to reduce the costs of manpower. The MES and OEE systems contribute to the accuracy of the production, anomaly detection, and the ability to receive a snapshot of the entire firm at any time. The DI knowledge is acquired mostly with the help of government offices or through clients. The assimilation is done through diversified but agile teams. These teams communicate knowledge and train the rest of the subunits. Otherwise, training is also offered externally.

Realized ACAP: In the Realized ACAP, there are two main goals: One is to increase production power by reducing manpower. This goal is achieved by transforming the ERP system of the production floor to manage the overall activities of the firm and also to plan future production. The implementation of sensors on individual machines to measure their production capacity and overall performance helps analyze reasons for stopping times, as well as the

machine's resistance. The second goal is keeping with industry demands to reduce emissions and recycle. This goal is achieved by co-creation with a client on recycling plastic food trays. Before a project starts, the firm is required to provide the client with a sample of the material, so the client may test it on their production line. Digital technology (CAD) is used to facilitate this phase, by producing a 3D model that shortens the appropriability test. Exploitation is measured by who is first to market according to the new recycling requirements and reduce the most CO_2.

German firm

Potential ACAP: Knowledge is acquired by a small team of CEO, COO, and one additional engineer. They acquired an app from a startup to improve the training and knowledge exchange within the firm. Additionally, they acquire digital technologies such as IoT-based sensors, designed to foresee problems with the motor or pumps of the machines. This opens new possibilities for planning production capacity, especially when they implement AI in the future. Big data analysis helps the firm analyze the client's behavior. An ERP system was also acquired to standardize the firm's activities of sales, logistics, and human resources. And they engage in research for recycling. Assimilation is done by giving a personal example, engaging in DI personally, sharing this with the rest of the firm, and training employees on how to use these technologies.

Realized ACAP: Transformation is measured by the extent to which the ERP system was customized to fit the firm needs and allow the firm to manage all their additional production plants and optimize and automate processes. The ERP system is also used as a database collecting big data and helping analyze clients' behavior. In this transformation, the firm was successful and the added value is considered exploitation which benefited the firm activities. Although not digital, innovation in this firm is also about recycling and CO2 reduction. Research conducted on recyclable plastic, the raw material of the firm, allows to shorten the testing time and saves costs. Exploitation is measured by being the first to market with recycled plastic packages and reducing the CO2 and plastic particles that should not penetrate the food goods. The firm seems to be one of very few that are able to implement this in the German market.

4.4.4 Interim Conclusion: The Case of Food Packaging

In the case of food packaging, similarities were found in the assimilation and transformation phases of ACAP. Both firms search for similar DI knowledge and digital technologies which they identified as relevant for the firm. These technologies were mostly ERP systems and automation to help cost reduction (due to the reduction of manpower), and increase the accuracy and efficiency of management. Moreover, these technologies are always acquired externally, and not developed internally. Also in terms of the managers' values, similar responses were received. Overall, digitalization is perceived to be everywhere and managers understand that change must be done throughout the firm and not in specific departments.

The strength of managers is defined in their deep understanding of the core business product and market trend. They define short-term strategies according to the developments and changes they foresee. These could be in regulation (for example reduction of CO2 through recycling) or the production processes. Managers mostly decide fast and alone although consulting thereafter their small teams. Following their decision to acquire DI knowledge, they support the employees through assimilation (facilitating training, resources, and time, allowing intrapreneurship and freedom, absorbing risk and failure) and transformation (defining how this knowledge should be used). Managers are concerned with sustainability, they are loyal to their employees providing them with a stable working environment and they are committed to providing value to their clients.

Two points of difference became meaningful in the acquisition and exploitation phase. The German firm did not approach government support or programs when acquiring DI knowledge. Moreover, they stated that the government hinders its digitalization processes with restrictions and regulations. In contrast, in Israel, the firm turned to government programs for technical support, funding, and networks. This may have translated into different exploitation abilities in favor of the Israeli firm.

Second, the German firm mentioned cultural that caused some rejection of DI. Both German employees and German clients were more reluctant (in comparison to their French production plant) to embrace changes caused by DI. For example, to reduce CO2, the thickness of the plastic box should have been slightly reduced (by 0.1 mm). German clients refused to accept

this change and demanded that the packaging remain as it was done before to ensure the hermetical sealing of the box.

Although the German government offers multiple programs, they are less approachable to firms. When asked about the reason, issues such as time-consuming, long processes, bureaucracy, and general lack of understanding about the specific needs of the sector surface. There seems to be a communication barrier that prevents these programs from being the first address for SMEs in need.

Since the CEOs did not show any difference in their innovative mindset and strategy, it is concluded that there is an optimation potential in the German government's programs, so they may offer an unmediated program, which is available ad hoc. Otherwise, German firms will continue to face challenges and eventually perhaps fail, for reasons outside their control.

4.5 Case 3: Israeli and German Dental Implants SMEs

Both firms in this case are privately owned. There are no external shareholders, which allows the CEOs flexibility and independence. The Israeli firm is larger than the German firm, however, both of them are stable, profitable, and enjoy financial freedom. Both CEOs are males above 50, and both are the owners. The educational background of the Israeli CEO is in economics and business, while the German CEO is a dentistry professor and an expert in his field. Additional informants, in this case, were the Israeli CTO and German VP of sales.

The dental field is traditional. It is estimated, that only 10% of dentists are attending conferences to learn about innovation trends[51]. Due to the complexity and high costs of inserting novel technologies, most dentists rejected innovation for a long time. However, the trend is changing towards innovation through DI. One of the trends is guided surgery[52], which to date, only 30%

[51] A citation of the Israeli CEO.

[52] Guided surgery refers to a transformation that occurred in the surgical world, where doctors rely on scanners that are combined with software and enable them to build visual planning of the tooth. This results in a more accurate implant produced cheaper and in less time and effort.

of the countries practice. Using 3D printing to produce accurate and personalized implants in a safer and faster way will one day be the standard in this field. Also, the digital workflow in dentists' practices stands at merely 20% to date.

Both firms serve two types of clients. Direct clients are dentist practices, and indirect clients are patients who receive the implants. The satisfaction of both clients is extremely important for both firms. So digitalization is not done only to save costs or make processes more efficient, but rather, to increase the well-being of patients (less pain and less time in the dentist practice).

4.5.1 Summary of the Interviews

Israeli Firm

Knowledge Base

Digitalization is everywhere in the firm: in distribution and production, but most importantly in logistics since this department combines the rest of the departments such as sales, finance, and development. They built a special learning system to document each product, as well as maintain digital archives, all of which make information available at the press of one button. When added to the product, digital technologies may also open new possibilities. For example, the use of scanners with a camera provides an accurate 3D picture of the patient's jaw which later helps construct the implant more accurately. In this sense, the product itself is produced digitally.

Knowledge is imperative throughout the production chain. Digitalization helps calculate the stock of raw materials and plan production capacity accordingly. It provides tools to create visual representations of the teeth to help dentists perform guided surgery and form the crown using CT technology. This technology is highly accurate and saves time and costs. Additionally, there is a new technology, Intraoral Scanner[53], that provides an even more accurate picture than CT. The intraoral scanner replaces the silicon impression by creating a 3D virtual model of the mouth in 3 minutes. 3D is also used in surgery for restoration. Using the intraoral scanner will

[53] Intraoral scanner is a device that creates a virtual model of the mouth.

become a standard in guided surgery. Additionally, the firm can gather big data. Despite the burden of gathering it, big data is essential to draw information about patients' behavior and satisfaction.

R&D is less crucial for the digitalization processes. R&D is in charge of the core business but they are also in touch with the direct clients (dentists), so they gather information about their needs. The input is delivered to a special multidisciplinary team that considers possibilities of innovation creation. It is decisive to master the knowledge about ISO regulations in each designated country. The process of innovation creation is, therefore, a joint effort of the entire firm and not a singular department.

The IT department is usually responsible for the security, maintenance, and monitoring of the data, but not for digitalization. Knowledge is protected by involving several people in each project from different departments and by treating them well, so they are more inclined to remain loyal to the firm. All 4,000 products of the firm are documented digitally and the firm history is archived. Training is also documented.

Managers

According to the CEO, only 15% of the dental implant market uses digital technologies to date. His estimations indicate that in the next 5 years, 90% of the market will rely on digital technologies, so the potential for further growth is immense. Managers must understand the macro business, their clients, and market trends. In the dental market, firms should aim more toward services and consider global changes and local regulations in their business analysis, when deciding which markets to enter. For example, this product is designed mostly for the middle class, who can afford it. The firm, therefore, analyzed the markets according to where the GDP is high, to make sure there is a market. Moreover, the firm also analyses which market regulations for entry are more flexible before they decide which market to aim for.

Decisions are taken by the CEO fast and heuristic, after a short consolidation with one or two additional managers. The role of the manager is to use digital transformation and DI knowledge to the firm's advantage according to its needs, strategy, and capacity. The manager is driven by doing what he loves and creating stable workplaces in Israel. Managers must use their understanding of the market to create guidance and allow a culture of exchange. Managers must

remain open-minded and work with interdisciplinary teams to ensure a brighter spectrum of knowledge. However, they must not allow „external noise“ to enter the business. They must focus on their core business and added value and not overload the team.

Cooperation & Co-creation

Cooperation partners are chosen according to their culture and knowledge base. US partners have proven to be rigid in their regulations, not flexible, and relatively slow in their decisions. They are target-oriented and are compensated only in cases of success, so they are, therefore, less inclined to take a risk. Before entering a cooperation relationship, the firm must consider the culture of the partner and decide whether they could work together. Every culture has its inflexibility. For example, Germany has strong social regulations and a rigid hierarchy and Israeli bureaucracy is very rigid and at times hinders innovation.

As an example of a project, the CTO shared that the firm acquired knowledge about an intraoral scanner from an expert supplier to increase sales. They also cooperate with universities on research and use external consultants. In the dental industry, it is difficult to trace developments, since each dentist practice is independent and private. Therefore, in the lack of a joint database, cooperation and knowledge exchange are valuable. An example of a negative experience was also given. The firm cooperated with a competitor since they were experts in the material. However, the project failed when the partner lied and did not deliver his knowledge in time. According to the CTO, cooperation is all about trust.

German Firm

Knowledge Base

The field of dental implants has been using standard ceramic implants for a long time. However, this solution was not satisfying for the owner, who is a dentist himself. This encouraged him to establish the firm to manufacture titanium implants in one piece. Such a solution was easier for the patient since it is less harmful to the tissue. This solution was designed in cooperation with a Swiss firm, using CAD software. The implant was then created using 3D printing. The root is produced by machines. The challenge is that it must be 100% secure and proofed. The firm

uses 3D navigation via X-Ray[54]. This navigation customizes the template creating an exactly fitting artificial root. The firm uses additional software for dentists to create a model of the root. This digital model makes any manual modeling obsolete and shortens the time in the practice for patients. However, despite the superiority of titanium, the market still demands ceramic implants. For this purpose, the firm had to acquire knowledge about ceramic implants. This was done via an acquisition of a firm that held 14 patents in this field. Although this is not DI knowledge, the firm had to acquire it to remain in the market.

With a focus on DI, the firm also created online animation videos explaining the solutions. They used DI knowledge to improve the intraoral scanner and also opened a digital shop. Finally, the firm uses digital platforms to offer training for both employees and clients. This helps clients (dental practices) and users (patients) inform themselves about the latest technologies and the way they are used.

The knowledge is managed solely by the CEO and two additional engineers who are also dentists. The close friendship between them helps protect the firm from knowledge loss. They collect ideas, impulses, and needs from clients, for example, to reduce treatment time and costs, and to increase the accuracy of fit of the root. The accumulated knowledge of the firm is also patent-protected. Moreover, the firm does not have shareholders, a fact that helps it remain independent. Finally, the IT department is external and does only maintenance.

Managers

The CEO of the German firm is a dentist and the owner. He wants to simplify the surgery and make the process and the healing faster and less painful for patients and keep their dentists' clients satisfied. Ethical considerations, such as safety, and costs are more important than digitalization to him. The CEO innovated his firm with the help of knowledge spillover from the field of orthopedics and not via DI knowledge. During his time as a trainee at his uncle's orthopedic practice, he learned that manual drilling in a bone speeds up the healing process. Since a bone is similar to a tooth root, he decided to apply this method in oral surgeries and help dental patients. At an international dental conference, he learned to add living bone

[54] Cone Beamed Computed Tomography also known as Digital Volume Tomography.

particles to the artificial root. This method reduces the rejection of the foreign organ by the patient’s tissue. In both examples, the innovation of the firm was not done solely on DI knowledge, but rather to serve the business value by giving better options to a broad spectrum of patients, not just a niche market.

The CEO decides fast and alone. He later shares his decision with the other two managers to help him implement it in the firm. The CEO does not believe in overloading the team. If their capacity must increase, they purchase more machines or a new production center. The international sales manager said, that the managers' job is to read reports and look for solutions to simplify the work of dentists. In other words, to serve the clients.

Cooperation & Co-creation

The dental field requires many tests before they may release a product. After a release, they collect improvement suggestions from the dentists following the vision of minimizing inventions and injuries. This could be seen as cooperation & co-creation with the clients. Cooperation is done also with universities for clinical tests, however, the results are received after 5 years. Despite its relatively smaller size, the firm does not engage in many cooperations, since they do not require it. However, they did cooperate with a Swiss firm to produce the titanium implants, due to their knowledge base. They also acquired a production center for both economic reasons and due to the knowledge they possess. However, the business flow is sufficient and no additional cooperation is done.

4.5.2 Within-Case Analysis

In the following paragraphs, the similarities between the Israeli and German firms of Case 3 are discussed in the order of the questions asked: first the sub-category of Knowledge Base, then Managers, followed by Cooperation & Co-creation. After which, the differences are discussed and portrayed in a table. In the section following that, the differences are discussed from the perspective of ACAP. Finally, a summary is presented in the interim conclusion section.

Similarities between The Case of Israeli and German Dental Implant SMEs

Both firms acquire similar digital technologies: 3D, CT scanners, and intraoral scanners to support what they identified to be the future in their field: guided surgery. The main focus is the automatic production of the crown which is tailor-made to patients' needs. Both CEOs are motivated by patients' well-being and the added value they create for their clients, the dental practices so that they will be able to offer a shorter and safer treatment and healing time, using a product of better quality.

Decisions are taken fast and heuristic, first by the CEOs and later, by sharing ideas and directions with the top engineers. Since similar regulations exist in both firms' markets, no meaningful differences arose from that point. COVID-19 had a similar effect on both firms: Communication and meetings were moved to digital platforms, however, due to the field, it could not replace meeting patients and visiting practices.

As to cooperation, both CEOs mentioned that trust, knowledge base (expertise), and culture (shared language) are important for cooperation to take place. Both firms sell to the general market out of conviction and calling to help as many people as possible and not specialize only in a niche. Finally, both firms have their IT department external to serve only for maintenance.

Differences between The Case of Israeli and German Dental Implants SMEs

In addition to making quality products available, digitalization per se is more sought after by Israeli firms to save costs and collect big data. The German firm is focused solely on the patients and sees less value in DI in itself. The Israeli firm views digitalization as the development of the market. They plan to draw advantage from the growth potential (only 15% of the dental market is using digital technologies in their production or treatment). This potential is a business strategy for the Israeli firm. When asked about market potential, the German CEO replied that "Digitalization is not a goal on its own, rather seen as means to relieve patient's pain. It should not be pursued at any costs and no risk should be taken".

International markets are the main focus of the Israeli firm, therefore, they must master knowledge about the ISO requirements in each designated market they are active. The German firm in comparison is focused mainly on the German and DACH countries' markets, so they are

less obliged to research and master knowledge about foreign markets. The Israeli firm sells all over the world, including China, India, the EU, and the US.

Due to the large number of products the Israeli firm produces (over 4,000 different crowns), its main priority is to digitalize the supply chain and bring it to optimum efficiency by automating and sharing data across the firm's subunits. The German firm has fewer products.

Ceramic implants, the industry standard to date, are not good enough according to the German CEO and therefore he focuses on titanium. From this perspective, the German CEO founded his firm. The German firm is more focused vertically and going deeper in knowledge and research to optimize its offer, while the Israeli firm is expanding horizontally, offering many tailor-made solutions to different markets.

From the idea generation to the production, the German firm is orchestrated as a one-man-show, while the Israeli firm demonstrates a huge cross-team effort being refined every day to operate more smoothly. All the communication in the German firm is done personally and ad hoc. No meetings are scheduled, except if there is a topic to discuss. The Israeli firm is more structured and must orchestrate several teams. This fact can be explained by the difference in the firms' size, however, also by the prior knowledge of the CEOs. While the German CEO is an expert professor and practicing dentist, the Israeli CEO comes from the field of business. Their perception of the firms' goals is somewhat different. While one is more about the practice, the other is more about business development. This difference surfaces in the transformation phase. While the transformation for innovation creation in the German firm was done also via non-digital knowledge (spillover from orthopedics), the Israeli transformation was done by automating the supply chain to be one of the first to excel in the digitalization of the dental market.

Table 6: Differences between the Case of Israeli and German dental implants SMEs.

Indicators of differences	**Israeli**	**German**
Digitalization of the field	DI is seen as a priority, business strategy, and a horizontal growth potential	DI is not seen as a priority. Innovation and novel ideas can be created also from

		non-digital ideas, vertical growth potential
Business Focus	International markets, mastering different ISO requirements and regulations	Local (mainly German but also the DACH countries)
Management	Cross-team effort	One-man-show
Firm's Offering	Very large	Moderate
Cooperation	Many partners	One Swiss partner helped in the inception of the firm
Relevant Prior Knowledge	Non-dentist	Dentist
Coordination Capabilities	Many weekly meetings involving cross-department teams	No meetings

4.5.3 ACAP and Innovation in Israeli and German Firms

Israel

Potential ACAP: The firm acquires digital technologies such as CT and 3D printing as well as intraoral scanners. They also collect big data via digital software and they acquire test results from universities. Decisions are taken by the CEO. The acquisition of knowledge is done by the CEO and R&D. This team is crucial since they have a deep knowledge of the core business but also, but they maintain close relations with clients. Another important type of knowledge is the ISO regulations in each market. In the assimilation phase, the initial group shares this knowledge with the rest of the firm's subunits. They work in interdisciplinary teams to cover all the technological trends and see how to fit them with the medical regulations.

Realized ACAP: The most important transformation for the Israeli firm was to digitalize the supply chain so that the logistics could operate smoothly across the world. The logistics incorporate the activities of production, distribution, sales, and development. However, digital technologies can also transform products. Through these technologies, the implants become more accurate, cheaper, installed faster, and safer. In the transformation phase, the firm adopted the use of DI, an intraoral scanner. Once dental practices supply the firm with the data of the patient, the firm is able to produce a tailor-made crown and send the accessory kit to the dental practice to implant it in the patient's mouth. This solution helps dentists perform guided surgery and ensures the exploitation phase, since the firm increases sales and global activity due to the use of these services, and more practices look for this solution.

Germany

Potential ACAP: Digital technologies such as CAD, 3D, and X-ray scanners are acquired to make surgeries more accurate and customized. In addition to digital technologies, the firm also acquired two novel concepts for dealing with surgeries. One was manual drilling of the bone and the second was using living bone grains of the original tooth in the artificial implant. Decisions are taken solely by the CEO. The assimilation is done via the additional dentists, who are also engineers. This team communicates the innovation to the rest of the firm. However, meetings are being conducted only on demand.

Realized ACAP: The transformation phase is twofold: digital and non-digital. DI knowledge is used to produce the products, like using CAD software, 3D printing, and 3D navigation via X-Ray to produce a perfectly fitting artificial titanium root. The model of the root is also created via additional software. However, there is innovation coming also from non-digital spillover from the orthopedy field. By using manual drilling, the healing time was shortened. Also using living bone grains in the artificial implant helps the body's acceptance of the implanted root. This transformation of knowledge helped answer patients' and dentists' needs, thereby, creating an advantage for exploitation.

4.5.4 Interim Conclusion: The Case of Dental Implants

Both firms use similar digital technologies. These include a 3D printer, and 3D software that traces the mimic of the human face and specifically the jaw. Both firms use a CT scanner

(computerized tomography, formally known as computerized axial tomography) for X-ray navigation. They both use similar solutions for the implants: mainly titanium and according to market demand, also ceramic. They are both motivated by patients' well-being and safety, so the use of digital methods is designed to reduce patients' time in the clinique, save costs, and shorten healing time. Both firms are motivated by giving value to the market and easing the pain of patients. In the Israeli case, providing stable workplaces in Israel was added. Both managers stated that their role is to understand their core business to a very detailed level and stay focused on their value. Finally, none of them overload their team. In both firms, the CEOs are central figures. They deeply understand the micro aspects of their firm but also the macro perspectives. They monitor market trends and are in a constant search to increase the value they give as a service provider. They are informed about every market's regulations and define the profile of the clients in each one. In both firms, IT is external and used for maintenance and security.

A difference was discovered in the amount of effort invested in acquiring DI knowledge as a part of a larger vision of the firm and international market trends. First, the Israeli firm uses an SAP system to share the stock status with clients, however, this small difference could be explained by clients' requirements that are generated in larger firms. The Israeli CEO needs digitalization to strengthen the logistics: To help it run more smoothly and remove the firm's dependency on partners. The topic of logistics includes several aspects of the firm: development, production, distribution, finance, sales, and research. The firm requires digitalization mainly in the fields of training and expediting production. Although R&D is very important, it does not stand alone, rather it is just a part of the logistic chain. Innovation is done by several teams together (R&D, production, chief scientists, and sales). In contrast, the German CEO and the additional two R&D engineers are all practicing dentists and they lead the process alone. However, this fact could be explained by the relatively small size of the German firm. The firms differ also in the assimilation phase. Whereas the Israeli firm invests much in coordination and meetings in all the units of the firm, meetings in the German firm, take place only on demand.

An additional difference concerns the transformation phase. While both firms changed, the Israeli firm change relies more on DI, while the German change is not based on DI. The German firm excels in using spillover from the orthopedy field in the form of using manual drilling in a

whole new way than was previously done in the dental field (via water cooling). This eases pain and shortens the healing time of the patients. A second method used by the German firm is to use bone grains from the natural tooth and place them around the implant. This method reduces the possibility of tissue rejection. In comparison, the Israeli firm also practices innovative ways of securing its product quality and digital functions. However, these different examples indicate slightly different approaches to the business and the significance given to the digitalization of processes and products. In sum, innovation creation was done in both firms, however, the Israeli firm excelled in transforming DI knowledge into exploitation, while the German firm, increased its knowledge base, which was not digital per se.

4.6 Case 4: Israeli and German Pipe Fittings SMEs

In this case, two SMEs manufacturing pipe fittings were interviewed. Founded in 1978, the Israeli firm is family owned and its CEO is the son of the founder, with prior knowledge in engineering. The German firm was founded in 1949, the CEO was recruited two years prior to the interview from a huge organization. His prior knowledge is in business and pedagogic. Both are male and above 40. Additional informants were the Israeli VP of R&D and the German logistic manager.

In the words of the Israeli CEO: “Although digitalization is a priority for both firms, people are more important”. What the firm lacks in knowledge, he makes up by hiring intrapreneurs, people who work well in a team and share much knowledge. The most important thing for managers, according to the Israeli CEO is: „To care and to show that you care about your employees, their problems and concerns. Then you will get 900% in return“. Socialization is a value in both firms. In the Israeli firm, sport is done together as well as social events. Also, the German CEO believes in empowering employees and learning from each other. He conducts conversations with them. Moreover, they engage socially: The manual assembly of products in this firm is done in cooperation with a non-profit social organization, hiring 700 people with different sorts of disabilities to assemble their products.

4.6.1 Summary of Interviews

Israeli firm

Knowledge Base

The Israeli CEO shared that he gained much knowledge about robotics from Germany, for example, Industry 4.0. However, he amended it for his use by implementing only parts of it, where it was needed. Digitalization increased knowledge sharing and made the firm global. It also speeds up processes and knowledge sharing, and shorten the production time. However, information overload remains a challenge. Operatively, digitalization brought people from all over the world to be present at one point but still save time, through online meetings. Digitalization must take place overall in the firm and not in one department. The main technologies that are required to operate in the digital era are ERP systems, 3D printing, and automation of production via cobots. Digitalization increases the firm's performance and resources. Mostly, digitalization is felt within the firm and not in the form of new products. For example, an ERP system helps create a standard and transparency overall in the firm from the production floor to management. Digitalization allows the retrieval of information ad hoc and combines the planning and the production to fit the client's needs.

The main groups that are involved are R&D and logistics/operations, however, marketing and finance must also participate in the process, almost in parallel. The IT department only gives input and maintenance for the hardware and software. R&D leads the innovation activity. The goal is to shorten production time by detecting and analyzing anomalies. This helps deliver a better product to clients. No ambidexterity is required since R&D has the required level of understanding of the product and the available technologies. They oversee the entire firm's needs and finally, they have a connection to the clients. Aside from DI knowledge, there is also a need to increase the knowledge base about raw materials to fit industry standards. Such new raw materials are complex and delicate. Knowledge about them requires learning new planning, modeling, and production processes as well as the ability to test the products according to each market's requirements. Also, this knowledge is the responsibility of R&D. Finally, each engineer has a 3D printer on their desk, with which they can experiment and create new ideas.

To protect explicit knowledge, the firms keep digital files on each product. This file contains information about the product and its production processes. Except for this filing method, no strategy to protect knowledge is practiced. IT only helps analyze trends in the market. However, business Intelligence (BI) helps managers access data about the overall performance of the firm, at any given time. BI provides intel on sales, the segments and their strength/weaknesses, and the stand versus the planning. So, the IT department helps analyze sales data and translate it into management reactions.

Managers

The role of the CEO is to monitor the firm and help make changes happen. The CEO should either push or cancel projects. Decisions are taken fast and alone, later they are approved. Hierarchies are flat. The drive is to protect the employees and give them stability. There is no overload. The CEO must be there for the employees, understand the needs of the firm, and prioritize. Especially in the transformation phase, the CEO must push ideas, „make them happen", and encourage the employees to continue or decide to cancel a project. However, it is important that the manager listens to the user and the team, and understands the required compatibility between the products and the market demands. Finally, the manager must create a platform for the employees to thrive.

Cooperation & Co-creation

The firm draws support from government programs for example the Advanced Manufacturing Institute[55] of the Ministry of Economy, which helps manufacturing firms map which digital technologies could be helpful and how to assimilate them, reaching automation through Industry 4.0. The programs grant 50% subvention in the form of monetary aid or consultancy hours and training. AMITEC[56] is another guidance program that accompanies firms through the implementation of digital technologies in their firm and helps in digitalizing the production floor. However, the team was not pleased with its performance. According to the CEO, it was

[55] https://advm.org.il/en/home-page/

[56] https://www.amitec-g.com/areas-of-activity/industry/

slow and inaccurate. Once trust was lost, the firm decided to rely on a private advisory service called Matics[57].

Support from government programs is crucial to help digitalize the production floor. However, other external partners also help bridge the knowledge gap. Cooperation was done also with suppliers and clients in the US and China, there was an attempt for a co-creation. For example, a production plant in China is known for producing complex cutting tools, used to cut the plastic pipes of the Israeli firm. Israeli engineers receive files from them to learn how to produce them. With a US client, there was an attempt to co-create a joint fitting, the American team gave feedback on new designs.

Suppliers help the firm adapt to relevant changes in the market, for example concerning raw material availability, and new package standards. Cooperation with clients is usually not done on the deep R&D level, but rather in raw material, for example, plastic pipes that could transport both cold and hot water. An example of cooperation focused on a new raw material used mainly in the American standard (F-1960). This material is special and new, so the firm searched for an expert and found a firm in Belgium. They got interested in the project and supported them technically by sharing knowledge about injections and design. This Belgian firm sent a team to accompany the project at the firm (physically). This personal guidance was imperative to the success of the project.

An additional project was generated by a client's request to improve raw materials to match the European standard of fire retardants. Due to a lack of European suppliers that offer products in this standard, the firm decided to study the regulations for the standard and provide an answer. However, there was no test institute in Israel to check the product according to the European standard. The firm, therefore, located a Spanish lab to test and amend the product. This development led to a completely new product line and gained the firm large international clients with demand for this standard.

The motivation for this cooperation and transformation was curiosity, willingness to take risks and follow instinct, and the trust to cooperate despite the distance. In the words of the Israeli

[57] https://matics.live/about/

VP of R&D: “Cooperation either succeeds or fails mainly due to cultural differences. Decisive is whether a friendship was established and whether the teams share the goal”. The managers of the firm shared that it was easier to cooperate in China, while they work very fast and are more inclined to take risks, in comparison to the Americans. The choice of partner is based also on the partner’s experience (knowledge) and whether they send personal guidance.

German firm

Knowledge Base

“Knowledge is always ahead of a firm. There is always more knowledge than the firm can learn”[58]. The knowledge overload and the learning curve are especially challenging for SMEs, due to the fewer employees and the time it takes to train them about DI. As a step towards digitalization, the firm implemented an ERP system to fully automate the process of a digital purchase system. A fully automated process launches the production process automatically and independently. However, automatization can only reach the assembly phase. The assembly of the products is done in SMEs manually due to the high costs and complexity of creating a fully automated production line.

The trend in this industry segment is towards automation of planning and paperless production (digital purchase system). Production orders will be received via email and the system will process them independently. Machines throughout the supply chain are networked, they communicate and collaborate on data. This process will eventually launch production independently, by sending logistic demands to the machine, also called: Production Planning Automation.

Production Planning Automation requires the digitalization of complete production. This includes (1) Digital monitoring of the cutting machines; (2) Automatic retrieval of information about setup times and problems; and (3) Automated quality control. An example project is the digitalization of the production orders, being sent from the ERP system directly to the production machines. This allows the planning of the best production way of data analysis. The

[58] A citation from the German CEO

classification of each article and sequence helps improve the planning for the cutting tools department and reduces setup times. Once the ERP system was acquired, the firm transformed it to its use by adding a program for detailed planning. This programming was done by an expert, but the firm contributed by deciding the features and abilities that needed to be installed.

The R&D department is doing both research and development in the German firm. They design new products and they also generate innovation for new products. Their impulses are coming from sales, therefore they work together closely. The IT department is relatively new, three years ago they were using a service provider, now they have internal IT people in charge of the daily operations and one dedicated to business intelligence solely for the ERP system. On the ERP system, they work together with the R&D.

To protect the firm against knowledge loss, they document a lot of material and work in teams, so no one has more information than the others. This is true across all projects. Ten years ago, employees spent their entire careers at the firm, there was no knowledge loss. Since then, the firm has doubled its size and most of the employees are very young. In the German firm, every team member can contribute suggestions for improvement. When those are implemented, they are compensated in extra payment, as a bonus. Connections of the employees go beyond the office space, they exchange knowledge in Biergartens and meet privately. An open-door policy allows employees to share private problems with the CEO, and HR is trained to support them in any way required.

Managers

The role of the CEO is to make the vision a reality. He is responsible for the realization of the projects, however, 90% of his time is dedicated to running the core business smoothly. Only the rest is dedicated to strategies. To support the digital transformation in the firm and of specific projects, the CEO must define clear steps and communicate them to the team through the acquisition and assimilation phases, not just during the transformation. Many projects in digitalization are difficult and they cannot solve the firm’s structural problems.

The managers under the CEO enjoy freedom in decision-making when it comes to digitalization in their departments. They are allowed to decide about small to medium-sized projects alone, they take risks and endure failure. New ideas are implemented modularly. For example, to

implement the fully automated ERP system, they start with 25% of the machines and test it. Every two weeks the mid-managers collect new ideas from their teams and decide together which one to pursue.

Digitalization is not a goal per se, it is needed only if it can help the firm. Automation via software design must only be attempted when the core business and the existing processes are known and clear. Since the financial basis of the firm is strong, the strategy is to focus on the core business and clients that generate this security and dedicate about 20% to new ideas or reactions to demands.

The social climate is so positive that both managers confirmed that their motivation is the closeness and fun they feel working in their teams. The CEO mentioned that it feels like a startup. The logistic manager spoke about the team's spirit that motivates him and his curiosity to see the digitalization process through.

Cooperation & Co-creation

DI did not define the growth success yet, however, it helped progress the organization of the firm. For example, the firm has completed a two-year effort to upload the entire portfolio on a 3D homepage, to which every client has access. This helped increase visibility. Through cooperation with a partner, they use their platform to market their solutions to potential clients. These clients can check the applicability of different items to their needs before they commit. Not all firms choose to dedicate time and allocate investment to convert their portfolio to 3D format, but the ones who are, benefit from higher visibility. The partner in both cases was chosen due to its geographical proximity to the firm, which eased the communication and helped build trust.

The firm also cooperates with a local university for the full automatization of the mounting and testing of the couplings (mostly about air pressure). The firm tries to improve the product's safety. For existing products, where only minor changes are made, the results are admitted quickly. However, new products require a complete testing process, and therefore, the results can last two to three years. The firm also engages students. With clients, there is an exchange of knowledge, for example, how to best offer online services. However, this exchange is not

directly related to the digital transformation of the firm. Finally, the firm cooperates with suppliers to get new models for the products and consider new production ways.

Last year, the firm applied for a Bavarian funding program for digitalization in SMEs[59]. This program is commissioned to help SMEs to change the processes and the structure of the firms. Despite winning a grant with a value of 200,000 euros, the firm decided thereafter to withdraw from the program. The arguments to disrupt the program had mainly to do with the short timelines and contradicting demands. According to the CEO: "This program seems to be disconnected from the practice". First, firms are demanded to calculate the accurate amount of required funds within 6 weeks. However, IT projects require a longer preparation time. Second, the program demands that the projects will be finished within 12 months. This is also not enough for the realization of the project. Third, the program presents somewhat contradicting demands. On one hand, the projects must not be launched before receiving the grants, but on the other hand, every offer and process must be defined before applying for the grants. This requirement does not apply when new needs or complications unfold during the implementation.

The firm attempted to gain funds for two additional projects[60], however, they resulted similarly. The reason for that, according to the CEO, is that: "The political focus in Germany is on large multinational firms. SMEs are not considered in the funding planning. Support in gaining DI knowledge is not tailored to medium-sized firms. There is also a lack of formal education among government officials, about which DI knowledge exists and how it could apply to firms, making their decisions about which projects to select, arbitrary".

Since 90% of the components in this industry are standard, there is no risk in cooperating. If there is special knowledge it is patented and protected via a non-disclosure agreement. However, cooperation is also influenced by geographical proximity. The firm does not cooperate with competitors since most of them are located internationally in low-price range

[59] https://www.digitaljetzt-portal.de/

[60]The projects names are Value Facturing (digitalization for production) and Product Data Management System.

countries and their quality is not sufficient. Moreover, communication with them (cultural and long-distance) is less effective.

An example of a failed project elevates the importance of trust and expertise. A large project that was intended to automate the overall firm was closed, amounting to a loss of five years and huge investments. The processes of manufacturing firms are so wide-ranging, that it is not clear where to start. The external consultant who was brought was not an expert and was not trustworthy. The instructive lesson was not to jump on any DI knowledge and to train the team to work agile and not plan for the long term but rather to change with the industry. However, the next project succeeded. To launch a new warehouse management system, the firm changed a former consultant they had worked with and chose a new partner. This partner is a supplier with whom they worked better to fully automate the software. The partner is geographically close. Local partners are especially important to the CEO since he wants to advance the region. However, they also need to be specialists in the segment and trust must be built.

4.6.2 Within Case Analysis: Case of Pipe Fittings

In the following paragraphs, the similarities between the Israeli and German firms of Case 4 are discussed in the order of the questions asked: first the sub-category of Knowledge Base, then Managers, followed by Cooperation & Co-creation. After which, the differences are discussed and portrayed in a table. In the section following that, the differences are discussed from the perspective of ACAP. Finally, a summary is presented in the interim conclusion section.

Similarities between the Case of Israeli and German Pipe Fittings SMEs

In both firms, employees are treated with respect, and a culture of empowerment, open-mindedness, and friendly communication is standard. Also, the personal problems or wishes of employees are being taken into consideration. Furthermore, the employees are meeting also socially. Both firms reported they struggle with knowledge overload and are challenged by deciding which DI knowledge to acquire and how to implement it. Both firms recognized the following technologies for their digital transformation: Implementing an ERP system, 3D printing, and cobots. Digitalization is done mainly in the production processes and techniques. The goal is to standardize, homogenize, and automate the production processes. Some digital

technologies are inserted also into products. For example, inserting IoT components on sensors, to give ad hoc feedback on machine anomalies. This helps make the product more transparent, both to the support service and to the user. Digital technologies are used also to get business intelligence from every machine. This helps managers receive a status update on the entire firm at any given time. None of the firms uses ambidexterity, rather they prefer working in interdisciplinary teams, assembled agile to fit the topic or the problem that needs to be solved. Protection against knowledge loss is done through documentation and by working in teams. Furthermore, by treating the employees well, the chance of them, and their knowledge, remaining in the firm, increases.

Differences between the Case of Israeli and German Pipe Fittings SMEs

The firms differ in their raw material. The Israeli firm manufactures plastic pipe fittings, while the German firm manufactures metal pipe fittings.

The Israeli CEO is the owner of the firm (son of the founder), and the German CEO was recruited to manage the firm. He is also relatively new (two years in the firm).

The Israeli CEO comes from the field of engineering while the German CEO comes from business and pedagogic.

While the Israeli team works on semi-automation, joining cobots and humans, the German firm strives for a fully automated supply chain, in which the ERP system launches the production process by itself and communicates directly to the machines. Only the assembly is done manually.

Each Israeli engineer has a 3D printer on their desk to experiment and build their ideas, on their own time. Novel ideas that are generated by the German team are compensated as a bonus if they get accepted.

The Israeli firm enjoys much support from government programs for example automation through Industry 4.0. This program of the Ministry of Economy participates in subsidizing 50% of the investment by either giving monetary aid or consultancy hours and training. Another guidance program (AMITEC) accompanies firms through the implementation of digital technologies in their firm and helps in digitalizing the production floor. However, this one was

replaced by a private service provider, for lacking accuracy in their input. In comparison, the German firm had won already two grants from government programs, however, they never received the funds. First, it takes too long to receive the funds, the application time is enormous and results must be provided before the funding. The German CEO stated that he is considering withdrawing from the current program due to the effort and time it costs.

Cooperation partners are chosen by the Israeli firm according to the shared goal and cultural understanding. The cooperation continues if friendships are established and the teams like to cooperate. Usually, cooperation is done with remote partners, for example in China or the US, Europe, and elsewhere. The German firm in comparison cooperates mainly locally. This is a decision of the CEO who places great value on strengthening the local region and giving local firms a chance. This applies also to the university they conduct tests with and the regional social project hiring 700 people with disabilities for the manual assembly of their products.

The Israeli firm takes more risks to generate and implement new ideas. The risk is taken thanks to "curiosity and trusting the instinct[61]". An example of transformation in the Israeli firm was to produce pipe fittings according to foreign standards which not even local firms could do, thereby, becoming the first in the market. Also, the German cooperation led to being the first to upload their products onto a 3D homepage, increasing visibility and gaining a competitive edge. However, this was not a game-changing transformation and led only to an incremental transformation.

The German firm conducts many tests with universities to increase the quality of the products, however, the results are available only between two to five years. The Israeli firm practices more experimentation. On the other hand, the Israeli firm focuses on cooperation that would lead immediately to exploitation.

[61] A citation of the Israeli VP of R&D.

Table 7: Differences between The Case of Israeli and German Pipe Fittings SMEs.

Indicators	**Israeli**	**German**
Manager	Owner. Related prior knowledge (Engineer)	External, joined two years ago. No prior related knowledge (business and pedagogic)
Coordination Capabilities	5 meetings /Week	10-15 meetings/week
DI	ERP, semi-automated, using cobots	ERP, fully automated, is being improved every day
Cooperation	Government and foreign partners	Local university and partners. No help from the government, despite winning two programs
Transformation Goal	Be first-to-market	Be the best in the market

4.6.3 ACAP and Innovation in the two Firms

Israel

Potential ACAP: The firm focuses on the acquisition of ERP systems and automation technologies. They also use 3D printing, to experiment with new designs. Knowledge about new raw materials must also be acquired since they are crucial to keeping a competitive edge and answering global clients' needs. Knowledge about new plastic raw materials opens new areas of application. For example, special pipes that deliver both hot and cold water are in demand. The raw material is special and complex and is defined in the US standard by F-1960. The demand to use this material was initiated by a client. Since the firm did not have experience dealing with such material, it cooperated with another firm. The cooperating firm taught the guidelines of how to plan, model, and produce the product and accompanied the firm throughout all the different phases. In a second project, there was a requirement by a European client to have a fire-retardant particle in the pipes. Since no other European firm could provide this feature, the client approached the firm. The firm had to study the standard requirements and

produce a new pipe according to them. The risk was high, but the opportunity seemed to be worth the effort. Moreover, the joint interests of other firms helped them reach their goal. In both examples, the acquisition was focused on novelty, but not necessarily on DI knowledge. The assimilation of all this new knowledge was made easier and more efficient through digital technologies: the building of a new ERP system, digital documentation, and digital knowledge exchange in meetings.

Realized ACAP: In the transformation phase of the first project, new knowledge was required and later on, used for other models and products. In the second example, the firm realized that they were lacking the proper raw material. They approached two market leaders but were still lacking a lab that could test the safety of the product. Therefore, they produced the raw material by themselves according to the knowledge they assimilated from the cooperating firm and sent small samples of it to the only lab in Europe that could perform such tests, in an agile way. According to the lab's input, they kept amending the raw material until they reached the right formula. Since the firm was the single producer of such a product according to the new European standard, they won in the exploitation phase by having the largest firm in this segment acquire products solely from them. This approach demonstrates a disruptive way of thinking. Using new knowledge, also when not of a digital nature, to gain a competitive edge and use the transformation phase to appeal to new clients, thereby serving the exploitation phase.

Germany

Potential ACAP: The potential ACAP is defined by setting the goals and vision according to what trends are coming. The German firm focuses on a fully automated smart system that receives production orders and begins the production process by itself while being networked to all the other production machines. Most of the effort is directed at this segment. In the assimilation phase, many experiments take place, installing software on selected machines, or trying new ways to make the ERP system even more intelligent and independent. Teams are working together to exchange information. However, in digitalization specifically, each department focuses on its challenges. For example, marketing is concentrated on digitalizing the homepage and offering platforms for communication, while logistics must cooperate with R&D and IT to define the ERP system, and business intelligence, and think of ways to optimize the processes.

Realized ACAP: The transformation of the ERP system included adding, at many efforts, programs unique to the firm. The system does not just organize the data and ease the information exchange but also launches the production process from the receiving of the order and managing the production process until the manual assembly of the products. Regarding exploitation, in the words of the CEO: "DI did not define our growth success yet, however, it helped us progress in the organization of the firm". The firm increased its visibility to new clients, increased its level of expertise, and strengthened its trust with clients. However, they are not focused on digitalization per se, but rather they digitalize and also perfect their production processes and internal coordination. Once the investment is returned, it will bring in future higher accuracy, safety, and cost reduction.

4.6.4 Interim conclusion: The Case of Pipe Fittings SMEs

In the case of pipe fittings, there were also similarities and differences. The segments in which those arose indicate the state of mind and goals of the CEOs. Both firms stated that the atmosphere in the firm and the good and open relationships between the employees and the management are a priority. Employees are granted the freedom to suggest and pursue ideas, there is a culture of empowerment and open communication. Both firms organize after-work activities and social gatherings. In terms of digitalization, work is done in multidisciplinary teams, and priorities are set on developing the ERP system further. The German firm has already pursued this to the extent of a fully automated independent system that launches and overviews the production line from the start to the assembly phase. While the latter is being done manually by people with disabilities. Social engagement became a tradition in the German firm.

To cope with the information overload that both firms experience, the German CEO engages in several cooperations, with clients, suppliers, and universities, all are local players. This fact is important to him since he wishes to strengthen the local region. The Israeli CEO in comparison is engaged in international cooperation from the US to China to solve problems and disrupt the market. Two of his cooperations helped the firm meet a unique standard that placed the Israeli firm as a market leader. The Israeli firm also enjoys massive support from government programs that help with monetary subventions, consulting hours, and training as well as an expert accompaniment to decide which digital technologies to choose and how to implement

them. Such support is lacking for the German firm. Although they won government programs twice, the funds were not received yet, due to the long process and the results they needed to prove before getting the help. This raises frustration and lowers trust in receiving efficient aid when required. Although the German firm demonstrates a higher ACAP of DI knowledge, they lose valuable time in perfecting this process and not enough in exploiting novel ideas, also when they are not digital per se. Whereas, the Israeli firm invests less in digital technologies but uses digital platforms to advance the realization of novel ideas.

4.7 Cross-Case Analysis

Through a cross-case analysis (Eisenhardt, 1989; Yin, 1994) patterns emerge and elevate insights about the ACAP of DI knowledge in Israeli and German traditional manufacturing SMEs. First, the data is reduced to ease the „conclusion drawing and verification“ (Miles and Huberman, 1984, p. 23). Second, the results are presented in a table, to help visualize the differences, but also, to highlight additional variables, thereby avoiding bias (Eisenhardt, 1989). In this table, the reduced data is compared versus all four industries, crystalizing the factors according to the ACAP activities of the firms and releasing conclusions that are industry-specific. This helps transfer best practices, also across cultures. The cross-analysis begins with summarizing the similarities and the differences and organizing them according to the ACAP phases. Finally, the table of differences is presented.

4.7.1 Similarities

All firms recognized that DI knowledge is required for their firm’s production processes and products, independent of the different industries in which they operate. Digital technologies were implemented into products and processes, at times opening new exploitation possibilities for the firm: new standards, new clients, and new positioning. CEOs were leading the ACAP processes together with a small team of managers. COVID-19 also expedited the increase in the use of digital tools for coordination capabilities: Ideas exchange, routines and meetings, and working processes were all done digitally and remotely. However, accessing DI knowledge was challenging for all firms. Some use experts, universities, and government programs to access knowledge while others rely on cooperation with clients and other partners. In sum, with minor

differences that could be associated with specific firm size or industry restrictions, all firms practice similar potential ACAP. However, they differ in the realized ACAP. In the sections below, the similarities according to the ACAP phases are elaborated on.

4.7.1.1 Similarities in the Acquisition Phase

All managers recognize the value of DI knowledge. To acquire DI knowledge, all firms cooperate with the external environment, mostly with clients, suppliers, universities, and different forms of government programs and associations. Finally, none cooperate with competitors. As a rule, cooperation is usually done if the risk of copying is controlled and low, and if there is trust and knowledge superiority of the partner.

All firms are challenged by the amount of available DI knowledge and the antagonism of employees who might oppose the transformation. All firms also act towards enlarging the knowledge base through training and networks. Decisions are taken usually quickly and by the CEO, in both Israeli and German firms, regardless of the industry segment. The CEOs share their decisions typically with additional managers from different departments. The role of the additional managers is to communicate the CEO's decision further to their teams and to make sure all the subunits of the firm are aligned with the new knowledge and direction. The CEOs are extremely involved in all firms. The exchange of information is frequent and focused on the goal. Information is kept open, transparent, and structured. The level of structure changes slightly from firm to firm and from industry to industry, but all in all, they all follow ISO requirements, document digitally, and try to make the retrieval of information more efficient.

Within the industries, firms are almost identical in the type of DI knowledge they acquire according to their needs, strategies, capacity, and vision. For example, furnaces, food packaging, and pipe fittings manufacturers focus mainly on automation, with the help of AI and ERP. They recognized their priority in standardizing the ERP system to monitor and communicate the entire subunit activities of the firm and increase efficiency (cost and time reduction) and accuracy (anomaly detection).

The furnace firms acquire IoT, AI automation, self-learning product lines, and Human-Machine Interfaces (HMI). Their problem lies in remote installation, and ERP on Cloud computing to integrate all processes across the firm. In firms where machines are responsible for value

creation, either as a production tool, or as a product (furnaces, food packaging, and pipe fittings), the OEE (overall efficiency equipment) is of value. Moreover, knowledge about raw materials (for example food packaging, pipe fittings, and dental implants), and country-specific standards and regulations (for example regarding safety tests) are of immense value to all firms.

4.7.1.2 Similarities in the Assimilation Phase

In the phase of assimilation, there is little difference in the way managers work. All eight firms invest extensive efforts to assimilate, document, and protect DI knowledge. While none of the firms practice ambidexterity by allocating the innovation activities to special groups, they engage several departments to face the challenges of acquiring and processing DI knowledge. These include the R&D, CEO, logistics, finance, sales, and marketing. Very seldom (only in one firm out of eight) the IT department is involved in the acquisition of DI, as an impulse giver.

Overall, all firms in all the cases gave similar answers in the last two sub-categories (Team and Coordination Capabilities). Meetings are held short and designed to solve problems. They all document digitally their processes, although to a different extent. Information, especially about client needs is exchanged regularly. All firms use the same digital technologies for remote communication and allow flexibility by working from home. They all communicate openly, are friendly, and rely on digital tools and technologies to allow flexibility and immediate knowledge exchange. All firms communicate both formally and informally and in a friendly manner.

Socialization is a strong component in all firms. The managers and the teams are close, encourage a culture of ownership, and empower their employees to get involved and search proactively for novel ideas in their fields of expertise. In terms of coordination, six out of eight firms have similar meeting schedules (between 4-5 meetings a week, focused on problem-solving and pitching new ideas). Only one firm meets upon demand, and one firm meets more than the average (10-15 meetings a week). Since no meaningful differences that could indicate or explain differences in the innovation creation and exploitation of DI knowledge were found in these two sub-categories, this work focuses on the main three sub-categories: Managers, Knowledge Base, and Cooperation & Co-creation.

The knowledge base remains a decisive factor in assimilation. All firms send their employees to training to better understand the DI knowledge and the opportunities it entails. The larger and deeper the prior related knowledge is, the easier it is to assimilate new DI knowledge. However, it was not found that managers with prior related knowledge have any exploitation advantage over managers with other types of education, like business, economy, or pedagogy. Managers are leaders, and their leadership is decisive for the success of the firm. They also use multidisciplinary teams to bridge their lack of knowledge, when applicable, and also to assimilate it. They provide training for the teams to gain knowledge and use digital apps to allow knowledge exchange and accompany the teams through digital transformation.

4.7.1.3 Similarities in the Transformation Phase

In the transformation phase, similarities emerge mostly from the way work is divided. Multidisciplinary teams continue to work together through the transformation as well. Departments like Engineering and R&D, Human Resources, Finance, Marketing, and Sales join the CEO to form a strong team with flat hierarchies that coordinate between clients' demands, firm capacity, and strategic vision. Some firms (two out of eight), include in the transformation also external partners such as clients, to conduct a pilot, or make proof-of-concept. Other firms (six out of eight) involved mediating institutions (universities or government programs) to provide test results or accompany the transformation. New capabilities in the field of business intelligence help managers analyze the firm's positioning in relation to the sales goals and steer the firm in the right direction.

4.7.1.4 Similarities in the Exploitation Phase

The exploitation phase refers to changes and improvements that are caused by the successful implementation of the antecedent phase in the ACAP process. The more successful and fast the previous three phases were, the more impact will be felt in the exploitation phase (Cohen and Levinthal, 1990). The exploitation phase refers to opening new markets, gaining new clients and market positions, and using novelty to create a competitive edge.

In this phase, all firms were successfully exploiting their DI knowledge implementation by either strengthening the internal structure, for example by using an ERP system, Cloud Computing, or an SAP system, open and shared with clients. Some firms' changes were made

to their products by adding digital features, at times leading to creating a new standard and opening new markets (Israeli Case 1 Furnaces and Israeli Case 2 Dental Implants), or to their production processes (Israeli Case 2 Food Packaging and German Case 4 Pipe Fittings), or using novel treatment ways, for either implants or recycling (German Case 2 Food Packaging and German Case 3 Dental Implants). In sum, all firms were able to capitulate from DI incrementally.

4.7.2 Differences

The similarities discussed above, indicate that all firms used similar ways to acquire and assimilate DI knowledge, to create a transformation change to some degree. However, they differ in the degree which eventually helped them capitalize on their ACAP process. This finding is imperative since the value is created through the Realized ACAP (Zahra and George, 2002; Leal-Rodriguez et al. 2014). Differences in the way that some firms implemented the newly acquired DI knowledge and transformed it to their benefit vary according to the vision and the mindset of the CEO. Overall, it was found that Israeli firms are more inclined to take a risk to be first in the market and to have the chance to disrupt the market. German firms avoid risk and prefer to focus on bringing their level of knowledge base to the top. In other words, being the best. In the following paragraphs, the main differences in the ACAP across the cases are summarized according to the phases.

4.7.2.1 Differences in the Acquisition Phase

Israeli and German firms somewhat differ in the type of partners they choose to cooperate with to acquire DI knowledge. Overall, except for one firm, Israeli firms cooperate more via personal networks and government programs, whereas German firms rely more on formal cooperation such as mediating institutions (universities) and government associations. Although one Israeli firm (Pipe Fittings) stated that they prefer cooperating with private actors to save time, this finding was stable across all cases and independent of industry.

Although exploitation represents the result of the ACAP process, it should be planned before the acquisition (Paley, 2021), as a vision. Overall, Israeli firms were more focused on calculating the exploitation potential, before deciding which DI knowledge to acquire (Israeli Case 1 Furnaces, Israeli Case 2 Food Packaging, and Israeli Case 3 Dental Implants). Most

firms cooperate with clients right from the beginning to decide which DI to acquire according to new market needs. Moreover, Israeli firms also enjoy guidance, subventions, and technological support from the Israeli government. These government programs operate in a hands-on approach and direct firms to produce specific products that would become market standard. In Germany, the government demands to excel in the digitalization processes. In other words, to do the process perfectly. However, these programs are difficult to access for German SMEs, therefore, fewer firms use them. All in all, it seems that the German firms focus on excelling in DI knowledge, while the Israeli firms focus on the immediate exploitation possibilities they may derive from DI knowledge.

4.7.2.2 Differences in the Assimilation Phase

All firms organize their work according to their respective ISO requirements. While Israeli firms mentioned using ISO mainly to decide which markets to penetrate and what is possible, German firms refer to ISO mainly in their structure and documentation requirements, also at the price of efficiency. Although the same ISO exists in Israel as well, no CEO mentioned it in the context of documentation (assimilation), but more in the context of safety considerations when knowledge is either acquired or transformed. This could indicate that the focus and effort invested in maintaining ISO in the assimilation phase are not as central to the Israeli firms in comparison to the German firms. Moreover, German government regulations oblige them to maintain physical files rather than using solely digital files. This detailed documentation comes at the cost of much time and effort, as well as monetary investment to place the archives. Moreover, employees are overloaded and are less focused on creating something new. Israeli firms tend to document less structured and on smaller scales.

4.7.2.3 Differences in the Transformation Phase

The differences in the processing of the newly acquired DI knowledge could be triggered by the goal of the CEOs, whether to develop disruptive or incremental innovation. Moreover, they could also coincide with the level of risk the CEOs, and at times, the team were willing to take (German Case 1 Furnaces). In Case 1 of Furnaces, the Israelis were efficient in transforming their services by adding a new DI knowledge (AR), seemingly not related to their field, to solve a remote installation problem. This novel integration revolutionized the furnace industry and

became a new standard, allowing remote installation by penetrating the servers of the clients. The German firm also went through changes due to the acquisition of DI knowledge. They move towards Cloud Computing and they also use an external service provider to expand their database techniques. Indeed, the German firm has gained a respected position in the market for offering superior know-how (being the best). However, this was an incremental development, versus a disruptive development strategy (being the first), taken by the Israeli firm.

In Case 2 of Food Packaging, the Israeli firm focused on new automation transformation methods, for which they asked for government aid in directions, subventions, and tests. The value of this automation is the ad hoc feedback from each machine, so the manager can track their activities but also analyze and solve problems in the production, and through it, increase the firm's capacity and save time and costs. The transformation of the German firm has also to do with internal automation. They set a priority of moving toward paperless production through the implementation of an intelligent ERP system (similar to the German Case 4 Pipe Fittings). Moreover, through an SAP system, they grant clients access to monitor their orders and production capacity. In sum, the difference between the transformation phases of both firms is the focus on establishing full versus semi-automation. The decision is subject mainly to costs. The German firm invests much effort in analyzing and optimizing each process, they do not receive consultancy or funding, while the Israeli firm works with the government to establish a more efficient factory, one they can save costs and increase production, thereby strengthening their exploitation potential.

In Case 3 of Dental Implants, both firms are successful and financially independent. However, they focus on different visions. The German CEO disrupted the field of implants by using knowledge spillover from other fields. His action was revolutionary for the end-user, the patient. However, it was neither related to DI knowledge nor digitalization. The Israeli firm also occupies itself with the well-being of the patients, however, they pursue DI knowledge to add value to their direct clients, the dentists. By adding features and new possibilities based on novel digital technology, they create innovation within their production and products. They focus on automating their logistic chain and strengthening the firm through this aspect. The Israeli managers are interested in changing the production process, while the German managers focus on changing the product value. In sum, the German CEO broke protocol by using

knowledge from the orthopedy field as well as using the living bone technique. In contrast, the Israeli CEO added IoT features to elevate the DI value his products offer.

In Case 4 of Pipe Fittings, digitalization triggered the implementation of an overall ERP system, but more in the German firm. Moreover, while the transformation of the German firm was strictly digital, the Israeli firm was focusing also on innovations that were not of a DI nature. These were on raw materials and achieving new European industry standards demands. By excelling in the acquisition of this knowledge, the Israeli firm transformed its positioning and became an expert. In sum, in the context of DI knowledge, the main difference between the pipe fittings firms is the strategic decision of the Israeli firm to focus on semi-automate the processes, while in German firm's goal is to fully automate them, also at the cost of much effort.

4.7.2.4 Differences in their Exploitation Phase

In most cases, the Israeli management realized the value of Industry 4.0 more immediately than their German counterparts. Moreover, the Israeli firms were able to gain a competitive advantage as trendsetters and open new markets for their offerings, while the German counterparts were focused on making the process fully automated and perfectly documented. Although it remains difficult to create something entirely new, due to different safety requirements and ISO instructions in each of the respective industries, Israeli firms speak more in terms of digital innovative vision. This vision is to fully explore the digitalization transformation wave, semi-automate the machine, and start working with it, drawing more data from the machine and analyzing it. Moreover, Israeli firms serve the international market, while German firms focus mainly on the DACH countries and give value to regional business cooperation.

In sum, despite the technological superiority that was observed in most German firms, they acquired much knowledge and invested much effort in assimilating it. Their goal is to have all the processes organized and optimized, then fully automated, before drawing value from them. Therefore, their progress is more incremental. Moreover, German firms are less inclined to endure risks and rather focus on current client demands rather than exploring new business opportunities. This is mostly due to safety constraints of their products or due to conservative clients who demand to keep things as they were. Israeli firms want to own intellectual property, become an industry standard, and disrupt the market. While the German firms focus on

incremental progress and becoming solid sources of knowledge for clients. Israelis started the acquisition with exploitation in mind (Paley, 2021), while the Germans went through the correct process, although it was not clear from the beginning how long and complex the process would be.

4.7.3 ACAP of DI knowledge in Israeli and German Traditional Manufacturing SMEs

The ACAP of DI knowledge in the investigated Israeli and German firms is different in almost every phase, and respectively, so is the innovation resulting from it. Overall, it seems that Israeli firms in the same industry, are more focused on adding digital technologies to increase the performance of products or services. While German firms use these technologies to improve production processes. Moreover, the Israeli and German firms differ in the type of partner they choose to cooperate with to achieve this innovation.

Israelis are more focused on clients and government programs, while German firms rely more on universities. German SMEs reported avoiding government programs for being too complex and for presenting conflicting requirements. Therefore, German firms focus mostly on cooperation with universities for research and testing and they must finance their digitalization transformation themselves, causing them to evaluate the urgency longer.

Israeli and German firms also differ in the purpose DI knowledge serves them. While Israeli firms focus on achieving fast exploitation, from the acquisition phase, German firms invest in perfecting the processes before they may exploit it. In other words, the Israeli focus is external, on the direction of the current and new markets, while the German focus is internal, focusing on becoming better and giving their current market value through their increased (incremental) quality. However, such perfection comes at a high cost of time, training, and monetary investment. Israeli firms, regardless of their industry, are focused more on using the acquisition and transformation phases to create new exploitation options, capitulating on novel ideas and trends in raw materials, technologies, and new foreign standards.

The ACAP of DI knowledge in the investigated Israeli and German firms are summarized hereafter according to the influencing factors. The empirical findings are compared to the literature. Each sub-category of the factors is handled separately.

1. Managers

In order to sustain in the digital era, managers are confronted with complex DI knowledge that overloads their capabilities and resources. Aside from possessing a deep understanding of their environment and knowledge about their vertical fields (Attewell, 1992; Zahra and George, 2002; Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012; Carlo et al. 2012; Flor et al. 2018), they must also possess knowledge about DI and digital technologies, to allow them to make novel combinations and seize opportunities (Nambisan et al. 2017; Zhai et al. 2018).

Aside from the German CEO in Case 3 (Dental Implants) and the Israeli CEO in Case 1 (Furnaces), all the other CEOs are educated in other fields, not directly related to their firm activities. The German CEO of furnaces came from business and economics, as did the German CEO of Case 2 (Food Packaging). The Israeli CEO of Case 2 studied electro engineering, but not machines, the Israeli CEO of Case 4 (Pipe Fittings) studied engineering, and the German CEO of Case 4 studied pedagogic and economy. None studied computer science, information systems, or anything else related to digitalization.

Prior related knowledge undoubtedly helps the CEO screen faster the relevant DI knowledge their firm will benefit from, however, it could not be established that the firm's success in digital transformation is associated precisely with the prior related knowledge of the CEO per se. This was seen especially in Case 3 (Dental Implants). While the German CEO had a very deep and vast knowledge about his field and also similar medical fields, he decided not to use nor focus on DI, since he saw little value in it for his firm and a potential risk for his patients. On the contrary, he could derive so much innovation from his dental knowledge that he did not prioritize digital topics. The Israeli CEO of the same case, in comparison, was very aware of any possible combination and spillover from other fields that could be integrated into his firm, maybe because he came from prior education in economics and, therefore, indicated a priority for the digitalization of his field. However, specific knowledge of a field does not seem to trigger a focus on DI knowledge to supplement this specific knowledge. This result remained consistent in other cases.

In sum, concerning the influence of prior related knowledge on the ACAP of DI knowledge, no meaningful differences were found across the case. This means, that all managers had some level of DI knowledge understanding. Moreover, possessing prior related knowledge in the

respective industries did not indicate meaningful differences in the level of success of the firm. In other words, the difference in their exploitation performance was not related to their prior knowledge, but to other managerial aspects and decisions.

In addition to prior related knowledge, treating the team as intrapreneurs, giving them freedom, responsibility, ownership, communicating the goals, deciding heuristically, and giving a personal example, belong to the sub-category of managers as well. Especially in traditional firms, DI knowledge is scarce (Ciriello et al. 2018) and requires changes on behalf of the users (Fichman et al. 2014). Managers must communicate their vision clearly (Drejer et al. 2004) and encourage intrapreneurship in their teams (Lynch and Corbett, 2021), by enduring risk and failure. This aspect was also integrated into the artifact.

In all cases, managers reported deciding fast and heuristically, serving as a personal example and giving freedom and empowerment to the employees. Whether by encouraging employees to experiment and search for new ideas, suggest novel combinations, or take ownership of their project ideas. However, the willingness to take risks and endure failure was not the same. Some managers were less reluctant to risks (German Case 3, German Case 4), and in other cases, the team was blocking the risk (German Case 1, German Case 2). These findings indicate, that while the theory is clear, in practice, another factor is deciding whether the risk is taken and how novel ideas are implemented. This concerns the mindset.

Management mindset and entrepreneurial approach also influence the ACAP and the firm's performance (Lynch and Corbett, 2021). Managers must systematically practice an entrepreneurial approach accompanied by a strong strategy and vision (Peeters et al. 2014; Aljanabi, 2017; Lynch and Corbett, 2021). The entrepreneurial mindset is characterized by higher risk-taking, failure tolerance, and focus on disruption, in addition to attending to current clients' needs (Lynch and Corbett, 2021).

In this aspect, differences between Israeli and German CEOs were found in Case 1 (Furnaces), Case 3 (Dental Implants), and Case 4 (Pipe Fittings). In the case of furnaces, the fact that the firms were merged (the Israeli firms acquired the German firm), strengthens the assumption that the organizational culture was kept similar. Also, their environmental constellation was similar: operating in the same market, producing the same product for the same clients, and

sharing a corporate identity. The differences in the entrepreneurial mindset of the two could be summed up as follows.

The Israeli CEO of Case 1 (Furnaces) stated his vision is to be first-to-market, disrupting the market by creating a new industry standard. He accepted taking risks to maintain. This points to the sense of urgency as fertile soil for innovating in the digital era by remaining entrepreneurial. The German CEO is also innovative, however, he had to fight much antagonism coming from his team regarding changes and risks. His vision, perhaps, therefore, is more focused on excelling in the knowledge base. From the German team's perspective, things must be evaluated to the full and planned in detail before any new direction can be explored. Stable revenue streams must not be jeopardized, nor the reputation of the firm. In the end, no risk was taken in the transformation phase. This indicates that national culture could have a large impact on individual decisions and strategies.

2. Knowledge Base

Concerning the knowledge base, the positioning of R&D was widely discussed in both the literature and the empirical investigation. However, not enough in relation to DI. Since the position of R&D also indicates a management decision on how to organize the ACAP of DI knowledge, it is important to include a clear guideline, specifically for SMEs. Despite the wide literature on ambidexterity (Jansen et al. 2005; Gray, 2006; Volberda et al. 2010; Mukherji and Silberman, 2013; Egbetokun and Savin, 2014; Savin and Abiodum, 2016; Broersma et al. 2016; Chowdhury et al. 2017; Broersma et al. 2016; Banerjee et al. 2020), SMEs do not practice it. They either let the R&D work overtime (Cohen and Levinthal, 1989) or combine the R&D with additional teams to create innovation (Nambisan et al. 2017).

Also, in the observed cases, R&D continues to be the focal source of innovation since they are most familiar with the technology of the core business and are in constant exchange with clients. However, DI is different from other forms of innovation because its complexity demands the involvement of the ecosystem, the awareness, and skills to tackle the new technologies, and the allocation of resources to allow the knowledge to be shared (Ciriello et al. 2018; Hund et al. 2019; Kiefer et al. 2021). Due to the complexity of DI knowledge, several additional departments must be integrated, especially in manufacturing firms. These functions include

typically the operations, sales, and the CEO, who must coordinate their goals and decisions according to the strategy and capacity of the firm.

3. Cooperation & Co-creation

To deal with the overload and complexity of DI knowledge, firms must seek cooperation Cohen and Levinthal, 1990; Zahra and George, 2002; Roberts et al. 2012; Acs et al. 2013; Badillo and Moreno, 2018; Cavillier and Wieser, 2018; Ciriello et al. 2018; Zou et al. 2018). In the empirical investigation, all firms stated cooperating with clients, suppliers, and other partners. None of them cooperate with competitors. However, two main differences were discovered in the context of cooperation & co-creation. The first reflects the tendency of Israeli CEOs, regardless of their industry, to activate personal networks in the search for a solution more than their German counterparts. The second has to do with the emphasis on co-creation with clients, which includes pilots for proof-of-concept, referred to as testing in the literature (Jansen et al. 2005; Broersma et al. 2016). Co-creation surfaced more in Israeli firms than in their German counterparts. Finally, approaching personal networks is quite common in Israeli culture, it is also easier due to the country's small size. Also, the literature indicates it as one of the success factors of ACAP (Tsai, 2001; Jansen et al. 2005; Gao et al. 2008; Ahlin et al. 2014; Guimaraes et al. 2016; Dahlin et al. 2019).

Regarding the factors of proximity to cluster (Avalos-Quispe and Hernández-Simón, 2019; Presutti et al. 2019; Zapata-Cantu et al. 2020; Darwish et al. 2020) versus international partners (Lane et al. 2001; Badillo and Moreno, 2018), it seems that most Israeli firms tend to cooperate internationally, while German firms tend to focus on the region and at times, only on the pan-European market. The choice of partners is done according to their expertise in the required area of knowledge and based on trust through recommendation or a previous acquaintance. Trust was incorporated into the artifact as operating conditions. Without trust, no project can succeed. But trust is relevant not only in the choice of partners but also within the firm, between the team and managers. The trust of the team in the vision influences commitment (Roberts et al. 2012; Komani and Bobek, 2020).

4. Mediating Institutions

Especially when the knowledge is complex, as with DI knowledge, firms need expert guidance in coping with it (Cohen and Levinthal, 1989; Attewell, 1992; Gao et al. 2008; Robinson and Stubberud, 2010; Carlo et al. 2012). In the sub-category of Mediating Institutions, several programs were regarded: Innovation programs such as incubators and accelerators, universities, and government support. In the interviews, the topic of mediating institutes was inserted in the sub-category of Cooperation & Co-creation since they serve as an additional source of external knowledge, flowing to the firm. However, in this section, these institutions are regarded separately, because these institutions do not strive to commercialize a product themselves. They mainly strive to create knowledge as part of their cooperation contract and for their research. Therefore cooperation with mediating institutions takes different forms than between firms.

Both Israeli and German firms cooperate intensively with universities for testing and research results. However, the triple helix of industry-university-government (Presutti et al. 2019) is somewhat weaker in Germany due to the lack of government involvement. In other words, German firms apply less for government innovation programs, as partners to receive monetary and technological support. The differences can be attributed to the focus and priority the programs have, and to the way they define accompaniment.

5. Team

The sub-category of Team focused mainly on the culture of the team. This included communication and knowledge exchange between the team members throughout the subunits of the firm (Nahapiet and Ghoshal, 1998; Leal-Rodriguez et al. 2014; Costa and Monteiro, 2016). Themes such as shared language (Nahapiet and Ghoshal, 1998; Leal-Rodriguez et al. 2014; Maes and Sels, 2014; Costa and Monteiro, 2016), socialization, ownership and empowerment, creativity, women in leading positions, open-mindedness, and willingness to learn were also included in this group. No meaningful differences were found between the firms investigated in the way managers treated their teams. However, differences were detected between the teams. The Israeli managers said that their team was excited to take responsibility and explore risky and novel ideas. Some teams were also working overtime to reach innovation goals that were not in the core business. The German managers expressed, to different degrees,

that their teams were more suspicious and reluctant to take risks. No team was working overtime.

6. Coordination Capabilities

The abundance of complex DI knowledge creates tension for firms since this knowledge needs to be integrated and coordinated (Cohen and Levinthal 1990; Todorova and Dursin, 2007; Roberts et al. 2012). The coordination is done through routines (meetings and documentation) (Zahra and George, 2002**;** Jansen et al. 2005; Lane et al. 2006; Volberda et al. 2010; Carlo et al. 2012; Chowdhury et al. 2017). Although every industry must comply with standards like ISO requirements, there are differences in the way that knowledge is documented and retrieved. This influences the firms' focus and ability to overcome their overload. All the firms conduct meetings and documentation routines to coordinate their activities. However, overall, Israelis, tend to meet and document less in comparison to German firms.

7. Environmental Features

The sub-category of environmental features includes the factors that tackle the complexity of the technologies Carlo et al. 2012; Roberts et al. 2012), the appropriability regime in certain locations or industries (Zahra and George, 2002; Ritala and Hurmelinna-Laukkanen, 2013; Kim et al. 2018), and the location of the cooperating partners, whether regional (Lambert, 2016; Guimaraes et al. 2016; Chandrashekar and Subrahmanya, 2017; Presutti et al. 2019; Zapata-Cantu et al. 2020), or remote (Lane et al. 2001; Badillo and Moreno, 2018). Appropriability regimes can neither be changed nor were they mentioned as influencing factors by the researched firms. However, they should be regarded, as they condition the firm’s operations.

The cross-analysis between the four cases: Furnaces, Food Packaging, Dental Implants, and Pipe Fittings, is summarized in the following table, using codes that emerged from the analysis that can explain the differences in the ACAP of DI knowledge. Bias can emerge when researchers ignore conflicting findings or disregard other possible influencing variables, resulting in process-based bias (Eisenhardt, 1989). Therefore, conclusions must be based on the examination of the data in several ways and „go beyond initial impressions“ (Eisenhardt, 1989, p. 541). Findings that emerge from comparing multiple cases, encourage the use of logic rather than simply aggregating data (Yin, 1994). Finally, the use of multiple cases allows the

emergence of additional influencing factors that explain the results, for example: „distinctive mission, geographic location, demographic profile, age, history, and particular internal structure and contextual settings“ (Yin, 1994, p. 285).

4.7.3.1 A Cross-case Analysis of the ACAP of DI Knowledge in Israeli and German Traditional Manufacturing SMEs

Table 8: Cross-case Analysis of the ACAP of DI Knowledge in Israeli and German Traditional Manufacturing SMEs. Own illustration according to Miles and Huberman, 1984.

ACAP Phase / **Case**	**Acquisition**	**Assimilation**	**Transformation**	**Exploitation**
Furnaces (IL/German)	Acquisition with exploitation in mind and use of government aid and strong co-creation/ vs. slower acquisition of a wider spectrum of DI knowledge	less documentation and meetings, teams working overtime/ vs. perfecting the processes so they could be fully automated	Disruptive and spontaneous/ vs. incremental and planned. Following a clear procedure and goal. In sum: Be the first/ vs. be the best	New markets and clients/ vs. better know-how to offer existing clients
Food Packaging (IL/German)	Intensive government support/ vs. alone with focused cooperation with universities for tests	Faster and less structured, focus on getting input from the machines/ vs. slow, structured, and focused on process optimization	In DI context: Modular and non-direct recycling/ vs. fully automated and full recycling cycle (tray-to-tray)	Already working with results/ vs. Waiting for test results

Dental Implants (IL/German)	The same technologies are acquired for the same procedures (guided surgery)	The goal is to use digitalization as a competitive edge/ vs. using only what is needed by the patients	Novel technologies are used in production and in product/ vs. novel ideas that are not DI	International, expanding to new markets/ vs. national and going deeper into the home market
Pipe Fittings (IL/German)	The same technologies acquired, with a focus on ERP, and business intelligence	Less documentation/ vs. complete documentation	Semi-automated/ vs. fully automated	Became market leaders due to reaching the EU standards/ vs. having a deep understanding and perfect automation

4.7.3.2 Frequencies Table according to Vogelsang et al. 2013

To add rigor by reducing the cross-analysis table, even more, the sub-categories were ranked according to the frequencies in which particular factors were mentioned (Vogelsang et al. 2013). Each of the influencing factors was chosen according to how frequently they were emphasized in the interviews. The factors were: R&D, IT, risk-taking, and cooperation & co-creation. These rankings vary from (-1) explicit rejection (0) no reference (1) reference and (2) reference with an accent.

Table 9: Frequencies. Own illustration according to Vogelsang et al. (2013). (*) with clients (**) with universities.

Factor	Furnaces		Food Packaging		Dental Implants		Pipe Fittings	
	Israel	Germany	Israel	Germany	Israel	Germany	Israel	Germany
R&D	2	2	1	1	2	1	1	1
IT	0	(-1)	0	0	0	(-1)	1	1
Risk	2	1	1	1	2	(-1)	1	0
Cooperation & Co-creation	2*	1**	2*	1**	2*	0**	2*	1**
Total	**6**	**3**	**4**	**3**	**6**	**(-1)**	**5**	**3**

R&D continues to be a relevant factor in the ACAP of DI knowledge in SMEs. The volume of this role depends on the nature of the core business. For example, in food packaging, the R&D consists mainly of chemists, and in the German dental firm, mainly of dentists. However, digitalization is mainly done by gathering interdisciplinary teams to work on digitalization issues together.

The IT department serves mostly as a service provider for maintenance and has little influence on generating new ideas. Most of the firms stated that there is no need for internal IT since IT is not their core business. The IT is needed only to install what the firm needs. However, in the Israeli furnaces firm, the CEO strives to own IP and have an internal IT in the future; In Case 4, both Israeli and German pipe fittings firms shared that there is a potential to strengthen the IT department to get better in business intelligence (BI) for the ERP system. As digitalization progresses, it could be possible that firms would be triggered to have IT internally, to protect their core business.

Israeli firms take much more risks compared to German firms. Although all CEOs agreed that risk-taking is a positive strategy that can have a great impact on the firm, in practice, their actions were different. This is due to the main reason, that in Germany, the danger of failure could not be endured. Each industry's standards dictate the safety requirements and regulations.

However, by comparing dyad firms, it became evident, that within the constraint framework, some risk could be taken in the business model, following a more disruptive strategy.

Cooperation is also a factor on which everyone was unanimous. No firm can tackle the challenges of DI knowledge alone. However, there is a clear difference in the emphasis that Israeli and German firms gave to the cooperation partner. Both firms mentioned clients and universities. However, the emphasis in Israel was on clients and co-creation, in acquisition based on an exploitation plan, while in Germany the emphasis was on universities and research institutes, that contribute firsthand to the expansion of the knowledge base in an incremental way, but take much longer to exploit.

In sum, in all cases, managers reported deciding fast and heuristically, serving as a personal example and giving freedom and empowerment to the employees. Whether by encouraging employees to experiment and search for new ideas, suggest novel combinations, or take ownership of their project ideas. However, firms differ in their willingness to take risks and endure failure. Some managers were less inclined to risks (German Case 3, German Case 4), and in other cases, the team was blocking the risk (German Case 1, German Case 2). Moreover, throughout the cases, Israeli firms were putting more emphasis on cooperation, especially with clients and government programs. These main differences in risk-taking and the tendency to cooperate concern the mindset. Israelis demonstrated a stronger entrepreneurial mindset, higher flexibility, and a proactive search for exploitation opportunities, already in the acquisition phase. These findings are independent of the industry. The implications of these differences are discussed in the next section.

4.7.4 Implications: Culture as a Cause for Difference in ACAP of Israeli and German SMEs

Cultural aspects dictate how firms behave and how knowledge is shared (Cohen and Levinthal, 1990; Attewell, 1992; Fichman and Kremerer, 1997; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Jansen et al. 2005; Lane et al. 2006; Todorova and Durisin, 2007; Roberts et al. 2012; Leal-Rodriguez et al. 2014; Mukherji and Silberman, 2013; Ahlin et al. 2014; Lambert, 2016; Lucena and Roper, 2016; Costa and Monteiro, 2016).

The ACAP level of firms is a direct result of the entrepreneurial mindset of their managers (Peeters et al. 2014; Aljanabi, 2017; Stelmaszczyk, 2020). Such a mindset exists in some cultures more than in others. To answer the question „Why do some societies invent more than others“? Shane concluded that innovativeness and inventiveness are a result of flat hierarchies that encourage creativeness and idea exchange through communication and acceptance of the change. The working ethics is based on trust and it is less structured. Moreover, the team is willing to invest extra work for innovation (Shane, 1992). Finally, life experiences shape a narrative that influences the way individuals conceptualize opportunities that DI knowledge brings (Nambisan et al. 2017).

Given this close connection between cultural dimensions and innovative behavior, this work was motivated by the avenues suggested by Avalos-Quispe and Hernández-Simón to enlarge the framework from the organizational level to the national level (Avalos-Quispe and Hernández-Simón, 2019). Therefore, the relationship between ACAP of DI knowledge and innovation creation was examined within the framework of culture, without distinguishing between organizational and national, as one is a mirror of the other (Gerhart, 2008). Figure 6 illustrates how culture is a wider framework that influences the mindset of managers in firms and shapes the ACAP process that leads to innovation.

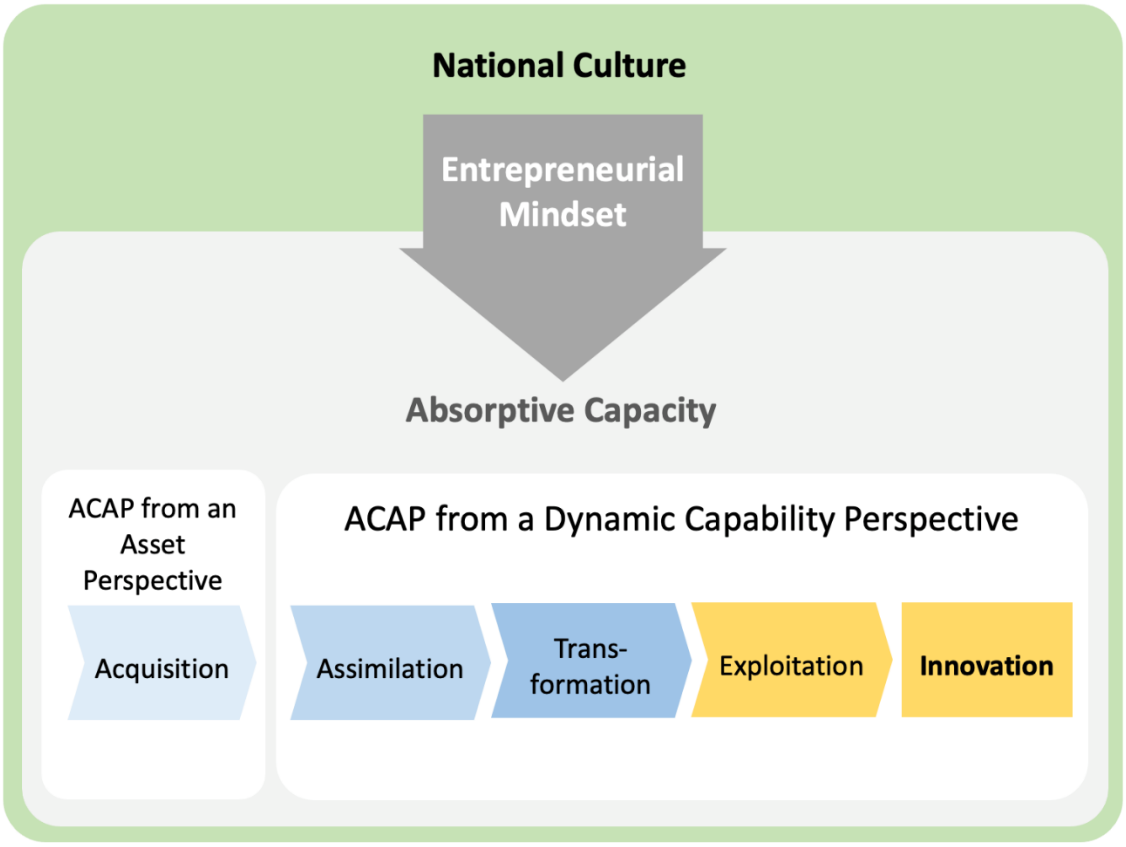


Figure 6: The framework of culture, ACAP, and innovation. Own illustration.

The more efficient the ACAP process will be, the easier it will be to create innovation through DI knowledge (Kiefer et al. 2021). Similarly, the more managers could be trained to recognize opportunities and to follow these opportunities in an entrepreneurial way of thinking by taking risks, collaborating, and thinking disruptively, the better the ACAP and through it, the innovation creation will become (Leidner and Kayworth, 2006; Todorova and Durisin, 2007; Peeters et al. 2014; Aljanabi 2017; Nambisan et al. 2017; Ciriello et al. 2018; Stelmaszczyk, 2020; Kiefer et al. 2021).

Building further on scholars who examined innovation under the cultural aspect in the framework (Krcmar, 2015; Dahlin et al. 2019), this work also compares firms in different national cultures. For this purpose, similar countries in terms of their innovativeness were chosen: Germany and Israel both share a common baseline, making the comparison easier and the results more distinct, as to differences in the absorption of DI knowledge, should they emerge.

As explained in Chapter One, both Israel and Germany are well-developed in their economy, technology, and access to knowledge. However, German firms are less successful in DI (BMWi, 2020). Compared to the OECD countries, including Germany, Israel is leading in almost every aspect of innovation and digitalization (OECD, 2020). Israel scored 1st in R&D intensity and ICT (WIPO, 2019).

In the year 2020, 58% of German CEOs rated their firm as latecomers to DI, while an additional 3% shared that they feel they have missed the boat. This especially holds true for SMEs (Bitkom Research, 2020). In complementary research, the reasons for such a lack were related to missing government strategy, fear of costs, lack of expertise and know-how, unknown solutions, and safety concerns (Sames and Diener, 2020). Moreover, Germany scores low on entrepreneurship (Bitkom Research, 2020). In comparison, Israeli businesses use different kinds of digital technologies in every segment and are characterized by high levels of entrepreneurship (WIPO, 2020).

Without defining beforehand the success or failure of firms in this research, it was intended to aggregate information on how dyad firms in two economies handle the ACAP of DI knowledge to sustain. By comparing the findings, best practices from both groups could be synthesized, thereby contributing to the enhancement of the ACAP in SMEs. Differences found could be connected to different levels of ACAP, which flourish more in certain cultures.

In the next paragraphs, a comparison of the differences between Israel and Germany in their cultural dimensions according to Hofstede, 1983 is presented. Later, these cultural differences are used to explain differences in the ACAP phases of firms from both cultures.

According to Hofstede's cultural dimension analysis, Israel and Germany differ almost on every level examined (Hofstede Insights, n.d.). Of six scales, only 5 were examined in both countries. Because the last dimension (indulgence) was not tested in Israel, we could not use it for the comparison. This work focuses thereafter on the first five dimensions: PD: Power Distance, IND: Individuality, MAS: Masculinity, UAI: Uncertainty Avoidance, and LTO: Long Term Orientation. (Hofstede Insights, n.d.).

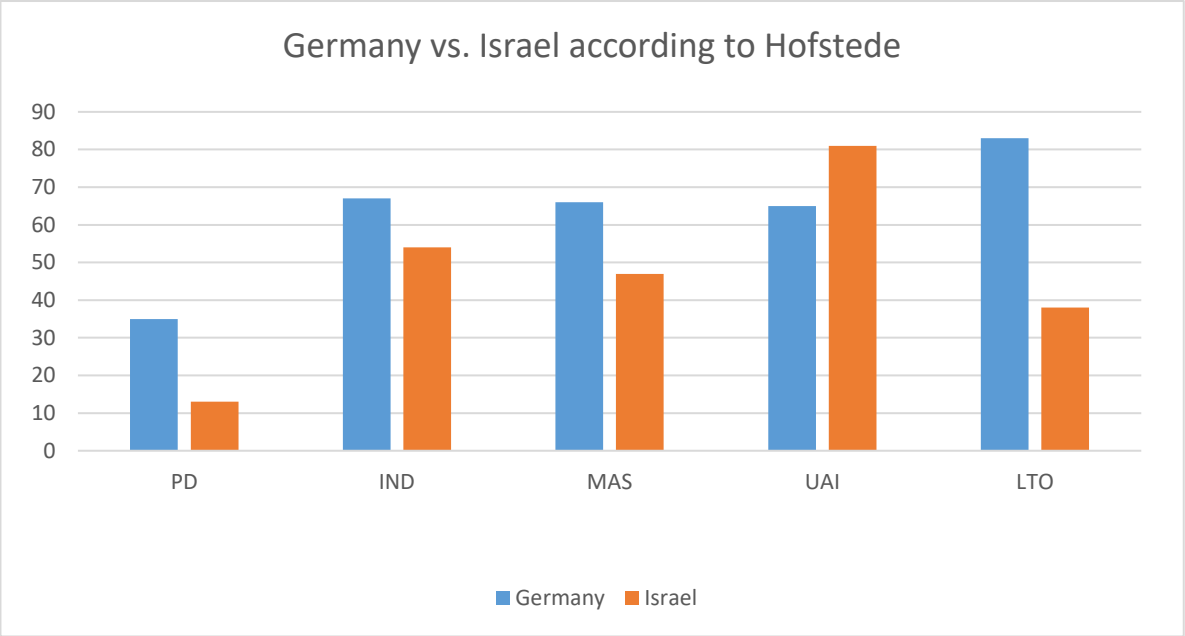


Figure 7: The five Cultural Dimensions of Israel and Germany. PD: Power Distance, IND: Individuality, MAS: Masculinity, UAI: Uncertainty Avoidance, LTO: Long Term Orientation. (Hofstede Insights, n.d.)

In comparison to Germany, Israel is characterized by a lower Power Distance (PD). A high score in the PD dimension indicates acceptance of leadership and a hierarchical structure. While a lower score indicates a higher level of entrepreneurship. Both countries score quite low, but Israel enjoys even lower PD relations (13) than Germany (35). A low PD was found extremely beneficial to entrepreneurship and innovation. In a lower PD, power is decentralized and managers count on the experience of their team members. Communication flows informally, new ideas are examined regardless of the position in the team and there is more trust. "The employees expect to be consulted" (Komani and Bobek, 2020, p. 61). An informal atmosphere prevails in the workplace with direct and inclusive communication on a first-name basis. „Israelis believe in independence, equality, accessible leaders, and that management facilitates and empowers. Respect among Israelis is something that is earned through practical experience.

In the Individualism scale (IND), the results are similar. While Germany scores higher (67), Israel scores (54). Israel's score indicates similar levels of both individualism and collectivism. This means, that in addition to individualism, Israel enjoys a high level of collectivism. This balance is important for cooperation, which proved crucial for innovation creation since high levels of individuality are connected to a high level of entrepreneurship (Zahed et al. 2001; Harrington and Guimaraes, 2005). A balance between the dimensions (individuality combined

with some degree of collectivism), indicates more knowledge sharing which contributes to ACAP. Socialization which manifests more collectively by definition, is imperative for the success of ACAP (Rindfleisch and Moorman, 2001, in Jansen, 2005), especially in IT (Roberts et al. 2012). Societies that have this balance are more inclined to „maintain close relationships with other companies (…) in the same business and innovation ecosystem“ (Komani, 2020, p. 61).

A higher score on the Masculinity scale (MAS), indicates clear gender roles and the importance individuals place on monetary stability, high and accurate performance, status, and hard work. Germany is more masculine (66) than Israel (47). In comparison, Israel enjoys similar levels of masculinity and femininity. The score of Israel resonates in equal roles and has a strong impact on emotions, such as liking to work with someone (Leidner and Kayworth, 2006). The lower MAS level shown in Israel makes emotional connections (to clients and the firm) stronger, which also helps innovation creation.

The Uncertainty Avoidance Index (UAI) scale indicates to which level uncertainty is conceived as something bad that must be avoided and how much anxiety is associated with it. In the UAI, Israel scores high (81) in comparison to Germany (65). This means, that „Israel is on the list of countries that avoid uncertainty the most“ (Komani and Bobek, 2020, p. 62). This avoidance serves as a motivation for them to innovate. In relation to innovation, a high level of UAI indicates how well innovation is organized in the country in terms of rules and hard work designed to secure themselves from the unknown (Komani and Bobek, 2020).

In the Long-Term Orientation (LTO) Germany scored 83 while Israel scored 38. LTO refers to societies that are oriented towards saving and the reward of hard work. LTO indicates pragmatism about awards, the importance of structures, and the security of stability (Hofstede Insights, n.d.). Shorter-term orientation societies are more flexible and adaptable to change (Zahed et al. 2001). In comparison to Germany, Israel is significantly more short-term orientated. A lower score in LTO is characterized by flexibility and tradition-driven rather than money-driven societies. Israel is more tradition-driven, and this acts as its prime motivation. Israelis are focused more on the past and present rather than the future. This focus lets them embrace changes and leads them to seek immediate gratification for their solutions, in the form

of commercializing their innovation and setting the trends in the market. This is also very important to innovation (Komani and Bobek, 2020).

The main difference between Israel and Germany as found in the empirical part could be summarized as follows: in comparison, Israelis are faster, more flexible, and risk-averse, they maintain closer cooperation with clients and have even more heuristic decision-making. To cope with the complexity and abundance of DI knowledge, Israeli and German firms acted differently in mainly the acquisition and the transformation phases of ACAP. These differences can be explained by cultural dimensions, and they are, therefore, discussed through these lenses.

With regards to Potential ACAP, no meaningful differences were detected in communication and coordination capabilities (assimilation phase). However, in principle, Israeli firms approached the acquisition phase with exploitation in mind. Meaning, that they decided on which DI to focus by monitoring the current and future clients' needs. Differences were detected also in the sub-category of Cooperation & Co-creation. Israeli firms involved clients in the acquisition and transformation phases. Moreover, they approached government programs to support their digital transformation. These programs supply technological assistance in screening which DI knowledge and which digital technologies could be complementary for the SMEs, how to acquire and assimilate them, and which priority. Although the German government offers similar programs, firms use them less. This difference will also be explained by culture.

The cultural dimensions of PD, UAI, and MAS scales explain the difference in the acquisition and assimilation phases. In the acquisition phase, the focus is on acquiring and exchanging external DI knowledge from cooperation partners. A lower PD score, such as the one witnessed in Israel, could explain the accessibility of these programs to the firms. Israeli managers in distress, are searching everywhere for help. From private networks to government programs, they are proactive in their search, they use a lower PD to communicate and get the knowledge and the needed accompaniment to help them assimilate the complex knowledge in the firm.

Also, the transformation phase is influenced by a middle score in the MAS dimension and a high score in the UAI. The MAS dimension indicates hard work and performance-oriented cultures. However, with similar levels of masculinity and femininity, Israelis are driven also by emotions of friendship. This makes their working environment more intense, helps knowledge

spillover via communication and regular exchange, and motivates them to go the extra mile to solve a problem. A high score in UAI indicates that Israelis are looking for solutions at any cost, they are innovation-driven by anxiety, and they are always on the go. This fosters creativeness and risk-taking, both important for the acquisition and transformation phase of ACAP. These differences in the heuristic, fast, and less structured decision styles could be explained by UAI as well. The Israeli firm follows more disruptive goals while taking higher risks, to avoid the uncertainty of the future and to find quick solutions for the unknown.

In the words of the Israeli CEO: „The drive for innovation is a strategy to survive by avoiding uncertainty.“ By not being risk averted, the Israelis react to changing circumstances to try and define the future, rather than waiting for it to surprise them. „Wherein uncertainty avoidance tends to incline one away from purchasing expensive new technologies but wherein the same uncertainty avoidance encourages one to seek as much information as possible in order to understand the environment“ (Leidner and Kayworth, 2006, p. 366). Indeed, the vision of the Israeli CEO in his words was to „lead the market“, „tell clients what they need rather than wait to hear what they want“, „become an industry-standard“, and „own intellectual property“. This was especially evident in the risk the Israeli CEO took by implementing new digital technology (AR), not knowing how it would turn out and what the client's reaction would be, should the project fail or damage the client's systems.

On the other hand, the German team favors safety, structure, and having the benefit of complete processes before they would give it further. German firms focus on developing a superior knowledge base. This approach is highly admired by their clients, however, it could result in missed opportunities at times. Specifically, concerning coping with a crisis, such as COVID-19, several differences in their entrepreneurial mindset, management strategies, and ACAP practices in general were detected. But most importantly, in the transformation skills of the ACAP.

The success of the exploitation phase is associated with the LTO dimension. A lower score in LTO is characterized by flexibility and tradition-driven rather than money-driven societies. Israelis are not motivated by the gain of their innovation or future stability. They are focused more on the past and present rather than the future. This focus makes them embrace changes and leads them to seek immediate gratification for their solutions, in the form of

commercializing their innovation and setting the trends in the market. In Israel, the situation must be solved immediately and techniques must be adapted fast. In the words of the Israeli CEO, „The project will be realized at all costs“. This pushes the Israelis to apply knowledge and exploit it faster. In the IND dimension, both Germany and Israel score high, which indicates a higher level of entrepreneurship and innovation affinity. However, combined with a similarly high level of collectivism, Israel is stronger in Cooperation & Co-creation. This is important, especially for the acquisition and exploitation phase of ACAP. Israelis are relying more strongly on developing their solution with clients. They care about liking the people they work with. It is not just business for them.

To sum up, national culture differs from country to country, and these differences manifest in the way innovation possibilities are captured and developed through DI knowledge. Behaviors such as empowerment, risk-taking, failure tolerance, flexibility, determination, effectiveness, open-mindedness, and knowledge exchange support innovation as described in Hofstede's rating and Kiefer et al. findings (Hofstede, 1983; Kiefer et al. 2021). In the designated countries of this research: Israel and Germany, these differences were examined through the ACAP lens, since the innovation success of firms is based on the efficiency with which firms organize their ACAP process (Kiefer et al. 2021).

In Israel, the acquisition process was done backward, meaning with exploitation in mind. This indicates a high UAI and a low LTO, trying to defy the uncertainty of the future by thinking about what innovations clients will need in advance. This way of thinking was also made possible thanks to a low PD, and moderate MAS and IND scales. Following this logic, Israelis would therefore be more inclined to remain close to clients and other players in the market. This cooperation with the external environment helps the exchange of knowledge and the setting of goals.

Although through DI the German culture has already shown signs of change, for example in lowering the PD (young CEOs invest in open and friendly communication, without hierarchy by using the direct personal pronoun: "you" ("Du" in German, rather than "Sie), and the tendency for a more moderate MAS and IND scales, the change has not penetrated the German government yet. The bureaucracy and complexity of accessing government programs indicate the importance of following a clear and pre-defined protocol, allowing little risk and almost no

failure tolerance. Programs are opened to firms after a long, complex, and tiresome application process, and funds are granted upon the receipt of the expected results.

The transformation phase is a clear indication of the decisions and priorities CEOs take. Sometimes, these decisions indicate more cultural constraints than individual traits. For example, in the case of furnaces, both CEOs were innovative and risk-affine, however, the Israeli CEO managed to convince his team to go disruptive while the German CEO had to hold back so the team would not feel pressured. They ended up with disruptive versus incremental transformation respectively. In the food packaging and pipe fittings, the German teams strived for perfection to achieve fully automated systems. However, this caused them time loss and a huge investment. In the case of dental implants, both CEOs were highly innovative. However, the Israeli CEO tended to use DI knowledge for his innovation, while the German CEO used industry spillover to implement new treatment methods from other medical segments into his own.

The exploitation that followed from this was also accordingly. All Israeli firms managed to open new markets by being the first to serve a gap and even define new standards, securing a competitive advantage for them internationally, while most German firms were putting efforts into becoming the best in knowledge and quality of products, making processes complete and perfected. For Israeli firms, digitalization is seen as a means to an end, to become a market leader, increase market share, or open new markets. For German firms, digitalization is a goal in itself. One which needs to be perfected. Knowledge needs to be gained before it is attempted to pursue digitalization. The perfection of the digitalization processes must serve a higher goal than that of the firm itself. It must comply with industry goals. Partners (such as universities and government associations) give German firms knowledge but not practical support.

5 Artifact: Design and Methodology

The goal of this work is to help SMEs overcome their challenges with DI knowledge by helping them pragmatically enhance their ACAP capabilities. To reach this goal, this work uses Design Science Research (DSR). DSR sets a goal to solve a problem through the design of an artifact. Under the term artifact, researchers may understand "constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented prototype systems)" (Hevner et al. 2004, p. 77). Especially IS[62] design-oriented research favors an innovative design over the observation of a phenomenon. Observation enables one „to identify causal relations" (Österle et al. 2010, p. 2).

Artifacts could be physical or digital products, but they may include also models, service systems, and methods (Hevner et al. 2004; Thoring et al. 2020). These artifacts must integrate people, and specifically managers' behavior (Hevner et al. 2004). The design approach allows flexibility since it regards the combination of three aspects: people, technologies; and organizational structure. Such a combination contributes to the relevancy of the solutions for practitioners (Österle et al. 2010). The artifact must be pragmatic by adding real components of best practices from the practice in addition to the theory. Foundations (theories and frameworks) and methodologies (data analysis) must also be incorporated into the artifact (Hevner et al. 2004).

In the next section, the guidelines for conducting DSR are introduced. Afterward, the artifact under the framework of ACAP is discussed. In the methodology section following, the design and evaluation of the artifact are presented. Finally, the artifact is introduced in the form of guidelines and operating conditions. The artifact is presented also graphically, helping managers visualize and follow action items to enhance their ACAP of DI knowledge.

[62] The German term Wirtschaftsinformatik correspondes with Busienss Information System Engineering, which relates to the overall term Information Systems (IS) (Österle et al. 2010).

5.1 Guidelines for Conducting Design Science Research: Review

The process of designing the artifact is iterative and comprises four basic phases: (1) Analysis; (2) Design; (3) Evaluation; and (4) Diffusion (Österle et al. 2010). In the analysis phase, the business problem is identified and gaps are elevated. The gap must describe an unsolved relevant problem. The researcher selects factors that may influence the problem and designs the artifact to attend to these factors as a solution (Hevner et al. 2004).

In the design phase, the development of the artifact must follow established research methods. These may include surveys, case studies, expert interviews, and analysis, to name a few. The design must remain flexible to endure amendments as the process develops. Moreover, the solution described in the artifact must relate to an important business problem (Hevner et al. 2004). In the evaluation phase, the artifact must be validated according to the objectives it was designed to achieve. In this stage, also the methods which were applied must be validated. Finally, in the diffusion phase, the novelty and contribution must be communicated to the relevant stakeholders (Hevner et al. 2004; Peffers et al. 2007; Österle et al. 2010; Sonnenberg and Brocke, 2012; Thoring et al. 2020).

An increasing number of researchers have formulated guidelines on how to conduct DRS. Some of them will be discussed later in this chapter. However, they all share these main principles: (1) Novelty: Artifacts must be novel and apply an abstraction – making the artifact appealing to a class of problems (Hevner et al. 2004; Österle et al. 2010); (2) Originality and deductive reasoning: Artifacts must contribute to the body of knowledge; (3) Justification refers to the validation capability of the artifact and the benefit refers to the contribution (Österle et al. 2010). Finally, (4) Evaluation is done in cycles, and iterations are necessary for rigorous design (Hevner et al. 2004; Österle et al. 2010; Mijač, 2019).

According to Mijač (2019), two evaluation cycles are required: Formative and Summative. The formative evaluation cycle provides early feedback and allows instant modification to the artifact; While the summative evaluation cycle gives feedback on the final result before the artifact can be implemented (Mijač, 2019). A DSR project must go through iteration cycles on all levels, from “awareness, suggestion, development, evaluation, and conclusion” (Peffers et al. 2007, p. 17).

According to Sonnenberg and Brocke (2012), there are seven guidelines for conducting DSR: (1) The creation of an innovative artifact; (2) For a specific and defined problem; (3) The artifact must be evaluated; (4) The solution must be novel; (5) The artifact must be rigorous, coherent well defined, and consistent; (6) The solution must be effective for the environment in which and for which it was created; (7) The results of the artifact must be communicated clearly to all parties involved, to ensure the effective application of the artifact.

These guidelines describe two main activities in DSR: build and evaluate (Sonnenberg and Brocke, 2012). In the building phase, the researcher must identify the problem, define a solution, and design the artifact. The main idea is to ask how things should be done to make an impact (Sonnenberg and Brocke, 2012). „Evaluation is the process of judging something's quality, importance, or value" (Mijač, 2019, p. 314). A rigorous DSR must evaluate the artifact before using it, ex-ante. This kind of examination allows it to combine both prescriptive assumptions of what results could be achieved, making the artifact's contribution even more valuable and truth-like (Sonnerberg and Brocke, 2012).

Peffers et al. (2007) suggest the following 6 phases: (1) Problem identification and motivation to include knowledge about the state of the problem and the importance and urgency of finding a solution; (2) Definition of the objectives for a solution, including what is plausible and to be expected; (3) Design and development of the artifact; (4) Demonstration of the use of the artifact; (5) Evaluation as a measurement of how well the artifact supports the solution; and (6) Communication of the problem and its relevancy, of the artifact and its utility, and finally, of the rigor of the design (Peffers et al. 2007).

In the next section, the methodology of designing and evaluating the artifact is discussed, resulting in the guidelines and graphic illustration of it.

5.2 Methodology: Design and Evaluation of Management Guidelines

Despite the growing number of authors dealing with DSR, all build further mainly on Simon (1996) and Hevner et al. (2004). This work concentrates mainly on the more recent, Hevner et al. (2004) while remaining loyal to the memorandum presented by Österle et al. (2010).

Moreover, more recent specifications are regarded and to some extent combined, to add rigor to the artifact, for example, Peffers et al. (2007) and Sonnenberg and Brocke (2012). These approaches represent a pragmatic and precise framework that integrates creativity and interpretation on one hand while demanding rigor on the other. Since this artifact is concentrated on processes and mindset changes of managers, these approaches were found most appealing to the purpose of this work and the goal of the artifact.

According to Hevner et al. (2004), DSR is conducted in four phases: understanding, designing, evaluating, and diffusing. In the first phase, *Understanding*, the focus is on defining the problem and searching for a solution within the environment, which defines the problem space (Simon, 1996; Hevenr et al. 2004). To implement the understanding phase, the problem space was defined as the digitalization challenges SMEs are facing, hindering their innovation, and thereby threatening their survival. Since ACAP was strongly connected to innovation, a possible solution would be to increase the ACAP of DI knowledge. A literature review was conducted to track the factors that influence ACAP and could enhance it. By using grounded theory analysis, 29 influencing factors emerged and were grouped into 7 sub-categories. Finally, hierarchies were defined: Manager, Knowledge Base, and Cooperation & Co-creation in the first level, with Managers being at the top. In the second hierarchy level, Team and Coordination Capabilities, are necessary for the efficient execution and enforcement of the manager's goals and vision. Environmental aspects, inside and outside the firm, which could influence the ACAP, were also regarded. Identified as important in shaping the ACAP of firms were entrepreneurial mindset and national culture.

Based on the literature review, cross-cultural empirical research was conducted. These findings contributed to the understanding of the problem and the possible solution by defining a new need: To enhance ACAP by repositioning managers' activities and encouraging them to adopt new ways of thinking more entrepreneurial.

In the second phase, *Designing*, the artifact is built. The design is usually done in agile and the iterative evaluation circles improve it until it effectively proves to answer the problem it was designed to solve (Hevner et al. 2004). To implement this phase, 15 guidelines were formulated in the form of action items and divided into the four ACAP phases. These guidelines were a

result of both the literature review and the empirical examination. The guidelines were drafted effectively, referring to whom to involve and what actions to take in each of the ACAP phases.

In the third phase, *Evaluation*, the artifact is validated. Rigor in the evaluation is achieved by properly collecting and analyzing data, reflecting on the artifact itself, and measuring its relevancy and applicability level to solve the problem. To evaluate the impact of an artifact, managers must agree to integrate it into the firm's existing infrastructure. After this, its diffusion (generalization) capability should be measured (Hevner et al. 2004). There are five methods to evaluate the effectiveness of the artifact design: (1) Observing (using case or field studies); (2) Conducting an analysis; (3) Experimenting (controlling or simulating); (4) Testing; and finally, (5) Describing (Hevner et al. 2004).

Due to the nature of our examination, the guidelines were analyzed in a workshop. A workshop was chosen since it complements the research objectives, as required by the evaluation method (Peffers et al. 2007). The purpose of the workshop is to "further develop the components taking detailed restrictions into account" (Aier and Gleichauf, 2010, p. 12). In other words, consolidate the artifact, decide whether the suggested guidelines are suitable, and discuss alternatives. Building further on Aier and Gleichauf (2010), the workshop was used to put the guidelines to the test. The evaluation was done in two cycles, formative and summative (Mijač, 2019). In the formative cycle, managers were asked whether they would derive benefit from using the artifact. Based on the initial feedback, the design was revised and amended. In the summative cycle, additional feedback was gathered from the second cycle with another case.

The workshop was conducted online and lasted one hour. The managers participating were the informants of Case 1 (Furnaces) and Case 2 (Food Packaging). This choice was made because the dyad firms in these cases demonstrate clear and meaningful differences that contribute to the understanding of the problem. Case 1 demonstrated an internal difference in the CEOs' and team's mindsets and ability to execute their vision in their respective teams. While Case 2 pointed out an external barrier in the acquisition and transformation, due to the complexity of approaching the German government programs. Finally, alternatives were considered (Aier and Gleichauf, 2010), by asking the interviewees for their points of view. In the end, final guidelines were designed for managers to follow, directing them on how to conduct the ACAP process.

Within the evaluation of the design, there is also a research contribution. This part must verify the novelty of the artifact. Finally, the style and beauty of the artifact must also be evaluated (Hevner et al. 2004). To implement the evaluation phase, the participants were asked to evaluate these three components: means; ends; and laws. *Means* refer to actions and resources available to solve the problem. *Ends* refer to the goals the firm wishes to achieve by solving the problem. *Laws* are the environment's requirements and constraints both from the technological and the knowledge domains. This resulted in adding operational conditions and additional guidelines to the artifact, representing the resources, laws, and mindset changes.

The contribution of the artifact is twofold. First, it enriches the theoretical basis on the topic of ACAP of DI knowledge. Its special focus on SMEs helps close gaps suggested by recent scholars (Nambisan et al. 2017; Siachou et al. 2020; Kiefer et al. 2021). Second, the clear formulation of the guidelines as action items is practical and easy to follow. Moreover, the guidelines incorporate cultural aspects that could be adapted by managers from other cultures, helping them become more entrepreneurial and innovative.

In the fourth phase, *Diffusion*, the research results, and the artifact are communicated to the relevant stakeholders. These are mainly CEOs and technological managers. The first group requires sufficient detail to allocate the necessary resources, while the technical group requires much deeper information and detail to determine the applicability of the solution artifact in their environment.

To implement this phase, the artifact was shared with all participating members of the cases. They confirmed that the guidelines are clear and possible to follow in other cultures. They confirmed they would allocate resources based on the guidelines, as they are convinced that the guidelines are helpful. Finally, they emphasized several guidelines that were already listed in the artifact and requested to emphasize them as most important. The artifact was altered accordingly. Finally, the results were submitted for two publications in scientific journals, of which one has already been accepted, and is also gaining exposure in this dissertation.

5.3 Analysis: Understanding of the Problem

The analysis of the literature review contributed to the understanding of the problem. The problem the artifact attempts to solve is summarized as follows: *How can traditional manufacturing SMEs enhance their ACAP of DI knowledge to continue to innovate and sustain?* The gap is divided into two parts: (1) The literature is missing an understanding of how the ACAP is done (Jansen et al. 2005; Volberda et al. 2010; Zou et al. 2018; Avalos-Quispe and Hernández-Simón, 2019); (2) There is no practical knowledge on how to enhance the ACAP capabilities of SMEs, particularly of DI knowledge. The understanding phase of the *problem identification* allows for the *definition of objectives* (Peffers et al. 2007). Therefore the artifact needs to comprise results from both the theoretical and the empirical parts of this research. These relate to (1) The sub-categories of ACAP as a result of the literature analysis (Wolfswinkel et al. 2011); (2) Refer to the theoretical frameworks of national culture (Hofstede, 1983; Leidner and Kayworth, 2006); and (3) Include aspects of an entrepreneurial mindset (Peeters et al. 2014; Aljanabi, 2017; Lynch and Corbett, 2021).

5.3.1 Summary of the Influencing Factors for Effective ACAP

By reviewing the literature between the years 1989 and 2020, without restricting the search to specific times or outlets, this literature review grasps a wider spectrum of 29 influencing factors. These factors were grouped into 2 categories (internal and external) and 7 sub-categories. The sub-categories were then evaluated to form a hierarchy of the influencing factors. The hierarchy was formed according to (1) The way the factors relate to each other in the literature, and (2) The value the interviewees gave to the factors. In both the theoretical and the empirical parts, there was a consensus about the influencing factors that contribute to the firm's ACAP, as well as their importance.

From 75 articles, 54 mentioned communication and knowledge exchange efficiency as well as cooperation & co-creation. Routines and coordination were mentioned in 48 articles, the knowledge base was mentioned in 43 articles, CEO and leadership involvement were mentioned specifically in 41 articles, and R&D in 35 articles. However, due to the involvement of the manager in orchestrating all the factors together, the sub-category of Managers represents the utmost superior factor.

Managers monitor the market and decide which type of knowledge to acquire, they use their private and official networks to cooperate and help acquire, experiment, or test the knowledge. Moreover, managers define the firm's vision and take decisions and risks to steer the firm strategically, they also can allow failure.

Second, in the hierarchy are the sub-categories: Knowledge Base and Cooperation & Co-creation. To remain competitive, firms must increase their knowledge base. Especially in the digital era, knowledge is complex, ever-changing, and overloading. Firms, therefore, rely on cooperation to access and process knowledge (Ciriello et al. 2018; Hund et al. 2019; Kiefer et al. 2021). Cooperation can come in different forms, from gaining insights from clients, experts, other partners, and innovation programs; to co-creating a solution together with clients. Managers are also in charge of these sub-categories. They use their personal networks, they decide whom to approach and which clients are relevant. They also steer the direction in which knowledge can serve the firm's vision best.

Internal factors such as the sub-categories: Team and Coordination Capabilities also define how fast and efficiently information is exchanged and protected throughout the subunits of the firm. Also here, managers set the priorities and the style. Managers can also influence the organizational culture, by setting a certain way of communication, treating the team as intrapreneurs, and limiting the coordination activities to essential activities only.

The insights obtained by the theoretical and empirical parts of this research are presented next in the context and order they were collected. Moreover, the artifact guidelines are formulated in a general way, which can exceed Israel and Germany and also the vertical industries in this research.

1. Managers

Israeli managers think more disruptively and take more risks. They focus on the latent needs of the market and use crises such as COVID-19 to create opportunities and reinvent their products, services, and markets. These tendencies are associated with national culture. However, they can be learned. To create an entrepreneurial mindset for managers and teams alike, the artifact encourages several actions to enhance the disruptive way of thinking.

2. Knowledge Base

According to the empirical findings in this research, R&D should not be divided up. This means research activities should not be separated from development activities. Even more, the development team should steer the research team regarding the technologies they must look for according to the input they receive from the market and their clients (Brock, den Ouden, Langerak, and Podoynitsyna, 2020). Following this logic, in the artifact, the guidelines recommend not separating R&D from innovation creation, but rather working agile using "distributed innovation agencies" (Nambisan et al. 2017, p. 225).

The artifact also suggests not pursuing full automation since this costs much time and investment and withholds current innovations on which the firm can capitalize. DI knowledge must contribute to the firm, and serve its current and new markets. By perfecting the production, no immediate value can be drawn. A modular implementation is more efficient. This is regarded by lowering the LTO by planning to immediate and mid-term.

Under the knowledge base, other topics were addressed, such as the role of the IT department in the ACAP process and knowledge protection. However, they refer mostly to the perception and circumstances of individual firms. General guidelines, therefore, could not be transferred in these cases. Therefore, the focus remains on the positioning of R&D in the digitalization process. When asked about the specific project, most firms mentioned their priority of implementing an ERP system, whether semi- or fully- automated. However, managing the knowledge base is to using standardized shared platforms, such as ERP systems (Yoo et al. 2010; Brock et al. 2020), was mentioned by all firms, and the way this system is implemented was also a consideration of resources and segments. Therefore, the artifact does not refer to this in the guidelines.

3. Cooperation & Co-Creation

From the empirical investigation, it seems that Israelis are in a constant search for DI knowledge. They activate social connections and use any platform that could help. As Nambisan et al. named it: "Sociotechnological context" (Nambisan et al. 2017, p. 226). These frameworks also help them to make sense of the technology. The better and more intensive the communication and the knowledge exchange, the better their exposure and integration of new

external knowledge. In this sense, it should be examined how informal networking can also be made available for German CEOs and whether they would use it. However, since such an open approach depends a great deal on national culture and individual capabilities, it is not mentioned explicitly in the artifact, but as a part of the overall guideline calling to increase collaboration. Cooperating with clients with a focus on testing and ensuring exploitation is a main guideline in the artifact since this could be easily transferred from the Israeli to the German culture.

4. Mediating Institutions

Mediating institutions comprise universities (Attewell, 1992; Gao et al. 2008; Carlo et al. 2012; Moilian et al. 2014; Maldonado et al. 2015; Lucena and Roper, 2016; Savin and Abiodum, 2016; Ciriello et al. 2018; Presutti et al. 2019; Avalos-Quispe and Hernández-Simón, 2019), government (Attewell, 1992; Ratten, 2016), or other innovation programs (Gao et al. 2008; Mukherji and Silberman, 2013; Ramirez et al. 2018), with which firms cooperate in the search for innovation.

Even though the German federal government has made programs available in a similar format to the ones available in Israel (funding, experts, coaching), they are less accessible. The reason for that does not lay in misinformation, since German firms are aware of the existence of such programs. Nor does it lay in a lack of funds. Nonetheless, German firms choose not to approach their government. The Digital Strategy 2025 report reveals that many funds are allocated for agencies and programs, however, it seems that the focus is more on the infrastructure, networking, and the facilitation of knowledge, but less on practical and personal accompaniment. Moreover, there is a strong focus on ICT, but less on Industry 4.0. When asked about personal experience with German government programs, three German CEOs shared their disappointment in the complex and sometimes contradicting requirements for the application these programs present. Moreover, funds are mostly granted after the firm delivers results, making the whole process more difficult to pursue. Since this work is limited to changes in SMEs, it cannot influence the government program, although some amendments should be taken to make the offering more accessible to SMEs. Therefore, the artifact includes a guideline to increase cooperation and search for alternatives (BMWi, 2016).

5. Team

In all firms, communication is done openly and friendly. In the practice, similar to the literature, managers give a personal example, include the team, and support them in becoming intrapreneurs (Mukherji and Silberman, 2013), and creative (Ahlin et al. 2014; Lambert, 2016). In some firms, social events such as sports or parties were also mentioned. Overall, in the words of the interviewee managers, they speak in the language of "we" and feel connected and close to their team, "like a family".

Another aspect of the team is the way the team works together and aligns with the firm's vision and strategy. Innovation creation requires intensive communication and cooperation between cross-department teams and at times, external clients or partners. As defined by Nambisan et al. (2017): "*distributed innovation agency*" (Nambisan et al. 2017, p. 225). Team members who are being trained and compensated to act as intrapreneurs and receive clear communication from the manager about the firm's vision, are more committed, independent, and loyal (Nambisan et al. 2017).

6. Coordination Capabilities

There is a logistic issue with documentation and retrieval efficiency. The topic of how to manage the knowledge base effectively was discussed at the evaluation workshops and therefore, also regarded in the artifact. The artifact is designed to guide managers to use common sense in deciding what needs to be documented and how. The artifact also includes a guideline to automate processes to make the coordination more efficient and accurate. This can be achieved, for example, by implementing robot-process automation, to automize and optimize processes and other solutions to make documentation and retrieval of knowledge more effective.

7. Environmental Features

Environmental features cannot be influenced, they are country and industry-dependent. Therefore, this aspect was inserted into the artifact as operational conditions that frame and define what can and cannot be done.

5.3.2 Summary of Best Practices according to the Phases of ACAP

In this section, best practices found in the literature and the empirical research are listed in the context of the ACAP phase they contribute to. In this way, the artifact follows the ACAP phases. This section revisits the best practices found in the literature and the empirical and divides them according to the phases.

Acquisition:

To enlarge their knowledge base, it is beneficial for managers to possess prior related knowledge about DI on their own (Carlo et al. 2012; Roberts et al. 2012), but also, have to collaborate with a wider spectrum of experts (Cohen and Levinthal, 1989; Attewell, 1992; Robinson and Stubberud, 2010; Carlo et al. 2012; Zapata-Cantu et al. 2020). Such experts can be found in their private and professional networks (clients, suppliers, competitors, and other partners), as well as through government programs. In cooperation, a tendency was found that Israeli managers were cooperating more with international partners and experts, they use their personal networks but especially, they partner with government programs. In comparison, German managers cooperate more regionally and avoid government programs.

Resources must be allocated to access these collaborations and facilitate the required operations (Zhang and Chen, 2021). However, managers are required first to think disruptively about digital technologies (Darwish et al. 2020). This change in mindset requires a systematic approach. Systematic means that managers have to have an overview of what new digital technologies are out there and create opportunities while reducing the risks of failure. Creating opportunities depends on an active search for novel combination possibilities but being prepared to endure failure and preparing an action plan for what to do in such a case (Paley, 2021).

Compared with the literature, the practical findings support the importance of managers, knowledge base, and cooperation & co-creation. While all CEOs are hands-on involved in leading the digitalization transformation in their firms, their own prior related knowledge is not decisive, but rather, their management styles. Israeli CEOs tend to take more risks and place digitalization as a vision, a prime goal defining the firm’s future position in the market.

The efficiency of the acquisition also depends on coordination between research and development (Nambisan et al. 2017; Paley, 2021). A new position within the R&D could be allocated for internal screening and matching with new external knowledge. Such a position will not only help firms keep informed about new digital technologies, market trends, or possible spillovers from other industries but also which ones to apply for the benefit of their firms and how to operate them, based on the R&D prior related knowledge and the connection to the clients. Especially in SMEs, R&D is mostly in touch with clients and can give valuable input on their needs and patterns. R&D is also prepositioned to monitor the competitors and plan accordingly the direction of the firm.

Assimilation:

Managers and R&D will also need to match and integrate new digital technologies within the existing knowledge base of the firm. For this, they must coordinate their internal activities and make matching and retrieval of knowledge more efficient, for example by investing in shared platforms (Yoo et al. 2010; Brock et al. 2020). Indeed, all eight firms mentioned the priority of installing an overall ERP system to coordinate knowledge exchange and detect potential problems or gaps of information.

The cross-department teams must have a shared language (Nahapiet and Ghoshal, 1998; Maes and Sels, 2014; Nambisan et al. 2017) and remain aligned with the vision of the firm (Brock et al. 2020). Indications that this was being practiced were found, but not enough. The shared language remains a hindrance for most firms. This should be changed by intensifying the communication between the managers and the team and nurturing an intrapreneurial environment and mindset in the team.

Coordination must be made more efficient by taking shorter meetings and concentrating on problem-solving while involving the team and treating them as intrapreneurs. Documentation must be made digital, standardized, and simple and rely on common sense to remain efficient. Moreover, it should not repeat itself (no multiple database platforms or overlaps between departments).

Transformation:

As a rule, work should be done in interdisciplinary teams, and involving dynamic flexible actors (Nambisan et al. 2017). The transformation phase could be opened to more actors than just the internal team. By applying agile methods, clients can already participate in a smaller resolution. This is similar to co-creation and was already introduced by the literature. Communication and knowledge exchange must be kept open and include cross-functional teams. CEOs should consider integrating clients or other partners for the co-creation and use the stage-gate process to cancel a project quickly and test regularly (Brock et al. 2020). Finally, reducing the risks could be approached by deciding on a modular implementation.

Indeed, most of the researched SMEs are practicing this strategy and are combining different teams in the process (except for the German dental implants firm, which operates more on silos due to its smaller size). However, the collaboration could be more intense. Overall in German firms, clients are usually not involved in the creation of solutions. Solutions are being developed for them. Combinations and spillovers are less evident in German firms (excluding the German dental implants firm). External experts, specifically from government programs are scarce. If a German firm approaches the government program at all, they would settle for support. No evidence of intensive and tailored accompaniment, such as the one Israeli firms benefit from, was found.

Co-creation increases the chances of acceptance of the transformed capabilities by the clients, and therefore, it increases the exploitation potential of the transformation phase. However, firms must aim also outside their current market. By adapting novel digital technologies, at times based on spillover from other industries, and selecting these choices carefully with the help of experts and agents, firms can secure the attention of other markets, and other governments and are gaining the potential to be of the first and the leader in a market.

Exploitation:

The exploitation phase must be done with the impact in mind. In other words, *planning backward* (Paley, 2021). This includes learning from the mistakes of the own firm as well as of the competition, analyzing, and planning the activities according to the desired impact. These activities were less viewed in German firms. Finally, reconfiguring and further building on

existing knowledge (*planning forward*). Both planning forward and planning backward were less seen in German firms. Although in Case 2 (Food Packaging) and Case 3 (Dental Implants), German firms were also aware of future trends, overall, they tended to focus their efforts on solving the current challenges or clients, while Israeli CEOs were focused on defining the market needs in the future.

5.4 Design of the Artifact: Framework, Guidelines, and Operating Conditions

Building further on Zahra and George (2002), Patterson and Ambrosini (2015) pointed out that the framework of ACAP is even more complex than assumed, stating that „ACAP is not a linear process, but rather an iterative one“ (Patterson and Ambrosini, 2015, p. 86) in the sense that phases overlap. Due to this nature, most managers fail to see the entire process, causing them to fail to draw on its full potential (Patterson and Ambrosini, 2015). This failure in managing the ACAP becomes even more challenging with DI. Also, more recent researchers recognize that innovation creation processes that are based on DI knowledge require different management using agile approaches, (Nambisan et al. 2017; Siachou et al. 2020; Kiefer et al. 2021). However, it remains unclear how to implement it in practice (Brock et al. 2020).

While Kiefer et al. (2021) call for a new organizational culture (Kiefer et al. 2021), Siachou et al. (2020) emphasize cooperation & co-creation with external partners (Siachou et al. 2020), and Brock et al. (2020) focus on the operative practice. They suggest a *hybrid stage-gate process*, combining both agile approaches and stage-gate processes. Stage-gate provides a platform to map activities and responsibilities, and agile methods focus on micro-planning and help the realization of the tasks (Brock et al. 2020). For this combination to succeed, they name a few conditions: (1) No separation between the research and the development functions; (2) Collaboration must be increased and the evaluation or testing of the innovation created must be done agile and regularly; (3) Communication and knowledge exchange must be ongoing and transparent (Brock et al. 2020).

This artifact consists of guidelines, formulated as action items. They fit into the ACAP phases and are limited by operating conditions. The artifact considers two aspects: external and internal

activities. Externally DI knowledge needs to be acquired. Internally managers orchestrate the entire ACAP process.

Each ACAP phase consists of sub-categories involving positions or roles within a firm. In the sub-category of Managers, the focus is specifically dedicated to CEOs. In the sub-category of Knowledge Base, the focus is on the positioning of the R&D group in the digitalization process. This role must be strengthened by agile teams (operational, logistics, sales, and finance). In Cooperation & Co-creation, the focus is on clients and other expert partners. Mediating Institutions include universities and government programs. In the sub-category of Teams, the emphasis is mainly on knowledge exchange and communication. These factors also give evidence of the organizational culture. In Coordination Capabilities, routines such as meetings and documentation are described to indicate effort versus efficiency. Finally, cultural dimensions (Hofstede, 1983) are added to each phase, indicating the change that could be taken to facilitate the required action.

The end of the ACAP process is the innovation creation which can come in the form of new offerings, new products, and processes, new business models, or new markets. The new knowledge gained from the transformation phase needs to be incorporated again into the firm's knowledge base, hence, it returns to the assimilation phase. The new result gained from the exploitation phase returns as external knowledge to the environment. These iterative actions are also marked in the artifact. Finally, the operational conditions required for the implementation of each activity are (1) The existence of trust in choosing the right partner; (2) Working agile; and (3) Iterating the entire process. The environmental features that may limit the ability of the firm to implement the actions, such as licensing requirements, security restrictions, and ISO demands, are also indicated in the artifact.

5.4.1 Deriving Guidelines

Already in the 80s and 90s, scholars argued that specific cultural values nurture more entrepreneurial and innovative behaviors and outcomes than others (Hofstede, 1983; Shane, 1992). This fact found support also in recent research (Krcmar, 2015; Kiefer et al. 2021). As discussed in Chapter 2, innovative behavior, which is mostly related to entrepreneurial organizational values (Kiefer et al. 2021), also corresponds with national cultural dimensions

(Hofstede, 1983). As illustrated in Chapter 4, cultural dimensions (Hofstede, 1983) play a central role in shaping the character, values, and behavior of individuals, in this case, managers and larger groups such as firms and countries.

Behaviors such as openness to knowledge and communication efficiency (Shane, 1992), are seen as derivative of cultural values which could explain differences in innovation. For example, innovation can be fostered by lowering the power distance (PD), practicing a balance between masculinity and femininity (MAS and FEM), and a balance between individualism (IND) and collectivism, raising the uncertainty avoidance (UAI) and lowering the long-term orientation (LTO). These activities could support an entrepreneurial mindset that would facilitate a smooth and effective ACAP process to enhance digitalization and harness DI knowledge for the current and future advantage of the firm.

To reach these outcomes, managers must change their mindsets, activities, and behaviors. Therefore, the recommended cultural changes were integrated into the artifact's guidelines. These changes will increase "corporate entrepreneurship and digital awareness" (Kiefer et al. 2021, p. 1). Managers that are aware, have also an "ecosystem orientation" (Kiefer et al. 2021, p. 1). They are market and customer-oriented and they understand that in order to acquire and integrate DI knowledge, they must also allocate resources, share more knowledge, and increase collaboration. Finally, these kinds of managers will redefine their team skills. Entrepreneurial managers will include employees in the decision and practice agile development and processes. They will implement a culture of risk-taking and failure tolerance, remain open-minded, and cultivate a willingness to learn.

The following artifact is designed to support managers in increasing their ACAP of DI knowledge pragmatically. The artifact is designed based on the above-mentioned action items and conditions following Hevner et al. (2004) while remaining loyal to the memorandum of Österle et al. (2010) and adding elements from Peffers et al. (2007) and Sonnenberg and Brocke (2012).

The artifact is multi-dimensional and relates to several aspects. First, the oval form and the arrows marked in the artifact capture the iterability aspect of the ACAP process (Patterson and Ambrosini, 2015). Furthermore, the artifact positions the manager (CEO) in the middle of the process. Moreover, the artifact separates the external and internal activities. In this way, it

becomes evident that the manager is responsible for acquiring external knowledge by (1) Nurturing relationships and facilitating cooperation with the external environment; and (2) Orchestrating the assimilation and transformation of this knowledge within the firm, through a series of activities (communication, management of team, and coordination capabilities). Finally, all the activities are determined by operating conditions.

Any knowledge that was created in the transformation phase, returns to the assimilation phase, to be incorporated back into the firm, and used for further development. This is indicated with a double arrow between the two phases. Similarly, new knowledge that was created in the transformation phase, is released through the exploitation phase to the external environment. There it would undergo new developments and novel combinations and could be absorbed by other firms.

The artifact is defined within a framework of national (and organizational) culture (this relation is defined through the green background). This framework influences the CEO directly. Within this framework, there are three levels. The first represents the ACAP phases. The second represents the sub-categories that are active in each of the phases. The third defines which individual influencing factors or actors are active in the sub-category in a certain phase. Finally, at the bottom, the operational conditions necessary for the specific ACAP process are defined.

The artifact itself, as shown in Figure 12, is a process stating each of the 15 guidelines that have to take place in each of the consecutive ACAP phases. At last, this process must repeat itself. The acquisition of DI knowledge begins with the availability of such knowledge external to the firm. To make sense of the available external DI knowledge, the CEO must possess both business and technological understanding. To allow novel business combinations building on technological possibilities, it is in the favor of the firm if the CEO has a technological understanding of their own, however, it is not the only way. What the CEO lacks in DI knowledge or digital technology capacity, they may supplement by asking for external aid from the R&D team or through cooperation with experts. In such a case, one-on-one coaching is better than overloading the manager with research or multiple sources of information.

In sum, the manager's abilities, decisions, network, and activities, influence how effective, agile, and successful the ACAP process will be. These decisions are also subject to the managerial understanding of the firm's needs and the DI knowledge that could support the firm

to reach this vision. Moreover, the manager has also an impact on the spirit of the team and the coordination capabilities. This includes facilitating a team spirit that nourishes the willingness to learn, increases communication and knowledge exchange, and treats the team as intrapreneurs, giving them responsibilities, ownership, and empowerment of their ideas and the firm's success. Finally, the manager decides, with whom to cooperate. This is usually based on trust, personal network, and the level of expertise that the cooperating partner possesses. At times, the cooperation is also decided based on geographical proximity. In Israel, it is mostly done with the government's innovation programs and international experts. While in Germany, the focus is more on universities and local clients.

In the middle layer, the artifact portrays the four consecutive phases of ACAP iteratively. The layer underneath the phases describes the influencing sub-categories that are put into use in each of the ACAP phases and the third layer indicates the level of persons or groups that are needed for the accomplishment of an effective ACAP, as discovered in the theoretical and empirical parts of this work. Finally, operating conditions are discussed separately and placed underneath. These include the need for iterations of the ACAP process; trust as a factor in deciding with whom to cooperate: and environmental features. The latter determines what kind of DI knowledge could fit, and what risks could be taken, according to industry requirements and limitations. The operating conditions are marked in the same color as their corresponding ACAP phases.

Once knowledge is acquired, it must be assimilated into the knowledge base of the firm. This is mostly done through the R&D to the subunits of the firm. Due to the lack of resources to facilitate ambidexterity, the manager assembles agile teams that are built of multidisciplinary professionals, typically, from R&D, sales, and production. These teams are not only changing internally according to the phase and requirements of the process and the desired results, but they are open to integrating also cooperation partners (Nambisan et al. 2017).

Once the assimilation is done, these teams may change. Whether or not they change their members, they continue to work with the manager. The goal is to transform the knowledge into the firm's intellectual property, which will later be either sold or used to change processes, thereby reducing costs and increasing efficiency and quality. Also in this transformation phase, the manager must use their technological understanding, take the risk, and rely on experts and

networks to inspire a novel combination or use that may create a competitive advantage for the firm. Additionally, the gained knowledge from the transformation phase must be assimilated again into the firm. In the last phase, exploitation is created in the form of new products or new markets. This knowledge spills back to the environment, to be acquired by other players.

Figure 10 presents the artifact in the form of a process that is based on the guidelines for managers. The transferability of this artifact was tested in the workshop, as described below. Insights and guidelines from this workshop were taken back to the design phase until a final artifact could be diffused and communicated to the relevant community, first to the participating members of the research and later as a publication to the scientific community.

Since the artifact is complex, the process of creating it is presented in four steps, from Figure 8 to Figure 11. The complete artifact is presented in Figure 12. Each step describes the evolution of the artifact until its final stage.

Figure 8 explains the ACAP framework as an iterative process moving throughout the phases, from acquisition to assimilation, transformation and exploitation, and so forth. Innovation creation is defined as a new product, a new market, or a new business model. An important addition here is the emphasis on the dual relations between transformation and assimilation (marked with a gray arrow). DI knowledge that was assimilated and transformed, creates new knowledge that needs to be assimilated again by the firm internally. Finally, transformed knowledge that was exploited, goes out to the environment and serves as new external knowledge for other firms.

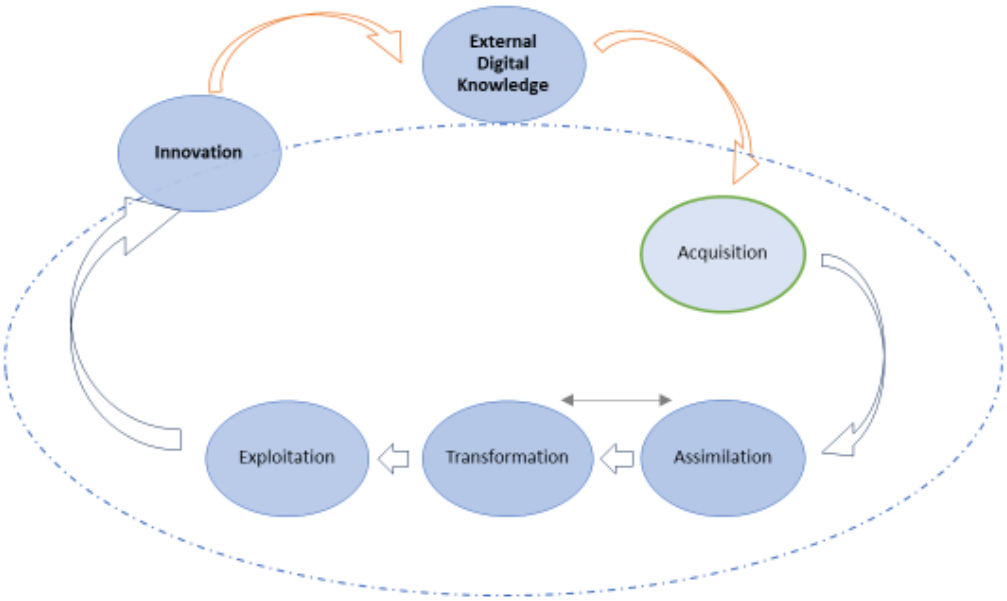


Figure 8: The ACAP of DI knowledge framework. Own illustration.

Figure 9 explains the ACAP process in further detail. It portrays the sub-categories that are active in each of the ACAP phases, and more specifically, the exact institutes or individuals that are important in each sub-category. The CEO is the main role since he or she orchestrates the process. The oval graphic illustrates the ACAP phases, the square stands for the sub-category, while the triangle head represents the main figure or the specific group.

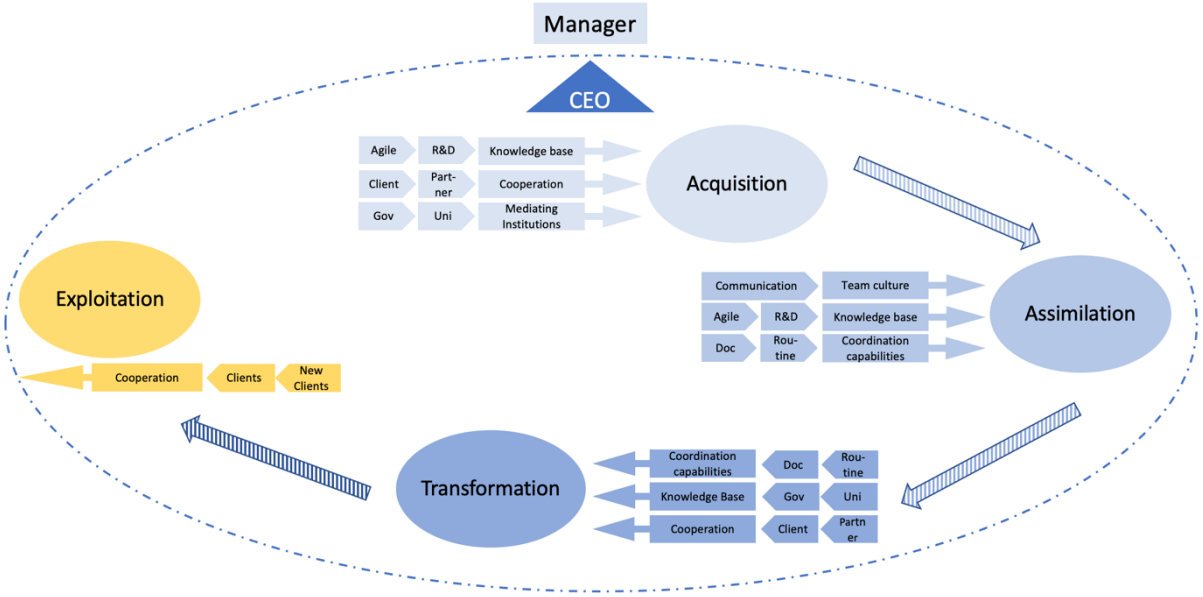


Figure 9: The influencing factors active in each ACAP phase. Own illustration.

Figure 10 expresses the entire context in which the ACAP process takes place by adding the inter and intra-firm relations and the operational conditions that influence the ability of firms to perform the ACAP process. Also, the national culture is added to the framework. National culture influences not only the manager but also the entire organization. An important addition here is the emphasis on the importance of client input to the acquisition (marked with a yellow arrow). Last, operating conditions are added to this framework. They are illustrated in the same color as the ACAP phase they are active in.

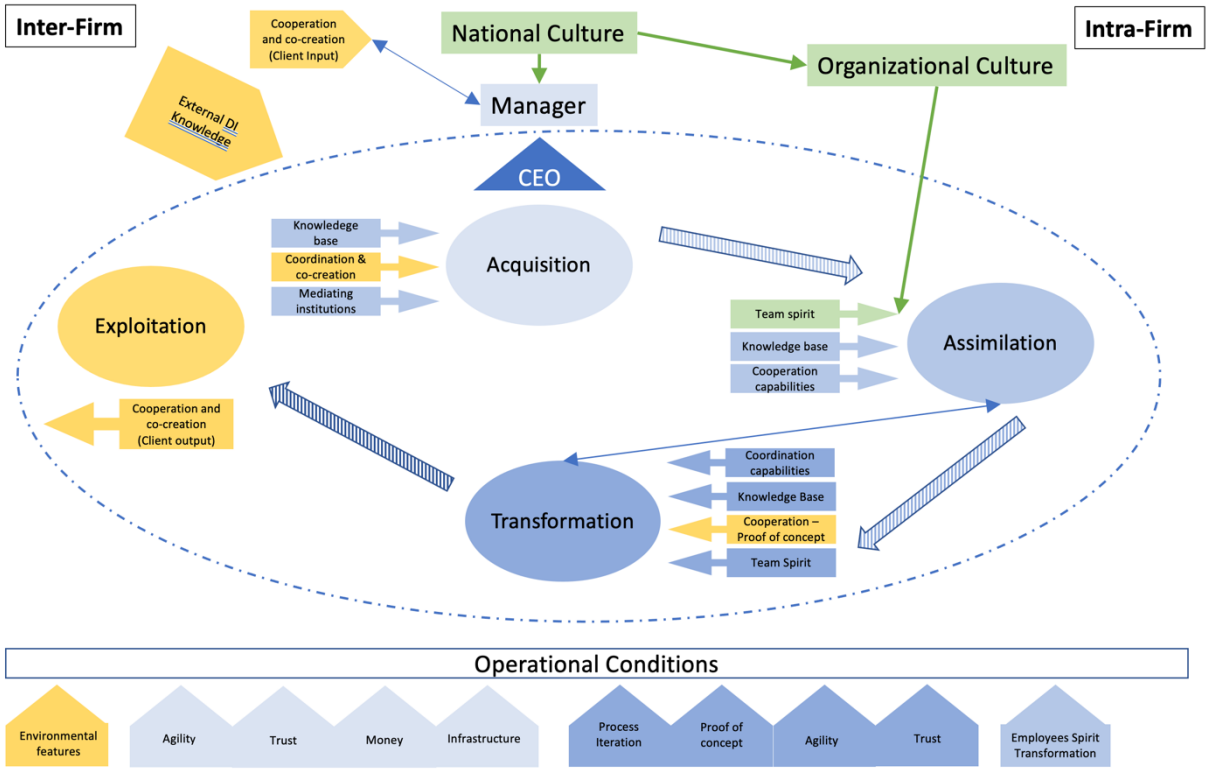


Figure 10: The full environmental context of the ACAP process. Own illustration.

In the next sub-chapters, each dimension: framework, guidelines, and operational conditions is elaborated on to illustrate the influence of national culture on the success of the ACAP process. Later the guidelines of the artifact are discussed.

5.4.2 Development of the Artifact

The following guidelines were gathered into the ACAP phases. They amount to 15 activities and they include cultural changes that could be transferred to other firms or cultures, as well as entrepreneurial behavior, that can be learned. The ACAP phases are presented consecutively, however, each ACAP phase should be seen iteratively. Moreover, the phases should be done in parallel since they could overlap with each other (Patterson and Ambrosini, 2015).

Acquisition:

The acquisition has to be done with exploitation in mind. CEOs must contemplate for whom is the firm developing now and who else could become a market. First, managers must possess some understanding of DI knowledge, also if they are no experts, and make sure their firm has access to a diversity of knowledge in DI and digital technologies (Gray, 2006). The activities for this phase are stated as follows:

1. Work systematically: Use competitive and internal analysis to determine the strengths and weaknesses of the firm and its competition (Paley, 2021). Through this, managers can learn to seize, but also create opportunities by monitoring what innovations already exist and how to use them for the firm. This was also proved in the empirical findings (Case 1).
2. Increase the uncertainty avoidance index (UAI), by actively searching and creating novel combinations of knowledge (Nambisan et al. 2017; Zhai et al. 2018). Use spillovers to promote the firm's competitive advantage and experiment. Experimentation includes cooperating already in the acquisition phase. For this, managers must maintain or gain technological or non-technological innovation, and take risks. This was also proved in the empirical findings (The Israeli Case 1, and the German Case 3).
3. Flaten the power distance (PD): Practice flat hierarchies and open communication and involvement of all relevant team members, even when not senior. In the empirical part, it was recommended to give freedom, support, training, and empowerment (Israeli Case 1, Israeli Case 2, German Case 4).
4. As a thumb rule, it is important to avoid long-term planning and try to develop more agile (Brock et al. 2020). Plan mid-term, thereby lowering the long-term orientation

(LTO). Placing focus on tradition and the present, rather than the gain in the long-term future. This helps to remain flexible. The literature shows that German culture tends to plan more for the future (Hofstede, 1983), and also according to German CEOs (Case 1, Case 2, Case 4), the education system is producing followers and not revolutionaries. This imprint must be questioned.

5. Increase collaboration, especially with clients, to enlarge the input of what DI knowledge is out there. Use universities and private networks, but especially with clients for co-creation. For Israeli firms, government programs were especially helpful in screening technologies that have novel application potential for the firm. However, for the German firms, this cooperation is problematic: According to CEOs' testimonies (German Case 1, German Case 2, German Case 4), the German government is not emphatic, especially not toward SMEs. Money takes more than a year to receive, and there is no creativity, openness, or risk tolerated by the government. The civil officers are not from the business segment, therefore lacking understanding and speed. At this point, no guideline could be drafted before the German government changes the accessibility of its programs. This, however, could be a topic for a new artifact. However, the point is stated, to keep awareness of the need for a change on behalf of the German government, or look for alternatives.
6. Keep R&D as leaders of the digitalization process: Let development engineers dictate the impulse and activate research (also via universities) to accommodate the need. Don’t separate R&D from innovation creation, but include interdisciplinary teams (Nambisan et al. 2017) to strengthen their perspective. Indeed, none of the SMEs have practiced ambidexterity per se. Combinations of multi-disciplinary and cross-department teams were joining R&D for the ACAP of DI knowledge. These teams can be agile and shift according to the phase and the need. Moreover, at times these teams may include also clients (Brock et al. 2020).

Assimilation:

7. Improve coordination activities by using digital technologies and platforms to integrate new external knowledge within the existing knowledge base (ERP system). The use of technologies such as RPA (robot process automation) or AI (artificial intelligence) could help detect patterns or retrieve information that became relevant and could serve

the firm in a new form. Firms from all cases have reported either the use or the intention to increase the use of such technologies to enhance their efficiency in processing DI knowledge.

8. Document new knowledge and possibilities that may emerge to make sure no matching opportunities are lost. Ensure retrieval of information is accessible to all team members, easy, and ad hoc. But don't document everything. Use common sense. Use one system and avoid duplicate information which results in overload. Most cases acknowledge that they experience difficulties in two areas: (1) Condensing the amount of knowledge, and (2) Integrating it into the existing knowledge base.
9. Promote a *shared language* (Nahapiet and Ghoshal, 1998; Jansen et al. 2005; Roberts et al. 2012; Maes and Sels, 2014) between the manager and the team and within the teams. Activate *distributed innovation agencies* (Nambisan et al. 2017) to communicate and create ideas that are aligned with the firm's vision. In communication, the emphasis must be on the outcome. This relates to the vision, the impact, and the change the firm needs (Paley, 2021). In the empirical investigation, it was found that firms did not focus enough on the vision and that the vision was not communicated systematically to all the relevant stakeholders. This guideline corresponds also with a balance between individualism (IND) and collectivism.
10. Treat the team as intrapreneurs to motivate and intensify their commitment and cooperation. Participation in decision-making leads to emotional bonds and feelings of ownership (Nambisan et al. 2017), that advance the product and the firm. Managers should invest in inspiring the team to take more ownership and responsibility. In Case 2, the German firm was practicing it actively. In Case 1, the Israeli firm was allocating special time for innovation. Team members were asked to come up with ideas or solutions to problems. In Case 4, the German CEO was granting freedom in decision-making to several department managers. This fact also corresponds to practicing a lower PD.

Transformation:

11. Involve external actors and experts in the transformation phase to co-create the solution. This will strengthen their acceptance of new products in the exploitation phase. Work with agile stage-gate (Brock et al. 2020), involve dynamic actors and

integrate testing (Nambisan et al. 2017). The best way is to engage clients in proof-of-concept experiments. In Case 1 the Israeli firm engaged their client by testing their idea with AR glasses. Practicing a balance between masculinity and femininity (MAS/FEM) will allow stronger ties and communication with clients and learn about their needs and involve them in co-creation as well as keep the team stronger.

12. Use interdisciplinary teams and work agile (Nambisan et al. 2017; Brock et al. 2020). Real changes and breakthroughs were witnessed in Israeli Case 1 by using AR, in German Case 2 by working to recycle their material, in Israeli Case 3 by inserting navigation systems into individual crowns, and in German Case 4 by refining an almost fully automated system. In this phase, disruption is the key, rather than incremental, if it is non-technological (see German Case 3).
13. The change into an entrepreneurial mindset is characterized mainly by taking risks to realize opportunities, but also enduring failure (Todorova and Durisin, 2007; Mukherji and Silberman, 2013; Peeters et al. 2014; Ciriello et al. 2018; Aljanabi, 2017; Avalos-Quispe and Hernández-Simón, 2019; Darwish et al. 2020; Lynch and Corbett, 2021). In practice, to endure failure, managers can try reducing the risks by implementing modular. For example in Case 2, the Israeli CEO implemented digital changes in the machine modularly. However, in Case 1, the Israeli CEO took a leap of faith, risking his reputation and his market share, by attempting to penetrate clients' servers for remote installation. This calculation was proved successful, however, the risk was enormous.
14. Aim for new markets. Allow any kind of novel result from the transformation phase to open new possibilities and markets for the firm's offerings. Create new opportunities by advocating the results into a new way of serving the market. For example, in Case 1, the Israeli firm gained a new market position by indicating a new standard of remote installation. This helped their products be favored by a foreign government.

Exploitation:

15. *Plan forward and backward* (Paley, 2021). Learn from mistakes. This added value will re-position the firm in an ever-changing digital environment. Finally, look for more knowledge, and start the ACAP new.

5.4.3 Operating Conditions

This section discusses conditions necessary, but not sufficient, for the ACAP process to succeed. Based on the empirical findings and the theory, the focus is on (1) Trust; (2) Agility and iteration; and (3) Environmental features.

Trust

Throughout the cases, all firms indicated that their main condition for co-creation with a partner is based on trust. While trust may seem intuitive, firms react to the pressure of acquiring knowledge by partnering at times with experts, based solely on their knowledge and not giving trust enough weight in their decision. This was seen in Case 4 (Pipe Fittings) when the German firm experienced an enormous loss in investment resulting in a five-year setback due to choosing the wrong partner. In Case 3 (Dental Implants), the Israeli CEO admitted to having partnered with the wrong person and having to cancel a project and lose millions of Dollars. In contrast, in the same case (Dental Implants), the German CEO, succeeded by partnering with a dentist he met at a conference, who shared with him a revolutionary method of using grained bone, a method he uses to date. The Israeli firm in Case 1 (Furnaces) also trusted a non-senior team member to introduce them to AR from partners they did not know. The Israeli VP of engineering in Case 4 (Pipe Fittings) was looking for an expert in a field and found it on the internet, with no prior acquaintance or recommendation. This experience went well since the expert helped the firm bridge the knowledge gap. These reviews indicate that although trust is the decisive parameter in each phase of the ACAP, it is safe to acquire knowledge without prior acquaintance, but not to co-create or transform knowledge. Especially in this phase, trust is decisive. Finally, trust relates also to the trust of the team in the management vision. When there is trust there is commitment (Roberts et al. 2012), since the employees are expected to be involved (Komani and Bobek, 2020).

Agility and Iteration

As discussed, the ACAP process is dynamic. A misalignment in any of the phases can cause the process to fail (Patterson and Ambrosini, 2015). The literature shows that the use of the framework of *agile stage-gate* "allows trial, error, and experimentation" (Brock et al. 2020, p. 521). By definition, the hybrid stage-gate process is more agile and fitting to DI knowledge and

should be done flexibly. No decisions or long-term strategies should be determined in advance. Rather, CEOs must define their goals as they progress and according to reality, changes in manpower and resources (Brock et al. 2020). Moreover, the dynamic involvement of changing professionals (*distributed innovation agency)* should be used (Nambisan et al. 2017), since they are "potential transfer recipients" (Brock et al. 2020, p. 520). Empirical investigations show that agile methods help make adjustments and corrections while not stopping the process. This could be seen in Case 1 (Furnaces), where both the Israeli and the German CEOs prepared an IoT HMI system that could deliver more information in the future. Also, in Case 2 (Food Packaging), the Israeli CEO chose to apply, test, and correct his moderate installations of the smart machine. In the same case, the German operative CEO was preparing a system that would integrate AI abilities in the future.

Environmental Features

Different regulations and market conditions need to be taken into consideration to determine what is feasible and what is not in a certain industry or market. Regulations may vary from market to market and so the ability to take risks could be industry-dependent. For example, what is not possible in furnaces or medical devices, may be possible for food packaging or pipe fittings. Therefore, the artifact states this condition to fit every industry in every country according to its environmental features, regulations, and mandatory processes.

Figure 11 presents the initial artifact as described and explained to the workshop evaluators. The sub-category of Managers (represented mainly by the CEO) is positioned in the middle of the activities. Influencing directly (down) the Knowledge Base. This sub-category includes the existing understanding of DI knowledge managers possess, the positioning of R&D, and the decision to hire experts. On the upper side, the CEO influence directly the Cooperation Capabilities to access new external DI knowledge. These include the screening and decision with whom to cooperate and being aware of the ecosystem. On the two sides, the CEO also influences the Team and Coordination Capabilities. Indicating and demonstrating how to cultivate communication and open-mindedness, learning, and exchange knowledge, and with how much effort (routines such as meetings and documentation).

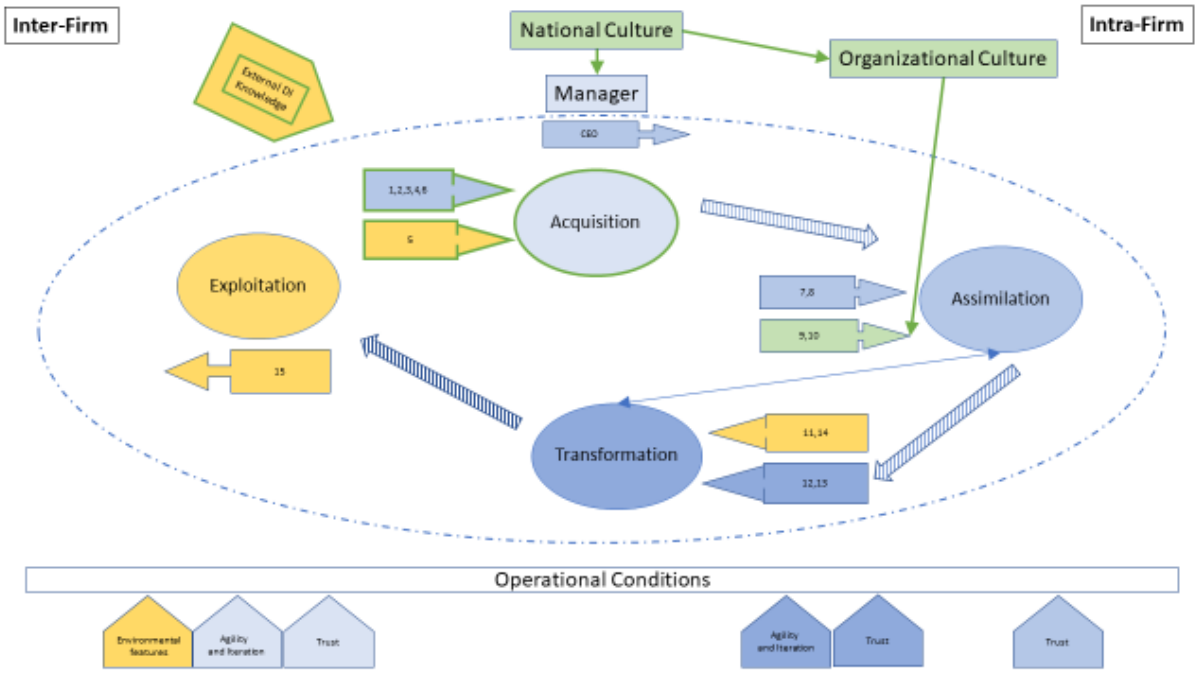


Figure 11: The initial artifact. Own illustration.

5.5 Evaluation of the Managerial Guidelines: Workshop

To evaluate the transferability of the guidelines and discuss which ones are perceived as relevant and effective, two cycles of evaluation were conducted in workshops. As mentioned in sub-chapters 5.1 and 5.2, the workshop helps consolidate the artifact, decide whether the suggested guidelines are suitable, and finally, discuss alternatives (Aier and Gleichauf, 2010).

The initial workshop was conducted with the managers of Case 1 and the second cycle with those of Case 2. These were chosen since Case 3 (Dental Implants) presented too wide differences that could be associated with the firm's size, thereby, jeopardizing the research results by associating the wrong conclusions and resulting in bias. Moreover, a comparison would not contribute much to the objectives, since the German CEO of Case 3 does not see DI as a goal. The firms in Case 4 (Pipe Fittings) were too much alike. They both see their digitalization transformation mainly from the ERP perspective. The Israeli firm does not strive for full automation as the German one, but this basis of comparison was too narrow and would also not serve the objectives of the research, so no revelations were expected for the framework.

The artifact, therefore, was presented to the dyad SMEs of Case 1 and Case 2 (later: the workshop evaluators) in two separate cycles, to allow amendments (Mijač, 2019).

Revisiting the differences between Case 1 (Furnaces) and Case 2 (Food Packaging) indicates that mindset and cooperation with the environment are the keys to firms' success. This was indicated also in the literature.

(1) Despite the similarities in their organizational processes due to the merger, Case 1 portrays a difference in the entrepreneurial approach to their market and the new business positioning. This new opportunity was imposed on the firms through digitalization, however, the strategies to seize and create new opportunities from it, were different. This was evident in risk-taking, the vision for the firm, and the desire to lead the market. However, the differences in mindset are not only the result of the CEO's approach but also, the support or antagonism they get from their respective teams.
(2) In Case 2 it was found that both CEOs were thinking alike, however, the benefit they drew from their ecosystem was different. The Israeli firm benefited from government support, while the German firm decided to give up this support direction. This had also a positive impact on the firm's ability to capitalize on ideas.

According to Hevner et al. (2004), the evaluation focused on three aspects: means, ends, and laws. In the aspect of *Means*, it was inquired whether the managers agreed with the actions suggested through the artifact and whether they would allocate resources to take these actions. Should they not agree, they were inquired about their reasons for reservation and hindrances. In the aspect of *Ends*, it was inquired whether the artifact solves the problem of the firm according to the firm's goals. The workshop evaluators were asked what additions they could suggest. In the aspect of *Laws*, it was inquired whether it is feasible to implement the guidelines in the environmental requirements (technological and knowledge domains) (Hevner et al. 2004). Since the artifact is designed to include internal changes in thinking and behavior and cultural changes in structure and approach, cultural dimensions (Hofstede, 1983) and organizational values (Kiefer et al. 2021) were also taken into consideration.

The workshop was conducted in two parts. Part one was dedicated to the introduction and review. In this part, the terms and framework were revisited and the problem the artifact intended to solve was explained. In part two, the guidelines were presented. The workshop

evaluators were asked to evaluate the relevance and the ability of the guidelines to solve their firms' problems. The below section indicates the introduction and the questions as presented to the workshop evaluators.

Part One: Introduction and Review

- Introduction of the terms: digital innovation and ACAP of DI knowledge.
- Introduction of the problem: the challenges SMEs face in accessing DI knowledge to remain competitive in their traditional manufacturing.
- Review of the approach: increasing the ACAP of DI knowledge.
- Introduction of the solution: the artifact according to the ACAP phases.

Part Two: The Workshop Questions

- Could you name digital technologies that could be helpful for your business?
- What could help you implement digital technologies? What hinders you today?
- Do you agree with the guidelines for actions as presented in the artifact? If not, could you specify why?
- Could you implement these guidelines in your business? If not, could you specify why?
- Would you allocate the required resources to take these actions? If not, could you specify why?
- Can this artifact solve the problems and help you reach the firm's goals to increase innovation by implementing DI knowledge?
- Can you explain what is missing from this artifact to help you reach your firm’s goals?
- Is the implementation of these guidelines feasible in your industry?

5.5.1 First Evaluation

After presenting the CEOs of Case 1 with the suggested artifact based on the 15 guidelines. They remarked the following:

1. The German CEO mentioned that the graphic representing the CEO in the center must be enlarged since they not only orchestrate the entire ACAP process, but are also involved with all the departments to make sure that the decisions are properly explained, accepted, and implemented.
2. Two additional operational conditions were added by the German CEO: resources and infrastructure; and employee acceptance. Without them, no acquisition, assimilation, or transformation could take place. First, the right infrastructure guarantees the bandwidth and the proper digital equipment necessary, investment of funds, training, and time is required to facilitate the acquisition and assimilation. Second, without enrolling the employees' consent through vision sharing and convincing, no transformation would occur, since they will defy the changes. The Israeli CEO added that although the level of resistance amongst his team is lower, there is always a certain level of opposition to change. He, therefore, agreed that enrolling the team in the change is imperative to the success of the ACAP process. The sub-category of Team was, therefore, added to the transformation phase. However, employee acceptance was taken under the already existing operation condition: Trust.
3. In the sub-category of Cooperation & Co-creation, clients were listed as the main influencing factor to be considered before the acquisition, as a part of the transformation, and as an output for the exploitation. However, the Israeli CEO suggested outlining the word client specifically. The reason was that in his view the decision on which DI knowledge to acquire depends a great deal on the accurate analysis of what would give clients added value. This added value can either come as a demand by the clients themselves, or the firm must facilitate the added value before the clients even know that they could need it. Either way, the client was, therefore, given a yellow color and added before the acquisition. The German CEO recommended illustrating it with an arrow, to illustrate the exchange between the client and the analysis of their needs, and the CEO of the firm. This is implemented with the yellow arrow.

4. In the transformation phase, the Israeli CEO added the need for a beta site or proof-of-concept. This was mentioned before under the term testing. In his view, the role of a beta is imperative to evaluate whether the analysis of the client's need was accurate and whether the value is desired by the client.

5.5.2 Final Evaluation

The above-mentioned changes were integrated and then presented as a refined to the managers of Case 2. Both CEOs said that the artifact is clear and holds everything discussed in the research. Some of the comments were not a specific call for changes, but a reinforcement of the importance of the guidelines. Therefore, these remarks are also incorporated into the list, also when they do not hold a specific addition or change.

5. The Israeli CEO stated that the return of knowledge from the transformation to the assimilation phase is extremely important and should be emphasized since the generation of new knowledge benefits the firm itself, as it does when this knowledge flows from exploitation to the external environment. In this case, no changes were necessary.
6. In the operational conditions, the Israeli CEO emphasized the importance of environmental features containing regulations and restrictions on industries are of immense importance since they limit the firm's digitalization and disruption capabilities.
7. The CEO also agrees with the framework of national culture. He mentioned its influence on the velocity of Israeli assimilation, due to the instability of political and security conditions. Specifically, a balance between masculinity and femininity (MAS/FEM), individualism (IND), and collectivism, as well as high uncertainty avoidance (UAI), all influence the way business is conducted and organized in Israel.
8. The transformation phase is viewed by the Israeli CEO as more internal. His focus is on the exploitation that can emerge from the transformation. Therewith, the Israeli CEO confirms the importance of planning backward (Paley, 2021).
9. In exploitation, the Israeli CEO mentioned that Israelis, due to their culture and small size, are always taking risks to penetrate new markets and expand. This corresponds with guideline 14 (aim for new markets) and guideline 15 (learning from mistakes in

planning ahead), known as planning forward (Paley, 2021). The German CEO agrees that exploitation requires also planning backward.

10. In acquisition, both CEOs confirm that firms must invest between 15%-20% of the total revenues in new knowledge including new machines. The German CEO agrees that although Germany does have problems and deficiencies, it is perceived as more stable. To maintain this stability, Germans are less willing to endure failure and therefore avoid risk. The Israeli CEO added, that there would be no escape from taking a risk, especially when the reality is changing. For example, in his words: "the approaching war in Europe". Therefore, the recommendation was to keep the guideline.
11. Lack of government support is a pressing issue that should be discussed. They have to focus on SMEs, educate them about what is important, and think of better ways to offer help. Although this point carries immense potential for further research with a focus on the efficiency and help of the German government, this topic cannot be covered fully in this work. Therefore, the guideline is to cooperate more and look for alternatives to government aid.
12. As much as documentation is a priority, the Germans should learn to document less. Use common sense to elevate only information that can be useful and retrieved later on. Since this guideline already existed, it was decided to keep it.
13. The German CEO added that changing the team culture in smaller firms can be done if CEOs act as role models. Giving ownership is more than giving information, it is about conveying the emotions and excitement that goes with it, if not, no transformation will appear.
14. The German CEO agrees that it is always beneficial to make a proof-of-concept and test the ideas. Therefore, this condition was kept.

Revisiting the design phase to comply with the feedback given by the four evaluating managers, the following changes were made:

1. Enlarging the graphic of the CEO.
2. Adding the additional operational condition: Resources and infrastructure (since employee acceptance was included in Trust).
3. Adding the influencing factor *client* before the acquisition and illustrating the knowledge exchange with the manager with an extra yellow arrow.

4. Adding the term proof-of-concept to the sub-category of Cooperation & Co-creation in the transformation phase.
5. Keeping a double arrow between assimilation and transformation.
6. Adding the term role model to guideline 10.
7. Seeking government aid was inserted in guideline 5, changed into increasing cooperation and searching for alternatives.

5.6 The Final Artifact

The final artifact is constructed from the initial guidelines and the incorporation of the two evaluation cycles. The colors in the operational condition correspond to the color of each ACAP phase. The last phase, exploitation, was changed from deep blue into yellow, representing cooperation with the external environment. Green indicated cultural frameworks, that influence the sub-category Team. All blue arrows remain in the ACAP context of knowledge exchange. The numbers correspond with the guidelines.

Figure 12 illustrates the final artifact after the two evaluation cycles. In sum, the following changes were made: (1) Adding resources, infrastructure, and proof-of-concept to operational conditions; (2) Adding co-creation with clients before the acquisition, thereby emphasizing the importance of acquiring with exploitation; (3) Adding co-creation also in exploitation (looking forward); (4) Adding a yellow double arrow to emphasize the importance of clients specifically as initiators of new external DI knowledge; and a blue arrow to illustrate that transformed knowledge created by the firm, needs to be assimilated again. Ideally, the artifact summarizes the following process.

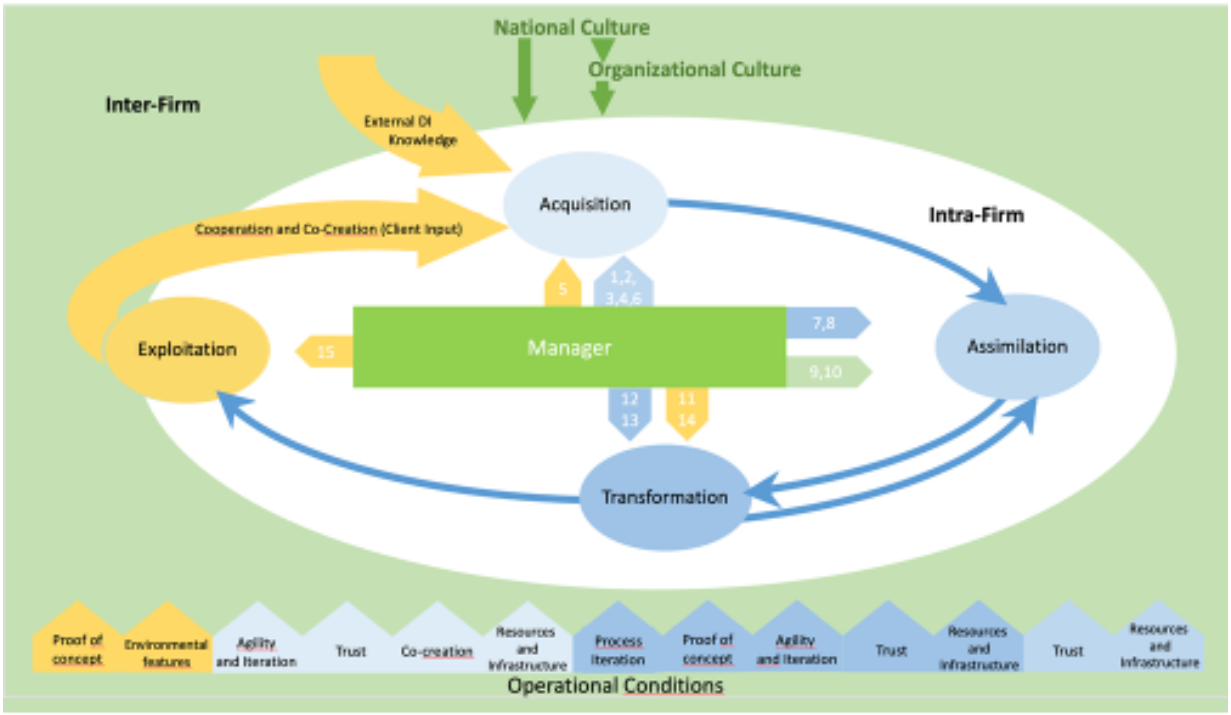
In the acquisition phase, external DI knowledge streams from the environment, with special attention to clients being the main source of needs and market trends. The CEO is the main category operating in the acquisition phase of this knowledge, giving the impulse, what DI knowledge to acquire, as well as facilitating the resources and infrastructure for the task. The CEO cooperates mainly with clients to get the direction of the market needs and potential new markets. The search for novel and disruptive ideas is motivated by high uncertainty avoidance (UAI). The CEO is also in charge of creating the right team culture and encouraging trust through the communication of the vision. Practicing a low power distance (PD) at this phase

helps gather input from experienced team members. Together with the R&D and interdisciplinary teams, the firm moves to the assimilation phase.

In the assimilation phase, the organization of the new DI knowledge is coordinated by keeping the meeting and documentation routines efficient and short. Shared language and treating the team as intrapreneurs help this phase excel. Resources are also required in this phase, for example in the form of investment in sophisticated ERP, SAP, or other systems. The digitalization process is costly. CEOs must allocate the funds, manpower, and required time to research, experiment, test, and transform DI knowledge into innovation. As a thumb rule, 80% of the revenues are dedicated to the core business and 20% to innovation creation through investment in machines, people, training, ideas generation, and knowledge acquisition. Last but not least, the CEO must ensure that the firms facilitate proper infrastructure (bandwidth, volume, speed, computers, licensing and software, and even 3D printers if applicable). Trust remains a condition to graduate from this phase in order to move on to the realized ACAP. The team must accept the vision, and be encouraged to experiment and create by themselves.

In the transformation phase, clients are again involved in the context of proof-of-concept. Interdisciplinary teams continue to work agile, to transform the DI knowledge into a firm offering. Experimentations involve risk, and the CEO must also endure failure, should it occur. Allocation of resources continues to be important to facilitate cooperation and experimentation. Moreover, trust remains decisive, whether the team sticks to the vision. Finally, the output of this phase, as a new capability, must be assimilated once again in the firm, pointing also to the importance of the operation condition of iteration.

In the exploitation phase new products, services, or capabilities are created and aimed at the market. The knowledge now flows back to the external environment, for other firms to use, the firm learns from mistakes (plans forward) and searches for new opportunities (plans backward).



Acquisition

1. Work systematically to evaluate the firm's position in the market.
2. Take risks to look for new opportunities (increase UAI).
3. Flaten PD.
4. Don't plan far ahead (lower LTO).
5. Increase collaboration, especially with clients, and search for alternative institutional aid.
6. Keep R&D as leaders of digitalization and support them with interdisciplinary teams.

Exploitation

15. Plan forward and backward (be open to new ideas and learn from mistakes by lowering PD).

Transformation

11. Involve clients and experts for proof of concept (increase collectivism).

12. Use interdisciplinary teams and work agile (increase collectivism).

13. Take more risks and endure failure by implementing modularly.

14. Aim for new markets.

Assimilation

7. Improve coordination by using digital systems.

8. Document less.

9. Promote shared language (strengthening femininity and collectivism scales).

10. Treat the team as intrapreneurs (lower PD) and act as a role model.

Operational conditions:

- Nurture the trust and acceptance of the team.
- Work agile and practice iteration.
- Be aware of environmental features that could help or hinder your product in advance.
- Allocate resources and infrastructure.

Figure 12: The final artifact. Own illustration.

5.6.1 Diffusion

The artifact is diffused in the following manner. In addition to sharing the results with the workshop evaluators, the remaining participants of this research will be exposed to it via this dissertation. Moreover, two articles were written about this work. The first deals with the cross-case analysis of Case 1 (Furnaces), and the second presents the evolvement of this artifact based on the cross-case analysis. The first paper was accepted by a B journal and the second was submitted. Thereby sharing this artifact as insights into this research with the scientific community. Finally, The author of this work teaches three seminars, all of which are built on the transfer of the findings into practice. The first seminar is a cross-cultural seminar focused on Germany and Japan. It is designed to elevate and break the cultural code as a barrier to international firms' success. The second is coaching a Berlin-sponsored program in cooperation with Bosch, this program is designed to train startups about entrepreneurship and innovative mindset. The third is a digital intrapreneurship seminar that deals with the digital transformation of German firms. This seminar is designed to train junior managers to support their firm by acting as intrapreneurs within their different departments and becoming agents of change.

6 Summary

This work displays that despite the vast literature on the ACAP construct, there is a lack of understanding to date, of what exact factors influence the ACAP (Jansen et al. 2005; Volberda et al. 2010; Chandrashekar and Subrahmanya, 2017). Moreover, there is a lack of a direct examination of this construct (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016), specifically in the context of SMEs (Trenkle, 2019; Zhang et al. 2022), under the analysis from a cultural perspective (Avalos-Quispe and Hernández-Simón, 2019; Dahlin et al. 2019). These gaps were answered in this work as described below.

To understand how ACAP can be enhanced in small and medium-sized enterprises, literature was screened to elicit the influencing factors. Therefore, the first research question was formalized to explore: **What are the influencing factors that enhance the ACAP of new knowledge?** This was answered by using an extensive literature review of both qualitative and quantitative published papers as well as four meta-analyses covering 3 decades of accumulated scientific findings. 29 influencing factors were clustered into 7 sub-categories. These categories were telling a story of complementary forces: internal and external, used as knowledge sources and implementation capabilities. This part helped resolve the long-year scientific debate on whether ACAP should be regarded from the asset perspective or the dynamic capability perspective. By assigning each to the chronological ACAP phases, building on each other, and assigning these perspectives to each phase, it was attempted to keep the ACAP concept as clean and logical as possible. Therefore, this work enhances the academic discussion on ACAP but also helps to understand how difficult it is to use this term in a clean, limited, and defined way, as many factors intertwine and influence each other.

On this basis, the second research question could be approached more specifically: **How do Israeli and German traditional manufacturing SMEs absorb new DI knowledge?** In this phase, the work concentrates specifically on two innovative markets, and on the largest segment of the economy, SMEs. Moreover, it limits the discussion to traditional manufacturers coping with their digital transformation challenges by having to acquire DI knowledge. This limitation was chosen since these types of firms are mostly challenged by DI knowledge (Alves et al. 2016) due to their smaller size and lack of resources and DI knowledge (Gray, 2006). In 16

expert interviews, four dyads of traditional manufacturing SMEs were compared, with the first comparison among the firms of the same segment but in different countries. It was discovered the ACAP of DI innovation knowledge is done differently in the two countries, forming patterns within the country, independent of segments. Innovation is found in both Israeli and German firms, but they differ in the way they reach it. This led to the conclusion that national culture has a significant role in shaping the ACAP of DI knowledge and that leadership styles are greatly influenced by national culture. Still, Israeli and German managers can both elevate to the best practices, there is no determinism in the role of culture as personalities may change according to the situation and training.

Such an understanding has created a new gap, the need to come up with best practices from both countries, to support managers in leading their ACAP of DI knowledge in their firms, independent of segment and culture. Such an artifact can help maneuver through the challenges of acquiring and processing DI knowledge. It was therefore possible to identify fields of action from the case studies from which guidelines could be derived. Thus the third research question: **Which guidelines can help SMEs enhance the ACAP of DI knowledge?** could be answered by creating an artifact that presents the guidelines and sets them into context. It represents the very first artifact dedicated to the ACAP based on best practices found in Israeli and German SMEs. In this artifact, logical and easy steps are described in each of the ACAP phases to help managers implement best practices gathered from both Israeli and German firms, thereby changing their innovation creation capability and sustainability chances.

The next sub-chapters review the findings of this work in further detail starting with the theoretical findings and moving on to discuss the empirical findings. These findings led to the conclusion that firms tend to exploit more and create innovation when they are led by managers with an entrepreneurial mindset. This includes taking risks, working agile, and cooperating. The most important cooperation partners are clients but also experts from innovation programs. The findings demonstrate that this type of mindset is strongly influenced by national culture. Habits and behaviors that increase innovation, although rooted in national culture, can be learned and transferred. Therefore, the artifact resulting from this work can guide managers from other segments and other cultures on how to change their mindset and behavior, to enhance the ACAP of DI knowledge and innovate more.

6.1 Review of Theoretical Findings

Acquiring and properly assimilating DI knowledge is challenging for all firms, especially for SMEs (Kammerlander et al. 2017; Avalos-Quispe and Hernández-Simón, 2019; Bitkom Research, 2020; OECD, 2020). This work focuses on Israeli and German manufacturing SMEs, undergoing digital transformation in their traditional industries. To overcome the challenges of this process, firms must have the capacity to absorb DI knowledge. This ability, called ACAP, is crucial for the innovation creation of firms, and through it, their sustainability (Cohen and Levinthal, 1990; Zahra and George, 2002; Lane et al. 2006; Roberts et al. 2012; Maes and Sels, 2014; Zapata-Cantu et al. 2020).

At first, firms acquire relevant knowledge and later assimilate it throughout the firm's subunits (Potential ACAP). Transforming and exploiting this knowledge (Realized ACAP) into a new ability will serve as a competitive advantage and a source of sustainability for firms (Zahra and George, 2002; Leal-Rodriguez et al. 2014). These last two phases are particularly tangible and complex. They require new ways of thinking, risk-taking, and understanding market trends. But also making fast decisions on how to use DI knowledge and digital technologies in the business (Peeters et al. 2014; Aljanabi, 2017; Avalos-Quispe and Hernández-Simón, 2019; Darwish et al. 2020; Lynch and Corbett, 2021).

To better understand how firms access and apply DI knowledge, this work compares their ACAP. Since the literature indicates that there is an ambiguity as to what are the influencing factors of ACAP (Jansen et al. 2005; Volberda et al. 2010; Chandrashekar and Subrahmanya, 2017), the first step was to aggregate and re-organize the factors. After conducting an extensive literature review covering 75 articles published between 1989-2020, 29 factors were discovered and clustered into 7 sub-categories.

After prioritizing their level of influence, their relationship was defined as follows: Managers, Knowledge Base; Cooperation & Co-creation. Second: Team, Coordination Capabilities, Environmental features, and Mediating institutions. All of which were indicated to some extent in the artifact. Since Environmental Features are a given fact and cannot be affected or changed easily, they were placed in the operating conditions. Mediating Institutions refer to institutions such as universities, government programs, or other innovation programs, that help firms access knowledge. They are therefore considered under Knowledge Base, and when applicable under

Cooperation & Co-creation. Leaving the research to focus on five main aspects. Of these, two were reduced due to a lack of meaningful differences and three remained to form the artifact.

The second gap guiding this work was the scarce literature focusing on the ACAP of DI knowledge (Avalos-Quispe and Hernández-Simón, 2019), especially in SMEs, despite the crucial role SMEs play in the world economy (OECD, 2000; OECD, 2020). In light of the struggle of SMEs with the digitalization transformation, this work offers help by gaining an understanding of how to increase SMEs' ACAP of DI knowledge.

The third gap was detected in the lack of literature on ACAP, specifically in the context of culture (Dahlin et al. 2019). By comparing dyad SMEs in two countries this work joins recent researchers like Krcmar (2015) and Darwish et al. (2020), and sheds light on how culture shapes the digitalization capacity of firms. However, this research is the first to focus on Israel and Germany, resulting in the pioneering best practices that could be transferred to other firms in these or other cultures.

6.2 Review of Empirical Findings

Building further on the literature findings, qualitative research using case studies was designed by conducting expert interviews in dyad manufacturing SMEs both in Israel and Germany. The questions were divided into five sub-categories and given this priority: Managers, Knowledge Base, Cooperation & Co-creation, Team, and Coordination Capabilities. It was inquired about how firms organize their activities to overcome their digitalization challenges, which roles and departments were leading the process, and how the environment contributes to it.

It was somewhat surprising to discover that both cultures were innovative in such different ways. There was not a clear hierarchy in the level of innovation, but rather in the way, these innovations were achieved through ACAP and the type of innovation that was reached. This point is important for the following reasons: (1) It abolishes the concept that one culture is better than the other, allowing best practices from both cultures to emerge; and (2) It contributes to the notion of the possibility of reaching change by training and learning. However, it is important to discuss the nature of the difference to help understand the concept of cultural impact on ACAP.

Meaningful differences were found in all of the ACAP phases to some degree, but the most meaningful was in acquisition and transformation. These impacted the exploitation phase dramatically. For example, by involving clients in the sub-category of Cooperation & Co-creation, already in the acquisition phase, Israeli firms benefited from focusing on the right DI knowledge, that would be needed by the market. Resulting in less rejection in the exploitation phase. The same holds true for involving clients in the transformation phase for proof-of-concept. German firms in comparison were focused on defining first for themselves, how to idealize the processes before innovation was created. Resulting in incremental innovation based on becoming better, or even the best, but not disrupting the market by being the first and pursuing novel goals.

In the same sub-category of Cooperation & Co-creation, Israeli CEOs tend to activate personal networks to reach a solution or knowledge. Moreover, they rely more on government support for funding and expertise to navigate the sea of possible digital technologies and DI knowledge overload. In comparison, German firms were left to fight the battle of overcoming complex and overloading DI knowledge, by themselves, resulting in time-consuming experimenting.

An entrepreneurial mindset is classified as risk-taking, failure-tolerating, and searching for new combinations (Peeters et al. 2014; Aljanabi, 2017; Ciriello et al. 2018; Avalos-Quispe and Hernández-Simón, 2019; Darwish et al. 2020; Lynch and Corbett, 2021). These behaviors were found more in Israeli firms in comparison to German firms. At times, German CEOs were rejecting risks (Case 3), and at other times, the team was restricting the CEO (Case 1). At other times, the German firm was simply lacking support and guidance (Case 2, Case 4).

The transformation phase of ACAP is the most difficult, yet decisive one for the success of the process (Zahra and George, 2002; Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012; Alves et al. 2016). It requires agility and novelty. Israeli firms demonstrated a higher tendency toward these behaviors. Working agile and pursuing novel ideas are associated with national culture (Shane, 1992; Hofstede, 1983).

Cultural aspects dictate how individuals (and firms) behave and how knowledge is shared (Cohen and Levinthal, 1990; Attewell, 1992; Fichman and Kremerer, 1997; Nahapiet and Ghoshal, 1998; Zahra and George, 2002; Jansen et al. 2005; Lane et al. 2006; Todorova and Durisin, 2007; Roberts et al. 2012; Leal-Rodriguez et al. 2014; Mukherji and Silberman, 2013;

Ahlin, 2014; Lambert, 2016; Costa and Monteiro, 2016; Lucena and Roper, 2016). Dimensions such as lower power distance (PD), higher uncertainty avoidance (UAI), shorter-term orientation (lower LTO), and a balance between masculinity and femininity (MAS/FEM) and individualism (IND) versus collectivism. All of these differences contributed to different exploitation levels since they define the extent to which firms would go to facilitate their vision, and the type of the vision (being best versus being first).

The motivation for this work was to help SMEs overcome their challenges with DI knowledge. The objectives for a solution were based on a combination of theoretical and practical findings and were made more rigorous by being compared across cultures, to determine how the two can learn from each other and what is plausible to transfer. The result of this examination is an artifact. The artifact is designed in the form of guidelines that managers can follow. These guidelines cover changes in mindset and activities that need to take place in each of the ACAP phases.

In the acquisition phase, the following guidelines are formulated: (1) Work systematically to evaluate the firm's strengths and weaknesses versus the market; (2) Take more risks and search for novel combinations, to deal with the uncertainty of ever-changing and complex digital context (increasing UAI); (3) Flatten the power distance (PD) and including any team member to pitch ideas; (4) Focus on the short-term of the firm, not planning too much ahead (lowering the LTO); (5) Practice cooperation & co-creation, especially with clients; (6) Let the R&D lead the innovation process with a combination of other teams.

In the assimilation phase, the following guidelines are formulated: (7) Use digital technologies to improve coordination of the work and the exchange of knowledge; but, (8) Document less; (9) Promote a shared language to make sure all members are aligned with the firm’s vision; (10) Treat the team as intrapreneurs, give them ownership, responsibilities, and leadership on their projects.

In the transformation phase, the following guidelines were formulated: (11) Involve clients and other experts to perform a proof-of-concept; (12) Use interdisciplinary teams and work agile; (13) Be willing to take more risks but implement modularly to lower the impact of failure; (14) Aim for new markets.

In the exploitation phase, the following guideline was formulated: (15) Plan forward to reach new goals and learn from the mistakes of others and your firm (plan backward). Finally, certain conditions that define the ability of the firm to implement those guidelines were inserted. These refer to trust, working agile and iterating the process, environmental features and regulations that must be regarded in every industry, and the allocation of resources and infrastructure to facilitate experimentation and fast working flow.

6.3 Contribution and Practical Implications

At the beginning of this work, contradicting perceptions of the nature of ACAP were reviewed. Inconsistencies were noted in the definitions of ACAP (as an asset or dynamic capability), but also about how and what to measure in the ACAP construct. Currently, ACAP is still measured as an asset (Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012; Alves et al. 2016) and not as a dynamic capability. Researchers often turn to indirect proxies such as investment in R&D, education of the employees, or patents (Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012), typically used in quantitative investigations rather than measuring the innovation output resulting from the complete ACAP process (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016).

This work provides a taxonomy with a clear separation of the ACAP phases. This is accomplished by acknowledging the tension between the asset perspective and dynamic capability perspective (Lichtenthaler and Lichtenthaler, 2009; Roberts et al. 2012) and by allocating them to the phases. An asset is related to the existing and acquired knowledge base in the assimilation phase, while dynamic capabilities relate to the remaining assimilation, transformation, and exploitation phases. However, this is to a certain extent a simplification due to the parallelism of the phases and the conflicting demands, such as exploration and exploitation (Zahra and George, 2002; Drejer et al. 2004). In an effort to advance toward a clearer concept, this work uses qualitative research methods to understand the positioning of the influencing factors in a deeper sense. Input from a vast scientific review was integrated stretching over three decades to avoid the bias that could result from a period-related change in focus.

The connection of ACAP to the very much neglected SME perspective helped close a long-time scientific gap (Trenkle, 2019; Zhang et al. 2022). It also helped enrich the construct and make it practical and available to the important economic power. This helps maintain the relevancy of the ACAP construct in both theory and practice. Moreover, the focus on DI knowledge closed a gap (Alves et al. 2016; Avalos-Quispe and Hernández-Simón, 2019) but also helped enrich the IS literature (Kammerlander et al. 2017; Avalos-Quispe and Hernández-Simón, 2019; Bitkom Research, 2020; OECD, 2020). Furthermore, a cross-cultural comparison was done seldom in relation to ACAP (Leidner and Kayworth, 2006; Dahlin et al. 2019). Finally, this work is the first to do so with a specific focus on Israel and Germany, according to the literature search at the beginning of this work in 2020. The concrete and easily formulated guidelines suggested in the artifact elevate this work into a practical approach that CEOs and other managers all over the world can apply, correct, and further develop to fit their needs.

6.3.1 Theoretical Contribution

The literature review phase enabled the researcher to close a gap relating to the ACAP construct and its influencing factors, as well as close the debate on whether this construct should be seen as an asset or a dynamic capability. Although there is no ambiguity as to the relation between ACAP and innovation, and the acceptance that increasing ACAP is crucial for the survival of firms, it became evident that there was a missing understanding of what ACAP means, how to regard and measure it (as an asset or a dynamic capability). There was a lack of understanding of what factors strengthen or hinder it, by whom it is controlled, and how it should be organized within the firm (Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012; Duchek, 2015). Moreover, very few studies were able to capture the complexity of the construct and pay attention to a wider spectrum of influencing factors (Duchek, 2015). This work contributed to closing this gap by examining the ACAP construct from an asset and dynamic capability perspective, revealing 29 influencing factors that were grouped into 7 sub-categories. This helped shed light on the mechanism of ACAP and how it could be enhanced. By focusing on these mechanisms, insights were derived into how ACAP is done practically, thereby, closing these gaps.

Second, DI knowledge offers new opportunities in all domains and will shape future work practices (Ciriello et al. 2018; Levkovskyi et al. 2020). However, very few papers cover this

aspect. Therefore, ACAP was examined in this work specifically in the focus on DI knowledge by interviewing firms specifically on this topic. Thereby contributing to the theoretical framework of ACAP of DI knowledge.

Third, most of the studies on ACAP to date were done quantitatively, restricting findings to indirect proxies Jansen et al. 2005; Volberda et al. 2010; Roberts et al. 2012). Scholars call for a qualitative investigation that can better trace the reasons for the challenges and elevate best practices as solutions (Cohen and Levinthal, 1990; Robinson and Stubberud, 2010; Volberda et al. 2010). Through qualitative methods, a deeper understanding of real-life firms could be gained. Thereby, contributing to the underlying mechanisms by which firms absorb DI knowledge. These mechanisms touch upon managers, the management of the knowledge base, and cooperation with the environment.

Fourth, this work entails a unique cross-cultural perspective, which to date was not present in the literature (Dahlin et al. 2019). By choosing interviewees from dyad SMEs, it was possible to keep disturbance variables, such as industry segments or appropriability regimes, relatively constant. The analysis elevated meaningful differences and shed light on different approaches to ACAP that are culture-dependent. Especially in the acquisition and transformation phases. By interviewing manufacturing SMEs, this work focuses on a group of firms that is crucial to most of the world's economy, rather than focusing on high technology sectors that benefit from the easiness of implementation and a deeper understanding of DI knowledge. Traditional industries, specifically SMEs, still struggle due to the complexity of DI knowledge, which they need to survive. By doing so, the gap suggested by numerous researchers (Kammerlander et al. 2017; Avalos-Quispe and Hernández-Simón, 2019; Bitkom Research, 2020; OECD, 2020; Bianchini and Kwon, 2020; BMWi, 2020) was closed.

Fifth, this work supports previous research and confirms that the ACAP of DI knowledge is subject to the entrepreneurial mindset (Peeters et al. 2014; Aljanabi, 2017). The entrepreneurial mindset was also connected to a larger framework of national culture, thereby, contributing to earlier research such as Hofstede (1983) and Shane (1992). This finding may have practical implications that can help managers and governments reevaluate their activities, priorities, and decisions concerning risk-taking, flexibility, and the extent to which they lead in a structured, rational way versus heuristic and innovative way (Peeters et al. 2014; Aljanabi, 2017; Ciriello

et al. 2018; Avalos-Quispe and Hernández-Simón, 2019; Darwish et al. 2020; Lynch and Corbett, 2021). Finally, researchers may use the framework of Culture – Mindset – ACAP to explore other dyad firms in other industries (also digital ones), sizes, and countries. This may also be the basis for developing a comparative cross-border digital innovative culture. And last, to help change government aid to SMEs specifically, and to firms in general.

Sixth, despite the vast literature on the importance of ambidexterity to innovation, it was found that SMEs don't use ambidexterity to reach their innovation goals and that their innovation activities are done through the different departments, mainly the CEO, engineers, sales, and production. This finding is especially surprising with regard to DI knowledge, as it was assumed that due to the complexity and ever-changing environment in which DI exists, a separation between the core business and the innovation ideas would be required to secure the stability of the firm (Jansen et al. 2005; Gray, 2006; Volberda et al. 2010; Mukherji and Silberman, 2013; Egbetokun and Savin, 2014; Savin and Abiodum, 2016; Broersma et al. 2016; Lucena and Roper, 2016; Chowdhury et al. 2017; Banerjee et al. 2020). However, this work supports other researchers such as Nambisan et al. (2017) and Zhai et al. (2018).

6.3.2 Practical Implications

In addition to the scientific contribution of linking ACAP to DI, this work provides managers with input on how to prioritize the activities that could help leverage ACAP, specifically in a complex digital environment. The artifact is designed rigorously and provides a remedy to the predefined problem: "How can SMEs increase their ACAP of DI knowledge." This is an immediate and practical contribution to managers and technological leaders who seek information, inspiration, and the benefit of best practices, on how to tackle the challenges of DI through ACAP and how to maintain the competitive edge in the digital era. The findings can be translated into several immediate guidelines with regard to the ACAP phases.

The artifact contributes in several ways (1) It is a coherent and comprehensible design making it an easy-to-follow process; (2) It becomes evident to which extent national culture influences the ability of firms to innovate, and what changes can be adopted by other cultures; (3) The artifact's guidelines are organized according to the ACAP consecutive phases, which ease managers to understand and implement them; (4) The novelty of this artifact is demonstrated

by focusing especially on the ACAP of DI knowledge, which until today, is not vastly handled in the literature; (5) The wide-scale content of the artifact embracing knowledge from theory and practice; (6) Focusing specifically on SMEs' makes the artifact relevant to 95% of the world's economy. Finally, (7) This artifact is the first of its kind to regard the cross-cultural examination of two innovative countries: Israel and Germany. This international and cross-cultural perspective brings rigor, relevancy, and advantage to those who use them.

6.4 Limitations

Despite the aforesaid, this work has the following limitations. The first limitation results from the research method in the research of the literature review; The second emerges from the conceptual framework defining the ACAP construct; The third limitation concerns the research method used for the second research question in this work; The fourth limitation related to our conceptual framework, using cultural theories and a cross-cultural comparison. The fifth emerges from the ability to implement the guideline. At the end of each limitation, the points are addressed to explain the choices that were taken in this work.

The first limitation results from the method used for the review, the excluding/including criteria as well as the databases which were searched. Reviewing the title and the abstract as an initial phase of the literature review could result in ignoring publications that could have contained relevant information but were omitted due to the pre-defined query. Additionally, articles in different databases and possibly in different languages should be reviewed to enrich the information retrieved from the literature and identify possible new aspects and relationships between the variables. These could have created a tendency for bias. However, almost every publication is limited to the existing literature knowledge base, and this is a general bias that exists in every publication. This limitation was addressed by conducting a forward/backward search and by keeping the query as wide as possible. Furthermore, the focus was not only on recent publications but instead included papers as early as 1989 to provide a wide perspective. The search included peer-reviewed articles and conference proceedings alike until saturation was reached.

A second limitation emerged from the different views on ACAP. The literature considers ACAP as an independent variable at times or as a mediating measurement at other times. In such

inconsistency, it is possible that other factors and variables, that should have been included, were ignored. Such variables could present a clearer view of the role of ACAP in generating innovation in firms. Alternatively, a relationship might be considered falsely strong, because researchers adopt measurements from previous researchers without questioning them (Volberda et al. 2010). However, despite the described above limitations, the main goal of the literature review, to identify the main and accepted influencing factors for generating innovation through ACAP, has been fulfilled and thereby set the groundwork for further research.

The third limitation emerges from the research methods used for this work. To close the gap of having a direct measurement to understand the ACAP construct (Cohen and Levinthal, 1990; Jansen et al. 2005; Lichtenthaler and Lichtenthaler, 2009; Robinson and Stubberud, 2010; Volberda et al. 2010; Roberts et al. 2012; Alves et al. 2016), qualitative research methods were used. This allowed a deeper understanding of a new phenomenon (Flick et al. 2004), especially in light of the focus on the "innovation potential" (Gey and Zinke, 2014, p. 92) of firms. However, qualitative research may suffer from several lacks. First, qualitative research lacks generalization power (Sarankatos, 1994). The results are limited at first, to these specific firms and second, to firms similar in size and segment. Moreover, objectivity and reliability are hard to secure. These challenges were addressed with several measures. The quality criteria of objectivity reflect the independence of the obtained results from the researcher and the setting. To avoid bias in these disturbance variables, clear documentation was practiced. The replicability problem arises because replication is difficult to achieve. To address this challenge, communication validation, interpretation argumentation, and documentation were used. The questions were kept identical to the script. Additionally, the interviews were conducted in the natural environment of the interviewees (Bryman, 2016). Finally, validity is concerned with the integrity of the conclusion generated by the research instrument. Although external validity is not possible to obtain, internal validity can be enhanced by avoiding suggestive questions, manipulation, and judgment (Diekmann, 2017).

The fourth limitation results from the conceptual framework. By focusing mainly on cultural and entrepreneurial mindset, other perspectives may have been overlooked. A related limitation in this segment emerges from the different views on culture. In his original research, Hofstede claimed that management depends a great deal on the national culture. Moreover, when organizational culture is dominant, it was found that the organizational culture must fit the local

culture (Hofstede, 2001). In other words, organizational culture mirrors the national culture (Javidan et al. 2004, in Gerhart, 2008). However, neither organizational nor national culture is homogeneous. There is a difference also among individuals which influences their knowledge, values, and norms (Gerhart, 2008). „Individuals differ in their knowledge of other cultures through their personal life experiences and interests (…). Persons who have multilingual proficiency, have lived in more than one country, or belong to more than one ethnic group will have more multicultural knowledge“ (Zahed et al. 2001, p. 93). In sum, in the specific innovative segment, international values could affect the ACAP as much as the national culture, although „the individual's cultural origin is normally captured in the cultural dimensions of the country he belongs to“ (Zahed et al. 2001, p. 93).

6.5 Avenues for Further Research

This section is also divided into a theoretical and practical appeal to scholars to pursue the following venues. This work helped close the gap about the influencing factors of ACAP, especially of DI knowledge, and traditional manufacturing SMEs, and provided insights into Israeli and German cultures. However, to receive deeper and more diverse input, this investigation should be repeated in additional dyad firms to evaluate whether the results remain. Second, this work compares two Western, innovative, and educated countries, Israel and Germany which differ strongly in some dimensions, but not in all. Dyads of other countries with stronger cultural differences in certain dimensions might highlight different cultural influences. Further comparisons with SMEs in different countries will provide new perspectives and elevate more best practices to learn from. Third, to provide a generalization possibility, a quantitative investigation following the same hypothesis can be conducted. Fourth, guidelines could be developed by comparing government programs to other programs in other countries, to track how firms may receive more aid.

7 References

Acs, Z.J., Audretsch, D.B., & Lehmann, E. E. (2013). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, 41(4), 757-774. https://doi.org/10.1007/s11187-013-9505-9

Adams, W. (2015). Conducting semi-structured interviews. In K. E. Newcomer, H. P. Hatry, & J. S. Wholey (Eds.), *Handbook of practical program evaluation* (pp. 492-505). Jossey-Baass Inc. https://doi.org/10.1002/9781119171386.ch19

Ahlin, B., Drnovšek, M., & Hisrich, R.D. (2014). Exploring the moderating effects of absorptive capacity on the relationship between social networks and innovation. *Journal for East European Management Studies*, 213-235. https://doi.org/10.5771/0949-6181-2014-2-213

Aier, S., & Gleichauf, B. (2010). Applying design research artifacts for building design research artifacts: A process model for enterprise architecture planning. In R. Winter, J.L. Zhao, & S. Aier (Eds.), *Global Perspectives on Design Science Research* (pp. 333–348) DESRIST 2010. Lecture Notes in Computer Science, vol 6105. Springer. https://doi.org/10.1007/978-3-642-13335-0_23

Aljanabi, A.R.A. (2017). The mediating role of absorptive capacity on the relationship between entrepreneurial orientation and technological innovation capabilities. *International Journal of Entrepreneurial Behavior & Research,* 24(4), 818-841.

Alves, M.F.R., Salvini, J.T.S., Bansi, A.C., Galli Neto E., & Galina, S.V.R. (2016). Does the size matter for dynamics capabilities? A study on absorptive capacity. *Journal of Technology Management & Innovation,* 11(3), 84-93.

Apriliyanti, I.D., & Alon, I. (2017). Bibliometric analysis of absorptive capacity. *International Business Review*, 26(5), 896-907.

Armstrong, J. (2010). Naturalistic inquiry. In Salk, N.J. (Ed.) *Encyclopedia of Research Design*, (pp. 880-885). Sage Publication Inc.

Arntz, M., Gregory, T., Jansen, S., & Zierahn, U. (2016). *Tätigkeitswandel und Weiterbildungsbedarf in der digitalen Transformation*. ZEW-Gutachten und Forschungsberichte. IAB-Kurzbericht (No. 22/2016). https://www.econstor.eu/bitstream/10419/148159/1/872916693.pdf

Attewell, P. (1992). Technology diffusion and organizational learning: The case of business computing. *Organization Science*, 3(1), 1-19. https://doi.org/10.1287/orsc.3.1.1

Avalos-Quispe, G.A., & Hernández-Simón, L.M. (2019). Open innovation in SMEs: Potential and realized absorptive capacity for interorganizational learning in dyad collaborations with academia. *Journal of Open Innovation: Technology, Market, and Complexity*, 5(3), 72. https://doi.org/10.3390/joitmc5030072

Badillo, E.R., & Moreno, R. (2018). Does absorptive capacity determine collaboration returns to innovation? A geographical dimension. *The Annals of Regional Science*, 60(3), 473-499. https://doi.org/10.1007/s00168-015-0696-7

Banerjee, A., Lampel, J., & Bhalla, A. (2020). A question of (mis)alignment: Innovation mandates and absorptive capacity routines. *R&D Management*, 50(2), 227-238. https://doi.org/10.1111/radm.12393

Becker, W., & Schmid, O. (2020). The right digital strategy for your business: An empirical analysis of the design and implementation of digital strategies in SMEs and LSEs. *Business Research*, 13(3), 985-1005. https://doi.org/10.1007/s40685-020-00124-y

Bernard, H.R. (2002). *Research methods in anthropology: Qualitative and quantitative methods* (3rd ed.). AltaMira Press.

Bianchini, M., & Kwon, I. (2020). *Blockchain for SMEs and entrepreneurs in Israel*. OECD SME and Entrepreneurship Papers (No. 18). https://www.oecd.org/cfe/smes/Blockchain%20in%20Israel.pdf

Bitkom Research. (2020, January 3). *Deutsche Wirtschaft läuft der Digitalisierung weiter hinterher*. https://www.bitkom.org/Presse/Presseinformation/Deutsche-Wirtschaft-laeuft-der-Digitalisierung-weiter-hinterher

BMWi. (2016, April). *Digital Strategy 2025*. https://www.de.digital/DIGITAL/Redaktion/EN/Publikation/digital-strategy-2025.pdf?__blob=publicationFile&v=9

BMWK. (n.d.). *Digital Agenda*. Retrieved April 25, 2022, from https://www.bmwk.de/Redaktion/EN/Artikel/Digital-World/digital-agenda.html

BMWi. (2020, January 27). *SMEs Digital: Strategies for the digital transformation*. Retrieved August 24, 2022, from https://www.bmwk.de/Redaktion/EN/Dossier/sme-policy.html

Bogner, A., Littig, B., & Menz, W. (2009). Introduction: Expert interviews—An introduction to a new methodological debate. In A. Bogner, B. Littig & W. Menz (Eds.), *Interviewing experts* (pp. 1-13). Palgrave Macmillan. https://doi.org/10.1057/9780230244276_1

Böhm, M., Hein, A., Hermes, S., Lurz, M., Poszler, F., Ritter, A. C., Setzke, D.S., Weking, J. Welpe, I.M. & Krcmar, H. (2019). *Die Rolle von Startups im Innovationssystem: Eine qualitativ-empirische Untersuchung*. Studien zum deutschen Innovationssystem (No. 12-2019). Expertenkommission Forschung und Innovation (EFI). https://www.econstor.eu/handle/10419/194282

Brock, K., den Ouden, E., Langerak, F., & Podoynitsyna, K. (2020). Front end transfers of digital innovations in a hybrid agile-stage-gate setting. *Journal of Product Innovation Management*, 37(6), 506-527. https://doi.org/10.1111/jpim.12556

Broersma, R., Van Gils, A., & De Grip, A. (2016, August 5-9). Ambidextrous innovation in SMEs: The role of absorptive capacity and CEO's engagement in the strategy process. [Paper presentation]. 76th Annual Meeting of the Academy of Management, AOM 2016, Anaheim, CA, United States. https://doi.org/10.5465/AMBPP/2016.201

Bryman, A. (2016). *Social research methods* (5th ed.) Oxford University Press.

Buschle, C., Reiter, H., & Bethmann, A. (2022). The qualitative pretest interview for questionnaire development: Outline of programme and practice. *Quality & Quantity*, 56(2), 823-842. https://doi.org/10.1007/s11135-021-01156-0

Carlo, J.L., Lyytinen, K., & Rose, G.M. (2012). A knowledge-based model of radical innovation in small software firms. *MIS Quarterly*, 865-895. https://doi.org/10.2307/41703484

Cavillier, Q., & Wieser, P. (2018). *Connecting academia and small enterprises: A new field for knowledge management experiments* [Paper presentation]. Proceedings of the 15th International Conference on Intellectual Capital, Knowledge Management & Organizational Learning (ICICKM 2018), Cape Town, South Africa. https://cris.vub.be/ws/portalfiles/portal/43639093/ICICKM18_Proceedings_Download.pdf#page=48

Chandrashekar, D., & Subrahmanya, M.H.B. (2017). Absorptive capacity as a determinant of innovation in SMEs: A study of Bengaluru high-tech manufacturing cluster. *Small Enterprise Research*, 24(3), 290-315. https://doi.org/10.1080/13215906.2017.1396491

Chowdhury, M., Jayaram, J., & Prajogo, D. (2017). The influence of socialisation and absorptive capacity on buyer's innovation performance. *International Journal of Production Research*, 55(23), 7022-7039. https://doi.org/10.1080/00207543.2017.1346321

Chudaeva, A.A., Mantulenko, V.V, Zhelev, P., & Vanickova, R. (2019). *Impact of digitalization on the industrial enterprises activities* [Paper presentation]. 17th International Scientific Conference on Problems of Enterprise Development: Theory and Practice. Samara, Russia. https://doi.org/10.1051/shsconf/20196203003

Ciriello, R.F., Richter, A., & Schwabe, G. (2018). Digital innovation. *Business & Information Systems Engineering*, 60(6), 563-569. https://doi.org/10.1007/s12599-018-0559-8

Cohen, W.M., & Levinthal, D.A. (1989). Innovation and learning: the two faces of R&D. *The Economic Journal*, 99(397), 569-596. https://doi.org/10.2307/2233763

Cohen, W.M., & Levinthal, D.A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 128-152. https://doi.org/10.2307/2393553

Costa, V., & Monteiro, S. (2016). Knowledge processes, absorptive capacity and innovation: A mediation analysis. *Knowledge and Process Management*, 23(3), 207-218. https://doi.org/10.1002/kpm.1507

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). Sage Publications, Inc.

Dahlin, P., Moilanen, M., Østbye, S. E., & Pesämaa, O. (2019). Absorptive capacity, co-creation, and innovation performance: A cross-country analysis of gazelle and nongazelle companies. *Baltic Journal of Management*, 15(1), 81-98. https://doi.org/10.1108/BJM-05-2019-0161

Darwish, T. K., Zeng, J., Rezaei Zadeh, M., & Haak-Saheem, W. (2020). Organizational learning of absorptive capacity and innovation: Does leadership matter? *European Management Review*, 17(1), 83-100. https://doi.org/10.1111/emre.12320

Diekmann, A. (2007). *Empirische Sozialforschung. Grundlagen, Methoden, Anwendungen*. (11. Auflage). Rowohlt Taschenbuch Verlag.

Digital Skills and Jobs Platform (n.d.). *Germany - Digital Strategy 2025*. Retrieved August 2, 2022, from https://digital-skills-jobs.europa.eu/en/actions/national-initiatives/national-strategies/germany-digital-strategy-2025

Drejer, A., Christensen, K. S., & Ulhoi, J. P. (2004). Understanding intrapreneurship by means of state-of-the-art knowledge management and organisational learning theory. *International Journal of Management and Enterprise Development*, 1(2), 102-119. https://doi.org/10.1504/IJMED.2004.004387

Duchek, S. (2015). Enhancing absorptive capacity for innovation and change: The role of structural determinants. *Journal of Change Management*, 15(2), 142-160. https://doi.org/10.1080/14697017.2014.988637

EFI – Commission of Experts for Research and Innovation (2022). *Report on research, innovation and technological performance in Germany 2022* (No. 202220232024). https://www.e-fi.de/fileadmin/Assets/Gutachten/2022/EFI_Summary_2022.pdf

Egbetokun, A., & Savin, I. (2014). Absorptive capacity and innovation: When is it better to cooperate? *Journal of Evolutionary Economics*, 2(24), 399-420. https://doi.org/10.1016/j.jedc.2015.12.005

Eisenhardt, K.M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550. https://doi.org/10.2307/258557

Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of Business Research*, 112, 119-127. https://doi.org/10.1016/j.jbusres.2020.03.004

Enkel, E., Groemminger, A., & Heil, S. (2018). Managing technological distance in internal and external collaborations: absorptive capacity routines and social integration for innovation. *The Journal of Technology Transfer*, 43(5), 1257-1290. https://doi.org/10.1007/s10961-017-9557-0

European Commission. (2020a). *Digital Economy and Society Index* (DESI) - *Thematic chapters*. https://innogrowth.org/wp-content/uploads/2020/07/DESI-2020.pdf

European Commission. (2020b). *Commission staff working document*: *Country Report Germany 2020*. https://ec.europa.eu/info/sites/default/files/2020-european_semester_country-report-germany_en.pdf

European Commission, Executive Agency for Small and Medium-sized Enterprises (2021). *Annual report on European SMEs 2020/2021: Digitalisation of SMEs*: Background Document. https://data.europa.eu/doi/10.2826/120209

Eurostat. (n.d.). *Small and medium-sized enterprises* (SMEs). Retrieved June 25, 2022, from https://ec.europa.eu/eurostat/web/structural-business-statistics/small-and-medium-sized-enterprises

Fichman, R.G., & Kemerer, C.F. (1997). The assimilation of software process innovations: An organizational learning perspective. *Management Science*, 43(10), 1345-1363. https://doi.org/10.1287/mnsc.43.10.1345

Fichman, R.G., Dos Santos, B.L., & Zheng, Z. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. *MIS Quarterly*, 38(2), 329-353. https://doi.org/10.2307/26634929

Fitzgerald, M., Kruschwitz, N., Bonnet, D. & Welch, M. (2013). *Embracing Digital Technology: A New Strategic Imperative*. https://sloanreview.mit.edu/projects/embracing-digital-technology/

Flick, U., von Kardoff, E., & Steinke, I. (Eds.). (2004). *A companion to qualitative research*. Sage Publications Ltd.

Flor, M.L., Cooper, S.Y., & Oltra, M.J. (2018). External knowledge search, absorptive capacity and radical innovation in high-technology firms. *European Management Journal*, 36(2), 183-194. https://doi.org/10.1016/j.emj.2017.08.003

Galbreath, J. (2019). Drivers of green innovations: The impact of export intensity, women leaders, and absorptive capacity. *Journal of Business Ethics*, 158(1), 47-61. https://doi.org/10.1007/s10551-017-3715-z

Galindo-Rueda, F., & Verger, F. (2016). *OECD taxonomy of economic activities based on R&D intensity*. OECD Science, Technology and Industry Working Papers (No. 2016/04). https://doi.org/10.1787/5jlv73sqqp8r-en

Gao, S., Xu, K., & Yang, J. (2008). Managerial ties, absorptive capacity, and innovation. *Asia Pacific Journal of Management*, 25(3), 395-412. https://doi.org/10.1007/s10490-008-9096-1

Gerhart, B. (2008). Cross cultural management research: Assumptions, evidence, and suggested directions. *International Journal of Cross Cultural Management*, 8(3), 259-274. https://doi.org/10.1177/1470595808096669

Gerring, J. (2008). Case Selection for Case-Study Analysis: Qualitative and Quantitative Techniques. In Janet M. Box-Steffensmeier, Henry E. Brady & David Collier (Eds.), *The Oxford Handbook of Political Methodology* (pp. 645–684). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199286546.003.0028

Gey, R., & Zinke, C. (2014). *Ein Plädoyer für qualitative Methoden in der Informatik*. Beiträge zum zweiten Methodentreffen für qualitative Methoden in Informatik und Wirtschaftswissenschaften [Paper presentation]. Leipziger Beiträge zur Informatik.

Leipzig, Germany. https://www.researchgate.net/profile/Ronny-Gey/publication/269628901_Ein_Pladoyer_fur_qualitative_Methoden_in_der_Informatik_Wie_Lehre_und_Forschung_davon_profitieren_konnen/links/54905c410cf2d1800d86523a/Ein-Plaedoyer-fuer-qualitative-Methoden-in-der-Informatik-Wie-Lehre-und-Forschung-davon-profitieren-koennen.pdf

Gick, M., Jensen, T., Nagar, Y., Salgado, D., Egbringhoff, A., & Krings, B. (2019). *German and Israeli Innovation: the best of two worlds*. Bertelsmann Stiftung, Gütersloh. https://www.bertelsmann-stiftung.de/de/publikationen/publikation/did/german-and-israeli-innovation-the-best-of-two-worlds

Giuliani, E. (2005). Cluster absorptive capacity: why do some clusters forge ahead and others lag behind? *European Urban and Regional Studies*, 12(3), 269-288. https://doi.org/10.1177/0969776405056593

Glaser, B.G., & Strauss, A.L. (2017). *The discovery of grounded theory: Strategies for qualitative research*. Routledge. https://doi.org/10.4324/9780203793206

Gray, C. (2006). Absorptive capacity, knowledge management and innovation in entrepreneurial small firms. *International Journal of Entrepreneurial Behavior & Research*, 12(6), 345-360. https://doi.org/10.1108/13552550610710144

Green, A.E., & Aarons, G.A. (2011). A comparison of policy and direct practice stakeholder perceptions of factors affecting evidence-based practice implementation using concept mapping. *Implementation Science*, 6(1), 1-12. https://doi.org/10.1186/1748-5908-6-104

Guimaraes, T., Thielman, B., Guimaraes, V.C., & Cornick, M. (2016). Absorptive capacity as moderator for company innovation success. *International Journal of the Academic Business World*, 10(2), 1-18.

Harrington, S.J., & Guimaraes, T. (2005). Corporate culture, absorptive capacity and IT success. *Information and Organization*, 15(1), 39-63. https://doi.org/10.1016/j.infoandorg.2004.10.002

Hart, C. (1998). *Doing a literature review: Releasing the research imagination*. Sage Publications London.

Hess, J., Singer, E., & Bushery, J. (1999). Predicting test-retest reliability from behavior coding. *International Journal of Public Opinion Research*, 11(4), 346-360. https://doi.org/10.1093/ijpor/11.4.346

Hevner, A.R., March, S.T., Park, J., & Ram, S. (2004). Design science in information systems research. *MIS Quarterly*, 75-105. https://doi.org/10.2307/25148625

Hofstede Insights. (n.d.). *Country comparison*. Retrieved May 20, 2022, from https://www.hofstede-insights.com/country-comparison/germany,israel/

Hofstede, G. (1983). National cultures in four dimensions: A research-based theory of cultural differences among nations. *International Studies of Management & Organization*, 13(1-2), 46-74. https://doi.org/10.1080/00208825.1983.11656358

Hofstede, G. (1991). Empirical models of cultural differences. In N. Bleichrodt & P. J. D. Drenth (Eds.), *Contemporary issues in cross-cultural psychology* (pp. 4–20). Swets & Zeitlinger Publishers.

Hund, A., Drechsler, K., & Reibenspiess, V.A. (2019). *The current state and future opportunities of digital innovation: A literature review* [Paper presentation]. 27th European Conference on Information Systems (ECIS2019), Stockholm-Uppsala, Sweden. https://core.ac.uk/download/pdf/301379523.pdf

Ilker, E., Sulaiman, A.M., & Rukayya S.A. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4. https://doi.org/10.11648/j.ajtas.20160501.11

IMD World Competitiveness Center. (n.d.). *World Digital Competitiveness Ranking*. Retrieved August 28, 2021, from https://www.imd.org/centers/world-competitiveness-center/rankings/world-digital-competitiveness/

International Federation of Robotics. (n.d.). *IFR presents World Robotics Report 2020*. Retrieved September 27, 2022, from https://ifr.org/ifr-press-releases/news/record-2.7-million-robots-work-in-factories-around-the-globe.

Interreg Europe. (2021). *Annual report on European SMEs 2020/2021*. https://www.interregeurope.eu/news-and-events/news/annual-report-on-european-smes-20202021

Jansen, J.J., Van Den Bosch, F.A., & Volberda, H.W. (2005). Managing potential and realized absorptive capacity: how do organizational antecedents matter? *Academy of Management Journal*, 48(6), 999-1015. https://doi.org/10.5465/AMJ.2005.19573106

Kamaşak, R., & Bulutlar, F. (2010). The influence of knowledge sharing on innovation. *European Business Review*, 22(3), 306-317. https://doi.org/10.1108/09555341011040994

Kammerlander, N. Matzler, K., & Prügl, R. (2017). *Balancing tradition and change: Theorizing on innovation and entrepreneurship in the family firm* [Paper presentation]. Research and Development Workshop (IFERA2017). Bolzano, Italy. https://nadinekammerlander.files.wordpress.com/2016/08/ifera-research-development-workshop_familyfirminnovation_bolzano_cfp.pdf

Kedia, B.L., & Bhagat, R. S. (1988). Cultural constraints on transfer of technology across nations: Implications for research in international and comparative management. *Academy of Management Review*, 13(4), 559-571. https://doi.org/10.2307/258375

Kiefer, D., Dinther, C.V., & Spitzmüller, J. (2021). *Digital innovation culture: a systematic literature review* [Paper presentation]. International Conference on Wirtschaftsinformatik (WI2021). Essen, Germany. https://www.researchgate.net/publication/348266362_Digital_Innovation_Culture_A_Systematic_Literature_Review

Kim, C., Lee, C., & Kang, J. (2018). Determinants of firm's innovation-related external knowledge search strategy: The role of potential absorptive capacity and appropriability regime. *International Journal of Innovation Management*, 22(06), 1850044. https://doi.org/10.1142/S1363919618500445

King, N., Horrocks, C. (2010). *Interviews in qualitative research*. Sage Publishing, Inc.

Komani, L., & Bobek, V. (2020). What can be learned from Israel by the European Union in the field of innovation? *International Journal of Diplomacy and Economy*, 6(1), 51-66. https://doi.org/10.1504/IJDIPE.2020.10031851

KPMG. (2021). *Going digital, faster: Global survey into the impact of COVID-19 on digital transformation* (No. 137170-G). https://assets.kpmg/content/dam/kpmg/xx/pdf/2021/01/going-digital-faster.pdf

Krcmar, H. (2015). *Informationsmanagement*. Springer Berlin Heidelberg.

Krosnick, J. A. & Presser, S. (2009). Question and Questionnaire Design. In J.D. Wright & P.V. Marsden (Eds). *The Handbook of Survey Research* (2nd ed.) (pp. 1-81). Elsevier. https://web.stanford.edu/dept/communication/faculty/krosnick/docs/2009/2009_handbook_krosnick.pdf

Lambert, J. (2016). Cultural diversity as a mechanism for innovation: Workplace diversity and the absorptive capacity framework. *Journal of Organizational Culture, Communications and Conflict*, 20(1), 68-77.

Lane, P.J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, 31(4), 833-863.

Lane, P.J., Salk, J.E., & Lyles, M.A. (2001). Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal*, 22(12), 1139-1161.

Leal-Rodríguez, A.L., Ariza-Montes, J.A., Roldán, J.L., & Leal-Millán, A.G. (2014). Absorptive capacity, innovation and cultural barriers: A conditional mediation model. *Journal of Business Research*, 67(5), 763-768.

Leidner, D. E., & Kayworth, T. (2006). A review of culture in information systems research: Toward a theory of information technology culture conflict. *MIS Quarterly*, 357-399.

Lerch, C., Jäger, A., & Maloca, S. (2017). *Wie digital ist Deutschlands Industrie wirklich?* Arbeit und Produktivität in der digitalen Produktion. Modernisierung der Produktion - Mitteilungen aus der ISI-Erhebung-Modernisierung der Produktion. Frauenhofer Institute für System und Innovationsforschung (ISI) (No. 71). https://www.isi.fraunhofer.de/content/dam/isi/dokumente/modernisierung-produktion/erhebung2015/pi71_readiness_i4-0.pdf

Levitt, B., & March, J.G. (1988). Organizational learning. *Annual Review of Sociology*, 14, 319-340.

Levkovskyi, B., Betzwieser, B., Löffler, A., & Wittges, H. (2020). *Why do organizations change? A literature review on drivers and measures of success for digital transformation*. 26th Americas Conference on Information Systems (AMCIS2020)

[Paper presentation]. Salt Lake City, Utah, United States. https://aisel.aisnet.org/amcis2020/org_transformation_is/org_transformation_is/25/

Lewis-Beck, M., Bryman, A.E., & Liao, T.F. (2003). *The sage encyclopedia of social science research methods*. Sage Publications Inc.

Libert, B., Beck, M., & Wind, Y. (2016). Questions to ask before your next digital transformation. *Harvard Business Review*, 60(12), 11-13.

Lichtenthaler, U., & Lichtenthaler, E. (2009). A capability-based framework for open innovation: Complementing absorptive capacity. *Journal of Management Studies*, 46(8), 1315-1338.

Lucena, A., & Roper, S. (2016). Absorptive capacity and ambidexterity in R&D: Linking technology alliance diversity and firm innovation. *European Management Review*, 13(3), 159-178.

Lynch, M. P., & Corbett, A. C. (2021). Entrepreneurial mindset shift and the role of cycles of learning. *Journal of Small Business Management*, 1-22. https://doi.org/10.1080/00472778.2021.1924381

Maes, J., & Sels, L. (2014). SMEs' radical product innovation: The role of internally and externally oriented knowledge capabilities. *Journal of Small Business Management*, 52(1), 141-163.

Maldonado, T., Vera, D.M., & Keller, R.T. (2015). *Reconsidering absorptive capacity: A meta-analysis to improve theoretical foundations and measures* [Paper presentation]. Academy of Management Convention 2015(1). Briarcliff Manor, New York, United States. https://doi.org/10.5465/ambpp.2015.298

Malhotra, A., Gosain, S., & Sawy, O.A.E. (2005). Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *MIS Quarterly*, 145-187.

Manyika, J., Lund, S., Bughin, J., Woetzel, J., Stamenov, K., & Dhingra, D. (2016). *Digital globalization: The new era of global flows*. McKinsey Global Institute (No. March 2016). https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/digital%20globalization%20the%20new%20era%20of%20global%20flows/mgi-digital-globalization-full-report.ashx

Mason, G., Rincon-Aznar, A., & Venturini, F. (2020). Which skills contribute most to absorptive capacity, innovation and productivity performance? Evidence from the US and Western Europe. *Economics of Innovation and New Technology*, 29(3), 223-241.

Mijač, M. (2019). *Evaluation of design science instantiation artifacts in software engineering research* [Paper presentation]. Central European Conference on Information and Intelligent Systems (CECIIS2019), Varazdin, Croatia. https://www.proquest.com/conference-papers-proceedings/evaluation-design-science-instantiation-artifacts/docview/2366654170/se-2

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Sage Publishing Inc.

Ministry of Economy and Industry of Israel. (n.d.). Retrieved April 25, 2022, from https://www.sba.org.il/hb/Pages/default.aspx

Ministry of Economy and Industry of Israel. (2018). *Advanced manufacturing. Investment models in Israel* (No. January 2018).

https://investinisrael.gov.il/HowWeHelp/downloads/ADVANCED%20MANUFACTURING.pdf

Moilanen, M., Østbye, S., & Woll, K. (2014). Non-R&D SMEs: External knowledge, absorptive capacity and product innovation. *Small Business Economics*, 43(2), 447-462.

Mukherji, N., & Silberman, J. (2013). Absorptive capacity, knowledge flows, and innovation in US metropolitan areas. *Journal of Regional Science*, 53(3), 392-417.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23(2), 242-266.

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. *MIS Quarterly*, 41(1), 223-238.

OECD. (n.d.). *OECD digital for SMEs global initiative*. Retrieved October 19, 2022, from https://www.oecd.org/digital/sme

OECD. (2000). *Small and medium-sized enterprises: Local strength, global reach*. Policy Brief (No. 80821). https://www.oecd.org/cfe/leed/1918307.pdf

OECD. (2016). *SME and Entrepreneurship Policy in Israel 2016*. OECD Publishing, Paris, https://doi.org/10.1787/9789264262324-en

OECD. (2018). *SME Policy Index: The Mediterranean Middle East and North Africa 2018 – Interim assessment of key SME reforms* (No. EZ-01-18-716-EN-N). https://www.etf.europa.eu/sites/default/files/2020-01/sme_policy_index_semed_2018_en.pdf

OECD. (2020). *Financing SMEs and entrepreneurs 2020: An OECD scoreboard*. https://www.oecd-ilibrary.org/sites/4a247de9-en/index.html?itemId=/content/component/4a247de9-en

OECD. (2021). *Digital-by-default: A new concept in Germany's development co-operation*. https://www.oecd.org/development-cooperation-learning/practices/dynamic/dcd-best-practices/8cf1b0d5/pdf/digital-by-default-a-new-concept-in-germany-s-development-co-operation.pdf

Offermann, P., Levina, O., Schönherr, M., & Bub, U. (2009). *Outline of a design science research process* [Paper presentation]. 4th International Conference on Design Science Research in Information Systems and Technology (DESRIST2009), Philadelphia, Pennsylvania, United States. https://doi.org/10.1145/1555619.1555629

Ohlert, C., Giering, O., & Kirchner, S. (2020). *Digital transformation is a process. Empirical findings from a large German employer survey* [Working paper] "Fachgebiet Digitalisierung der Arbeitswelt" (No. 02). Technische Universität Berlin. Berlin, Germany. https://www.da.tu-berlin.de/fileadmin/i62_datypo3/PDF/DP_No_2_Paper.pdf

Onwuegbuzie, A.J., & Weinbaum, R.K. (2016). Mapping Miles and Huberman's Within-Case and Cross-Case Analysis Methods onto the Literature Review Process. *Journal of Educational Issues*, 2(1), 265-288.

Österle, H., Becker, J., Frank, U., Hess, T., Karagiannis, D., Krcmar, H., Loos, P., Mertens, P., Oberweis, A. & Sinz, E.J. (2010). Memorandum on design-oriented information systems research. *European Journal of Information Systems*, 20(1), 7-10.

Öz, Ö. (2004). Using boolean-and fuzzy-logic-based methods to analyze multiple case study evidence in management research. *Journal of Management Inquiry*, 13(2), 166-179.

Paley, N. (2021). *The manager's guide to competitive marketing strategies*. Routledge. https://doi.org/10.4324/9780203736463

Palmatier, R.W., Houston, M.B., & Hulland, J. (2018). Review articles: Purpose, process, and structure. *Journal of the Academy of Marketing Science*, 46(1), 1-5.

Patterson, W., & Ambrosini, V. (2015). Configuring absorptive capacity as a key process for research intensive firms. *Technovation*, 36, 77-89.

Patton, M.Q. (2022). *Qualitative research and evaluation methods*. (3rd ed.) Sage Publications Inc.

Peeters, C., Massini, S., & Lewin, A.Y. (2014). Sources of variation in the efficiency of adopting management innovation: The role of absorptive capacity routines, managerial attention and organizational legitimacy. *Organization Studies*, 35(9), 1343-1371.

Peffers, K., Tuunanen, T., Rothenberger, M.A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3), 45-77.

Pinchot III, G. (1985). *Intrapreneuring: Why you don't have to leave the corporation to become an entrepreneur* (1st ed.). Joanna Cotler Books.

Presutti, M., Boari, C., Majocchi, A., & Molina-Morales, X. (2019). Distance to customers, absorptive capacity, and innovation in high-tech firms: The dark face of geographical proximity. *Journal of Small Business Management*, 57(2), 343-361.

Ramírez, V.C.L., Flores, C.L.V., Borbón, M.R., del Río, S.V., & Ramírez, M.A.N. (2018). Absorptive capacities and innovation in graduated companies from a business incubator in the North of Mexico. *International Journal of Advanced Corporate Learning* (iJAC), 11(2), 11-15.

Rangus, K., Drnovšek, M., Di Minin, A., & Spithoven, A. (2017). The role of open innovation and absorptive capacity in innovation performance: Empirical evidence from Slovenia. *Journal of East European Management Studies*, 39-62.

Rarick, C., & Han, T. (2015). The role of culture in shaping an entrepreneurial mindset. *International Journal of Entrepreneurship*, 19, 119.

Ratten, V. (2016). Service innovations in cloud computing: a study of top management leadership, absorptive capacity, government support, and learning orientation. *Journal of the Knowledge Economy*, 7(4), 935-946.

Raymond, L., Bergeron, F., Croteau, A.M. & St-Pierre, J. (2016). IT-enabled knowledge management for the competitive performance of manufacturing SMEs: An absorptive capacity-based view. *Knowledge & Process Management*, 23(2), 110-123.

Ritala, P., & Hurmelinna-Laukkanen, P. (2013). Incremental and radical innovation in coopetition—The role of absorptive capacity and appropriability. *Journal of Product Innovation Management*, 30(1), 154-169.

Roberts, N., Galluch, P. S., Dinger, M., & Grover, V. (2012). Absorptive capacity and information systems research: Review, synthesis, and directions for future research. *MIS Quarterly*, 625-648.

Robinson, S., & Stubberud, H.A. (2010). *Inspiring innovation in Norway* [Paper presentation]. Academy of Studies in International Business, 10(2), Las Vegas, United States. https://web.p.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=4&sid=5460b28d-3a19-485b-a8d4-0ca7420db8d0%40redis

Rodriguez, L., & Da Cunha, C. (2018). Impacts of big data analytics and absorptive capacity on sustainable supply chain innovation: A conceptual framework. *Scientific Journal of Logistics*, 14(2), 151-161.

Ruiz, É., Brion, S., & Parmentier, G. (2018). Absorbing knowledge in the digital age: The key role of integration mechanisms in the context of crowdsourcing for innovation. *R&D Management*, 50(1), 63-74.

Rusu Mocanasu, D. (2020). *Determining the sample size in qualitative research* [Paper presentation]. International Multidisciplinary Scientific Conference on the Dialogue between Sciences & Arts, Religion & Education, 4(1), 181-187. https://www.researchgate.net/publication/349872963_DETERMINING_THE_SAMPLE_SIZE_IN_QUALITATIVE_RESEARCH

Ryzhkova, N., & Pesämaa, O. (2015). Absorptive capacity, collaboration with customers and innovation performance of gazelle companies in knowledge-intensive industries. *International Journal of Innovation Management*, 19(5), 1550059.

Sames, G., & Diener, A. (2020). *Stand der Digitalisierung von Geschäftsprozessen zu Industrie 4.0 im Mittelstand – Ergebnisse einer Umfrage bei Unternehmen* (THM Hochschulschriften No. 9). http://digdok.bib.thm.de/volltexte/2018/5281/pdf/THM_Hochschulschriften_9_Endfassung.pdf

Santoro, G., Bresciani, S., & Papa, A. (2020). Collaborative modes with cultural and creative industries and innovation performance: the moderating role of heterogeneous sources of knowledge and absorptive capacity. *Technovation*, 92-93.

Sarantakos, S. (2017). *Social Research*. Bloomsbury Publishing.

Savin, I., & Egbetokun, A. (2016). Emergence of innovation networks from R&D cooperation with endogenous absorptive capacity. *Journal of Economic Dynamics and Control*, 64, 82-103.

Schein, E. H. (2010). *Organizational culture and leadership* (2nd ed.). John Wiley & Sons.

Shane, S. A. (1992). Why do some societies invent more than others? *Journal of Business Venturing*, 7(1), 29-46.

Siachou, E., Vrontis, D., & Trichina, E. (2020). Can traditional organizations be digitally transformed by themselves? The moderating role of absorptive capacity and strategic interdependence. *Journal of Business Research*, 124, 408-421.

Simon, H.A. (1969). *The Sciences of the Artificial* (3rd ed.). MIT Press.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333-339.

Sommerlad, E., & David, Y. (2021). *Digital inequalities in times of the COVID-19 pandemic in Israel and Germany. COVID-19 and a World of Ad Hoc Geographies*. In Brunn, S.D. and Gilbreath (Eds.), Springer Cham, New York, pp. 1111-1127.

Sonnenberg, C., & vom Brocke, J. (2012). *Evaluations in the science of the artificial– reconsidering the build-evaluate pattern in design science research* [Paper presentation]. International Conference on Design Science Research in Information Systems (DESRIST 2012), Las Vegas, Nevada, United States. https://www.researchgate.net/profile/Srikar-Velichety/publication/262203263_Common_Citation_Analysis_and_Technology_Overlap_Factor_An_Empirical_Investigation_of_Litigated_Patents_Using_Network_Analysis/links/5dc97b564585151435035a4f/Common-Citation-Analysis-and-Technology-Overlap-Factor-An-Empirical-Investigation-of-Litigated-Patents-Using-Network-Analysis.pdf#page=392

Stelmaszczyk, M. (2020). How absorptive capacity and organisational learning orientation interact to enable innovation capability? An empirical examination. Entrepreneurial *Business and Economics Review*, 8(1), 7-32.

Strese, S., Adams, D.R., Flatten, T. C., & Brettel, M. (2016). Corporate culture and absorptive capacity: The moderating role of national culture dimensions on innovation management. *International Business Review*, 25(5), 1149-1168.

Tarutė, A., Duobienė, J., Klovienė, L., Vitkauskaitė, E., & Varaniūtė, V. (2018). *Identifying factors affecting digital transformation of SMEs* [Paper presentation]. Proceedings of the International Conference on Electronic Business (ICEB2018), Guilin, China. http://iceb.johogo.com/proceedings/2018/ICEB2018_paper_04_full.pdf

Thoring, K., Mueller, R.M., & Badke-Schaub, P. (2020). *Workshops as a research method: Guidelines for designing and evaluating artifacts through workshops*. 53rd Hawaii International Conference on System Sciences (HICSS 2020), Wailea, Hawaii, United States. https://scholarspace.manoa.hawaii.edu/server/api/core/bitstreams/c78f65c6-8097-4099-a2a5-09b384c17e69/content

Todorova, G., & Durisin, B. (2007). Absorptive capacity: Valuing a reconceptualization. *Academy of Management Review*, 32(3), 774-786.

Tongco, M.D.C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research and Applications*, 5, 147-158.

Trenkle, J. (2019). *Survival in the digital age*: A *framework for formulating a digital transformation strategy in SME*. 19th International Conference on Electronic Business (ICEB2019), Newcastle Upon Tyne, United Kingdom. https://core.ac.uk/download/pdf/301389617.pdf

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5), 996-1004.

Van Vliet, V. (2009). *Geert Hofstede*. https://www.toolshero.com/toolsheroes/geert-hofstede/

Vogelsang, K., Steinhüser, M., & Hoppe, U. (2013). *A qualitative approach to examine technology acceptance*. 34th International Conference on Information Systems, Milan Italy. https://core.ac.uk/download/pdf/301361231.pdf

Volberda, H. W., Foss, N. J., & Lyles, M. A. (2010). Perspective-Absorbing the concept of absorptive capacity: How to realize its potential in the organization field. *Organization Science*, 21(4), 931-951.

Wang, Y.L., Wang, Y.D., & Horng, R.Y. (2010). Learning and innovation in small and medium enterprises. *Industrial Management & Data Systems*, 110(2), 175-192.

Ward, V., House, A., & Hamer, S. (2009). Developing a framework for transferring knowledge into action: a thematic analysis of the literature. *Journal of Health Services Research & Policy*, 14(3), 156-164.

Webster, J., & Watson, R.T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, xiii-xxiii.

WIPO. (2019). *The Global Innovation Index 2019*. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019-chapter1.pdf

WIPO. (2020). *The Global Innovation Index 2020*. WIPO World Intellectual Property Organization. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

WIPO. (2021). *Global Innovation Index 2021*. Tracking Innovation through the COVID-19 Crisis. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf

Wolfswinkel, J.F., Furtmueller, E., & Wilderom, C.P. (2011). Using grounded theory as a method for rigorously reviewing literature. *European Journal of Information Systems*, 22(1), 45-55.

Wuryaningrat, N.F. (2013). Knowledge sharing, absorptive capacity and innovation capabilities: An empirical study on small and medium enterprises in North Sulawesi, Indonesia. *Gadjah Mada International Journal of Business*, 15(1), 61-77.

Yin, R. K. (1994). Discovering the future of the case study method in evaluation research. *Evaluation Practice*, 15(3), 283-290.

Yin, R. K. (2009). *Case study research: Design and methods* (5th ed.). Sage Publishing Inc.

Yin, R. K. (2017). *Case study research and applications: Design and methods*. Sage Publishing Inc.

Yoo, Y., Lyytinen, K. J., Boland, R. J., & Berente, N. (2010). *The next wave of digital innovation: Opportunities and challenges*: A report on the research workshop "Digital Challenges in Innovation Research." https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1622170

Zahed, F. Van Pelt, W. V., & Song, J. (2001). A conceptual framework for international Web design. *IEEE Transactions on Professional Communication*, 44(2), pp. 83-103.

Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. Academy of management review, 27(2), 185-203.

Zapata-Cantu, L., Rialp, J., & Rodríguez, A.O. (2020). Relative absorptive capacity as a booster of innovation in an automotive cluster: Competitiveness Review. *International Business Journal*, 30(2), 175-193.

Zhai, Y. M., Sun, W. Q., Tsai, S. B., Wang, Z., Zhao, Y., & Chen, Q. (2018). An empirical study on entrepreneurial orientation, absorptive capacity, and SMEs' innovation performance: A sustainable perspective. *Sustainability*, 10(2), 314. https://doi.org/10.3390/su10020314

Zhang, L., & Chen, J. (2021). *Research on the evaluation index of digital transformation level of manufacturing enterprises*. Proceedings of the 3rd International Conference on Economic Management and Cultural Industry (ICEMCI 2021), Chongqing, China. C:\Users\pe0001\Downloads\125966247 (1).pdf

Zhang, X., Xu, Y., & Ma, L. (2022). Research on successful factors and influencing mechanism of the digital transformation in SMEs. *Sustainability*, 14(5), 2549.

Zmud, R. (1997). Editor's Comments. *MIS Quarterly* 21(2), pp. xxi-xxii

Zobel, A. K. (2016). Benefiting from open innovation: A multidimensional model of absorptive capacity. *Journal of Product Innovation Management*, 34(3), 269-288.

Zou, T., Ertug, G., & George, G. (2018). The capacity to innovate: A meta-analysis of absorptive capacity. *Innovation: Organization & Management*, 2*0*(2), 87-121.

8 Annex A: Methodology of Pretest

According to the qualitative pretest interview of Buschle et al., the interview topic and proceedings were clarified, both in writing ahead of the interview and at the interview itself. It was established that the pretest interviewee was an expert. Research-ethical aspects like voluntary participation and anonymity were discussed in advance. In addition, basic information regarding the situation, duration, recording, and the option of clarifying the answers after the research interpretation were addressed. Finally, the topic of length was defined (Buschle et al. 2022).

The pretest informant also commented that from his experience, indeed knowledge base and management are extremely important, and all the managers he knows are asking themselves how to digitalize their production. He also said that the R&D question is especially interesting since while in large firms there is a tendency to practice ambidexterity and to separate the core business from the innovation activities, he doubts whether SMEs can finance this separation. From experience, he said he would expect to take people from different departments and have them cooperate on a project basis. He did suggest asking what is the digital maturity of a firm and whether the whole firm must be digitalized or just specific departments. „The R&D knowledge about digitalization is low". Moreover, the IT department does not focus on business development. Rather, their job is mostly maintenance of hardware/software and network. They do not think of building the business, direct sales, or digitalization of the production.

The role of managers is indeed important. The expert agreed that digitalization depends on the manager's mindset and therefore, suggested adding the question of how managers estimate their level of digitalization. This addition was done for several interviews, however, was taken out since all the managers replied the same: that they recognize the importance of digitalization but struggle with the decision of which digital tool to implement, in what priority, and whom to involve. The pretest expert added that the manager's role is to orchestrate the entire process and

show the team what to do. The managers also decide whether to take on a project and whether to continue with it. In his own words, „Managers know where success lays“[63].

Regarding collaboration, the pretest expert mentioned that digitalization changes the business model to come closer to the customers. Digitalization in production means measuring machine efficiency and increasing productivity, bringing more digitalization of robots and automation. The decision is the cost comparison between bringing robots and employees. Since most SMEs miss knowledge by themselves, they are forced to cooperate, but this is also a risk of losing control. Therefore, the question: “*How do you estimate the risk of sharing versus the advantage of gaining more knowledge through collaboration”*? Was added.

The team section was moved down since it represented a secondary influencing factor to managers, collaboration, and knowledge base. Also, the location of the questions was changed. For example, the questions about an engineer leaving were moved from the team to the knowledge base section, since it was designed to answer the aspect of protection of knowledge and not the team aspect of losing a colleague. Also, the section about IT, which preliminary was included in the team communication, was moved up to the knowledge base. The reason was that it was important for the researcher to find out the IT’s role in providing digital impulses to the digitalization process in firms. Following this logic, the question was more fitting for the part of the knowledge base.

The coordination capabilities topic was focused on routines that help exchange knowledge and make decisions for the future, such as meetings. The pretest expert was doubting whether SMEs are practicing efficient routines, so the question was separated into two parts. First, inquire about what routines are being held in general, and second, inquire about the role of digital technologies in conducting these routines.

[63] A citation from the pretest expert.