



INSTITUTO
UNIVERSITÁRIO
DE LISBOA

The link between Absorptive Capacity and IT Firm performance in Portugal

Mário Nuno Neves da Silva Mata

PhD in Management, specialization of Strategy and Entrepreneurship

Supervisor:

PhD José Moleiro Martins, Associate Professor, ISCAL-IPL

PhD Pedro Leite Inácio, Assistant Professor, ISCTE-IUL

PhD José Bonito Filipe, Assistant Professor with Habilitation, ISCTE-IUL

December, 2022



BUSINESS
SCHOOL

Department of Marketing, Operations and Management

The link between Absorptive Capacity and IT Firm performance in Portugal

Mário Nuno Neves da Silva Mata

PhD in Management, specialization of Strategy and Entrepreneurship

Supervisor:

PhD José Moleiro Martins, Associate Professor, ISCAL-IPL

PhD Pedro Leite Inácio, Assistant Professor, ISCTE-IUL

PhD José Bonito Filipe, Assistant Professor with Habilitation, ISCTE-IUL

December, 2022



BUSINESS
SCHOOL

Department of Marketing, Operations and Management

The link between Absorptive Capacity and IT Firm performance in Portugal

Mário Nuno Neves da Silva Mata

PhD in Management, specialization of Strategy and Entrepreneurship

Jury:

PhD João Marques Guerreiro, Assistant Professor, ISCTE-IUL (President)

PhD Álvaro Augusto da Rosa, Associate Professor with Habilitation, ISCTE-IUL

PhD Aurora Castro Teixeira, Full Professor, Faculdade de Economia, Universidade do Porto

PhD Maria José Madeira, Assistant Professor with Habilitation, Universidade Beira Interior

PhD José Moleiro Martins, Associate Professor, ISCAL-IPL

December, 2022

We can't solve problems by using the same kind of thinking we used when we created them

(Attributed to Albert Einstein)

Acknowledgment

Acredito que nada na vida nada se faz sozinho, nem se chega a lugar nenhum sozinho. Algumas pessoas, familiares e amigos, alguns infelizmente já não estão connosco, , contribuíram para que este trabalho se tornasse realidade. Como reconhecimento desses contributos, expresso aqui alguns agradecimentos:

Aos meus orientadores que com a sua sabedoria muito me ajudaram. Ao Professor José Moleiro Martins que muito contribuiu para que encontrasse o meu caminho, ao Professor Pedro Inácio, que para mim será sempre a minha grande e maior referência como Professor, ao Professor José António Filipe que teve um papel determinante para que o caminho e o destino fosse alcançado.

Este trabalho é dedicado à minha mãe, Eulália Neves, a minha estrela, o meu girassol que está no céu, cuja paciência e apoio ajudaram a realizar muitos dos meus sonhos, a pessoa que mais desejava que este trabalho chegasse ao fim, infelizmente já não pode ver em vida o final deste trabalho.

À minha mulher e companheira, Jéssica, por todo o apoio, pelas inúmeras revisões e leituras deste trabalho, pela ajuda nas revisões do inglês, nos inquéritos e tratamento dos dados, sem ela tudo tinha sido muito mais difícil.

À minha prima Zélia Rebelo pela ajuda incansável nas traduções de inglês.

À minha avó e segunda mãe, Olimpia Pitorro das Neves, pelo papel que teve na minha educação e formação. Tanto desejei terminar este trabalho com ela em vida, felizmente ainda hoje está connosco, mas a doença de Alzheimer leva-a todos os dias um bocadinho.

Ao meu colega de Doutoramento José Antunes que infelizmente já não está entre nós, o colega que me fazia acreditar que este trabalho ia ser alcançado e com um final feliz para os dois, à minha colega Isabel Moura que este ano também termina o seu trabalho de Doutoramento e que nas nossas tantas conversas nos motivamos um ao outro, para chegar ao fim, finalmente está quase.

A todos os meus professores que, desde o Ensino Primário ao Superior, contribuíram para a minha formação e para a construção de um olhar diferente sobre a vida e sobre coisas.

Resumo

Esta dissertação é composta por três artigos como produtos de um projeto de pesquisa mais amplo focado no seguinte objetivo de estudo:

Esta pesquisa pode ajudar a indústria portuguesa de TI (Tecnologia da Informação) de Portugal a entender a importância da inovação colaborativa para atingir os objetivos financeiros. Também poderia ajudar os pesquisadores a entender melhor a relação entre inovação colaborativa e capital intelectual em relação à obtenção e manutenção da capacidade de absorção.

As novas contribuições da pesquisa de PMEs em empresas de TI baseadas em projetos em Portugal são como a capacidade de absorção potencial e realizada aumenta o sucesso do projeto e a agilidade estratégica atua como um mecanismo mediador e moderador da complexidade do projeto?

Existe alguma relação entre capacidade de gestão do conhecimento do cliente, agilidade estratégica, capacidade de absorção, desempenho financeiro e capacidade de inovação colaborativa?

No artigo 1, os resultados mostram que a inovação colaborativa tem um impacto positivo e significativo no desempenho financeiro das empresas portuguesas de TI. A capacidade de absorção é considerada um potencial mediador entre a inovação colaborativa e o desempenho financeiro. Além disso, o capital intelectual do moderador fortalece a relação entre inovação colaborativa e capacidade de absorção.

No artigo 2, os resultados indicam que as duas subdimensões da capacidade de absorção, capacidade absorção potencial e realizada, não só afetam diretamente o sucesso de um projeto, mas também indiretamente através do mediador da agilidade estratégica. Embora o papel moderador da complexidade do projeto tenha um efeito positivo e significativo na relação entre capacidade de absorção potencial e agilidade estratégica, é insignificante no que diz respeito à relação entre capacidade de absorção realizada e agilidade estratégica.

No artigo 3.º, os resultados demonstram que a inovação colaborativa contribui significativamente para o desempenho financeiro das empresas de TI em Portugal. Os resultados também indicam que a capacidade de absorção e a agilidade estratégica afetam positiva e significativamente a relação entre a inovação colaborativa e o desempenho financeiro de uma empresa. No entanto, enquanto o papel moderador da capacidade de gestão do conhecimento do cliente (CKMC) tem um efeito positivo e significativo na relação entre inovação colaborativa e agilidade estratégica, o CKMC modera apenas insignificamente a relação entre inovação colaborativa e capacidade de absorção. Por fim, são feitas contribuições teóricas e práticas, são sugeridas limitações de pesquisa e pesquisas futuras.

Palavras-chave: Inovação Colaborativa; Desempenho financeiro; Capital intelectual; Capacidade de absorção; agilidade estratégica; complexidade do projeto; Capacidade de gestão do conhecimento do cliente, Portugal

Abstract

This dissertation comprises three articles as outputs of a broader research project focused on the following study purpose:

This research may help Portugal's IT (Information Technology) industry better understand the importance of collaborative innovation with regard to achieving financial objectives. It could also enhance researchers' understanding of the relationship between collaborative innovation and intellectual capital regarding attaining and maintaining absorptive capacity.

The additional contributions made by research on SME project-based IT Companies in Portugal relate to the way in which potential and realized absorptive capacity enhance project success and strategic agility act as a mediated mechanism and moderator of project complexity.

Is there any relationship between customer knowledge management capability, strategic agility, absorptive capacity, financial performance, and collaborative innovation capability?

In article 1, the results show that collaborative innovation has a positive and significant impact on the financial performance of Portuguese IT companies. Absorptive capacity is considered a potential mediator between collaborative innovation and financial performance.

In article 2, The results indicate that the two sub-dimensions of absorptive capacity, potential and realized absorptive capacity, not only affect a project's success directly but also indirectly through the mediator of strategic agility.

In article 3, The findings demonstrate that collaborative innovation contributes significantly to the financial performance of IT firms in Portugal. The results also indicate that absorptive capacity and strategic agility both positively and significantly affect the relationship between collaborative innovation and a company's financial performance. Lastly, theoretical and practical contributions are made, and research limitations and future research suggested.

Keywords: Collaborative Innovation; Financial Performance; Intellectual Capital; Absorptive capacity; strategic agility; project complexity; Customer knowledge management capability.

JED Code: M1; M10; D8.

Abbreviations

Acronym	Abbreviations
CI	Collaborative Innovation
IT	Information Technology
SMEs	Small And Medium Enterprises
RBV	Resource-Based View
FP	Financial Performance
AC	Absorptive Capacity
PAC	Potential Absorptive Capacity
RAC	Realized Absorptive Capacity
CKMC	Customer Knowledge Management Capability
PS	Project Success
SEM	structural equation modelling
OECD	Economic Co-operation and Development
GDP	Gross domestic product
IC	Intellectual Capital
KBV	knowledge-based view
PLS	partial least squares
SA	Strategic Agility
CR	composite reliability
AVE	Average Variance Extracted
HC	Human Capital
SC	Social Capital
OC	Organizational Capital
VIF	Variance Inflation Factor
LLCI	Lower Limit Confident Interval
ULCI	Upper Limit Confident Interval

INDEX

Acknowledgment.....	iii
Resumo.....	vii
Abstract	ix
Abbreviations	xi
CHAPTER 1.....	1
Introduction.....	1
1.1 Research Scope, Context and Objectives	1
1.1.1 Research Scope.....	1
1.1.2 Research Context.....	3
1.1.3 Research Objectives	7
1.1.3.1 Article 1	7
1.1.3.2 Article 2	7
1.1.3.3 Article 3	8
1.2 Articles.....	8
1.2.1 Article 1 (Chapter 2)	8
1.2.2. Article 2 (Chapter 3)	10
1.2.3 Article 3 (Chapter 4)	11
1.3 Methodology	12
1.4 Theoretical contributions	15
1.5 Research outputs during the development of this thesis	15
1.6 Structure of the thesis.....	16
CHAPTER 2.....	19
Collaborative Innovation and Absorptive Capacity as An Antecedent of IT Firm Financial Performance	19
Abstract	19
2.1 Introduction.....	20
2.2 Literature Review	21
2.2.1 Impact of Collaborative Innovation on Financial Performance.....	21
2.2.2 Impact of Collaborative Innovation on Financial Performance.....	23
2.2.3 Absorptive Capacity and Financial Performance.....	24
2.2.4 Absorptive Capacity as a mediator between Collaborative Innovation and Financial Performance	25

2.2.5 Intellectual capital as a moderator between collaborative innovation and intellectual capital	26
2.3. Research Methods.....	28
2.3.1 Sample and Data Collection	28
2.3.2 Measures	29
2.4. Results	29
2.4.1. Analytical technique	29
2.4.2. Validity and reliability.....	30
2.4.3. Discriminant Validity by Fornell-Larcker Criterion	32
2.4.4. Assessment of Second Order Construct.....	33
2.4.5. Structural Equation Model	34
2.5 Discussion	36
2.6 Theoretical and Practical Implications	37
2.7 Limitations and Future Directions	38
CHAPTER 3	39
Impact of Absorptive Capacity on Project Success Through Mediating Role of Strategic Agility: Project Complexity as a Moderator	39
Abstract	39
3.1. Introduction.....	39
3.2 Literature Review	41
3.2.1 Underpinning theory	41
3.2.2 PAC and RAC on Project Success	42
3.2.3 Relationship of Potential absorptive capacity and Realized absorptive capacity with Strategic Agility.....	43
3.2.4 Strategic agility as a mediator	44
3.2.5 Project Complexity as a moderator.....	46
3.3 Research Methodology	47
3.4 Measures	49
3.5 Results	50
3.6 Discussion	56
3.7 Theoretical and Practical implications	57
3.8 Limitations and future research	58
CHAPTER 4	59
Collaborative Innovation, Strategic Agility, & Absorptive Capacity Adoption in SMEs: The Moderating Effects of Customer Knowledge Management Capability.....	59

Abstract	59
4.1 Introduction.....	59
4.1.1 IT agility in SMEs.....	63
4.2 Literature Review	64
4.2.1 Theoretical Foundations of the Research	64
4.2.1.1 Contingency theory	64
4.2.1.2 The knowledge-based views	65
4.2.1.3 Collaborative innovation and financial performance.....	66
4.2.1.3 Mediating role of absorptive capacity	68
4.2.1.3 Mediating role of Strategic Agility.....	69
4.2.1.3 Customer knowledge management capability as moderator.....	71
4.3 Research Methods.....	74
4.3.1 Sample and Data Collection	74
4.3.2 SMEs	76
4.3.2.1 Overview of SMEs.....	76
4.3.2.2 SME policy priorities.....	76
4.3.3 Measures	78
4.3.4 Results	78
4.3.4.1 Discriminant Validity by Heterotrait-Monotrait (HTMT).....	81
4.3.4.2 Structural Equation Model	81
4.4 Discussion.....	84
4.5 Contributions to the Literature	86
4.6 Limitation and future directions.....	87
4.7 Limitation and future directions.....	88
CHAPTER 5.....	89
Conclusion	89
5.1. Summary of the main findings	89
5.2. Main contributions.....	92
5.2.1. Theoretical contributions	92
5.2.2. Managerial contributions	93
5.3. Limitations and further research.....	95
Bibliographic References.....	97

List of Figures

Figure 1 -Overview of the articles in this thesis	14
Figure 2 - Structure of the thesis.....	18
Figure 3 - Conceptual Model	27
Figure 4: Measurement Model Analysis.....	32
Figure 5 : PLS-Path Analysis of (n = 5000 bootstrapped samples)	34
Figure 6 – Conceptual Model	47
Figure 7 - Quantitative Research Method.....	48
Figure 8- Measurement Model Analysis	53
Figure 9 - Conceptual Model	73
Figure 10- Portuguese IT SME growth (Source: (European Commission (2019) SBA fact sheet: Portugal	76
Figure 11 Measurement Model Analysis (Source: Author).....	80
Figure 12 PLS-Path Analysis (Source: Author)	82

List of Tables

Table 1 - Theoretical Contributions to this study.....	6
Table 2 - Measurement Model.....	30
Table 3 - Discriminant Validity by Fornell-Larcker Criterion	32
Table 4 - Outer Weights and VIF Values.....	33
Table 5 - Coefficient of Determination.....	34
Table 6 - Structural Equations Model Results	36
Table 7 – Descriptive Statistics.....	49
Table 8 - Measurement Model.....	51
Table 9 - Heterotrait – Monotrait (HTMT) Analysis	53
Table 10 - Determination coefficient in the PLS method	54
Table 11 - Result of Structural Equation Model	55
Table 12 – Descriptive Statistics.....	75
Table 13 -Measurement Model.....	79
Table 14 -Discriminant Validity by HTMT	81
Table 15 - Coefficient of Determination `	81
Table 16 - Structural Equations Model Results	83

CHAPTER 1

Introduction

The current thesis examines how absorptive capacity influences the performance of small and medium sized IT companies operating in Portugal. This is the central issue that drives our study. The topic is investigated through the use of a deductive approach, seeking to understand causal connections between the variables selected. The quantitative technique was used to collect data from programming managers, designers, project supervisors and operation managers working in different Portuguese Small and medium enterprises (SMEs). Multiple definitions of SMEs have been proposed. The European Commission (2005) defines small, medium, and micro enterprises as follows (2005, 2008): Medium: having less than 250 employees and less than 50 million (euro) in annual revenue. Small businesses have less than 50 employees and an annual revenue of less than 10 million euro. Micro: having less than 10 employees and less than 2 million euro in revenue. The thesis is built around three articles that constitute the empirical investigation.

First, this introductory chapter investigates into the scope, context and objectives of the research. After that, a summarized version of each of the articles that make up this thesis is discussed. Following that, we will discuss the methodology, the primary contributions of the study, and a summary of the main results. The framework of the thesis, which we have outlined, brings us to the end of the introduction to the chapter (Figure 1.1).

1.1 Research Scope, Context and Objectives

1.1.1 Research Scope

Absorptive capacity (AC) is the ability to acquire new knowledge through collaborative learning, the incorporation of external sources, and the development of new skills (Ibarra-Cisneros et al., 2021). A key component of dynamic capacities, AC is essential for the growth and survival of innovative businesses (Yoo et al., 2016). Furthermore, it appears that AC presented at the partner level is necessary for organizational arrangements (such as mergers and acquisitions and alliances) to be effective concerning innovation performance (Rehman et al., 2020), particularly in industries that are highly reliant on these arrangements to innovate, such as the information technology (IT) sector (Senivongse et al., 2020). Consequently, despite the fact that this research emphasizes the role of AC in determining organizational outcomes like creativity, financial success (Papazoglou & Spanos, 2021; Marrucci et al., 2022), and a competitive edge, the process by which businesses cultivate AC has been generally overlooked.

Since, the majority of studies point to the importance of AC to determine organizational results such as: knowledge creation and sharing, alliance management systems, network knowledge development and transfer, and the relatedness of firms, Yu et al. (2022) argue that it is necessary to determine which interorganizational antecedents have the greatest impact on AC empirically. Despite the fundamental formulation of AC by Burita, and Yang (2022) suggesting that AC may be impacted on by various interorganizational processes (such as networks), research evaluating the impact of alliances on AC is sparse. It is important to understand the many ways in which coalitions might differ, and scholars should focus on the finer details of how they function. One of these is the level of interaction between partners and customers, which is especially important in alliances that have the aim of developing new technologies or bodies of knowledge (Haider & Kayani, 2020), as it determines the extent to which each of the parties involved will have the opportunity to learn and grow, which is essential for the advancement of AC.

However, the fact that there are few empirical studies that acknowledge the multidimensional nature of the AC construct is a challenge due to operational difficulties; thus, both investments (for example, the intensity of R&D) and structure for technology development (for example, the training and formal education of the R&D team) are used as proxies. The conceptualization of aspects of AC such as, potential absorptive capacity (PAC) and realized absorptive capacity (RAC) by Yeoh (2009) and Leal-Rodríguez et al. (2014), provides a useful framework to create an appropriate empirical methodology. The former is fundamental to the processes involved in learning and retaining information, while the latter is fundamental to the practices involved in creating new insights and making use of existing ones.

Therefore, this research contributes to understanding this problem by studying the impact of some variants of alliance on PAC and RAC, since there is a dearth of studies addressing the heterogeneity of the dimensions of AC and the effects of interorganizational antecedents on it. Based on this circumstance, we hope to have made a contribution to the field by addressing the following research questions in the current study. How do potential and realized absorptive capacity enhance a project's success? And how does strategic agility function as a mediating mechanism and a moderator of project complexity? These are the new contributions of this research on SME project-based IT Companies in Portugal. Is there any relationship between the ability to manage customer knowledge, strategic agility, absorptive capacity, financial performance and collaborative innovation capability?

Furthermore, this research may help the Portuguese IT industry to understand the importance of collaborative innovation in order to achieve financial objectives. It could also help researchers to understand the relationship between collaborative innovation and intellectual capital to attain and maintain absorptive capacity better.

1.1.2 Research Context

The external environment of businesses is rapidly evolving as a result of factors such as the increasing importance of the internet in today's society and the international nature of the economy (Ávila, 2022). Customer requirements are more individualistic and diverse due to the emergence of new competitors and the reduction in the average product's lifespan, both of which enhance the uncertainties and risks faced by IT companies (Cuevas-Vargas, Aguirre, & Parga-Montoya, 2022). In this context, increasing strategic agility, customer knowledge, and collaborative innovation are crucial to stay competitive and adapt to the ever-shifting demands of customers and suppliers (Aditiawarman & Wahyuni, 2022). Information systems that aid company operations should be flexible enough to evolve with the times so that they may continue to meet the varying needs of their customers.

In order to answer the study question, we focused on SME level IT companies operating in different cities of Portugal, since they compete in a scientific and interdisciplinary field., More crucially, for the purpose of this research, they were chosen because they primarily function at the interface of several actors, this is why AC could be a useful tool to boost innovation output. According to Haider et al. (2020), the IT sector is one of the most promising business fields in the world and has significant consequences for the global economy. Millions of research articles are generated annually on the subject and some recent studies are presented in Table 1.

Table 1- Theoretical Contributions to this study

Title	Author	Objectives	Methodology	Variables	Theory
Collaborative innovation capability in IT-enabled inter-firm collaboration	Wang et al. (2017)	The purpose of this paper is to investigate the impacts of digital platforms on collaborative innovation capability (CIC) under the conditions of two distinctive governance mechanisms. Furthermore, the competitive benefits of CIC at different levels of environmental uncertainty are examined to clarify the performance of collaborative innovation.	The research model is proposed based on: dynamic capabilities theory, information technology, (IT)-enabled organizational capability and governance mechanisms., It is validated by using partial least squares with data collected from 200 Chinese firms that engage in digital collaboration with their major distributors.	Environmental uncertainty, Collaborative innovation capability, Digital platforms, Governance mechanisms, IT and innovation, IT-enabled inter-firm collaboration	Dynamic Capabilities Theory
How collaborative innovation networks affect new product performance: Product innovation capability, process innovation capability, and absorptive capacity.	Najafi-Tavani et al. (2018)	The aim of this research is to explore the role of product and process innovation capabilities as two distinct mechanisms through which collaborative innovation networks improve new product performance. The study also examines the contingent effects of absorptive capacity on the relationship between collaborative innovation networks and two innovation capability dimensions (i.e., product and process innovation).	Survey data from 258 respondents from the Iranian high and medium technology manufacturing industries indicate the need for caution when developing collaborative innovation networks.	New product performance, Absorptive capacity, Collaborative innovation networks, Innovation capability,	Resource Based View (RBV), organizational learning theory
Impact of ICT adoption on absorptive capacity and open innovation for greater firm performance.	Cuevas-Vargas et al. (2022)	The purpose of this research is to examine empirically the impact of the adoption of information and communication technology (ICT) on absorptive capacity (ACAP) and open innovation (OI) for a greater business performance and determine whether ACAP has a mediating role in the relation between ICT adoption and OI.	A quantitative approach and cross-sectional design through the Structural Equation Modelling was applied. A simple random sampling technique and a self-administered questionnaire was used to gather data from 145 small companies in Bogota, Colombia.	ICT adoption Absorptive capacity, Open innovation, Company performance, Mediating effect, PLS-SEM	Economic theory
Knowledge management practices and absorptive capacity in small and medium-sized enterprises: is there really a linkage?	Valentim et al. (2016)	Small and medium-sized enterprises (SMEs) are more vulnerable to globalization and rapid technological change due to their scarcity of resources. SMEs' absorptive capacity allows them to access knowledge and plays a key role in their ability to explore and exploit opportunities in their environment. Therefore, the aim of this study is to identify and categorize knowledge management practices that SMEs can adopt to develop absorptive capacity.	From a population of 4,534 Portuguese SMEs, 260 usable completed questionnaires were returned. We concluded that Portuguese SMEs are engaged in knowledge management practices, through collaboration with business partners. These favor learning processes based on experience, knowledge transfer to employees and knowledge absorption by employees, reflecting the importance given by SMEs to the tacit nature of knowledge which helps them to improve efficiency, adapt strategies, and launch new products and services.	Knowledge management practices, Absorptive capacity, Portuguese SMEs.	

Potential absorptive capacity, realized absorptive capacity and innovation performance.	Yaseen, (2019)	The aim of this research is to investigate the relationship between potential absorptive capacity, realized absorptive capacity, and innovation performance. Drawing on the knowledge-based theory, the study conceptualizes absorptive capacity as two distinct and separate dynamic capabilities of knowledge: potential absorptive capacity and realized absorptive capacity. The research addresses potential ACAP and realized ACAP separately and analyzes their influence on a company's innovation performance.	Using structural equation modeling (SEM) in a sample of 12 firms from the Jordanian pharmaceutical industry, the research revealed that potential and realized absorptive capacities have significant and direct relations with a company's innovation performance.	Potential absorptive capacity, realized absorptive capacity, innovation performance	Knowledge-based theory
Absorptive capacity and firm performance: The mediating role of strategic agility.	Kale et al. (2019)	The purpose of the study is to examine the mediating role of strategic agility concerning the effects of absorptive capacity on the performance of accommodation establishments in Turkey.	A survey was used to collect data. Questionnaires were sent out and 190 viable ones were returned via e-mail. From the exploratory factor analyses, absorptive capacity was determined to have two dimensions (acquisition and use).	Absorptive capacity, Company performance, Strategic agility	
Strategic renewal of SMEs: the impact of social capital, strategic agility and absorptive capacity	Khan et al. (2020)	This research was carried out with the purpose of empirically testing the model to explain the procedures concerned with the translation of social capital (SC) into strategic renewal (SR) of SMEs in developing economies like Pakistan. This procedure involves the mediating role of a company's strategic agility (SA) as well as the contingent effects of its absorptive capacity (AC).	This study employed a cross-sectional design to evaluate the model hypothesized. To validate the moderated mediation model, data was collected from 519 CEOs, owners, finance managers and managing directors of 123 manufacturing units dealing in: agricultural machinery (32 units), automobile accessories (16 units), pharmaceutical instruments (11 units), electrical equipment (25 units), IT related accessories (21 units) and garments (18 units).	Social capital, Strategic agility, Absorptive capacity, Strategic renewal	Institutional theory, dynamic capability theory
Project complexity and team-level absorptive capacity as drivers of project management performance.	Bjorvatn et al. (2018)	Many believe that project complexity reduces project management performance. However, research has failed to establish this causal relationship conclusively so far. We extend research on project complexity by introducing the concept of team-level absorptive capacity and by studying its role as a mediator between project complexity and project management success.	Applying structural equation modeling to a sample of 285 respondents, we find an unequivocal, direct and positive statistical association between project complexity and delays and overspending.	Project management success, Project management performance, Project complexity, Absorptive capacity,	Project management theory
Customer knowledge management in SMEs: Review and research agenda.	Grandinetti, (2016)	Studies on knowledge management have generated awareness that it is fundamentally important for SMEs to be able to exploit sources of knowledge outside the company by means of external relationships. However, this understanding has not been followed up by an adequate theoretical and empirical research effort to analyze the role of relationships in knowledge management processes of SMEs.	The present contribution first outlines this gap on the grounds of the literature reviews available. It then proposes a framework – focusing on the concept of absorptive capacity – with a view to filling this theoretical gap. Finally, based on the framework proposed, two specific topics of considerable importance to SMEs are discussed: (i) how capabilities are developed in the start-up phase of a	SMEs; absorptive capacity; relationships; tacit knowledge; knowledge codification; new ventures; geographical clusters; inter-firm cooperation	

			new venture; and (ii) knowledge processes in geographical clusters.		
The impact of customer knowledge management capability on project performance-mediating role of strategic agility.	Haider et al. (2020)	The purpose of this study is to examine the relationship between customer knowledge management capability (CKMC) on project performance through strategic agility in the context of project-based software companies in Pakistan. The aim of the paper is to find out whether and how customer knowledge is beneficial for project performance and recognized as an important source of advancement of the knowledge management (KM) theory.	In this study, a non-probability, simple random sampling method was used to collect the data because it excludes bias from the data collection process. The population of this research includes 307 employees working in 30 different public and private project-based software companies, operating in the twin cities of Rawalpindi and Islamabad. The respondents are project supervisors, team members and customers working on these different projects. Because of time limitations the data was collected over four months (i.e., November 2018 to February 2019) for this study. It is not a time-lagged study and the data were collected at one time, so the design is cross-sectional in nature. The analysis was established using partial least squares-structural equation modeling (Smart PLS-SEM v.3.2.8) software to test hypotheses."	Customer knowledge management capability, Strategic agility, Project performance, Partial least square (PLS	Knowledge management theory

Table 1 - Theoretical Contributions to this study

1.1.3 Research Objectives

The research goals include the rationale for studying specific correlations. We have drawn up the following aims in our research based on the typology of the study's objectives.

1.1.3.1 Article 1

1. To examine the relationship between collaborative innovation and a company's financial performance.
2. To examine the relationship between the collaborative innovation and absorptive capacity.
3. To examine the relationship between the absorptive capacity and a company's financial performance.
4. To examine the mediating effect of absorptive capacity on the relationship between collaborative innovation and a company's financial performance.
5. To examine the moderating effect of intellectual capital on the relationship between collaborative innovation and absorptive capacity.

1.1.3.2 Article 2

1. To examine the relationship between the potential absorptive capacity and a project's success.
2. To examine the relationship between the realized absorptive capacity and a project's success.
3. To examine the relationship between the potential absorptive capacity and strategic agility.
4. To examine the relationship between the realized absorptive capacity and strategic agility.
5. To examine the relationship between the realized strategic agility and a project's success.
6. To examine the mediating effect of strategic agility on the relationship between potential absorptive capacity and a project's success.
7. To examine the mediating effect of strategic agility on the relationship between the realized absorptive capacity and a project's success.
8. To examine the moderating effect of project complexity on the relationship between potential absorptive capacity and strategic agility.
9. To examine the moderating effect of project complexity on the relationship between realized absorptive capacity and strategic agility.

1.1.3.3 Article 3

1. To examine the relationship between the collaborative innovation and a company's financial performance.
2. To examine the relationship between the collaborative innovation and absorptive capacity.
3. To examine the relationship between the absorptive capacity and a company's financial performance.
4. To examine the mediating effect of absorptive capacity on the relationship between collaborative innovation and a company's financial performance.
5. To examine the relationship between the collaborative innovation and strategic agility.
6. To examine the relationship between the strategic agility and a company's financial performance.
7. To examine the mediating effect of strategic agility on the relationship between collaborative innovation and a company's financial performance.
8. To examine the moderating effect of customer knowledge management capability on the relationship between collaborative innovation and absorptive capacity.
9. To examine the moderating effect of customer knowledge management capability on the relationship between collaborative innovation and strategic agility.

1.2 Articles

This thesis comprises 3 articles and based on three main research questions: How does collaborative innovation enhance the financial performance of small to medium IT enterprises operating in Portugal? How Potential and Realized absorptive capacity enhance project success, and strategic agility as a mediated mechanism and moderator project complexity are the new contributions for SMEs research in project-based IT Companies in Portugal? Is there any relationship between Customer knowledge management capability, strategic agility, absorptive capacity, financial performance and collaborative innovation capability? A brief description of each article now follows.

1.2.1 Article 1 (Chapter 2)

Article 1: Collaborative innovation and absorptive capacity as an antecedent for an IT company's financial performance.

The purpose of this research was to analyse the moderating effect of intellectual capital and the mediating role of absorptive capacity on the relationship between collaborative innovation and financial success in the IT industry. The rapid expansion in the IT industry at the SME level in Portugal was seen after the COVID-19 outbreak and is the focus of this study's empirical investigation. Due to the COVID-19 pandemic, significant development was seen in the IT industry at the SME level, as determined by an empirical investigation concerning a population of Portuguese IT-based SMEs. By providing additional empirical evidence in the domain of resource-based theory, in which collaborative innovation has been hypothesized as a resource to better understand the relationship between intellectual capital and attainment and maintenance of absorptive capacity, the present study provided a theoretical implication.

This investigation employs a deductive methodology in an effort to comprehend the causal relationships between the variables chosen. Evaluating absorptive capacity as a mediator between collaborative innovation and financial performance generates a number of hypotheses. These measure the role of intellectual capital as a second-order moderating variable based on three dimensions: human capital, organizational capital, and social capital. On a 5-point Likert scale, each item was evaluated. This research is comprised by a closed-ended questionnaire from several sources used to analyse four variables.

Using Smart PLS tools v.3.0, a structural equation modelling (SEM) analysis was conducted (Hair et al., 2019). SEM is a multidisciplinary method often used to investigate interactions between structures (Mai et al., 2021). It permits the simultaneous examination of several variables inside an integrated model (Hair et al., 2016). Due to the small sample size and non-parametric character of the data, PLS was chosen over other methods. By using PLS-SEM, a relatively small sample size may be estimated. This technique is equally effective for the analysis of non-distributed data (Hair et al., 2017).

All dimensions of IC have a direct impact on absorptive capacity, and a company's ability to learn external knowledge will increase the IC output effect. However, there is a lack of understanding concerning this interconnectedness. This research helps to understand the contribution of AC to a company's performance. The study's results clarify the challenges that SMEs have while attempting to manage intangible assets in the context of the globalization of innovation and the information economy (Mata et al., 2021). Furthermore, it could enhance the evaluation of the financial performance of Portuguese IT company management (Martins et al., 2018). This research contributes to business strategy by highlighting the need for a unified, well-communicated team effort in complicated situations, as well as the need for a transparent, collaborative approach to decision-making that allows individual members to take control when needed.

1.2.2. Article 2 (Chapter 3)

Chapter 3 of the thesis is Essay 2 and is titled: The impact of absorptive capacity on project success through the mediating role of strategic agility: project complexity as a moderator.

Under the complexity of a dynamic, rapidly changing environment, small- to medium-sized information technology (IT) enterprises must rely on external sources in order to survive (Tallon et al., 2018; Haider et al., 2020). The literature has previously underlined the importance of acquiring and managing knowledge. Overall company performance may be enhanced and competitive advantages can be generated. Liu et al. (2017) and Khan et al. (2020) explored absorptive capacity (AC) to a degree, acknowledging that a company needs new external information in order to comprehend it and effectively use it to fulfil organizational objectives.

The aim of this research is to fill this gap by concentrating on the absorptive capacity of Portuguese SMEs and develop a model to determine its possible determinants. We utilize the current literature as a foundation to improve our understanding of this idea and its impact on the performance of SMEs in relation to SA. Furthermore, market dynamics have been seen as a crucial driver of corporate innovation and growth, since quick technological developments influence the competitive business environment (Xue & Swan, 2020). Because of this environment, businesses are under great pressure to adapt and perform increasingly complicated initiatives in order to compete with challenging market competitors while improving and maintaining their market share.

Thus, the goal of this study is to investigate how potential and realized absorptive capacity improve project success, and strategic agility as a mediated mechanism and moderator of project complexity are both new contributions to research on project-based small and medium sized IT companies in Portugal.

Data were collected from 285 respondents working in the IT sector of small-medium sized Portuguese companies using simple random selection. Because of the Covid-19 pandemic, data were gathered from and distributed through a variety of Internet platforms (Gmail, LinkedIn, Twitter, and Facebook). For the analysis, Smart PLS-SEM, version 3.2.8 was utilized. The findings show that the two absorptive capacity sub-dimensions, prospective and realized absorptive capacity, influence project performance not only directly but also indirectly through the mediator of strategic agility. Although project complexity has a positive and substantial moderating impact on the relationship between potential absorptive capacity and strategic agility, it has no influence on the relationship between realized absorptive capacity and strategic agility.

According to the findings of this research, proactive companies scan their environment quicker and can identify more market opportunities than other organizations. Companies are increasingly open to gaining information from external environments as a means of growth (customers, competitors, markets, etc.). Transforming this information effectively results in new services and products, promoting innovation and increasing project success rates. These results support the view that organizations should create a proactive, risk-taking, innovation-driven, and enterprise-driven atmosphere to increase the likelihood of successful initiatives. Strategic agility may provide additional information to assist companies in strategically reforming and renewing themselves. As a result, enterprises should see AC as a source of information. Companies must consider both absorptive capacity and strategic agility while defending and expanding current market shares for a variety of reasons, including the intense rivalry among companies and shifting consumer and stakeholder expectations. As a result, they should be able to recognize external knowledge, integrate its relevance into their operations and, finally, apply that information to their goods or services. All of these factors will lead to enhanced project success rates.

1.2.3 Article 3 (Chapter 4)

The last article of the thesis occurs in chapter 4. Article 3 is titled Collaborative innovation, strategic agility, & absorptive capacity adoption in SMEs: the moderating effects of customer knowledge management capability.

The aim of this research is to know how IT professionals in Portugal perceive the concept of strategic agility. Numerous strategies, including maximizing market share, profits, and customer outcomes such as satisfaction, have been presented as methods for achieving this goal (Kale et al., 2019). In reality, an IT company's financial success is sensitive to being influenced by a number of external variables, including absorptive capacity (AC), customer knowledge management capability (CKMC), and strategic agility (SA). Strategic agility refers to the essential characteristics that companies have in order to adapt to dynamic business environments (Haider & Kayani, 2020); these capabilities allow an organization to recognize, adapt, and respond to such conditions.

This research investigates the link between collaborative innovation and a company's financial performance through the mediating role of strategic agility, absorptive capacity, and the moderating role of CKMC in the context of Portugal's small and medium sized IT enterprises. Three hundred respondents working in various small and medium-sized IT companies across several cities in Portugal provided the data. Data were gathered by a simple random sampling technique, and hypotheses were evaluated using Smart partial least squares-structural equation modelling (Smart PLS-SEM version 3.2.8).

The results of the structural equation modelling showed that collaborative innovation made it much easier to understand what customers need and want. This, in turn, reduced project delays, managed to keep costs from going over budget, and made the business more profitable. Also, strategic agility as a mediator has a positive and statistically significant effect on financial performance, both directly and indirectly. The research also found that a company's AC has a strong relationship with its FP, with the results showing that when AC is higher, strategic capabilities related to innovation will grow and the company will have a long-term competitive advantage. Although CKMC has a positive and statistically significant influence on the relationship between collaborative innovation and strategic agility, it only has an insignificant effect on the relationship between collaborative innovation and absorptive capacity.

1.3 Methodology

Our selection of methods is detailed below (Figure 1). According to the Organization for the 2020 Economic Co-operation and Development (OECD) report, there is substantial development in small and medium sized IT enterprises in Portugal as a result of the COVID-19 pandemic. This analysis is based on an empirical sample of Portuguese SMEs (Lamichhane et al., 2021). SMEs in the IT sector have a large employment potential. They are the primary contributors to economic growth and a significant source of revenue generation for developed countries. Therefore, economies have focused on the progressive importance of SME's concerning economic prosperity (Müller et al., 2021; Nyamrunda et al., 2021). Similarly, the IT industry's contribution to Portugal's GDP is substantial (Sousa et al., 2020). Consequentially, the continued growth of this industry has a significant effect on several economic indices.

We selected small and medium-sized enterprises as the unit of analysis for this research because of the significance of this industry. For all three studies, a simple random sampling approach was utilized to collect data from both public and commercial project-based software companies operating in several Portuguese cities between November 2020 and February 2021 (for articles 1 and 3) and February 2022 and May 2022 (for article 2). Initially, the information on IT-sector SMEs in Portugal was extracted from the PORDATA database. The SMEs in the IT industry of industrialized nations are more susceptible to fierce competition and environmental change. They acknowledge and value the significance of knowledge resources and continuous renewal (Galina et al., 2016; Silva et al., 2021).

Due to the Covid-19 pandemic, self-administered questionnaires (created using Google Docs) were disseminated through many Internet platforms (Gmail, Linked In, Twitter, and Facebook) and used to collect the data. This enabled the largest feasible number of individuals to participate in the survey. Project managers, shift supervisors, and team members from both public and commercial IT businesses replied.

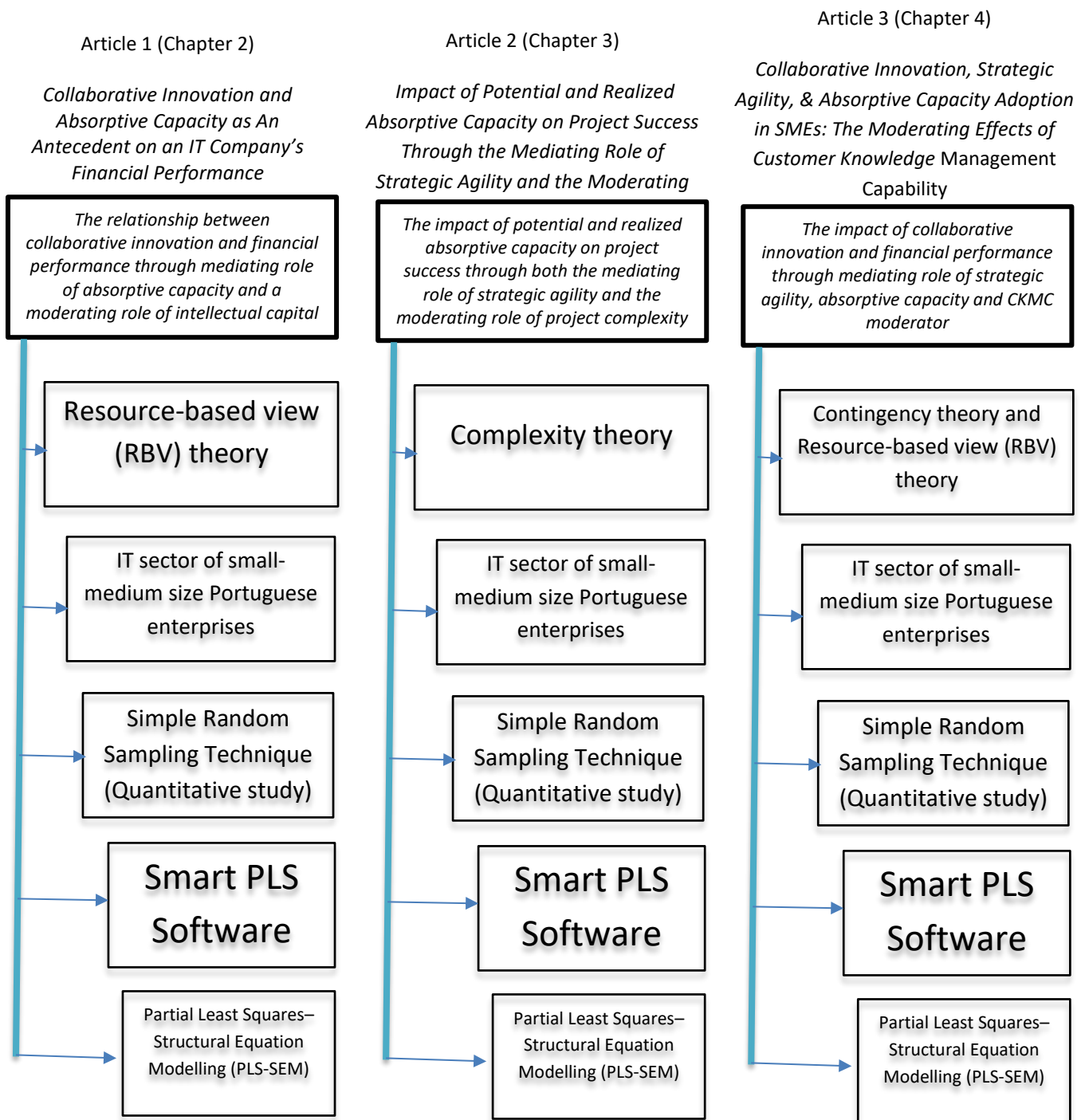


Figure 1 -Overview of the articles in this thesis

1.4 Theoretical contributions

Moreover, the IT sector relies heavily on scientific research skills due to the complexity and structure of the knowledge base inside the sector. According to Mansell and Wehn (1998), a company developer's knowledge and experience is an invaluable intangible asset that has been built up through time. The AC "cycle" cannot be completed without a company's research capacity and the developer's team skills in order to generate new information and apply it in the form of innovation and market attention (Senivongse et al., 2020). The qualifications of the company's project managers and supervisors are very important in making strategic decisions. Therefore, in a technologically unpredictable world, it is essential to identify the capabilities in which the business invests to maximize the future productivity of the research process. Training the company's personnel is crucial in multinationals for the transition of external information into innovation.

Human resource expertise might be put to use in the study of SMEs in the development of strategic agility capability, a topic that is both timely and important. New empirical research has been conducted to better understand the connection between AC and upper management, with studies like Kale et al (2019), looking at the role of managerial learning-supportive behaviors and employee learning in establishing this connection. According to the findings of Jansen et al. (2005), RAC may be increased by hiring more qualified workers.

In addition, Khan et al. (2020) notes that a company's history of knowledge seeking in its industry is determinant in its AC's evolution. Since this information concerning "strategic agility" and "customer knowledge management capability" is internalized as a "collaborative innovation and intellectual capital" it influences the growth of future acquisition capabilities and may be critical to maximize a company's competitive advantages. Another point made by Lin, Tan, and Chang (2002) is that future research on the causes of AC should explicitly specify factors at the individual level.

1.5 Research outputs during the development of this thesis

Several articles were written and submitted to academic journals. Because of the helpful comments we got, we were able to make significant improvements. Additionally, two articles making part of the thesis have been recognized on a global scale. The following is a list of the articles completed:

- Submission to Journal of the Knowledge Economy publisher Springer Verlag (ABDC 'C', Impact factor 2.235)

- Collaborative Innovation and Absorptive Capacity as Antecedent on IT Firm Financial Performance
 - Progress: Passed by editor and reviewer, revision is submitted.
- Submission to journal of innovation and knowledge publisher Elsevier (Scopus Q1, Impact factor 11.219)
 - Impact of Absorptive Capacity on Project Success Through Mediating Role of Strategic Agility: Project Complexity as Moderator.
 - Progress: Passed by editor and reviewer, revision is submitted.
- Submission to Journal of Knowledge Management publisher Emerald (Scopus Q1, Impact factor 8.6)
 - Collaborative Innovation, Strategic Agility, & Absorptive Capacity Adoption in SMEs: The Moderating Effects of Customer Knowledge Management Capability.
 - Progress: Passed by editor and got revision.

1.6 Structure of the thesis

Based on Figure 2, this thesis may be divided into five sections. The topic of this dissertation has been presented, and its scope, context, and primary goals were described in this first chapter. Next, we introduced the three articles that make up this line of argumentation and gave a brief summary of each. We then provided a brief review of the major findings and a recap of the methods we used. In the last section of this chapter, we present the findings of our study and detail the overall organization of this thesis.

Article 1 is presented in Chapter 2; this section focuses on the importance of collaborative innovation in order to achieve the financial objectives of small and medium Portuguese IT enterprises. It will also help researchers to better understand the relationship between collaborative innovation and intellectual capital concerning attaining and maintaining absorptive capacity.

Article 2 is included in Chapter 3, the aim of this section is to examine how potential and realized absorptive capacity enhance project success, and strategic agility as a mediated mechanism and moderator project complexity are the new contributions for SMEs research in project-based IT Company's in Portugal.

Article 3 is presented in Chapter 4, this section examines the relationship between collaborative innovation and a company's financial performance through the mediating role of strategic agility, absorptive capacity and the moderating role of CKMC in the context of portuguese small and medium sized IT companies.

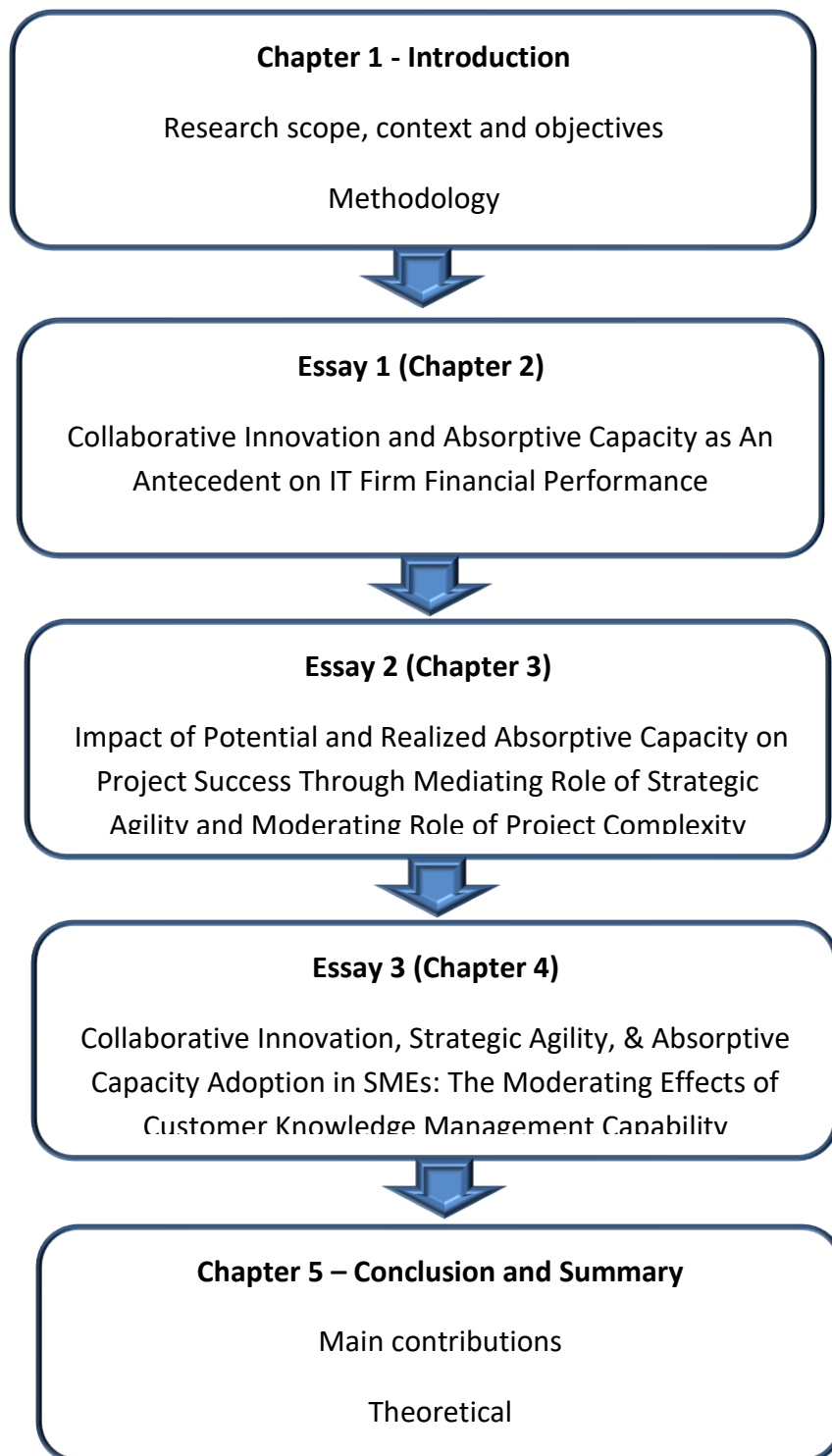


Figure 2 - Structure of the thesis

Chapter 5 concludes with a summary of the study's key results and a demonstration of how those findings contribute to its stated goals. This chapter concludes with a review of the study's scholarly contributions, limitations, and suggestions for future research.

CHAPTER 2

Collaborative Innovation and Absorptive Capacity as An Antecedent of IT Firm Financial Performance

Abstract

Lack of collaborative innovation and absorptive capacity in firms causes the failure of projects. Managers/employees in small and medium enterprises (SMEs) are not aware of practices of intellectual capital and they also don't collect, share, transfer, and utilize knowledge properly. Therefore, the current study focuses on the relationship between collaborative innovation and financial performance of Portuguese IT sector SMEs, with a mediating role of absorptive capacity and a moderating role of intellectual capital based on three sub-domains (human capital, organizational capital, and social capital). Close ended questionnaires were used to get data from 308 employees and managers due to COVID-19 pandemic data also collected through an online survey method. The simple random sampling technique was used to collect data and analyze it using the PLS- SEM method. The results show that collaborative innovation has a positive and significant impact on the financial performance of IT firms in Portugal. The absorptive capacity is considered a potential mediator between collaborative innovation and financial performance. Moreover, the moderator's intellectual capital strengthens the relationship between collaborative innovation and absorptive capacity.

Keywords: Collaborative Innovation; Financial Performance; Absorptive Capacity; Intellectual Capital.

2.1 Introduction

As innovation turns out to be unpredictable to such an extent that it can't be overseen by a single organization (Lo et al., 2020; Mahmood et al., 2020). Collaborative innovation (CI) is a trans-disciplinary approach for increasing the entirety cooperation to progress the effectiveness of an association from side to side rounded, reasonable and consistent relations between revolution contributors in a definite atmosphere (Stojčić, 2020). Information technology (IT) firms especially small and medium enterprises (SMEs) are turning to new ways to open up to overcome their skills shortages (Benhayoun et al., 2020a; Thomas et al., 2021). In fact, while SMEs contribute to the promotion of innovation due to their inventiveness, ingenuity and market approach (Kraus et al., 2020), they consolidate external resources to keep it competitive, as they help maintain high levels of internal performance within a limited number of technology fields (Kafouros et al., 2020). To acquire valuable innovation skills, SMEs rely heavily on collaborative strategies (Nabeel-Rehman & Nazri, 2019). In this regard, they are developing new CI involving various actors, working together in a state of mutual trust and strong exchanges to achieve the goal of mutual benefit (Hong et al., 2019).

The resource-based view (RBV) theory advises that immaterial assets like intelligent essential are the foremost motivating services after organizational competitive advantage (Lichtenthaler, 2016). According to Barney (1996), RBT treats initiatives as latent inventors of value-added competences. Empathetic the improvement and immersion of such aptitudes, and the primary administrative abilities, contains inspecting the properties and properties of the well-founded from a scholarly capital perception (Cheah, & Yuen-Ping, 2021). Considerable exploration has been completed on the appliances, reproductions and tactics for CI and the petition for refining the presentation of CI and importance of CI for financial performance (FP) (Benhayoun et al., 2020b; Feranita et al., 2021). Around is, nevertheless, a deficiency of a methodical study of such a gentle buttressed by experimental educations from the standpoint of absorptive capacity (Feranita et al., 2017). The idea of absorptive capacity (AC) of project supervisor has advanced and extended from a static view, which centers on earlier learning, to a progressively powerful, process-based point of view, which underlines aggregate capacity (Ávila, 2021). Project based IT organization ordinarily need to create absorptive capacity to keep up their productive execution in the global market (Bolívar-Ramos et al., 2013). They are compelled to team up with different firms, networks and, specifically, colleges to separate their item contributions from those of universal contenders with lower production. Firms enriched with more noteworthy absorptive capacity of undertaking administrator relied upon to beat rivals.

Surprisingly, Intellectual capital is one of the widespread strategies for refining the performance of collaborative innovation in management in order to accomplish financial performance (Hernandez-Espallardo et al., 2018). The progression of developing innovations depends on intellectual capital and how it is designed, shared, and immersed in information technology production. There is a widespread gratitude that the controlling of intellectual capital is a crucial section of consecutively any type of business (Chernenko et al., 2021; Weqar et al., 2021). An improved adopted of the methods in which organizations accept and contrivance innovation in technologies, like IT, is compulsory for the reason that previous exploration in the area is partial and a significant percentage is out of date due to the hurriedly altering finances of using IT, and the subsequent increased assumption by many initiatives. Furthermore, this research may help IT industry of Portugal to understand the importance of collaborative innovation in order to achieve financial objectives. It will also help the researchers to better understand the relationship of collaborative innovation and intellectual property to attain and maintain absorptive capacity.

2.2 Literature Review

2.2.1 Impact of Collaborative Innovation on Financial Performance

Collaborative innovation mentions to charitable contracts between separate businesses, which include communication and sharing of assets such as the primary, information, knowledge, and technology in order to achieve a common goal of modernization (Stojčić, 2020; Cheng et al., 2022). According to Thomas et al. (2021), the perceive like inter-firm affiliations as momentary contracts with a quantified time structure, on the foundation of interchange and partaking, connecting only fractional internalization as the possessions are static possessed by the relevant owner. Therefore, literature on collaborative innovation is huge, incorporating an extensive choice of theories from dissimilar institutes of thought, and dispersal through several types of productions and nations (Agger & Lund, 2017). There may be internal or external collaborative innovation, however, we bound our assessment opportunity to alliances identified as collaborative association with outward association in relation to revolution in IT industry.

The dissimilar angles of collaborative innovation are tactical collaborative innovation, transformational collaborative innovation, and collaborative relationships (Southern, 2005). Tactical collaborative innovation denotes to companies' pursuit of superior act via instantaneous opportunity-seeking and advantage-seeking doings (Ind et al., 2017). Both small and large companies face impediments while chasing tactical collaborative innovation. While small firms' opportunity-seeking expertise may be solid, their restricted knowledge shares and shortage of market power inhibit their capability to enact the competitive benefits essential to suitable value from chances the companies choose to pursue (Thomas et al., 2021). In contrast, large firms are trained at founding competitive advantages, but their heavy emphasis on the proficiency of their standing businesses often destabilizes their capability to constantly explore for additional chances (Kraus, Breier & Dasí-Rodríguez, 2020). Collaboration that methods organizational volume, moves persons to take part, and pushes the segment forward, by contrast, contains right co-creation and uses the exceptional strengths of each companion as building blocks (Kafouros et al., 2020). This type of collaboration has the latent to be transformational on both a distinct and an organizational level (De Jong & Freel, 2010). Furthermore, collaborative affiliations can establish information for revolution; we aware a bit about these prolific affiliations how developed. Thus, we inspect the technical and societal subtleties of pioneering association upgrading and the special effects on assimilated information and solicitation (Anderson & Hardwick, 2017). Based on a variety of concepts, including network and resource-based innovation, it is argued that collaborative innovation may certify IT enterprises in their respective challenges.

Typically, the financial performance of IT firms has been dignified using a combination of financial ratios analysis, benchmarking, calculating recital against financial plan or a mixture of these policies (Rosita et al., 2020). A firm's competitiveness can be sustained by means of operational performance measurement, as a consequence corporation have to identify the reasons that inspiration their act and accomplish them in an effective way (Mondal & Ghosh, 2012). An analysis of the academic literature displays that well-founded performance has conventionally been the reliant adjustable of experimental studies, and there is a prosperity of confirmation in signifying an optimistic association with modernization (Un et al., 2010). A reasonable version for the influence of information on attractiveness is recommended in the RBV theory of the firm (Kamboj et al., 2015). The classical approach of RBV theory contends that a stable can build competitive benefits founded on appreciated, rare, incomparable, and non-substitutable resources (Barney, 1991). Earlier studies have established a durable affiliation between innovation and performance (e.g. (Perez-Luno et al., 2014; Petrakis et al., 2015; Thomas et al., 2021). Therefore, we propose our first hypothesis.

H1: Collaborative innovation is positively associated with financial performance.

2.2.2 Impact of Collaborative Innovation on Financial Performance

The IT sector negotiates the product-service field, and is occupied by administrations that convey nonspecific and modified software, technology structure, technical sustenance and consultancy. These administrations are significant for co-designing products and facilities for outside clients and scheming new organisms for active use by inner clients (Hong et al., 2019). An IT organization is capable to structure and manage its innovation process using an intellectual capability and absorptive capacity. Collaborative innovation is conventional on shared trust, frankness, danger and advantage involvement (Najafi-Tavani et al., 2018). Administrations launch long tenure and close collaboration affiliations with contractors and clients. Each association shares statistics with other administrations in its source chain to enhance source allocation and reduce overall source series expenses, accordingly gaining modest benefits (Santoro et al., 2020). Market variation, value conflicts and condensed product lifecycles have led extra administrations to struggle to accept collaborative innovation. Therefore, absorptive capacity is an organization's ability to identify the value of new information, integrate it, and apply it to profitable ends (D'Angelo et al., 2020). It influenced by greatly on prior related information and variety of the background in administrations.

Absorptive capacity is accumulative, sense that it is calmer for an association to capitalize on a continuous basis in its absorptive capability than investing promptly (Apa et al., 2020). Kostopoulos et al. (2011) suggested that absorptive capacity is a set of managerial routines and methods, by which administrations obtain, integrate, transform and exploit information to create a vibrant structural capability. Mahmood et al. (2020) states that the absorptive capacity is a significant source for the association performance. The concept of potential absorptive capacity is planned in which the attention is more on knowledgeable capability and assimilation capability. It can be distributed into demand-pulling capability and technology-driving capability (Murovec & Prodan, 2009). There are several precarious aspects that affect absorption capacity of administrations containing inner exploration and progress, personnel activity, innovative collaboration and initiative approach (Miroshnychenko et al., 2020). Collaborative innovation can not only speed up the flow of information and understanding between administrations, but also improve administrations' information accumulation and form actual learning and communication appliances, thus encouraging organizational absorptive capacity (Manik & Lukito-Budi, 2020). In organizations there is a well-recognized connection between collaborative innovation and absorptive capacity.

H2: Collaborative innovation is positively associated with absorptive capacity.

2.2.3 Absorptive Capacity and Financial Performance

An organization's absorptive capacity is described as its ability to perceive, integrate, acquire, transform, and exploit new knowledge (De Jong & Freel, 2010). This definition emphasizes the diversity of individuals in the workplace regarding their ability to comprehend new knowledge, change its meaning, integrate it into the organization, and eventually allocate it for use and application (Zhang et al., 2021). Individual integration occurs due to analyzing and using project information (Flatten et al., 2011; Papazoglou & Spanos, 2021). In the current period of development, there has been a noticeable movement in organizations in which the competencies of individuals in workgroups are seen as one of the most critical factors for increasing creativity, learning lessons, and financial performance (Manik et al., 2020). Individuals that are diverse in their knowledge backgrounds are more likely to integrate and absorb from one another, resulting in enhanced creativity, innovation, and, as a result, financial performance (Haider & Kayani, 2020; Miroshnychenko et al., 2020). Thus, we hypothesize that after a fact, increases in absorptive capacity will be counterproductive to additions in firm financial recital. The above literature leads to hypothesize that:

H3: Absorptive capacity is positively associated with financial performance.

2.2.4 Absorptive Capacity as a mediator between Collaborative Innovation and Financial Performance

The high level of collaborative innovation has increased the frequency of direct communication between the company's leading players and its external players (Hong et al., 2019). As a result, organizations that collaborate with external parties are better positioned to innovate because they have more access to the resources needed to develop new goods and processes. While coordinated effort with market actors can assume a vital part in firms' advancement abilities. Therefore, absorptive capacity has been regarded as crucial to maintaining a competitive environment (Chaudhary & Batra 2018). When an organization's knowledge-based assets are redefined and skillfully structured, an organization can handle changes in a convenient and sensitive manner. Through its capabilities, it will boost its growth, align the change with activity and other domains and thus enhance its innovation and financial performance (Murovec et al., 2009; Papazoglou et al. 2021). Based on the competitive view of potential, companies with high absorptive capacity are likely either from rivals, consumers, channel partners, and suppliers to gain new expertise externally. Such know-how is used in businesses to recognize business opportunities such as consumers push, technological advancement, an unpredictable world, and the trending to changing the market places (Benhayoun et al., 2020b), all of which would increase the level of profit and market share significantly (D'Angelo et al., 2020). In addition to commercially relevant practical applications, absorptive capacity can incorporate new external expertise, create beneficial prospects, and improve productivity (Cheah et al., 2021). As regards quality and value, absorptive capacity provides a margin for growing business overall growth. The fourth hypothesis is therefore formulated as follows:

H4: Absorptive capacity as a mediator between collaborative Innovation and financial performance.

2.2.5 Intellectual capital as a moderator between collaborative innovation and intellectual capital

Intellectual capital is a collection of immaterial resources used in organizations to generate added value (Khalique et al., 2015). IC consists of three sub-dimensions: human capital, organizational capital, and social capital (Bontis et al., 2015; Baima et al., 2020). The highest and most valuable intangible resource of the business is human capital. It contains knowledge, experience, talents, and skills shared within the organization. Human capital (HC) includes the expertise, preparation, knowledge, and expertise of its members (Denizci & Tasci, 2010; Chernenko et al., 2021). Financial performance is a method to grow intellectual capital that has been tailored to meet the organizations' needs to produce intellectual capital (Kianto et al., 2017). Selected workers increase human resources efficiency by ensuring that professional and experienced applicants are recruited (Gürlek & Uygur, 2019). Similar incentive programs are also powerful resources to maintain the enterprise and recruit skilled human capital. Furthermore, Social capital (SC) means social norms, beliefs, principles, ties, friends, trusts, responsibilities, flows for knowledge, social norms, mutual benefit commitments, collective acts, and social and economic development contributions (Xu & Liu, 2021). SC is called networks of connections between people who live and work in a community to make them more successful (Gupta & Raman, 2021). The SC definition was initially known in community studies and was used to describe one person's connection to the other in the community (Chang et al., 2006).

Considering the characteristics of small and medium-sized enterprises (Berends et al., 2014), it should be added that their material assets and finances are small, which means that their competitive advantage will be derived mainly from intangibles (Silva, & Moreira, 2021). Also, small business owners do not have access to a large number of important market studies and data or do not have a proper control system in place (Kraus, Mahto & Walsh, 2021). This makes it very important for an organization's finances to reach the right performance level that focuses on how organizations are structured, the processes that they use, and the systems they use. Lastly, organizational capital (OC) incorporates activities that impact company performance and is related to priorities and strategic planning, preparation, job descriptions, coordination, and decision-making communication for employees (Dženopoljac et al., 2016; Haider et al., 2022). This definition is clear but strategically distinct, according to Martín-de-Castro et al. (2006), as workers own the human capital, these organizations, including organizational culture, technical processes, and formal structures, own and maintain organizational capital, all of which help organizations absorb and refine understanding.

Resource-based view theory adds to its external trade situation (what advertise requests and what contenders offer) a firm inner potential. The capacity to clarify and call intangible or moderate materials frequently, Amit and Schoemaker (1993) has proven more resilient. The internal capacity essentially refers to the ability of the organization to prepare capital. The main asset which sees such benchmarks is the "learning" of whether they are referred to as unrecognizable resources, absorbent skills, central skills, essential resources, incorporeal resources, structure memory, or similar alternative ideas. The study found a positive correlation between Collaborative Innovation and the company's Absorptive Capacity. Absorptive capacity shows the economy to take advantage of the knowledge and incorporate it for ultimate purposes (Soo et al. 2017). While, Zahra and George (2002) employed it in an organizational context, describing AC as an organization's ability to recognize, integrate and implement the value of the latest information for commercial ends. Therefore, based on arguments above, the following hypothesis is established.

H5: Intellectual capital as a moderator between collaborative innovation and absorptive capacity.

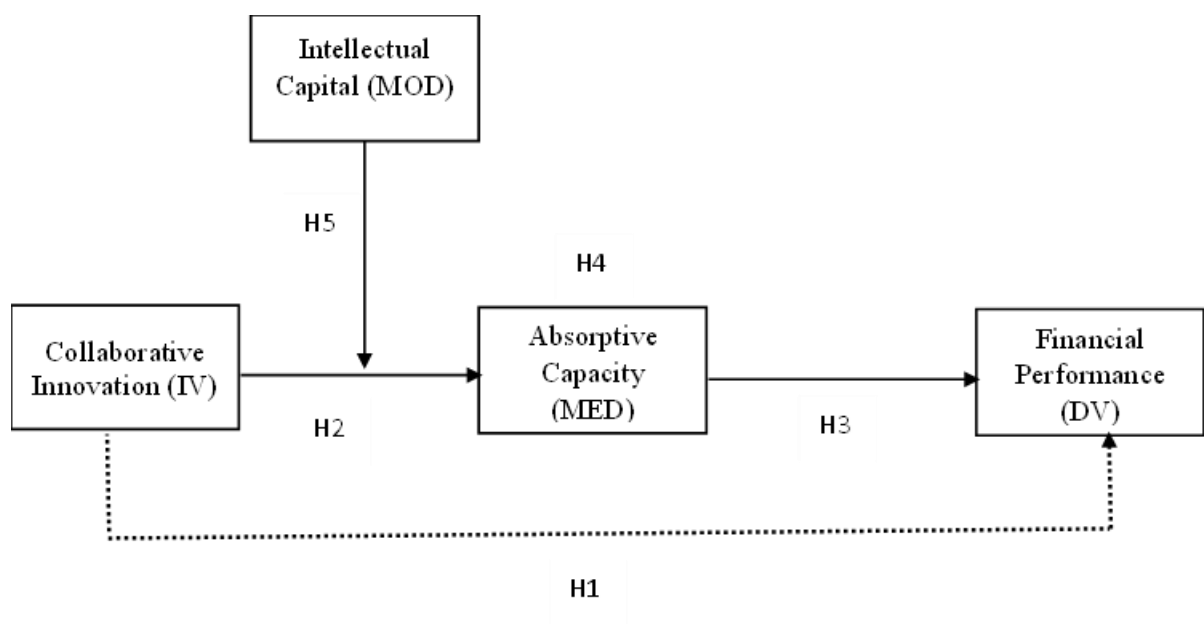


Figure 3 - Conceptual Model

2.3. Research Methods

2.3.1 Sample and Data Collection

The current research purpose was to inspect the effect of collaborative innovation on firm performance of Portugal. The study is based empirically on a sample of small and medium size enterprises operating in the Portuguese due to COVID-19 pandemic there is rapid growth seen in IT SMEs as shown in the Organisation for Economic Co-operation and Development (OECD) report 2020 (Lamichhane et al., 2021). For the current study, simple random sampling technique was used, and data were obtained from both public and private project-based software organizations operating in different cities of Portugal from November 2020 to February 2021. Data has been collected through a self-administered paper-and-pencil survey and in some cases through online-survey due to COVID-19 pandemic. The respondents are programming Managers, designers, project supervisors, operation managers working in different IT SMEs companies. The G* power-software shows 119 respondents to get a capacity of 0.95 and a medium impact of 0.15 for this study as the minimum sample-size (Hair et al., 2016). Scholars received data from 335 target respondents, which was more than the minimum sample size need. Initially, 400 questionnaires were distributed and 7 questionnaires was excluded based on missing information and incorrect answers, which make these questionnaires inconclusive and thus excluded. However, only 308 usable surveys were received, resulting in a 77% response rate.

The questionnaire consisted of two areas. Section A covered personal information such as age, gender, marital status, job title and experience. Section B included questions to evaluate the link between independent and reliable diversity. Males made up 52.7 percent of the 308 respondents, while females made up 47.3 percent. Most of the participants had Bachelor's and post graduate degrees holder and age between 20 and 40 years. The strength shows that most respondents had experience in projects between 1-5 years and above six years. After data collection Harman's one-factor analysis findings showed that the study had no problems with common method analysis, based on the exploratory factor analysis and the principal analysis approaches, since the single factor explained a cumulative variance of 19.33 percent, lower than the suggested 50 percent threshold (Tehseen et al., 2017).

2.3.2 Measures

This research follows a deductive approach, seeking to understand causal connections between the selected variables. Evaluating the Absorptive Capacity as mediator between collaborative innovation and financial performance leads to the creation of a range of hypotheses also measure the role of intellectual capital as a moderating variable of second-order in the three dimensions: Human capital, organizational capital, and social capital. All items have been evaluated at a 5-point Likert scale. This study consists of a closed-end questionnaire from various sources used to evaluate four variables. A 11-item questionnaire is adapted for collaborative innovation by (Bucic et al., 2012). To measure financial performance 4-items scale created by Shashi et al. (2019) was embraced. The 10-item scale mediating variable Absorptive Capacity was used develop by Zahra et al. (2002), and moderating intellectual capital as second order variable based on 14-items scale (Human capital (5-items), organizational capital (4-items), and social capital (5-items)) adopted from Singh et al. (2016).

2.4. Results

2.4.1. Analytical technique

The analysis was applied using Smart PLS tools v.3.0 to measure structural equation modelling (SEM) (Hair et al., 2019). SEM is a multidisciplinary approach used commonly to research relationships with structures (Mai et al., 2021). It allows the simultaneous analysis of multiple variables in an integrated model (Hair et al., 2016). Due to the limited sample and non-parametric nature of the results, PLS was favored over other techniques. Relatively low sample size can be determined by PLS-SEM. This method is equally successful for the study of non-distributed data (Hair et al., 2017).

2.4.2. Validity and reliability

The adoption of the PLS-SEM approach for data analysis includes an evaluation of efficiency and adequacy of structural models based on measuring parameters that analyze the reliability and validity of the model (Henseler et al., 2015; Mai et al., 2021). The bootstrapping method (5000 sub-sample for T-test) was used to assess load, weight and path coefficients for 308 cases (Hair et al., 2017). Table 1 below displays the effects of the validity and reliability controls. The values for composite reliability (CR) and Cronbach Alpha (α) were tested for internal consistency. Table 2 findings demonstrate the buildings' internal consistency: values are greater than 0.70 for CR and for the of Cronbach. Also, factor loading values were evaluated to verify the reliability of indicators. Factor loading should exceed 0.70, according to Hair et al. (2017), to assess the reliability of the indicator. The Average Variance Extracted (AVE) values should be greater than the specified threshold of 0.50. However, some indicators from CI6, CI9, CI10, and CI11 items were removed in order to boost the value of AVE. Hair et al. (2017) introduced this strategy after discovering that items with loadings between 0.40 and 0.70 should be eliminated from deleting the variable observed will improve the reflective scale composite reliability. Accordingly, after the removal, all estimations of factor loadings, CR and AVE are greater than the suggested cut off criteria; therefore, Figure 4 states that, since all thresholds are met, the model and its constructions are internally consistent and convergent invalidity.

Table 2 - Measurement Model

Constructs/ Items	Items	Factor Loadings	α	CR	AVE	Authors
Absorptive Capacity			0.892	0.909	0.504	Zahra et al. (2002)
We are successful in learning new things within this group.	AC1	0.764				
We are effective in developing new knowledge or insights that have the potential to influence product development.	AC2	0.790				
We have effective routines to identify, value, and import new information and knowledge.	AC3	0.792				
We have adequate routines to analyze` the information and knowledge obtain.	AC4	0.805				
We have adequate routines to assimilate new information and knowledge.	AC5	0.826				
We are effective in transforming existing information into new knowledge.	AC6	0.592				
We can successfully exploit internal and external information and knowledge into concrete applications.	AC7	0.628				
We are effective in utilizing knowledge into new products.	AC8	0.644				
We are able to identify and acquire internal (e.g., within the group) and external (e.g., market) knowledge.	AC9	0.590				

Prior to the project, did your project team have the expertise required to assimilate the knowledge that came from the other subsidiaries?	AC10	0.606				
Collaborative Innovation			0.834	0.880	0.524	Bucic et al. (2012)
New product prototypes (still in the development stage)	CI1	0.804				
New products or services introduced to the market which are new to the market or the firm	CI2	0.811				
Significant modification to existing products or services	CI3	0.793				
New/modified production or manufacturing techniques	CI4	0.791				
New/modified administration or managerial techniques/practices/policies	CI5	0.824				
New/modified marketing (inc advertising and distribution) techniques	CI7	0.466				
Patents either applied for, pending or obtained	CI8	0.460				
Financial Performance			0.866	0.911	0.720	Shashi et al. (2019)
The return on investment of our company is higher compared to competitors.	FP1	0.921				
The return on assets of our company is higher compared to competitors.	FP2	0.801				
The sales growth and profitability of our company are higher compared to competitors.	FP3	0.730				
The total operating costs of our company are lower compared to competitors	FP4	0.925				
Construct: Intellectual Capital						Singh et al. (2016)
Sub-Construct						
Human Capital			0.850	0.893	0.626	
Employees are highly skilled.	HC1	0.781				
Employees are widely considered the best in our industry.	HC2	0.774				
Employees are creative and bright.	HC3	0.829				
Employees are experts in their particular jobs and functions.	HC4	0.809				
Employees develop new ideas and knowledge.	HC5	0.762				
Organizational Capital			0.825	0.884	0.656	
Organization uses patents and licenses as a way to store knowledge.	OC1	0.826				
Organizational knowledge is contained in manuals, databases, etc.	OC2	0.773				
Organization's culture (stories, rituals) contains valuable ideas, ways of doing business, etc.	OC3	0.821				
Organization embeds much of its knowledge and information in structures, systems, and processes.	OC4	0.819				
Social Capital			0.837	0.885	0.609	
Employees are skilled at collaborating with each other to diagnose and solve problems.	SC1	0.810				
Employees share information and learn from one another.	SC2	0.838				
Employees interact and exchange ideas with people from different areas of the company.	SC3	0.817				
Employees interact with customers, suppliers, alliance partners, etc., to develop solutions.	SC4	0.780				
Employees apply knowledge from one area of the company to problems and opportunities that arise in another.	SC5	0.641				

Abbreviations: Composite Reliability (CR); Cronbach Alpha (α); Average Variance Extracted (AVE)

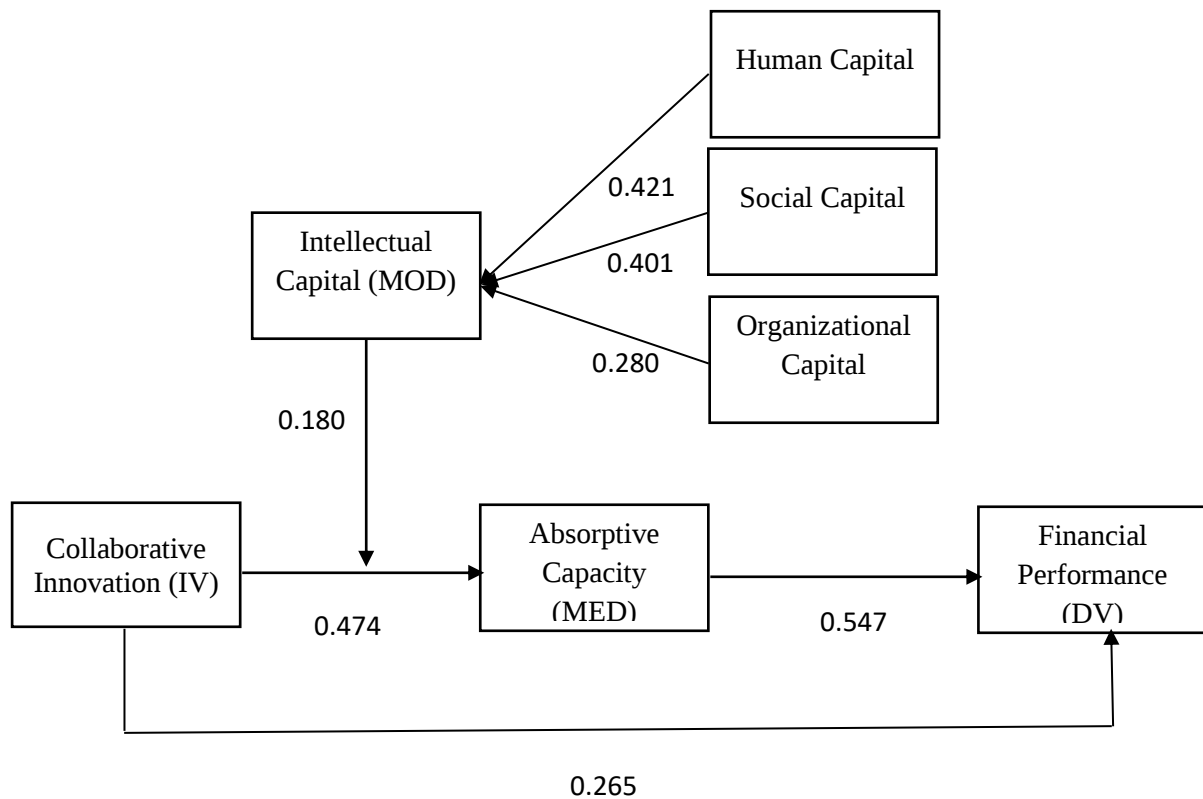


Figure 4: Measurement Model Analysis

2.4.3. Discriminant Validity by Fornell-Larcker Criterion

After confirming that the model has converged and fulfilled the pre-set criteria, the next step was to validate the model discriminatory by Fornell-Larcker Criterion. Fornell-Larcker states that the square root of the AVEs should be greater than the construct's correlations (Fornell et al., 1981). Table 3 shows a discriminating validity since the square roots of AVEs are greater than the correlations between structures, as shown by the bold products.

Table 3 - Discriminant Validity by Fornell-Larcker Criterion

Constructs	1	2	3	4	5	6	7
1. Absorptive Capacity	0.788						
2. Collaborative Innovation	0.710	0.724					
3. Financial Performance	0.759	0.710	0.848				
4. Human Capital	0.520	0.503	0.481	0.791			
5. Intellectual Capital	0.497	0.470	0.465	0.716	0.944		
6. Organizational Capital	0.309	0.283	0.316	0.641	0.809	0.810	
7. Social Capital	0.483	0.452	0.436	0.864	0.780	0.631	0.939

2.4.4. Assessment of Second Order Construct

After analyzing and validating the first-order constructions, the second-order construction for multicollinearity of items and analysis of outer weight and its importance was reviewed. A two-stage process was presented to analyze the second-order (Hair et al., 2017). First, the latent variable values of the lower-order components were determined. Intellectual capital scores are used for all variables after the latent variables have been determined in the initial step. The intellectual capital measurement approach was evaluated based on Hair et al. (2017), and the results are reported in Table 3. The Variance Inflation Factor (VIF) and a high correlation between two or more construct elements are used to achieve multicollinearity (Hair et al., 2017). The reflective construct was investigated in multicollinearity. A number greater than 5 indicates multicollinearity. Table 3 shows that multicollinearity is not a concern based on the second-order reflective, dimensional VIF values. The reflective indicators' outer weights were evaluated. Bootstrapping also checked the weights' value. The importance and weight of the measures are depicted in Figure 4. External human capital, organizational capital, and social capital weights were all relevant for one item, as shown in Table 4.

Table 4 - Outer Weights and VIF Values

Relationship among constructs	Original Sample	Sample Mean	Standard Deviation	T Statistics	VIF	LLCI 5.0%	ULCI 95.0%
Human Capital -> Intellectual Capital	0.421	0.421	0.010	40.521	3.184	0.402	0.443
Organizational Capital -> Intellectual Capital	0.280	0.279	0.012	23.135	1.768	0.255	0.302
Social Capital -> Intellectual Capital	0.401	0.401	0.010	39.175	3.096	0.381	0.421

2.4.5. Structural Equation Model

The structural equation model is calculated after the measuring model is finished. This study used the standard bootstrapping procedure to obtain a significant level of any link between the constructs. To investigate the mediating effects of absorptive capacity, we use the methodologies proposed by Henseler et al. (2015). The direct and indirect effects of the structural equation models were assessed using four key parameters: To begin, determine the sum of variance explained by all constructs in endogenous latent variables R² (Hair et al., 2018). Although an adequate evaluation of R² relies on the analysis (Cohen, 1998), there is a high, moderate, and low evaluation of 0.26, 0.13, and 0.09, respectively. In the current study, however, R² values for the endogenous variable financial performance are anticipated to be 65.1 percent due to collaborative innovation and absorptive capacity. In addition, the predicted R² for absorptive capacity for collaborative innovation and intellectual capital is 61.2 percent, and the model exhibits appropriate precision in prediction, as demonstrated in Table 5 and Figure 5.

Table 5 - Coefficient of Determination

Constructs	R Square	R Square Adjusted	Q ² (=1-SSE/SSO)
Absorptive Capacity	0.612	0.608	0.298
Financial Performance	0.651	0.649	0.460

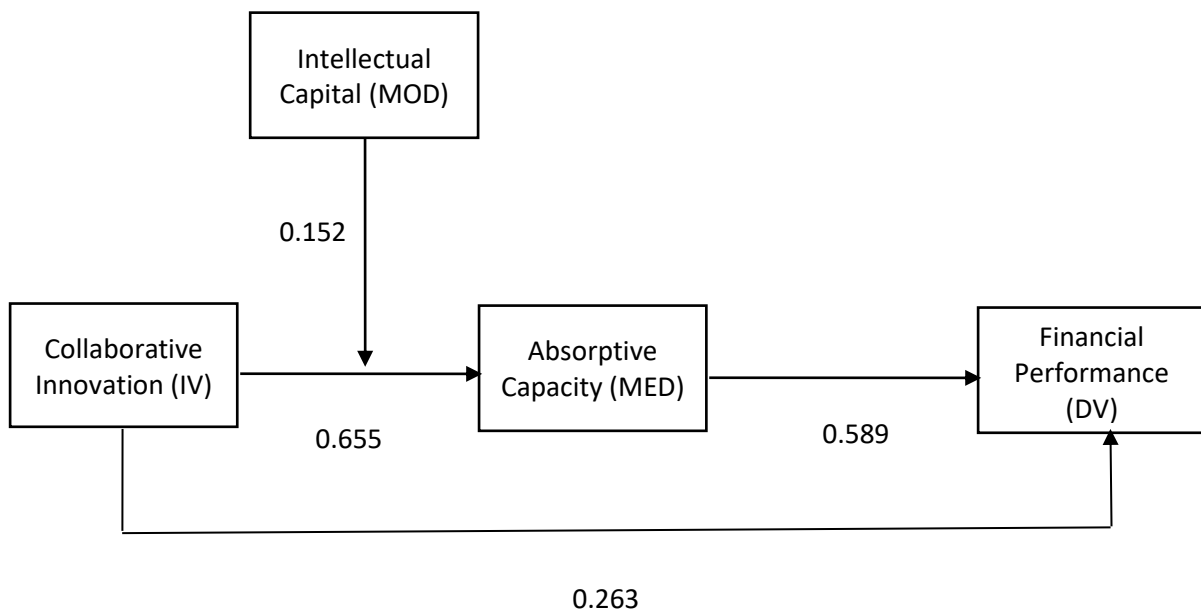


Figure 5 : PLS-Path Analysis of (n = 5000 bootstrapped samples)

Second, a cross-validation redundancy measure was also applied to determine predictive validity to estimate the study model has validated relevance (Hair et al., 2016). In Table 4, the importance of the direct effect of a model can be observed since the model's predictive importance is considered acceptable because Q2 values are more significant than zero (Henseler et al., 2015). The direct influence of collaborative innovation on financial performance ($\beta = 0.262$, $p < 0.001$), collaborative innovation on absorptive capacity ($\beta = 0.495$, $p < 0.001$), and absorptive capacity on financial performance ($\beta = 0.562$, $p < 0.001$) is further supported by the H1, H2, and H3 results. As a result, each of the three direct hypotheses was accepted.

Third, Effect Size (f^2) is an independent variable that expresses the external (independent) effect on the dependent variable (Hair et al., 2016). The effect size values are 0.02, 0.15, and 0.35, respectively, according to the Cohen rule (1988), with small, medium, and significant effects. The CI to FP impact size is 0.084, the CI to AC effect size is 0.818, and the AC to PF effect size is 0.421, according to Table 6. The findings show that these exogenous components have a medium and high impact on the endogenous structure. Finally, for this analysis, the model suggested and validated that absorptive capacity can mediate the relationship between collaborative innovation and financial performance. Table 6 describes that the Lower Limit Confident Interval (LLCI) and Upper Limit Confident Interval (ULCI) of .319 and .457. Both the ULCI and LLCI has same sign positive and there was no zero present between these two. hence, we can conclude from here that mediation is happening. The significant and positive indirect effect from AC to FP ($\beta = 0.387$ and $p < 0.05$), as discussed in Table 6, is less than the direct effect. However, if the effect is indirect and significant but less than direct, it will also be shown to be partially mediated, the hypothesis 4 was therefore accepted.

Hypothesis 5 enunciated that intellectual capital moderates the relationship between collaborative innovation and absorptive capacity. The values in the Table 6 provided support for the hypothesis of moderation. The results showed that interaction term of “collaborative innovation and intellectual capital” moderates on the relationship of collaborative innovation and absorptive capacity both the LLCI=0.317 and ULCI=0.486 has the same sign, and there was no zero present. In addition, intellectual capital has a positive and significant moderating effect ($\beta = 0.152$, $p < 0.05$). Therefore, the findings have demonstrated the support for hypotheses H4 and H5.

Table 6 - Structural Equations Model Results

Hypothesis	Relationship between Constructs	β	Mean	S. D.	T Values	f^2 Values	LLCI 2.5%	ULCI 97.5%	Remarks
Direct Effects									
H1	CI -> FP	0.262***	0.261	0.049	5.350	0.084	0.168	0.356	Supported
H2	CI -> AC	0.655***	0.654	0.035	18.495	0.818	0.582	0.722	Supported
H3	AC -> FP	0.591***	0.592	0.047	12.507	0.421	0.498	0.681	Supported
Indirect Effects									
H4	CI -> AC -> FP	0.387***	0.387	0.035	11.122		0.319	0.457	Supported
H5	CI * Moderating Effect 1 -> AC	0.152**	0.151	0.038	7.961		0.317	0.486	Supported

Abbreviations: AC: Absorptive Capacity, FP: Financial Performance, CI: Collaborative Innovation, IC: Intellectual Capital, S. D.: standard deviation, f^2 : Effect Size, LLCI: Lower Limit Confident Interval, ULCI: Upper Limit Confident Interval * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

2.5 Discussion

The objective of this study was to examine the impact of collaborative innovation on IT firm financial performance through mediating role of absorptive capacity and moderating role of intellectual capital. The study based empirical analysis on a sample of SMEs operating in the Portuguese IT sector due to the COVID-19 pandemic rapid growth were seen in IT sector at SMEs level. This study looked at the complex role of absorptive capacity on the relationship between collaborative innovation and financial Performance. The results also support the statement that collaborative innovation is a crucial catalyst for the capacity to absorptive. This means that knowledge acquisition, assimilation, change, and exploitation are made easier by capable workers, effective organizational structures, and good relations with stakeholders. This study demonstrates that intellectual capital has a positive moderating effect on collaborative innovation and absorptive capability, which is in line with previous research results from (Soo et al., 2017; Engelman et al., 2017; Ávila, 2021).

Additionally, the alteration of newly assimilated information is likely to not happen immediately or without struggle. Previous knowledge is essential to the firm's capability to worth new information (Haider et al., 2020). As companies attain information from beyond afield bases, it is less probable that the firm will own the preceding knowledge essential to fully figure out and properly value its findings, principal to wasted chances. Therefore, at extraordinary stages of absorptive capacity, previous information confines additional constrain the proficiency of information absorption efforts. Occupied together, the costs accompanying with the acquisition, integration, and alteration of new information would be estimated to overhaul the economic revenues connected with the manipulation of that information at high levels of absorptive capacity. Thus, we hypothesize that after a fact, increases in absorptive capacity will be counterproductive to additions in firm economic recital. Therefore, absorptive capacity is positively associated with financial performance.

However, previous studies have shown that collaborative Innovation, absorptive capacity and skills substantially affect financial performance. Though, companies are reluctant to invest in their employees. For various reasons, some scholars have identified for a long time, including that their organizations cannot wholly own individuals, many companies are also unable to invest financial resources in intellectual capital (Lyver and Lu 2018; Rehman et al. 2018). Most of the studies identified positive relations that examined intellectual capital and absorption. Therefore, this study verified that intellectual capital is a good forecaster for absorptive capacity also for financial performance of SME's.

2.6 Theoretical and Practical Implications

The present study has provided a theoretical implication by giving further empirical evidence in the domain of resource-based theory, where collaborative innovation has been hypothesized as a resource to better understand the relationship among intellectual capital to attain and maintain absorptive capacity. The result showed that all IC dimensions have a direct influence on absorptive capacity, the willingness of a firm to learn external information will boost the output effect of IC. There is, however, a lack of awareness to grasp their integrated relations. This study helps to comprehend the value of AC to boost the efficiency of an organization. Moreover, AC helps the businesses to obtain and use external information effectively, improve their learning capacity, respond to environmental changes, and innovate. Furthermore, the intervention of an absorptive capacity system nevertheless significantly enhances the link between collaborative innovation and financial performance. It can thus be concluded that absorption of information by stakeholders and employee applicability affect company performance positively. This research support IT industry of Portugal to understand the importance of collaborative innovation in order to achieve financial objectives.

In the domain of project-based IT organizations the findings of this investigation would give insights to SME's which confront the trouble dealing with the intangible resources comparing to the globalization period of innovation and information-based economy (Mata et al., 2021). It would likewise help the Portuguese IT firm managers to evaluate the variables in for well financial performance (Martins et al., 2018). This study adds practically towards the business that in order to diminish the complexity, jointly efforts by whole team are necessary with excessive communication when situation is complex and in order to avoid misleading details, information sharing with joint decision-making strategy must be followed to let the team members leads towards success of project. The companies of Portugal have to spend more in intangible resources other than putting resources into old style factors of productivity. The organization have to invest more in intellectual capital and its components for the better productivity and profitability in the future.

2.7 Limitations and Future Directions

As it is not possible to cover all aspects in one study, a few limitations are always there in research although these are tried to eliminate. A few research gaps have been filled by adding appreciative facts in literature. On the other hand, time and resource restrictions are some of the limitations associated with this study. The study is focused only on the project-based IT and SMEs of Portugal and other sectors may not be generalized by the results. Future studies can test this model in other field i.e., construction sector, Hotel industry. The data collection for the present study is cross-sectional due to time and resources limitations, future research can consider conducting a study by utilizing longitudinal study as it helps in illustrating the causal relationship comprehensively. The model was analyzed by the single mediator and moderator, future research can also focus on the mediating role of other variables between the relationship of collaborative innovation and financial performance i.e., organizational ambidexterity, collaborative strategies. Also, employee learning, social interaction as moderator between collaborative innovation and absorptive capacity. With the addition of more relevant variables, the existing grounds for the research in this particular field can really be increased.

Impact of Absorptive Capacity on Project Success Through Mediating Role of Strategic Agility: Project Complexity as a Moderator

Abstract

The purpose of this study is to explore the role of potential and realized absorptive capacity on project success through both the mediating roles of strategic agility and the moderating role of project complexity. A simple random sampling was used to collect data from 285 respondents working in the IT sector of small-medium sized Portuguese enterprises (SMEs). Due to the Covid-19 pandemic, data were collected from and distributed on, several online channels (Gmail, LinkedIn, Twitter, and Facebook). Smart PLS-SEM, version 3.2.8 was used for the analysis. The results indicate that the two absorptive capacity sub-dimensions, potential and realized absorptive capacity, not only directly affect a project's success but also indirectly through the mediator of strategic agility. Although the moderating role of project complexity has a positive and significant effect on the relation between potential absorptive capacity and strategic agility, it is insignificant concerning the relation between realized absorptive capacity and strategic agility. Finally, theoretical and practical contributions are made, research limitations are stated and future research is suggested.

Keywords: Potential absorptive capacity; realized absorptive capacity; project success; strategic agility; project complexity.

3.1. Introduction

Small-medium IT enterprises (SMEs) must use external sources for a better response and survival under the complexity of a dynamic, rapidly changing environment (Tallon et al., 2018; Haider et al., 2020). The need to learn and manage knowledge has been emphasized in the literature so far. A company's overall performance can be improved and competitive advantages created. Liu et al. (2017) and Khan et al. (2020) investigated absorptive capacity (AC) to a degree, which acknowledged that a company needs new external information, to understand it and use it to achieve organizational goals successfully.

The absorptive capacity theory presumes that the absorption of new knowledge assists organizations to increase their success and also makes them more flexible and innovative than not having new knowledge absorption (Kale, Aknar, & Başar, 2019). Andersén (2015) and Albort-Morant et al. (2018) stated that absorptive capacity has two common states: potential absorptive capacity and realized absorptive capacity. Potential absorptive capacity (PAC) comprises learning and absorption. It encompasses endeavors used to distinguish and secure new outside information and to absorb information taken from outside sources (Lyu et al., 2022). Realized absorptive capacity (RAC) comprises information change and utilization. It contains inferred new bits of knowledge and the results from a blending of the existing and recently obtained information and fuses changed information into tasks (Kotabe, Jiang, & Murray, 2011).

The identification of AC as a dynamic capability point to interesting research opportunities. Organizations are now undergoing continuous transformation. The influence of different elements such as technology, innovation, industrial trends and growing rivalry means that competitive advantages are further required (Galvin et al., 2020). Therefore, strategic agility (SA) serves to detect the changes in the business environment and to respond to them. There is a reasonable amount of literature available in the domain of absorptive capacity and strategic agility. However, the existing literature is completely silent on information technology (IT) companies at the SME level in the context of developed countries (Kohtamäki et al., 2020; Nyamrunda et al., 2021).

This study is an attempt to fill this gap by focusing on the absorptive capacity of Portuguese SMEs by presenting a model to identify its potential factors. We use the present literature as the background to strengthen our grasp of the concept and its influence on the success of SMEs in relation to SA. Moreover, market dynamics have been seen as a significant driver for innovation and growth for businesses, as rapid technological developments influence the competitive world (Xue & Swan, 2020). Due to this environment, companies are under enormous pressure to adapt and implement more complex projects to survive among tough market competitors, while improving and sustaining their market share. Organizations are continuously researching and taking new and innovative steps to gain an advantage on their competitors and to strengthen their position in the market (Haider et al., 2022). However, technological change is hard to oversee among SMEs worldwide and it is significantly more difficult if the project is complex (Costa et al., 2021; Rehman et al, 2021). So, it is important for both practitioners and academics to understand project complexity (PC), to know how to handle PC, and how it affects individuals and organizations (Bjorvatn & Wald, 2018).

The literature shows that time, budget and quality are not the only criteria for a project's success, but the handling of complexity has to be considered as well (Marnewick, Erasmus, & Nazeer, 2017). The most suitable theory, and chosen as the theoretical foundation for our conceptual framework, is complexity theory (Larsen-Freeman, 2017). Complex systems are made up of a lot of minor parts with no centralized control. As a result, organizations exhibit non-linear and unexpected behavior. The term "complex system" refers to a system that contains a large number of components and their interactions (Ladyman et al., 2013). Complexity is a term used throughout the literature on project management and it usually brings additional difficulties to achieving the desired outcome (Luo, Zhang, & He, 2020). There must be some techniques to manage the project complexity so that a team does not face difficulty while working on the project (De Toni & Pessot, 2021). The environment of the 21st century is uncertain and comprises huge risks to meet the criteria of project success (Gurca et al., 2021). Within these conditions, the current study proposes a framework that can be applied by different SMEs within the IT sector and future analysts. In addition, this exploration is a commitment to fill, at least partially, gaps existing in earlier investigations. Experts have mainly neglected the moderating effect of project complexity on the relation between PAC and SA, as well as RAC and SA, therefore its role should be examined thoroughly. Thus, the aim of this research is to examine how Potential and Realized absorptive capacity enhance project success, and strategic agility as a mediated mechanism and moderator of project complexity are the new contributions for SMEs research on project-based IT Companies in Portugal. Furthermore, this article is in accordance with the following. To begin, we show important literature and theory to support in the development of hypotheses. After that, technique was described, followed by data analysis. Then comes the results, discussion, and implications, led by the conclusion and suggestions.

3.2 Literature Review

3.2.1 Underpinning theory

Complexity theory is used to analyze complex systems in the area of strategic management and organizational studies, also called complexity strategy, or complex adaptive organizations (Anderson, 1999; Benbya et al., 2006). It is based on research in the field of natural sciences that examines insecurity and non-linearity. The notion of complexity highlights interactions and feedback loops whose systems constantly change. While it claims that systems are unpredictable, it also claims that order-generating laws constrain them (Larsen-Freeman, 2013). Complexity theory has been applied in the domains of strategic management organizational studies. Examples of areas of application have been introduced in order to understand how companies adapt to their environments and deal with

uncertain situations. Organizations have complex structures by having dynastic interaction networks and not adding many static elements (Larsen-Freeman, 2017).

3.2.2 PAC and RAC on Project Success

The term absorptive capacity (AC) was first introduced and defined by Cohen and Levinthal (1990), to describe a company's capacity to identify, assimilate and exploit information available in its environment. Zahra and George (2002) define AC as "a set of organizational routines and processes through which companies acquire, assimilate, transform and exploit knowledge to produce a dynamic organizational capacity". Lichtenthaler (2016) investigated a reversed U-molded connection between absorptive capacity and the financial outcome of a company. Absorptive capacity increases the financial outcome of a company further on. However, after a certain point, the financial outcome is negatively affected. Actual absorptive capacity has been reported as being related to data securing and increasing new item market success (Liu et al., 2013). This concept is also called an organization's ability to gather and organize information, to create operational capabilities (García-Sánchez et al., 2018). It includes four features of the organization's learning process: "acquisition, assimilation, transformation and exploitation" (Spithoven et al., 2010; Rehman et al., 2021).

The acquisition capacity shows, according to research, the ability of a company to differentiate and secure external information essential for the organization. Assimilation offers schedules and procedures for examining, processing, transforming and capturing the data obtained by the organization. Similarly, change refers to the ability of a company to produce and develop plans that integrate existing knowledge with newly acquired expertise. Finally, exploitation means the power of a company to incorporate information in real time and accommodate it into its operations. The focus is on transforming information into new processes.

The first two abilities can be combined to generate a potential absorptive capacity that captures a company's ability to evaluate and obtain outside knowledge, growth and expect expansion in the company's information databases (Lyu et al., 2022). The last two can be grouped under a realized absorptive capacity using the data gathered from its operations to generate new ideas (Albort-Morant et al., 2018). The existing literature has mostly focused on large-scale organizations in manufacturing industries (Liu et al., 2017; Duan et al., 2021). So, it is also necessary to examine the impact of AC on SMEs belonging to the IT sector, as the results might differ due to differences in infrastructures and the support provided to them (Müller, Buliga, & Voigt, 2021). According to Nyamrunda et al. (2021), technological absorptive capacity in technical endeavors significantly and positively generates hierarchical knowledge and progress. Empowering innovative absorptive capacity inside a company guides workers to look for and learn new ideas. By transforming this information into new services efficiently, production will increase, the innovation performance of companies will be improved and the success rate of projects will grow in return.

Companies with higher levels of AC, in comparison to others, are more likely to recognize market opportunities, obtain market information and understand the clients' requirements. As a result, they undertake innovation development activities appropriately, improve the company's success and increase opportunities for high-success rate projects (Duan et al., 2021; Wang et al., 2020). Based on the above argumentation, the following hypotheses may be considered:

H1: Potential absorptive capacity is positively associated with project success.

H2: Realized absorptive capacity is positively associated with project success.

3.2.3 Relationship of Potential absorptive capacity and Realized absorptive capacity with Strategic Agility

The concept of agility previously appeared in an Iacocca Institute review in America in 1991. It concentrated on ability as well as adaptable and agile creation to meet the quickly varying requirements of business (Dove, 1991). It is the change of constant and capriciously evolving customer circumstances into beneficial capacity in a competitive environment (Haider, 2019). It makes advances and evolves in a changeable and unexpected climate, performing actively and modifying itself in a violent environment and creating opportunities before change (Sheppard & Young, 2006). According to Kohtamäki et al. (2020), a deeper investigation of the mechanisms by which AC influences learning ability could improve our understanding of the relationship between IT competency and strategic agility. AC is a knowledge-based and IT-driven capacity that provides an organization with the ability to master a given area of knowledge and adjust its existing processes to respond to changes, resulting

in significant commercial value (Hurtado-Palomino et al., 2022). Agility is believed to be better understood from a coordinated point of view. As a result, absorptive capacity serves as a link between IT competence and SA (Harvey et al., 2010; Khan et al., 2020). In order to bring IT-enabled improvements, the development of absorptive capacity is an essential method (Ali et al., 2021). The dynamic capacity-based study was focused on conceptual clarifications of absorptive capacity outcomes such as innovation, adaptability, and performance (Volberda, Foss, & Lyles, 2010). Absorptive capacity and strategic agility are linked as two dynamic characteristics because researchers use complexity theory as a reference framework to define the role of agility (Bakarada & Koronios, 2018). The sub-dimensions of absorptive capacity are substantially similar to the sensing and reacting components of SA, according to Verma, Bharadwaj, and Nanda (2017). Furthermore, SA focuses on change management, whereas absorptive capacity is connected to knowledge management. As a result, absorptive capacity provides sufficient explanatory power to explain the organizational capacities of perceiving and responding to change in this investigation.

According to ALTaweel and Al-Hawary (2021), SA implies the capacity to survey or rediscover the organization and its strategy in relation to changes in the business climate. The capacity to be agile is straight forwardly identified with human performances, cycles, and association advancements. Škare & Soriano (2021) stated that SA has the purpose to get data of normal modifications into business through the organization's participation. Current research shows an absence of analysis managing the connection between strategic agility and absorptive capacity. Some investigations offer indirect help for this association. Rojo et al. (2018) concluded that those elements of strategic learning included: information procurement, understanding, scattering, and actuation (strategic information creation, strategic information understanding and strategic information execution), which are entirely identified with SA. Based on this discussion, we can predict that:

H3: Potential absorptive capacity is positively associated with strategic agility.

H4: Realized absorptive capacity is positively associated with strategic agility.

3.2.4 Strategic agility as a mediator

Haider et al. (2021) explained that strategic agility is a company's capacity to respond swiftly, accommodate and act to manage uncertainty in the changing business environment. According to Shams et al. (2021), strategic agility is a tool to create a company's competitive advantage. Researchers have been discussing the impact of market factors such as technology, sustainability, and competitiveness (Gurca et al., 2021). Pereira et al. (2021) believe that IT and agility increase corporate success by leveraging the defining agility elements: sensing and responding. The importance of

strategic agility in the IT sector is supported by Morton, Stacey, & Mohn (2018). A corporation should constantly be open to transformation by addressing strategic agility as a concept. Tzokas et al. (2015) mentioned how vital investments of IT resources are to SMEs in order to achieve market leverage. According to Tallon et al. (2018), SA is an emotional competence governed by IT, which increases corporate success. Zahoor et al. (2022) note that a corporation must have a business continuity plan while making a change. It entails ensuring that the company can cope with turbulent change while still operating at total capacity. Strategic agility has a strong relationship with transformation. Companies with high-level SA are better able to assimilate, codify, and use new knowledge created by AC and proactively seek new ways to react to environmental changes swiftly. Consequently, they have adequate business model innovation and strategic transformation (Junni et al., 2015). Inter-organizational knowledge acquisition about organizational transformation may vary depending on a company's ability to transfer and use the information learned to their organizational renewal processes.

Kale et al. (2019) and Kohtamäki et al. (2020) consider strategic agility as a mediator of absorptive capacity and company success. Rehman et al. (2020) also claim that strategic agility has an increasing effect on the organization, especially in a changing corporate environment. Tallon and Pinsonneault (2011) discovered that company agility has a mediating role in the impact of strategic IT alignment on project success. Another study found that strategic agility plays a mediating role in the relation between the ability to manage customer knowledge and project success (Haider et al., 2020). Albort-Morant et al. (2018), who focused on innovation due to AC, explored the role of AC in prior studies. An integrated approach is required to comprehend agility properly. Agility can also be achieved through strategic collaborations. Nyamrunda et al. (2021) stressed that agility is a synthesis that many companies, each with different fundamental skills and qualities, create to respond to customers' requirements. They also suggested that essential elements, such as people, organizations, and technology should be integrated to achieve agility. Through inter-company cooperation, SA tries to obtain information about predicted market developments. SA is proactive and knowledge-based, as opposed to reactive production agility. Based on prior research findings, strategic agility may have a role in the influence of absorptive capacity on project success, leading to the following hypotheses:

H5: Strategic agility is positively associated with project success.

H6: Strategic agility mediates the relation between PAC and project success.

H7: Strategic agility mediates the relation between RAC and project success.

3.2.5 Project Complexity as a moderator

In the context of project management, complexity is the most important topic, and, at the same time, it is very controversial (Bakhshi, Ireland, & Gorod, 2016). Complexity is defined as “the property of a project which makes it difficult to understand, foresee and keep under control its overall behavior, even when given reasonably complete information about the project system” (Vidal & Marle, 2008). To be more precise, complex projects are inclined to schedule delays and budget overruns (Mikkelsen, 2020). A project is considered as complex, when it is extremely dependent on its (political, economic, or legal) environment, with continuously changing stakeholders’ demands, requirements and having conflicting stakeholders’ interests (Luo et al. 2020) . It becomes more complex when there is an inadequacy of information and too many variables are involved simultaneously (Luo et al., 2015). According to Benbya et al. (2006), complexity theory is the foundation for team members to represent structured behavior and cooperate in dealing with ambiguous situations. Complexity theory demonstrates how principles from various disciplines can be combined and applied to related contexts (Kasemsap, 2020). It claims that a set of rules governs complex behavior. All complex systems are made up of a network of interconnected components interacting according to those rules. According to Ruoslahti (2020), complexity theory is a concept used to manage project teams to foster the creativity required to meet project objectives.

It is widely reported in the literature that projects have become more complex over time (Zhu & Mostafavi, 2017; Hansen et al., 2020). The success of software development projects has had a broad impact on different industries and business management processes (Andersén, 2015) e.g., operational planning and control (Rehman et al., 2021), human resource management, inventory management, supply chain management etc. (Eckstein et al., 2015). This literature emphasizes the fact that project success depends on the project's complexity and its features, including size and timing, depending on the tasks (Luo et al., 2020). Complexity in a project may have a negative influence on the success of the project but, on the other hand, it may also have a positive influence on project results/outcomes as a result of emerging properties which can create new opportunities (Bjorvatn et al., 2018).

Therefore, the main focus should be on how to manage project complexity in a constructive way rather than focusing on reducing it or avoiding it completely. In today's dynamic environment, only those project-based organizations from the software development industry will be able to deal with project complexity and successfully improve their project success (Butler, Vijayasarathy, & Roberts, 2020). A high rate of project failures is a fact which is experienced by both advanced and developing nations, especially in the software industry (Varajão et al., 2014; Sousa et al., 2020; Morcov et al., 2021). According to De Toni & Pessot (2021), to eliminate the influence of project complexity on project success, research is urgently needed to identify the risks associated with project complexity and offer techniques to minimize the risks that may have an impact on a project's success. Thus, we propose that (see Figure 6):

H8: Project complexity negatively moderates the relationship between potential absorptive capacity and strategic agility.

H9: Project complexity negatively moderates the relationship between realized absorptive capacity and strategic agility.

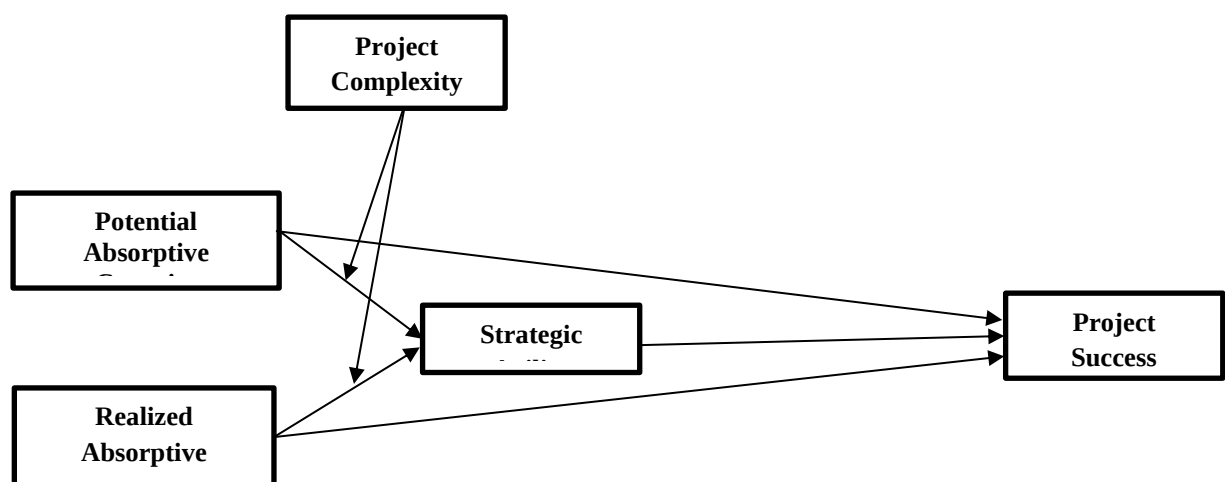


Figure 6 – Conceptual Model

3.3 Research Methodology

SMEs have great employment potential. They are the main contributors to economic development and are a major income source of generations. Therefore economies have concentrated on the SMEs' successive role in economic prosperity (Müller et al., 2021; Nyamrunda et al, 2021). Likewise, SMEs from the IT sector in Portugal contribute significantly to the country's GDP (Sousa et al., 2020). Consequently the ongoing development of this sector has a major impact on different economic indicators. Taking into account the importance of this sector, we have chosen SMEs for this study as an analysis unit. This research used the hypothesized model with a cross-sectional design (see Figure

7) (Kalof, & Dan, 2008). Data cannot be collected from the entire population due to limited time and resources .

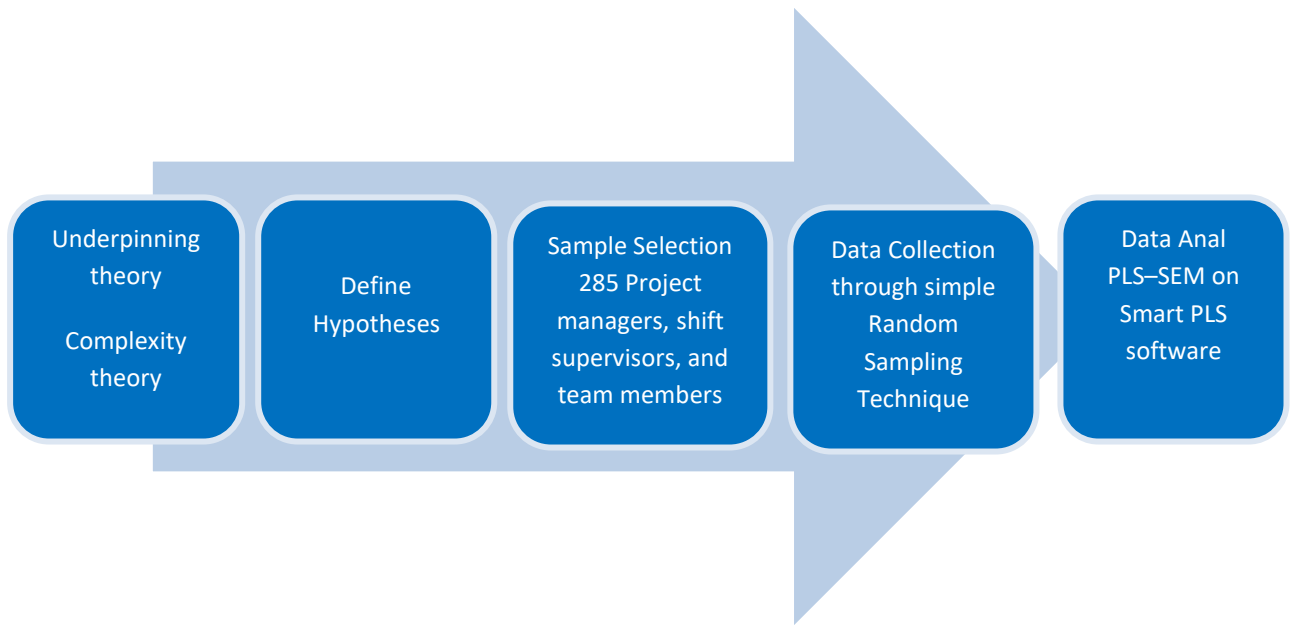


Figure 7 - Quantitative Research Method

Thus, a simple random sampling technique was used for the collection and investigation of information (Taherdoost, 2016). The data was collected during four months, from February 2022 to May 2022. This information was initially collected from the PORDATA database regarding SMEs in the IT sector in Portugal. SMEs from the IT sector of developed economies are more open to intense competitiveness and environmental change. They recognize and appreciate the importance of knowledge resources and continued renewal (Galina et al., 2016; Silva et al., 2021). The selection was made among five small to medium IT companies from Portugal with an estimated number of 900 workers. Among these companies are: Unbabel, BI4ALL, Glintt, Vortal, and Timestamp. The sample size of 276 was adopted based on the Slovin formula, accepted globally to calculate the sample size and used recently in the SMEs by Kosasi & Yuliani (2017).

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{900}{\{1 + 900 * (0.05)^2\}}$$

$$n = 276$$

Due to the Covid-19 epidemic, the data was collected through self-administered surveys (generated via Google Docs) and distributed across several online channels (Gmail, LinkedIn, Twitter, and Facebook). This allowed the most significant number of people possible to take part in the survey. A total of 380 questionnaires were circulated and 323 people responded to the survey. Project managers, shift supervisors, and team members from public and private IT organizations are among those who answered. After removing any partial replies, 285 surveys were eligible, resulting in a 75% response rate, which was highly encouraging during the pandemic. Harman's one-factor analysis findings revealed that the study had no issues with common method analysis, based on the exploratory factor analysis and the principal analysis approaches, because the single factor explained 16.43 percent of the cumulative variance, which was less than the suggested 50 percent threshold (Fuller et al., 2016). The bulk of the 285 responders are aged between 20 and 40, 23.9% female and 76.1% male. As for their formal qualifications, 26.3% have a bachelor's degree, 44.9% a master's degree, 20.4% have an MBA/Post Graduation degree and 3.9% have a PhD. In terms of job experience, 7.7% respondents have less than one year's experience, over 33% have one to three years' experience, 34.4% four to six years' experience and 24.9% have more than six years' experience (see Table 7).

Table 7 – Descriptive Statistics

Demographics	Categories	Frequency	Percent
Gender	Female	68	23.9
	Male	217	76.1
Age	20-30	99	34.7
	31-40	131	46.0
	41-50	53	18.6
	>50	2	.7
	Any Other	13	4.6
Education	Bachelor	75	26.3
	Master's	128	44.9
	MBA/Post Graduation	58	20.4
	PhD	11	3.9
	Any Other	13	4.6
Experience	<1	22	7.7
	1-3	94	33.0
	4-6	98	34.4
	>6	71	24.9

3.4 Measures

In order to measure five constructs, the questionnaires were used to gather data, and all of the constructs were derived from existing sources. Questionnaires were administered in two languages English and Portuguese, using a Likert scale ranging from 1 to 5, 1 representing “strongly agree” and 5 representing “strongly disagree” respectively. A total of 39-items were included in the questionnaire.

Two independent variables were adopted: a potential absorptive capacity (PAC) based on a 6-item scale and realized absorptive capacity (RAC) based on a 9-item scale, from Albort-Morant et al., 2018. In addition, an 8-item scale was used to measure the dependent variable project success adopted from (Luo et al., 2020). Strategic agility (SA) was used as a mediator and measure by a 13- item scale adopted from Khan et al., 2020. The last variable introduced, the moderator project complexity, was measured based on a 3-item scale adopted from Bjorvatn et al., 2018.

In order to assess each instrument's dependability, a pilot test comprising of 50 questionnaires was conducted as part of the ongoing investigation. Cronbach's alpha, which gives the structure a trustworthy or internal consistency, was used to measure reliability (Tavakol & Dennick, 2011). Internal cohesiveness refers to the application of the same concept to all the items of a construct. It has a value that runs from 0 to 1. A Cronbach's alpha value of 0.70 or above was the general rule (Taber, 2018). The Cronbach's alpha value for each construct is shown in Table 8. Common method variance (CMV) may exist in the data since the same respondents were used to collect all the variables. However, several procedural remedies were applied to lessen the issue of CMV, such as a cover letter to assure respondents' confidentiality, description of new words, brief and straightforward questions, etc., nevertheless CMV was a part of the process (Tehseen et al., 2017). In addition, the statistical treatment of Dziuban & Shirkey's (1974) "Correlation Matrix Procedure" (CMP) was used to examine the CMV's influence through the correlation of latent variables. Because the correlation between the primary variables was less than 0.90, CMV was not discovered in this technique. Similarly, CMV was investigated using a complete collinearity evaluation approach.

3.5 Results

PLM–SEM (Partial Least Squares–Structural Equation Modeling) is divided into two components (Sarstedt et al., 2017). The first component is a measuring model (or external model), which depicts the relationship between the components and their indicators. The structural model (or internal model) is the second component, and it depicts the link between two constructs. Exogenous or endogenous constructs are used. There is no arrow pointing to exogenous constructs because they are independent variables. The constructions explained by other factors are known as endogenous constructs (i.e., arrows are pointing towards them). When an endogenous construct is inserted between two variables, it becomes an independent variable. Smart PLS-SEM release 3.2.8 was used for the analysis. The 285 individuals were analyzed using the T-test 5,000 subsamples to determine their significance level (Wong, 2013), path coefficients, and weights for loading. To evaluate the measurement model, using indicator loads or weights, composite reliability, multicollinearity, convergent and discriminant validity can be applied (depending on whether the construction is

formative or reflective). The next step: the structural equation model was measured by evaluating the coefficient of determination (R²), pathway, and predictive relevance (Q²) values (Sarstedt et al., 2019).

Table 8 - Measurement Model

Constructs/Items	Factor loadings	A	CR	AVE	Source
Potential Absorptive capacity		0.868	0.904	0.620	Albort-Morant et al. (2018)
We have frequent interactions with top management to acquire new knowledge.	0.844				
Employees regularly visit other units or project teams.	0.836				
We collect information through informal means.	0.849				
Members do not visit other units or project teams.	0.833				
We periodically organize special meetings with clients, suppliers, or third parties to acquire new knowledge.	0.851				
Members meet regularly with external professionals, such as advisers, managers, or consultants.	0.415				
Realized Absorptive capacity		0.853	0.873	0.510	Albort-Morant et al. (2018)
We regularly consider the consequences of changing market demands, in terms of new ways to provide services	0.667				
We quickly recognize the usefulness of new external knowledge for existing knowledge	0.726				
Employees hardly ever share practical experiences	0.669				
We laboriously grasp opportunities for our unit from new external knowledge	0.709				
We periodically meet to discuss the consequences of market trends and new service development	0.455				
It is clearly known how activities within our unit should be performed	0.693				
We have a clear division of roles and responsibilities	0.713				
We constantly consider how to better exploit knowledge	0.630				
We have difficulties implementing new services	0.638				
Project Success		0.847	0.883	0.507	Luo et al. (2020)
Time	0.821				
Cost	0.849				
Quality	0.630				
Health and safety	0.828				
Environmental performance	0.858				
Participants' satisfaction	0.524				
User satisfaction	0.517				
Commercial value	0.473				
Strategic Agility		0.938	0.946	0.577	Khan et al. (2020)
Our company adopts technology-driven production systems such as just-in-time.	0.759				
Our company adopts advanced production techniques such as value analysis, concurrent engineering, and modular design systems.	0.628				

Our company invests in upgrading production, information, and inventory management systems.	0.805				
Our company upgrades process/product design by investigating customer needs in the product development process.	0.788				
Our company promotes collaboration among major functions from the planning stage.	0.649				
Our company collaborates with customers for process development and improvement.	0.753				
Our company provides an optimal working environment in which best performance practices can be disseminated.	0.784				
Our company promotes interdisciplinary training and team-based activities.	0.792				
Our company empowers employees for individual learning to manage customer contact services effectively.	0.743				
Our company promotes individual and organizational learning for business environment adaptation.	0.755				
Our company aligns functional strategies with business strategy well.	0.816				
Our company aligns operations strategy with other functional strategies well.	0.792				
Our company aligns its goals and objective measures with strategic task performance well.	0.783				
Project Complexity		0.826	0.896	0.741	Bjorvatn et al. (2018)
The project had a high degree of complexity concerning content.	0.872				
To me, the project had a high degree of complexity concerning interdisciplinary participants.	0.868				
The project was characterized by high risk and uncertainty.	0.843				

Abbreviations: Cronbach's Alpha (α), Composite Reliability (CR); Average Variance Extracted (AVE)

The validity of explicit indicators can be evaluated by examining their factor loading. This suggests that factors with a loading of more than 0.50 are reflected significant (Hair et al., 2020). Therefore, the findings of the five variables PAC, RAC, PS, SA and PC are all valid measurements of their specific variables, which are shown in Figure 8. According to Ahmad et al. (2016), the average variance value extracted (AVE) must be greater than 0.5, and the composite reliability is above 0.6. The convergent validity of a variable is accepted this way. The measurement model has a convergent validity (see Figure 8). According to Hair et al. (2017), a method has been proposed that suggests that items with loads from 0.40 to 0.70 should be removed from the assessment, provided that the removal of the observed variable increases the reliability of the reflective scale composite. Thus, all factor loads, composite reliability (CR), and AVE estimations are higher than the cutoff criteria proposed. Table 8 shows a convergent validity in the measurement model.

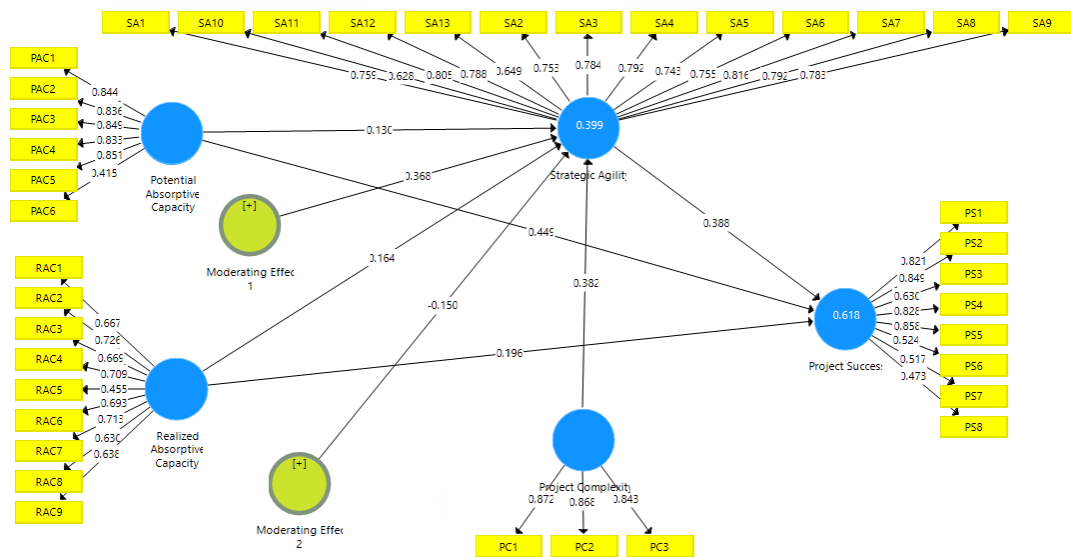


Figure 8- Measurement Model Analysis

As proposed by Henseler, Ringle and Sarstedt (2015), the Heterotrait-Monotrait (HTMT) method was utilized in two ways to evaluate the validity of discrimination. First, the threshold value was measured by HTMT. A more significant value than the HTMT threshold indicates that there is no discrimination. When the correlation is close to one, the precise HTMT threshold value is debatable. Some experts have recommended a threshold value of 0.85 (Purwanto, 2021), while others have proposed a value of 0.90. (Voorhees et al., 2016). Secondly, discriminant validity was determined and established by evaluating HTMT values with less than one confidence interval. When the value of 1 is removed from the interval range, the variables become empirically evident. The HTMT values among the constructs are less than 0.85, as shown in Table 9. As a result, discriminating validity is recognized in this research.

Table 9 - Heterotrait – Monotrait (HTMT) Analysis

Constructs	1	2	3	4	5	6	7
1. Moderating Effect 1							
2. Moderating Effect 2	0.662						
3. Potential Absorptive Capacity	0.169	0.087					
4. Project Complexity	0.092	0.022	0.832				
5. Project Success	0.088	0.060	0.767	0.868			
6. Realized Absorptive Capacity	0.172	0.264	0.568	0.555	0.520		
7. Strategic Agility	0.214	0.112	0.511	0.607	0.763	0.437	

After the measuring model was completed, the SEM was calculated. The techniques proposed by Sarstedt et al. (2019) were also adopted in this study in order to examine the necessary results of strategic agility and the moderating role of project complexity. In order to assess the direct and indirect effects of SEM, three specific criteria were used (Hair et al., 2016). The first step was to determine the variance values displayed by all the variables by calculating the R² level for endogenous latent components. Although Hair et al. (2014) noted that a satisfactory assessment of R² was dependent on the study context, the evaluation of 0.26, 0.13, and 0.09 revealed high, moderate, and low values, respectively. However, the direct effect model revealed that strategic agility was 0.399 for the R² values for endogenous variables in the current study, implying that PAC, RAC, and PC predicted a 39.9% change in SA. Furthermore, the R² for project success was 0.618, implying that PAC, RAC, PC, and SA can predict a 61.8 percent change in PS. Table 10 shows that the model has high predictive accuracy. Secondly, a cross-validated redundancy measure (Q²) was used to assess the research model's estimated significance (Hair et al., 2014). Table 10 shows that the Q² values for two constructs are 0.210 for SA and 0.302 for PS. They are greater than zero, indicating satisfactory predictive relevance of the model.

Table 10 - Determination coefficient in the PLS method

Constructs	R Square	R Square Adjusted	Q ² (=1-SSE/SSO)
Strategic Agility	0.399	0.388	0.210
Project Success	0.618	0.613	0.302

Figure 8 and Table 11 show the direct effect of PAC on PS ($\beta=0.441$, $t = 7.485$, $p<0.05$), RAC on PS ($\beta=0.195$, $t = 4.847$, $p<0.05$) and SA on PS ($\beta=0.398$, $t = 7.040$, $p<0.05$). They are all positive and significant. Therefore, a 1-unit change in PAC, RAC and SA leads to a 44.1%, 19.5% and 39.8% change in PS. Furthermore, the direct effects of PAC on SA ($\beta=0.130$, $t = 2.559$, $p<0.05$), and RAC on SA ($\beta=0.164$, $t = 3.339$, $p<0.05$) are positive and significant. Thus, all the direct hypotheses H1, H2, H3, H4, and H5 were accepted. Finally, the model anticipated and validated the hypothesis that SA would mediate the association among PAC, RAC and PS. As designated in Table 11, the indirect effects of PAC on PS ($\beta=0.054$, $p<0.05$) and RAC on PS ($\beta=0.065$, $p<0.05$) are both positive and significant but less than the direct effect. However, if the indirect effect is significant, its effect is less than a direct effect, nevertheless it is still considered as partially mediated. In addition, the moderating effect of project complexity is positive in relation to the relationship between PAC and SA ($\beta=0.368$, $p<0.05$), but has a negative influence on the relationship between RAC and SA ($\beta=-0.150$, $p<0.05$). Consequently, the outcome has revealed that the hypotheses H6, H7 and H9 were accepted but H8 was rejected.

Table 11 - Result of Structural Equation Model

Hypothesis	Relationship between Constructs	β	Mean	S.D.	T Value	P Values	Remarks
Direct Effect							
H1	PAC -> PS	0.441	0.442	0.059	7.485	0.000	S
H2	RAC -> PS	0.195	0.193	0.051	4.847	0.005	S
H3	PAC -> SA	0.130	0.129	0.074	2.559	0.014	S
H4	RAC -> SA	0.164	0.162	0.070	3.339	0.019	S
H5	SA -> PS	0.398	0.396	0.057	7.040	0.000	S
Mediating Effect							
H6	PAC -> SA -> PS	0.130 * 0.398 = 0.052	0.050	0.034	2.238	0.024	S
H7	RAC -> SA -> PS	0.164 * 0.398 = 0.065	0.064	0.029	2.284	0.022	S
Moderating Effect							
PC -> Strategic Agility							
H8	Moderating Effect 1 - > SA	0.382 0.368	0.384 0.367	0.073 0.059	5.255 6.204	0.000 0.000	S S
H9	Moderating Effect 2 - > SA	-0.150	-0.149	0.060	2.507	0.012	NS

Abbreviations: PAC: Potential Absorptive Capacity, RAC: Realized Absorptive Capacity, PS: Project Success, SA: Strategic Agility, PC: Project Complexity, S.D.: Standard Deviation, S: Support, NS: Not Support

3.6 Discussion

The success of SME establishments in the IT industry, affected by environmental uncertainty and rapid changes, requires absorptive capacity (Müller et al., 2021). The technological transformation of Portuguese SMEs is difficult to manage, and it is even more difficult when the project is complex (Costa et al., 2021). This framework is offered in the light of this reality. The IT industry can be used by various organizations and future analysts. Furthermore, this investigation is an effort to fill, at least partially, the gap left by previous studies. Following along the path of previous research and conclusions, the primary goal of this study was to investigate the relationship between potential and realized absorptive capacity and its impact on project success through the mediating role of strategic agility and the moderating role of project complexity within the context of the Portuguese IT sector. The results also indicate that the PAC and RAC both positively influence project success directly and indirectly through mediating strategic agility. The absorption capacity achieved symbolizes the active influence of the new ability (Albort-Morant et al., 2018). Other studies have empirically established the impact of potential capacity on already realized capacity (e.g., Volberda et al., 2010; Andersén, 2015). Currently, information concerning absorptive capability and project success is regarded as critical to dynamic capabilities. To establish a long-term competitive limit, organizations should manage them from a strategic perspective. In the literature, the importance of these capacities justifies the significant increase of knowledge about absorptive capacity and project success (Duan et al., 2021).

The current study's results indicate the complexity of projects. Project complexity a moderator has a positive and significant effect on the relation between potential absorptive capacity and strategic agility but a negative and insignificant one on the relation between realized absorptive capacity and strategic agility, respectively. The management of complex systems is challenging and most projects can be successful if they are handled by analyzing earlier success patterns. They can fail if managers only focus on aspects of project complexity (De Toni et al., 2021). The triple constraints of money, time, and scope has traditionally been used to measure project success, in spite of many additional criteria now being incorporated as contributing considerations (Majeed et al., 2021). It has been suggested that a project's complexity has adverse effects on the success of the project. The results also indicate that a project's success will be negatively affected if complexity is not appropriately evaluated. Project success can be measured in various ways, e.g., completion in a particular time, quality and a specific budget, for example.

3.7 Theoretical and Practical implications

This study is a contribution to a new domain in the literature. The relation of strategic agility is tested and analyzed with variables such as PAC and RAC and their effect on project success. By providing additional empirical evidence in the area of project complexity theory, this research points to some theoretical implications. Significant aspects of project complexity have been analyzed as variables with a moderating effect on PAC, RAC. SA is also shown to moderate mediation on project success. The results of the current study indicate that proactive companies have faster environmental scanning and can find more market opportunities than other organizations. As a possibility for development, companies are more willing to acquire knowledge from external environments (customers, competitors, markets, etc.). Transforming this information efficiently leads to new services and products, improving innovation and boosting the success rate of projects in return. These findings reinforce the position that companies should build a proactive, risk-taking and innovation-driven, enterprise-driven environment to improve opportunities for successful projects. Strategic agility can provide further information to help organizations reform and renew strategically. Therefore, organizations should consider AC as a source of knowledge.

The findings also have some practical implications. The results have led us to the conclusion that the dimension of absorptive capacity affects the performance of small and medium enterprises. Obtaining external information may not directly impact on company success, but it is necessary as a first step in the absorptive capacity process. This study explored the favorable effects of using the characteristics of absorptive capacity on strategic agility. Although there has been no research on this topic, some studies have looked at the impact of knowledge reach, knowledge skills, strategic learning, and other aspects of strategic agility. An option for a specific research subject would be to look into the impact of a company's stakeholders on strategic agility. Furthermore, studies on absorptive ability and strategic agility could assist managers to enhance their management success, especially in nations where environmental changes happen quickly, like in the IT industry (Lowry & Wilson, 2016). Companies must evaluate both absorptive capacity and strategic agility when protecting and developing existing market shares for various reasons, including severe competition among enterprises and changing consumer and stakeholders' expectations. Therefore, they should be able to identify, incorporate the significance of external knowledge in their processes, and eventually apply that information to their products or services. All this will contribute to increased success rates for their projects.

3.8 Limitations and future research

Limitations exist in every study; the current investigation also has some, which include time and resource constraints. For this reason, the research data were gathered from Portuguese project-based IT organizations. The outcome might have been different if the information had been gathered from other organization domains in Portugal. The sample size used can also be considered as a limitation. Due to the Covid-19 pandemic, the data collected from 285 respondents may be considered relatively small. Future studies could test this model on a broader range of industries. Moreover, we recommend further research to explore this phenomenon, which is not necessarily crucial to enhance a company success by capturing value ideas. The early discoveries of local optimization concerns may be investigated further, depending on the performance study of alternative configurations of business-model systems, such as via fuzzy-set analyses. However, its effectiveness is limited to the increase of short-term percentages by adopting such a business-model system in the long term to benefit performance.

Given the scarcity of this kind of study on both topics, future research could examine this issue regarding overall business success and various forms of performance (e.g., financial performance, customer knowledge management capability, innovation performance) in IT, the manufacturing industry and large and small tourism enterprises. Further research is needed to explain agility-related concepts, distinguish strategic agility from other types, help businesses comprehend its value, and fill gaps in the literature.

The results of this research may contribute to the literature and serve as a basis for future research. Additionally, the study on the effects of project complexity on strategic agility and project success needs further research, because these variables could be studied in other sectors by analyzing different dimensions of complexity (i.e., technical complexity, environmental complexity, organizations complexity, resource complexity, etc.). Such an approach would be necessary in mega construction projects (i.e., Dams, Airports, Railways, Road, etc.).

Collaborative Innovation, Strategic Agility, & Absorptive Capacity Adoption in SMEs: The Moderating Effects of Customer Knowledge Management Capability

Abstract

Purpose: The main objective of this research is to identify the relationship between collaborative innovation and the financial performance of Information technology (IT) firms through the mediating role of strategic agility and absorptive capacity. Customer knowledge management capability (CKMC) is also explored as a potential moderator.

Design/methodology/approach: Data were collected from 300 respondents working in different small to medium IT enterprises operating in different cities around Portugal. The simple random sampling method was used for data collection, and Smart partial least squares-structural equation modeling (Smart PLS-SEM version 3.2.8) was used to test the hypotheses.

Findings: The findings demonstrate that collaborative innovation contributes significantly to the financial performance of IT firms in Portugal. The results also indicate that absorptive capacity and strategic agility both positively and significantly affect the relationship between collaborative innovation and firms' financial performance. However, while the moderating role of CKMC has a positive and significant effect on the relation between collaborative innovation and strategic agility, CKMC insignificantly moderates the relation between collaborative innovation and absorptive capacity.

Originality/value: The main objective of this research is to identify the relationship between collaborative innovation and the financial performance of Information technology (IT) firms through the mediating role of strategic agility and absorptive capacity. Customer knowledge management capability (CKMC) is also explored as a potential moderator.

Keywords: Collaborative innovation; financial performance; Absorptive capacity; Strategic agility; Customer knowledge management capability.

4.1 Introduction

Given the increasing unpredictability of innovation, no single organization can effectively manage it (AlTaweel & Al-Hawary, 2021). However, by fostering well-balanced, fair, and consistent relationships amongst various contributors in a predetermined environment, collaborative innovation (CI) may boost the overall efficiency of an organization (Wan, Gao, & Hu, 2022). Firms in the information technology (IT) industry, particularly small and medium-sized enterprises (SMEs), are exploring novel approaches to filling knowledge gaps (Pu et al., 2021; Shehzad et al., 2022). SMEs are not only important for the advancement of innovation because of their inventiveness, ingenuity, and market approach (Zutshi et al., 2021), but they also play a crucial role in keeping the sector competitive by concentrating external resources to ensure the highest internal performance in a few selected technology fields. SMEs depend significantly on collaborative innovation to obtain crucial innovative capabilities (Soto-Acosta et al., 2015). In this way, they are creating novel CI with the help of many multiple stakeholders, all of whom are committed to working together in an atmosphere of trust and via robust exchanges to maximize their individual and collective success.

Increasingly nowadays, information technology enterprises are exposed to continual transformation (Ping et al., 2018). The effect of several factors such as technology, innovation, industry trends, and growing competition, increases the demand for competitive advantage (Pollanen et al., 2017). Strategic agility is the capacity of an organization to recognize and respond to changes in the business environment (AlTaweel et al., 2021). The literature will serve as a basis for enhancing our knowledge of strategic agility and its influence on financial performance (FP) (Arokodare & Asikhia, 2020). The purpose of this study is to comprehend the idea of strategic agility and how Portugal IT workers see it. Numerous strategies, such as maximizing market share, earnings, and customer outcomes such as satisfaction, have been proposed as means towards achieving this objective (Kale et al., 2019). The financial performance of an IT company is a multidimensional construct that can be influenced by various factors such as absorptive capacity (AC), customer knowledge management capability (CKMC), and strategic agility (SA). Strategic agility refers to the fundamental capabilities that businesses demonstrate to adapt to dynamic business environments (Haider & Kayani, 2020); these capabilities enable an organization to perceive, adapt, and react to such circumstances. Strategically agile firms are sensitive to market changes and available possibilities, capable of swiftly reorganizing their resources to capitalize on those chances, and committed to avoiding sluggish reactions that could be caused by internal disputes (Shams et al., 2021). The literature identifies several favorable effects of strategic agility, such as enhancing a firm's ambidexterity (Ahammad et al., 2020; Clauss et al., 2020), improving its performance (Zhou et al., 2018), enhancing long-term efficacy, and enhancing the potential to acquire a competitive edge (Arokodare & Asikhia, 2020). Firm ambidexterity is the ability of businesses to effectively manage both radical and incremental innovation in a balanced manner. It reflects the widely accepted idea that, in order to succeed in a competitive economy, businesses must find a balance between exploring new markets and products while also optimizing operational efficiency and adaptability (Park, Pavlou, & Saraf, 2020).

Moreover, CKMC is acknowledged as the main source for the development of the knowledge-based view (KBV) theory and is regarded as a crucial topic in practice (Martín-de Castro, 2015). Haider et al. (2020) stated that CKMC is one of the criteria to improve the performance of new products, increase product/service quality, decrease costs, and boost an organization's competitiveness, leading firms to seek a well-functioning CKMC in order to deal with obstacles (Sindakis et al., 2015). Therefore, knowledge must make sense of how to ensure the supply of vital products and services to customers and achieve their satisfaction (Suid, Nor, & Omar, 2017). Current economic conditions require that KM serve as a crucial component for the benefit and competitive advantage of IT firms (Migdadi, 2021). IT firms must recognize how to utilize KM to generate their revenues, advantages, and objectives (Korhonen-Sande & Sande, 2016). Given the importance of information to the economy as a whole, organizations may be searching for this crucial component known as CKMC (Rai et al., 2015; Braganza et al., 2017). Therefore, in this current study, CKMC is used as a moderator on the relationship between collaborative innovation and strategic agility, collaborative innovation and absorptive capacity.

Being under increasing pressure to find more effective ways to compete in the global dynamic marketplace of the 21st century, firms must seek greater agility (Johnsen and Lacoste, 2016; Zhou et al., 2018). Strategic agility enables system reorganization, rapid response to change, reforms, flexibility, and the development of processes to regulate environmental change and deal with uncertainty (Gao et al., 2015; Shams et al., 2020). In software companies, knowledge management, agility, and performance are key elements (Jaziri, 2019). Understanding software industries as a fundamental component of economic systems has a substantial impact on the global economy and financial commerce (Santoro et al., 2018; Xie et al., 2018). With increasing competition, software firms realized the need to attract customers and provide points of interest. Customer satisfaction is one of the most important aspects of a software firm's success (Jahan et al., 2019; Kilu et al., 2019). CKMC preferences should be implemented in software businesses so that knowledge and experience are systematically used to enhance the organization's capacity, efficacy, and accountability (Esterhuizen et al., 2012; Akhtar et al., 2018).

The current study addresses this gap by investigating the relationships between collaborative innovation and firms' financial performance in the context of SME level IT firms operating in Portugal. Our study differs from previous investigations in three ways. Few studies have explicitly connected collaborative innovation with firms' financial performance; this study attempts to fill that gap. Moreover, this research investigates the mediating role of strategic agility and absorptive capacity in the relationship between collaborative innovation and financial performance. Finally, by discussing the moderating effect of CKMC, which leads to enhance financial performance, this study proposes that when complex and unpredictable situations occur, managers should focus on customer-oriented strategies and innovation at the same time to outpace their competitors.

Furthermore, according to Zutshi et al. (2021), SMEs do not have a universally accepted definition. In accordance with economic, social, and cultural distinctions, each country has developed its own categorization over the years (Guerrero et al., 2021). Other classifications of small and medium-sized businesses have been based on the number of workers or the firm's yearly sales volume. In some countries, however, the quantity of capital and the amount of credit received are of less relevance (Guerrero et al., 2021). Due to their strength and direct impact on economic and industrial activity, as well as their vital role in the sustainable development of countries (Bouazza, Ardjouman & Abada, 2015), SMEs have been widely recognized as crucial contributors to gross domestic product (GDP) growth in recent decades (Darwish, 2014).

The following sections are structured as follows. First, a literature analysis of collaborative innovation, firms' financial performance, strategic agility, absorptive capacity and CKMC, an overview of the key issues. Second, we create a research model in order to formulate hypotheses. We then provide a study approach for data gathering and measure validation processes. Finally, data analysis, results, and final comments are provided, followed by the study's conclusion.

4.1.1 IT agility in SMEs

Today, it is widely acknowledged that a firm's IT capabilities and competencies may enhance a firm's performance in a variety of ways (Abbasi, & Malik, 2015). In fact, the widespread use of information technology in SMEs makes it easier for managers to communicate across functional and geographical boundaries (Lindner, Wald, 2011). It also improves the coordination of multiple country activities that are associated with superior performance (Andersen and Foss, 2005). However, multinational firms must be nimbler with regard to recognizing and protecting against market risks and when pursuing market opportunities. For instance, big data analytics and related capabilities enhance decision-making processes (Li, Lin, Ouyang, & Luo, 2022) and, when paired with knowledge management skills, have been proven to be connected to a firm's performance (Rezaei, Khalilzadeh, & Soleimani, 2021). Some research in this field links IT skills to agility. For instance, Lu and Ramamurthy (2011) discovered that CKMC competence improves organizational agility, indicating that CKMC permits both market capitalizing agility and operational adjustment agility. In addition, Zhen et al., (2021) suggested that a comprehensive examination of an CKMC is necessary for attaining agility.

4.2 Literature Review

4.2.1 Theoretical Foundations of the Research

4.2.1.1 Contingency theory

In accordance with the principles of contingency theory, a firm's administrative structure should be determined mostly by organizational factors. Thus, this is a feature of environmental dynamism that primarily addresses randomness and the lack of order (Yuan, Xue, & He, 2021). According to Child, Chung, and Davies (2003), contingency theory is primarily focused on the compatibility between organizational variables and predetermined tactics and structures. It holds, then, that a firm's performance depends on its ability to respond to changing environmental circumstances by modifying its own internal structure and procedures to provide better results (Gunarathne & Lee, 2021). This research applies the perspective of contingency theory to comprehend the strategic agility and structure of organizations in turbulent environments. According to Tosi Jr & Slocum (1984), the level to which the organization is integrated and controlled is, from a contingency viewpoint, advantageous to the firm's strong financial performance and the existing conditions. In emerging economies or marketplaces, when the environment is uncertain or illiberal, a basic application of the contingency theory argues that tightly related organization types always lead to greater performance. Relevant to this research, the contingency theory asserts that there is no one way that can best manage a firm's financial performance through absorptive capacity and strategic agility. As a result, businesses that are concerned about understanding and implementing strategic agility and absorptive capacity should integrate potential impacts from both internal and external elements into environmental analyses. Furthermore, it is hypothesized that AC, as the internal competence and capacity of the business, has an explicit focus on product performance and SA capabilities, and that it influences the relationships between CI and FP (Najafi Tavani et al., 2013).

4.2.1.2 The knowledge-based views

In accordance with the knowledge-based view (KBV), a firm's knowledge is its most valuable strategic resource since it is often difficult to imitate and socially complex; it also has the ability to provide persistent competitive advantage and improved firm performance (Iranmanesh et al., 2021). The KBV is a refinement of the resource-based view (RBV). Since its inception, the RBV has been the standard for analyzing and explaining the systematic performance differences across companies within the same sector (D'Oria et al., 2021). In accordance with the RBV, firm-specific resources may have a big impact on productivity (Mahoney and Pandian, 1992). Assets, infrastructure, expertise, and so on are all considered resources under the RBV. The RBV is founded on two fundamental hypotheses: resource heterogeneity and resource immobility. Competing enterprises' resources and competencies are heterogeneously dispersed and may be a source of competitive advantage if they are valued, scarce, difficult to duplicate, and not replaceable by other resources (Barney, 1991; Schulze, 1992).

Moreover, resources and capabilities are a source of sustained competitive advantage, meaning that differences can be long-lasting (resource immobility) when protected by barriers to imitation (Mahoney and Pandian, 1992) or isolating mechanisms such as time compression diseconomies, historical uniqueness, embeddedness, and causal ambiguity (Barney, 1991; Peteraf, 1993). The RBV also emphasizes the role of resource complementarities as a source of business value. When the presence of one resource boosts the value of another resource, such resources are deemed complimentary (Ravichandran, 2018). This complementarity of resources is a cornerstone of RBV and has been used to explain how information and communication technologies overcome their paradoxical nature and contribute to commercial value, for example (Popa, Soto-Acosta, & Perez-Gonzalez, 2018). E-business technology is often imitable; hence, these technologies should not provide a competitive edge (Barney, 1991). This study is based on knowledge and resource-based views, and it investigates the connections between collaborative innovation and financial performance, as well as the mediating effect of absorptive capacity in the connection between strategic agility and the moderating role of customer knowledge management capacity. Knowledge is a crucial factor with regard to boosting a company's competitiveness, and e-business tools may facilitate knowledge creation and sharing.

4.2.1.3 Collaborative innovation and financial performance

Collaborative innovation refers to altruistically based agreements between competing firms that encourage open dialogue and the exchange of resources including money, data, expertise, and equipment in pursuit of a shared aim of progress toward modernization (Stoji, 2020). Thomas et al. (2021) state that inter-firm affiliations are seen as short-term contracts of established duration, based on the principles of trading and sharing, with only partial internalization occurring as the relevant owner always retains full ownership of the assets in question. As a result, there is a vast body of work dedicated to the topic of collaborative innovation, with entries coming from all walks of academic life and spread over a wide variety of media and geographical locations (Agger & Lund, 2017). While collaborative innovation may come from within an organization or from outside it, for the sake of our evaluation, we will only be considering external alliances that are characterized as collaborative associations linked to the revolutionary shift in the IT industry. Collaborative innovations in Internet-enabled products, services, and corporate processes have the potential to provide substantial competitive advantages. According to research by Merroo-Cerdan et al. (2008b), most collaborative technologies have a favorable effect on innovation in SMEs. Knowledge gained from interactions with customers and vendors may also be shared over the internet and extranet for the purpose of innovation (Popa, Soto-Acosta, & Perez-Gonzalez, 2018). In a nutshell, it is anticipated that the advancement of organizational innovation will be prompted by business advantages such as efficient information and knowledge exchange and working with individuals from remote sources.

The RBV has been used in the past to provide theoretical backing for research models that analyze the connections between technological capital and economic output. For instance, (Mikalef, Boura, Lekakos, & Krogstie, 2019) uses the RBV as the basis for a study model that examines the connection between IT resources and financial success inside individual businesses. Using the RBV, Ravichandran (2018) examined the connections between IT resources, IT support for core competencies, and financial performance to verify the validity of Bharadwaj's (2000) research. The findings demonstrate that a firm's success is tied to how well its IT resources are utilized to advance its core capabilities.

Effective collaboration, on the other hand, involves proper co-creation and makes use of each partner's unique capabilities as building blocks in order to scale organizations, motivate people to participate, and advance the segment (Kafouros et al., 2020). Such partnerships have the potential to bring about change on both an individual and institutional scale (De Jong & Freel, 2010). Also, we know a little bit about how these prolific affiliations evolved, which is important since collaborative affiliations might build information for revolution. As a result, we have investigated the technological and social nuances of pioneering association upgrading and its unique consequences on assimilated data and solicitation (Anderson & Hardwick, 2017). It is suggested that collaborative innovation may certify IT organizations with regard to their particular issues based on a number of different principles, including network and resource-based innovation. Traditionally, IT companies' financial performance has been elevated using a mix of financial ratio analysis, benchmarking, calculation of a recital plan versus a financial plan, and so on (Rosita et al., 2020).

Operational performance assessment is an important tool for maintaining a company's competitive edge; as a result, businesses need to understand and act upon the motivations behind their actions (Mondal & Ghosh, 2012). From what can be gleaned from the scholarly literature, it is clear that reliable performance has traditionally served as the go-to for experimental investigations, and that there is a wealth of evidence to support the claim that modernization has only brought benefits to society (Un et al., 2010). In the RBV theory of the company, it is suggested that a moderate version of the impact of information on attractiveness is appropriate (Kamboj et al., 2015). According to the traditional approach to RBV theory, a firm may amass competitive advantages by capitalizing on resources that are highly valued but also unique, irreplaceable, and difficult to replicate (Barney, 1991). There has been long-term research showing that innovation and success go hand-in-hand (see also: (Petrakis et al., 2015; Thomas et al., 2021). So, here is our first working theory.

H1: Collaborative innovation is positively associated with financial performance.

4.2.1.3 Mediating role of absorptive capacity

In macroeconomics, absorptive capacity indicates the capacity of the economy to exploit knowledge and absorb it to produce ultimate ends (Migdadi, 2021). Zahra and George (2002) employed this concept in an organizational context and reached the conclusion that absorptive capacity is the ability of an organization to “recognize the value of new information, to integrate it, and apply it to commercial ends” (Kostopoulos et al., 2011). According to Cunha Filho, (2022) there are four categories of absorptive capacity: acquisition, assimilation, transformation, and exploitation. Acquisition of knowledge is the ability of a company to find and acquire external knowledge, while assimilation is the capability of the firm to grasp and evaluate such information (Zahra & George, 2002). In the following phase, the firm uses and adapts the knowledge to achieve a new combination of the system; this is termed transferability. In the final phase, a firm uses the information to enhance and extend the current operating processes (Migdadi, 2021). Ultimately, absorptive capacity impacts the firm’s performance regarding product and process innovation.

Most of the literature on this subject is devoted to identifying the determinants of absorptive capacity, such as organizational structure, communication, and the ability to combine knowledge (Migdadi, 2021). However, limited research has been conducted on how absorptive capacity receives the impact of collaborative innovation on financial performance and transmits it to organizational innovation. Small and medium-sized businesses (SMEs) often struggle to keep up with large enterprises in terms of absorptive capacity, primarily due to ongoing deficiencies in management, communication, and problem-solving skills crucial for fostering innovation and adopting new technologies (Kosasi et al., 2017; Kafouros et al., 2020). The slow progress of collaborative innovation among SMEs can also be attributed to the significant financial requirements involved in partnering with vendors for the implementation and operation of innovative technologies (Zhou et al., 2018). Consequently, recent research has highlighted distinct differences in the approaches to collaborative innovation between large enterprises and SMEs (Brink, 2017). Compared to SMEs, larger enterprises possess greater capabilities to allocate resources, investments, technologies, and skills, leading to more effective performance improvement strategies (Liu et al., 2022). The increased resources and bargaining power of large enterprises may account for the disparities in their ability to establish robust supply chain connections with external partners (Chan et al., 2017; Chatterjee et al., 2022).

A firm's absorptive capacity is a strategic characteristic that allows it to use diverse external sources of information for innovation. Moreover, it is self-evident that a company whose objective is to increase organizational innovation must have enough absorptive capacity (Murovec & Prodan, 2009). Firms' asymmetric absorptive capacity influences the rate, frequency and amplitude of innovation. Although a number of studies (Migdadi, 2021) have evaluated the impact that absorptive capacity has on a firm's performance, few have examined its impact on organizational innovations (Xie et al., 2018; Migdadi, 2021). In addition, despite the fact that process innovation produces long-term competitive advantage, research has neglected to examine how process innovations are developed and maintained (Kale et al., 2019). Although organizational innovations are seen as a crucial predictor of a firm's productivity and economic development (Kafouros et al., 2020), the capability of organizations to innovate varies and is dependent on the firm's ability to absorb information. A firm's absorptive capacity is contingent on resources that are firm-specific and non-transferable (Martín-de Castro, 2015). Several studies have analyzed the link between an organization's AC and product innovation (Kale et al., 2019), while others have analyzed the connection between intellectual capital and absorptive capacity (Gürlek, 2021).

H2: Collaborative innovation is positively associated with absorptive capacity.

H3: Absorptive capacity is positively associated with financial performance.

H4: Absorptive capacity as a mediator between collaborative Innovation and financial performance.

4.2.1.3 Mediating role of Strategic Agility

The term strategic agility is used to describe the methods through which businesses create value in uncertain and ever-changing markets (Arokodare & Asikhia, 2020). Strategic agility, as defined by (AlTaweel, & Al-Hawary, 2021), is a meta-capability that involves the allocation of resources to enhance distinctive competencies across a firm's function in a way that is consistent with maintaining agility to ensure a balance of competencies over time. Doz (2020) stressed the importance of strategic agility in assisting businesses and suggested that SMEs could avoid "rigidity traps" and over-focusing on external embeddedness by prohibiting organizational recession and orienting toward increased operational flexibility. Market conditions create a climate where firms must adapt quickly to changing circumstances, and this requires the capacity to quickly pivot by methodically altering organizational processes and structures.

Doz and Kosonen (2010) considered that strategic agility was a critical capacity that information technology SMEs must possess in order to develop and alter their business model to become more interactive in the current model context based on a business environment dynamic. The authors contend that strategic agility has three remarkable capabilities: (a) strategic sensitivity, (b) resource flexibility, and (c) leadership unity. Strategic sensitivity plays a crucial role in enhancing the ability to not only recognize the surrounding environment and sense changes in it, but to be able to determine whether these changes represent opportunities that IT firms can exploit or threats they can avoid through planning and predicting future activities to develop alternatives to face potential scenarios (Doz, 2020). Resource flexibility is associated with organizational capacities to restructure and acquire a range of new resources and competencies that enable SMEs to generate value for consumers and transition to modern business models. It signifies leaders' support for policies, collaboration, and collective commitment, in addition to accelerating decision-making processes in a fast-changing environment when time is of the essence (Haider & Tehseen, 2022). The relevance of leadership unity, according to AlTaweel and Al-Hawary (2021), is most notable in establishing efficient communication channels between the different administrative levels of firms.

In addition, the efforts of companies aimed at fostering innovation capacity may be assisted by adopting ways of operating based on strategic agility. Farhana and Swietlicki (2020) noted that strategic agility helps SMEs to offer value for consumers by identifying untapped market possibilities that contribute to meeting customers' expectations (Clauss et al., 2020; Farhana et al., 2020). Strategic agility in innovation was described by Kohtamaki et al. (2020) in terms of three primary practices: proactive idea creation, value-based product development, and product commercialization based on a market-oriented approach.

Since, the tentative or late presentation of a SMEs offer results in a decrease in efficiency and the maximization of costs, Atieno and Senaji (2017) commended the role that strategic agility plays in improving the financial performance of organizations by stimulating a sense of timing, which constitutes a milestone. The capacity to manage resources to ensure efficacy whilst staying in harmony with changing customer needs, as suggested by Clauss et al. (2019), is strongly correlated with financial performance. In addition, Vaillant and Lafuente (2019) found that the provision of a wide range of high-end products and services is profoundly influenced by factors such as: a capacity to adjust to changes in the workplace; the availability of adaptable resources that can be reconfigured to improve innovation capacity; the presence of a shared dedication to achieving strategic goals; and the involvement in R&D. A company's performance may be enhanced if it consistently innovates in response to changing consumer preferences by providing products and services that no one else provides. Such an enterprise will also enjoy a higher market share, greater financial returns, and more customer loyalty. Accordingly, the research hypotheses can be formulated as follows:

H5: Collaborative innovation is positively associated with strategic agility.

H6: Strategic agility is positively associated with financial performance.

H7: Strategic agility as a mediator between collaborative Innovation and financial performance.

4.2.1.3 Customer knowledge management capability as moderator

Previous studies have shown that CKMC should be prioritized as a key component of absorptive capacity and agility (Esterhuizen et al., 2012). In addition, research by Martinez-Conesa et al. (2017) showed that CKMC not only creates a more conducive environment for achieving organizational absorptive capacity and agility, but also increases the likelihood of constant innovation. However, much of the firm-level empirical evidence of absorptive capacity focuses on larger enterprises and R&D-intensive industries (Brink, 2017; Liu et al., 2020), there is a notable absence of data that explores how this crucial aspect of learning impacts SMEs in establishing and maintaining partnerships with other businesses and organizations. Acquiring, disseminating, and using client-specific information to aid in product innovation are all aspects of customer knowledge management (Granados et al., 2017). For instance, Roos et al. (2001) proposed that organizations following distinct strategies had different value-creating processes (people-centered and process-oriented), but they did not investigate the moderating influence of knowledge management approach. There are some similarities between Kale et al. (2019) people-centered strategy and the current study's customer centered approach to knowledge management, and between their absorptive capacity and the strategic agility was used in this study. Delivering value (improved organizational performance) is the work of skilled employees who use their expertise to build meaningful relationships with customers (Idrees et al., 2023). Competent global managers with robust worldwide networks are found to increase a company's competitiveness in the literature on international human resource management (Antal, 1993). Cross-cultural abilities and international networks are crucial to effective international management. Hence, agility promotes informal, face-to-face communication and knowledge exchange between teams and their clients. Improvements in project success may be attributed to this open exchange of information (Singh et al., 2011). According to Ofoegbu and Akanbi (2012), information technology SMEs absorptive capacity is a key source of success and a strong predictor of its overall performance. Haider (2019) illustrated that the CKMC encourages tactical adaptability as a way to set up effective new regulatory processes. Hence, the CKMC supports strategic agility for reliable new regulatory procedures (Hanisch et al., 2009). With KBV theory, the hypotheses are strengthened even more. CKMC execution has been thought of as a capability, with absorptive capacity and agility providing the ability to adapt to unpredictable conditions in order to improve financial performance (Chatterjee et al., 2022).

A IT firm's knowledge of its customers and its nimbleness enable it to react promptly to consumer needs; high responsiveness and high adaptability provide a competitive advantage over competitors in the market (Belkahla et al., 2011). The purpose of other research (Al-Qatawneh et al., 2019; Kale et al., 2019) was to determine whether industrial agility may be the most significant success factor for a number of organizations by examining the influence of agility on financial performance. Tallon and Pinsonneault (2011) demonstrated that agility mediates the relationship between IT position and performance. Williams et al. (2015) contend that projects should be separate, short-term tasks that are regularly started to achieve a certain set of goals. However, Queiroz et al. (2018) argue that the scope of work and goals that must be reached when responding to the financial performance environment are not clear.

Looking back at the research, the concept of agility was initially introduced in the 1990s in a study conducted at the Iacocca Institute in the United States. In order to maintain a competitive edge in an uncertain market, agile measures and a strategy for empowering employees were originally adopted (Anderson and Tushman, 2004). The original definition of "agile" has evolved and broadened over time. To remain competitive, businesses need strategic agility, which Kale et al. (2019) define as the capacity to incorporate and adapt to novel ideas into the development of products, services, and alternative approaches to problem solving. As a result of the ever-changing nature of the corporate world, problems and dissatisfaction are expected to occur (Chan et al., 2017). Strategic agility and absorptive capacity to face unanticipated variations, capitalize on the financial potential of change, and attract customers (Zhang and Sharifi, 2007; Battistella et al., 2017). To compete with global rivals and successfully fulfill the changing wants of consumers, organizations must be nimble; provide new products; adapt to constantly advancing political change; create solid customer relationships; and provide top-level management (Oyedijo, 2012; Martinez-Sanchez and Lahoz-Leo, 2018) (see Figure 9).

H8: Customer knowledge management capability as a moderator between collaborative innovation and absorptive capacity.

H9: Customer knowledge management capability as a moderator between collaborative innovation and strategic agility.

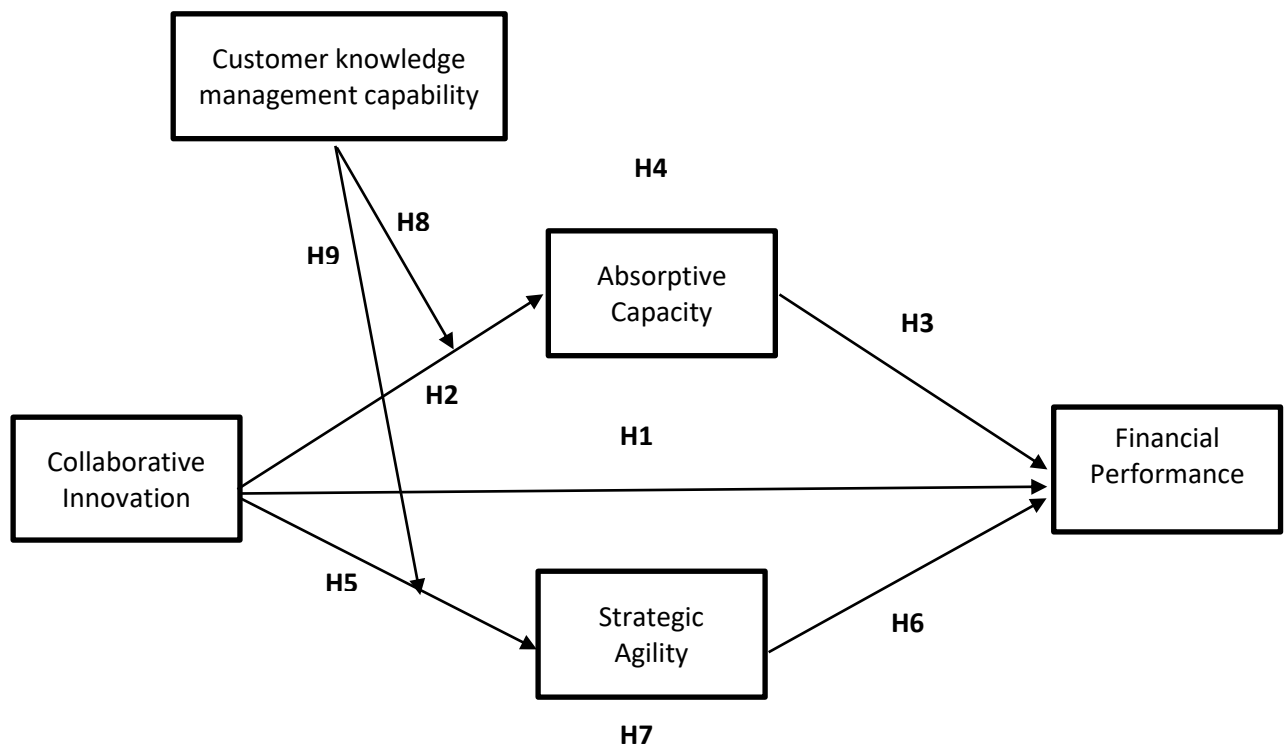


Figure 9 - Conceptual Model

4.3 Research Methods

4.3.1 Sample and Data Collection

The goal of the present study was to analyze how collaborative innovation in Portugal has influenced the financial performance of SME level information technology companies. The report by the Organization for Economic Co-operation and Development (OECD) for 2020 shows that, despite the COVID-19 pandemic, Portuguese SMEs in the information technology sector are seeing strong development (Alam & Murad, 2020). In the current study, probability, simple random sampling technique was used (Meng, 2013), and data was collected within four months from November 2021 till February 2022. The respondents were project managers, software development teams, designers, and operation managers working in twenty-four public and private small to medium-sized IT companies operating in different cities of Portugal. For this study, we used a self-administered paper-and-pencil survey and, in some cases, an online survey through google doc and monkey survey to gather data due to COVID-19 pandemic. This information was initially collected from the PORDATA database regarding SMEs in the IT sector in Portugal. SMEs from the IT sector of developed economies are more open to intense competitiveness and environmental change. They recognize and appreciate the importance of knowledge resources and continued renewal (Galina et al., 2016; Silva et al., 2021). Among the respondents, the majority work at Unbabel, BI4ALL, Glinntt, Vortal, and Timestamp, with these companies collectively employing an estimated total of 900 employees. The sample size of 276 was adopted based on the Slovin formula, accepted globally to calculate the sample size and used recently in the SMEs by Kosasi & Yuliani (2017).

$$n = \frac{N}{1 + N(e)^2}$$
$$n = \frac{900}{\{1 + 900 * (0.05)^2\}}$$
$$n = 276$$

The data gathered by scholars from 320 target respondents exceeded the minimum sample size requirement. From the initial distribution of 400 questionnaires, 320 were returned. However, 20 were rendered unreliable due to missing information and/or incorrect responses and had to be excluded. This left 300 valid questionnaires, giving a response rate of 75%. There were two sections to the questionnaire. Individual characteristics were collected in Section A, including demographics like age, gender, marital status, occupation, and years of experience (as presented in Table 12). Section B includes questions to assess the relationship between independent and dependent variables. Among the 300 responders, 52.7% were men and 47.3% were women. In terms of educational level, the majority of respondents held a master's and bachelor's degree. Regarding working experience, 7.3% had less than 1 year of experience, 33.3% had 1-5 years, 33% had 6-10 years, and 26.3% had more than 10 years of experience in IT projects. This distribution indicates the quality of their responses. Harman's one-factor analysis results indicated that the study had no problems with common method biases analysis, based on exploratory factor analysis and principal analysis approaches, as the single factor explained 24.52 % of the cumulative variance, which is below the suggested 50% threshold (Fuller et al., 2016).

Table 12 – Descriptive Statistics

Demographics	Categories	Frequency	Percent
Gender	Female	142	47.3
	Male	158	52.7
Age	20-30 years	106	35.3
	31-40 years	135	45.0
	41-50 years	55	18.3
	More than 50 years	4	1.3
Education	BACHELOR	77	25.7
	MASTERS	135	45.0
	MS/Phil.	64	21.3
	PhD.	11	3.7
	Any Other	13	4.3
Experience	Less than 1 year	22	7.3
	1-5 years	100	33.3
	6-10 Years	99	33.0
	More than 10 years	79	26.3

Note: (Source: Author)

4.3.2 SMEs

4.3.2.1 Overview of SMEs

From 2008 to 2020, data on the number of SMEs in Portugal by size reveals that micro-sized firms with up to nine employees make up the majority of SMEs in Portugal, with around 889,296 of them in 2020 (European Commission, 2019). The small and medium sized enterprises (SMEs) in Portugal are vital to the country's "non-financial business sector," producing 68.3% of GDP and employing 77.4% of the workforce. SME employment and value added both increased by 15.2% and 27.0%. Although consistent with global trends, growth slowed in 2017–2018, with SMEs adding 3.4% to their workforce and 4.6% to their value.

4.3.2.2 SME policy priorities

According to the European Commission (2019) policy measures are required: to improve the performance of Portugal's SMEs in terms of internationalization; to protect SMEs against late payments from public and private customers; and to assist SMEs in securing public sector contracts. Although Portugal has established new policy measures and achieved some good improvements regarding access to finance, many difficulties persist that necessitate continuous policy attention.

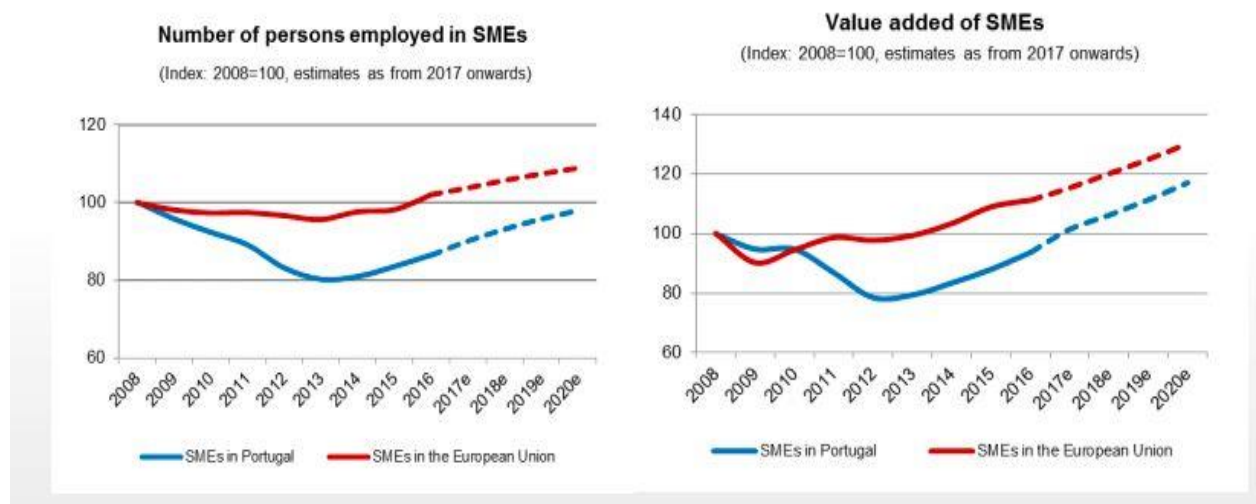


Figure 10- Portuguese IT SME growth (Source: (European Commission (2019) SBA fact sheet: Portugal

In recent years, Portuguese IT SMEs have developed significantly. From 2014 to 2018, SME employment grew by 9.5%, while SME value added increased by 18.3% (see Figure 2). Since 2014, this has mostly been due to improving market circumstances and the general economic recovery and growth. This economic recovery has prompted a rise in both local investment and international investment of multinational IT firms. The significant role that SMEs play in the IT supply chains of major companies was a significant contributor to the 29.4% rise in SMEs value added in the IT sector between 2014 and 2018 (European Commission, 2019). This sub-sector is vital to the country's IT sector, generating 15.1% of the total value contributed by SMEs and supplying intermediate inputs to a broad variety of other sub-sectors.

Since 2008, the Portuguese government has made considerable efforts to improve SMEs' access to capital, with initiatives being focused on credit lines sponsored by the government. In addition, it has implemented co-investment initiatives to attract venture capital and business angels. These policies were developed as part of "Startup Portugal," the national plan for entrepreneurship. The project Portugal INCoDe.2030 unveiled in this year's national reform agenda will also include steps to improve ICT skills.

Owing to the inflexibility of large corporations and their tendency to upgrade existing goods in order to increase their numbers and gain public advantage, many technical processes and breakthroughs are credited to SMEs (Pu et al., 2021). Furthermore, SMEs also provide employment possibilities, employing a significant portion of a nation's labor population and enabling these people to advance their professional abilities (Mosca et al., 2021). Consequently, these businesses are essential to economic growth because they create high-quality employment opportunities that promote economic inclusion and alleviate poverty, particularly in Portugal. In this process, SME growth and expansion into new markets occurs over time.

4.3.3 Measures

The deductive method was used to establish relationships between the selected variables. We developed a set of hypotheses based on absorptive capacity and strategic agility as mediators between collaborative innovation and financial performance. In this study, we used a 5-point Likert scale to rate each item. This study consists of a closed-end questionnaire from various reliable sources used to evaluate five variables. An 11-item scale was used for the independent variable (collaborative innovation) developed by Bucic et al. (2012). To measure the dependent variable (financial performance), a 4-item scale adopted from Shashi et al. (2019) was used. The current study used two mediating variables: absorptive capacity (a 10-item scale) developed by Zahra et al. (2002); and strategic agility (an 8-item scale) adopted from Queiroz et al. (2018). Lastly, the moderating variable customer knowledge management capability was measured using a 4-item scale adopted from Tanriverdi (2005).

4.3.4 Results

To evaluate structural equation modeling (SEM), the study used Smart partial least squares (PLS) software version 3.2.8 (Hair et al., 2019). SEM is a multidisciplinary technique often used to investigate relationships between variables. It enables simultaneous examination of various variables in an integrated model. PLS was selected over other approaches due to the limited sample size and non-parametric nature of the findings. This technique is equally effective for the analysis of non-distributed data (Hair et al., 2017). The PLS-SEM method of data analysis includes an evaluation of the structural models' efficacy and adequacy using metrics that assess the model's validity and reliability (Henseler et al., 2015). Factor loading and path coefficients for the three hundred samples were evaluated using the bootstrapping technique (5000 sub-sample for T-test) (Hair et al., 2017). The results of the validity and reliability checks are shown in Table 13. Internal consistency was examined by calculating the composite reliability (CR) and Cronbach's Alpha (α). The results in Table 2 show that the constructs are internally consistent, since both the CR and Cronbach's Alpha were greater than 0.70. Furthermore, indication validity was checked by calculating factor loading values. Based on the Figure 11 for convergent validity, the reliability indicator indicates that the loading of each item falls within the range of 0.542 and 0.925. Following Hair et al. (2017) guidelines, factor loadings between 0.40 and 0.70 should only be deleted if doing so would result in an increase in the average variance extracted (AVE). To be considered acceptable, the values of the AVE should be greater than the specified threshold of 0.50 (Hair et al., 2017). Therefore, one collaborative innovation item (CI6) was removed to increase the value of AVE. After deleting the specific items would result in higher factor loadings, CR, and AVE values than the recommended cut-off values.

Table 13 -Measurement Model

Constructs/ Items	Items	Factor Loadings	α	CR	AVE	Authors
Absorptive Capacity			0.892	0.911	0.507	Zahra et al. (2002)
We are successful in learning new things within this group.	AC1	0.747				
We are effective in developing new knowledge or insights that have the potential to influence product development.	AC2	0.774				
We have effective routines to identify, value, and import new information and knowledge.	AC3	0.781				
We have adequate routines to analyze` the information and knowledge obtain.	AC4	0.790				
We have adequate routines to assimilate new information and knowledge.	AC5	0.812				
We are effective in transforming existing information into new knowledge.	AC6	0.616				
We can successfully exploit internal and external information and apply knowledge to concrete applications.	AC7	0.651				
We are effective in utilizing knowledge in new products.	AC8	0.664				
We are able to identify and acquire internal (e.g., within the group) and external (e.g., market) knowledge.	AC9	0.616				
Prior to the project, did your project team have the expertise required to assimilate the knowledge that came from the other subsidiaries?	AC10	0.631				Bucic et al. (2012)
Collaborative Innovation			0.850	0.879	0.524	
New product prototypes (still in the development stage)	CI1	0.722				
New products or services introduced to the market which are new to the market or the firm	CI2	0.732				
Significant modification to existing products or services	CI3	0.704				
New/modified production or manufacturing techniques	CI4	0.705				
New/modified administration or managerial techniques / practices / policies	CI5	0.739				
Patents either applied for, pending or obtained.	CI7	0.581				
Publications in academic, scientific or technical journals by people in the collaboration	CI8	0.594				
Formal presentations at conferences or seminars	CI9	0.571				
Licenses or technology rights sold	CI10	0.542				Queiroz et al. (2018)
Licenses or technology rights purchased	CI11	0.580				
Strategic Agility			0.909	0.926	0.612	
Respond to changes in aggregate customer demand.	SA1	0.766				
Customize a product/service to suit an individual customer.	SA2	0.754				
React to new product/service launches in the market.	SA3	0.813				
Introduce new pricing schedules in response to changes in competitors' prices.	SA4	0.787				
Expand into new regional and/or international markets.	SA5	0.735				
Expand or reduce the variety of products/services available for sale.	SA6	0.785				
Adopt new technologies to increase the throughput of products/services.	SA7	0.844				
Switch suppliers or partners.	SA8	0.771				Tanriverdi, (2005)
Customer Knowledge Management Capability			0.825	0.884	0.656	
CREATE. Creating marketing skills and knowledge that are applicable across multiple business units	CKMC1	0.826				
TRANSFER. Transferring relevant customer knowledge among business units	CKMC2	0.775				
INTEGRATE. Integrating relevant customer knowledge of multiple business units to gain new customer insights	CKMC3	0.820				
LEVERAGE. Changing marketing & product policies of business units based on relevant customer knowledge discovered in other business	CKMC4	0.819				

units.

Financial Performance		0.866	0.910	0.720	Shashi et al. (2019)
The return on investment of our company is higher compared to competitors.	FP1	0.920			
The return on assets of our company is higher compared to competitors.	FP2	0.807			
The sales growth and profitability of our company are higher compared to competitors.	FP3	0.725			
The total operating costs of our company are lower compared to competitors	FP4	0.925			

(Source: Author), Abbreviations: CR: Composite Reliability; α : Cronbach Alpha; AVE: Average Variance Extracted, AC: Absorptive Capacity, FP: Financial Performance, CI: Collaborative Innovation, IC: Intellectual Capital, CKMC: Customer Knowledge Management Capability, SA: Strategic Agility.

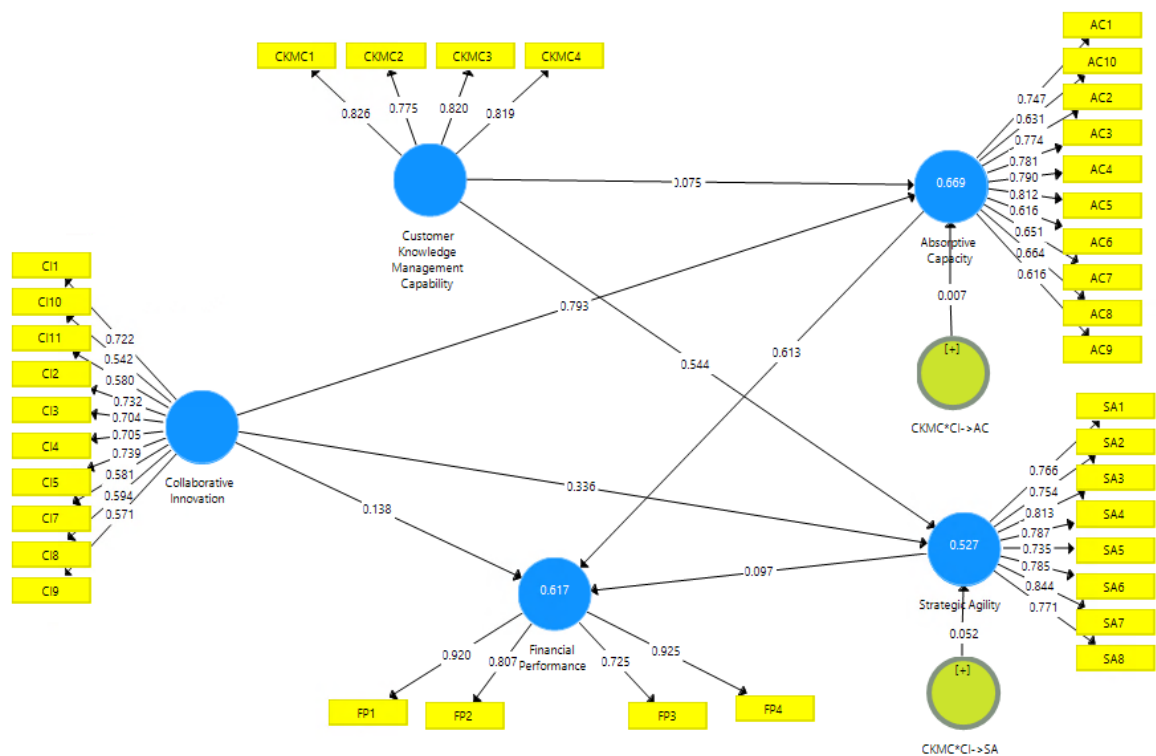


Figure 11 Measurement Model Analysis (Source: Author)

4.3.4.1 Discriminant Validity by Heterotrait-Monotrait (HTMT)

The validity of discrimination was assessed in two ways, using the HTMT technique established by Henseler, Ringle, and Sarstedt (2015). We started by using HTMT to determine the threshold value. A score higher than the HTMT minimum threshold suggests no discrimination or bias exists. When the correlation is close to one, the precise HTMT threshold value is debatable. Some scholars advocate that a threshold value must be less than 0.85 (Purwanto et al., 2021), while other, more lenient scholars, posit that HTMT values can be less than 0.90 (Benitez et al., 2020). Second, using HTMT values with a confidence range of 0–1, we were able to establish and assess discriminant validity. When the value 1 is taken out of the interval range, the actual values of the variables stand out more clearly. It can be seen in Table 14 that the HTMT values between constructs are below 0.85. This study therefore recognizes the existence of discriminating validity.

Table 14 -Discriminant Validity by HTMT

Constructs	AC	CI	CKMC	FP	SA
Absorptive Capacity					
Collaborative Innovation	0.557				
Customer Knowledge Management Capability	0.350	0.342			
Financial Performance	0.839	0.767	0.373		
Strategic Agility	0.542	0.546	0.748	0.534	

(Source: Author), Abbreviations: AC: Absorptive Capacity, FP: Financial Performance, CI: Collaborative Innovation, IC: Intellectual Capital, CKMC: Customer Knowledge Management Capability, SA: Strategic Agility.

4.3.4.2 Structural Equation Model

Once the measurement model is completed, the structural equation model is calculated. This research used the standard bootstrapping method to determine the significance of any correlation between the constructs. We use the techniques given by Henseler et al. (2015) to study the mediating effects of absorptive capability and strategic agility. Using four key parameters, the direct and indirect impacts of structural equation modeling were evaluated. First, to determine the total variance of R² is explained by all endogenous latent variable constructs (Hair et al., 2018). Although the analysis is necessary for an acceptable assessment of R² (Hair et al., 2017), there are high, moderate, and low values of 0.72, 0.56, and 0.34, respectively. Due to collaborative innovation and absorptive capability, strategic agility and CKMC, the R² values for the endogenous variable financial performance are projected to be 61.7% in the current research. In addition, the anticipated R² for absorptive capacity is 0.669, and strategic agility is 0.527, indicating that collaborative innovation and CKMC predicts a 66.9% change in absorptive capacity and a 52.7% change in strategic agility. The model predicts this with sufficient accuracy, as shown in Table 15 and Figure 12.

Table 15 - Coefficient of Determination `

Constructs	R Square	R Square Adjusted	Q ² (=1-SSE/SSO)
Absorptive Capacity	0.669	0.665	0.337

Financial Performance	0.617	0.613	0.435
Strategic Agility	0.527	0.522	0.316

Note: (Source: Author).

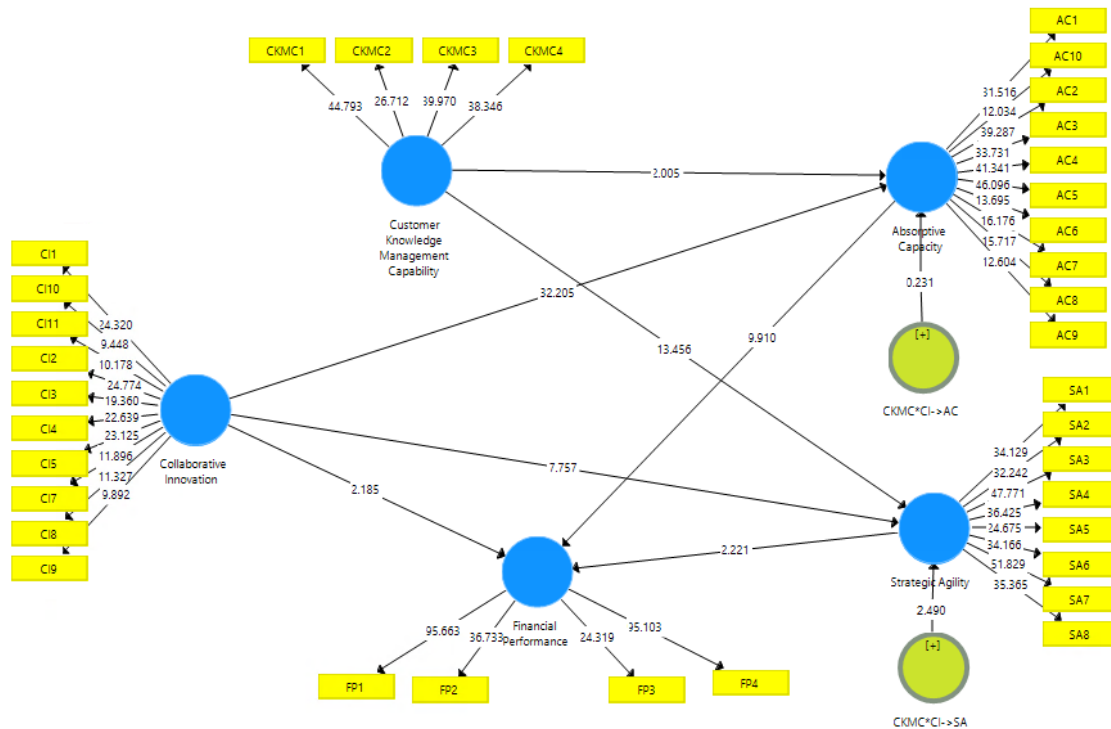


Figure 12 PLS-Path Analysis (Source: Author)

Secondly, a cross-validation redundancy was used to evaluate the research model's predictive relevance (Q2) (Hair et al., 2017). Table 15 shows that the direct effect model provides significant estimates, since Q2 is greater than zero for all endogenous latent variables: absorptive capacity (0.337); financial performance (0.435); and strategic agility (0.316). In order to measure how much impact an exogenous (independent variable) has on the endogenous (dependent variable), we used a metric called effect size (f2) (Hair et al., 2017). According to the criteria established by Cohen (1988) the effect sizes range from 0.02, 0.15, and 0.35, these being small, medium, and high, respectively. As shown in Table 16, the effect size of CI on FP is 0.216, CI on AC is 1.731, AC on FP is 0.317, CI on SA is 0.218, and SA on FP is 0.118. That is why these external constructions have medium and high impact sizes on the endogenous construct. The findings show that these exogenous constructs have a medium and high impact on the endogenous constructs.

The direct effect of collaborative innovation on financial performance is positive and significant ($\beta = 0.137$, $p < 0.05$). Furthermore, the direct effect of collaborative innovation on absorptive capacity ($\beta = 0.792$, $p < 0.05$), collaborative innovation on strategic agility ($\beta = 0.336$, $p < 0.05$), absorptive capacity on financial performance ($\beta = 0.615$, $p < 0.05$) and strategic agility on financial performance ($\beta = 0.336$, $p < 0.05$) were all positive and significant. Therefore, all direct hypotheses H1, H2, H3, H5 and H6 were accepted. We tested whether absorptive capacity and strategic agility positively and significantly mediates the relationship between collaborative innovation and financial performance as follows: the indirect effect was calculated as described in Table 5, the indirect effect of AC on CI and FP ($\beta = 0.487$, $p < 0.05$) and SA on CI and FP ($\beta = 0.032$, $p < 0.05$) both were positive and significant. Hence, both mediating hypotheses H4 and H7 were accepted. Finally, the moderating effect of CKMC on the relationship between CI and AC ($\beta = 0.007$, $p > 0.05$), also CI and SA ($\beta = 0.052$, $p < 0.05$) were tested. The results in Table 16 revealed that CKMC positively and significantly moderates the relationship between collaborative innovation and strategic agility. However, CKMC does not significantly moderate the relationship between collaborative innovation and absorptive capacity because the p value is greater than 0.05. Therefore, the findings demonstrate that while hypothesis H9 is accepted, H8 was rejected.

Table 16 - Structural Equations Model Results

Hypotheses	Relationship among Constructs	Direct Effect	Indirect Effect	Mean	S. D.	f ² Values	T Values	P Values	Remarks
H1	CI -> FP	0.137		0.139	0.063	0.216	2.185	0.029*	Supported
H2	CI -> AC	0.792		0.794	0.025	1.731	32.205	0.000**	Supported
H3	AC -> FP	0.615		0.615	0.062	0.317	9.910	0.000**	Supported
H4	CI -> AC-> FP		0.792*0.615 =0.487	0.488	0.052		9.361	0.000**	Supported
H5	CI -> SA	0.336		0.339	0.043	0.218	7.757	0.000**	Supported
H6	SA -> FP	0.096		0.096	0.043	0.118	2.221	0.026*	Supported
H7	CI -> SA-> FP		0.336*0.096 =0.032	0.033	0.016		2.038	0.042*	Supported
H8	CKMC*CI->AC		0.007	0.006	0.032		0.231	0.617	Not Supported
H9	CKMC*CI->SA		0.052	0.052	0.035		2.490	0.036*	Supported

(Source: Author), Abbreviations: AC: Absorptive Capacity, FP: Financial Performance, CI: Collaborative Innovation, IC: Intellectual Capital, CKMC: Customer Knowledge Management Capability, SA: Strategic Agility, S. D.: standard deviation, f²: Effect Size, * $p < 0.05$, *** $p < 0.001$.

4.4 Discussion

The primary goal of this research was to analyze the impact of collaborative innovation on financial performance within the context of Portuguese IT SMEs, taking into account the mediating roles played by absorptive capacity, strategic agility, and with customer knowledge management capability as a moderator. Consequently, the findings from the structural equation modeling showed that collaborative innovation significantly enhanced capacity to understand customer needs and wants, which in turn reduces project delay, avoids over consumption of the budget, and increases financial performance. In addition, the mediating role of strategic agility also has a favorable and statistically significant direct and indirect effect on financial performance. Furthermore, Esterhuizen et al. (2012) and Tang et al. (2020) showed that CKMC not only enhances the possibility to continuously innovate but also provides a supportive culture conducive to fostering strategic agility within the firm. According to Ping, Chinn et al. (2018), strategic agility is a strong predictor of an organization's success and is key to its survival. It stands to reason that businesses would fare better financially, satisfy their customers, and increase their market share if they implemented agile strategies that focused on creating realistic scenarios based on perceiving changes in the business environment. This finding implies that the ultimate objective of innovation capabilities may be attained through strategic agility, which enables firms to be aware of market shifts and consumer requirements. Therefore, strategic agility is considered a must for SME level IT companies (Iddris et al., 2014). With regard to innovation capability, the specific contribution that strategic agility makes can be explained by its exceptional capabilities, which include recognizing the external environment through strategic sensitivity, acquiring new resources or reshaping existing resources (resource fluidity), and its total commitment to facing external challenges (leadership unity).

The research also discovered that the organization's AC has a substantial correlation with FP, with the results showing that when an AC increases, innovation-related strategic capabilities will grow, and the corporation will achieve a sustained competitive advantage in the future. Moreover, AC supports an innovation-focused organizational culture and encourages workers to take the initiative and act creatively in order to thrive in this age of intense competition. This is consistent with the findings of Kostopoulos et al. (2011). In other words, strategic competence provides an organization with knowledge about the market, while customer focus and innovation capability allow a company to develop new processes or inputs and produce innovative goods. Therefore, the ability of organizations to create products and services that satisfy customer demands is enhanced by their awareness of the significance of predicting changes in the business environment, and their ability to reallocate available resources in proportion to the exploitation of opportunities and avoidance of threats. This ultimate goal can be reached by using a modern management strategy that encourages continuous growth, as shown by a rise in productivity, a wide range of customers, and an increase in long-term returns.

Considering that the majority of IT firms in Portugal are small and medium-sized businesses, allocating capital and personnel to CKMC is a formidable challenge for any firm. The findings of this study would suggest that IT company managers implement processes within their organizations that give customers access to all essential data and provide related services to each market segment (Marcucci et al., 2021). Similarly, managers are advised to assist in the process of acquiring and transforming knowledge into a competitive advantage and to build the necessary frameworks.

Customer knowledge management (CKM) has been shown to have a favorable effect on financial performance, and this is consistent with previous research (Belkahlia et al., 2011; Pollanen et al., 2017; Jaziri, 2019). The current research, which is founded on resource-and knowledge-based perspectives, sheds light on the favorable impact that collaborative innovation capabilities have on the financial performance of Portuguese IT SMEs. The empirical findings indicate that the use of collaborative innovation capabilities enhances financial performance immediately. Previous research (Del Giudice and Della Peruta, 2016; Meroo-Cerdan et al., 2007; Soto-Acosta et al., 2015) has shown that in order to build innovation processes, businesses are embracing more collaborative technology, such as databases, repositories, forums, and workflows. Meroo-Cerdan et al. (2007) discovered that the majority of collaborative technologies allow and promote organizational innovation in SMEs. This research provides empirical evidence of the favorable influence of collaborative innovation, consistent with literature.

4.5 Contributions to the Literature

This research makes several contributions to the literature on strategic agility, collaborative innovation capability, financial performance, CKMC, and absorptive capacity. What is more, it posits the theoretical implication (by providing additional empirical evidence from proven hypotheses) that strategic agility is a key resource. Since the studies of CKMC and strategic agility are limited in the KM literature, the results of this study should add to the literature and serve as a foundation for future research (Haider, & Kayani, 2020). Similarly, the findings demonstrate that strategic agility has a large and favorable mediating impact on the relationship between collaborative innovation and financial performance. Likewise, it is essential that managers understand how CKMC influences the organization strategies and absorptive capacity. If organizational actors are functioning autonomously without interdepartmental collaboration, the performance of the organization will be severely affected. There has to be an emphasis on other values than cooperation, such as creativity, reliability, and efficiency. Management must also stress the need to implement and adhere to KM practices. SME-level firms' performance suffers if employees do not understand customer requirements properly (Tang and Marinova, 2020). It is the duty of the executive team to foster an environment where knowledge management approaches are adopted and used in a way that leads to the sustaining of a competitive advantage. Only IT firms that can effectively compete with their competitors can survive in today's competitive environment. Following KBV, it is recommended that firms maintain and even strengthen the connection between collaborative innovation, absorptive capacity and strategic agility through the use of CKMC practices.

Moreover, SA and AC enable firms to identify market possibilities and evaluate the applicability of their internal capabilities to capitalize on these chances. A continued commitment of management to work together also makes it easier for a company to adapt to changes in the environment. This research demonstrates that strategic agility is fundamental to innovation capabilities. The capacity to integrate resources, which is essential for fostering innovation, is the most significant implicit characteristic of strategic agility. Innovation is the transformation of ideas into new methods or products, which is a dynamic skill that entails concentrating on current resources and processes while using new knowledge to adapt to a changing organizational context. The function of CKMC in this situation is to assess the nature of the environmental change and determine the appropriate reaction. In many instances, however, businesses are unable to adequately meet the challenge to adapt to environmental change. This demonstrates the significance of strategic agility, and the importance of AC and CKMC regarding meeting market demands.

4.6 Limitation and future directions

One of the limitations of this study is that the data was only collected from workers in 24 Portugal IT SMEs enterprises, which raises the possibility that the sample data may not be applicable to all Portuguese IT SMEs. As the software market environment is always evolving, it is possible that the present research may not accurately reflect future business situations, which limits its generalizability. To test the proposed framework, we recommend that in future studies, researchers consider a longitudinal approach using a larger sample and a broader representation of firms in other industrial sectors (such as construction and fashion), as well as other geographic contexts, and compare the results with those of this study. Innovation measures are subjective in that they are based on the Likert-scale answers of the Portuguese IT SME workers, so it may be relevant to add objective innovation data when assessing this construct. Future designs of studies could also consider the different levels of innovation (radical and gradual) and other types of innovation, such as new business models. Despite its limitations, however, this work paves the way for more research in areas connected to agility. According to Mao et al. (2015), there is little evidence to suggest how much an organization's knowledge management skills influence its agility. Using conceptual works that attempt to establish the possible consequences of knowledge management and agility as a starting point, researchers should endeavor to link their research (Shams et al., 2019). Finally, to provide a set of ideas that lead to organizational growth, future research should attempt to establish the influence of strategic agility on managerial and economic variables, including entrepreneurial orientation, sustainable competitive advantage, and organizational development.

4.7 Limitation and future directions

Due to its unique emphasis on IT businesses in Portugal, the primary data collected make a useful addition to the theme under study. We may conclude that strategic agility is a difficult issue that nevertheless has been shown to have an effect on IT businesses. The literature and the results of our research show that there are many different aspects of strategic agility that affect financial performance. Among these is its ability to successfully affect operational states in response to unpredictable and changing demands imposed by a business environment that is very variable and dynamic. The conventional method of planning a corporation is not especially effective in international enterprises, which is due to the fact that organizations must integrate and comprehend external difficulties and obstacles in order to react effectively. To attain its targeted performance, a company must monitor and identify all the essential aspects that contribute to its operational flexibility. Thus, the primary purpose of an agile organization is to guarantee that all of its customers and staff are satisfied and happy to gain the skills required to do so quickly and efficiently.

We sent out 400 self-administered questionnaires, choosing for analysis 300 from the 320 that were returned. The results of the study accepted all but one of the hypotheses posited: H1, H2, H3, H4, H5, H6, H7, and H9, with the exception being H8. CKMC entails enhancing corporate knowledge to comprehend customer requirements and preferences. The study contributes to the expansion of the conceptual framework of strategic agility, which is the ability to respond effectively to dynamic and unpredictable business environments by reorganizing the system, responding quickly to change, and developing procedures to deal with environmental changes. It also aids in enhancing the performance of IT SME organizations. The study also provides an incentive for more research on this topic in so far as it relates to CKMC and strategic agility. It also gives some advice on how to approach this problem.

CHAPTER 5

Conclusion

This chapter provides a summary of the key results, identifies the study's most significant contributions, discusses its limits, and suggests areas for future study.

The present thesis consisted of three separate articles. In each of the articles, the issue of the link between absorptive capacity and the performance of Portuguese IT companies was analysed from a unique perspective. In the first article, we examine collaborative innovation in order to achieve the financial objectives of such companies. It may also help researchers to understand how collaborative innovation and intellectual capital attain and maintain absorptive capacity. The second article examines how potential and realized absorptive capacity enhance project success, and strategic agility as a mediator and moderator project complexity are the new contributions for SMEs research in project-based IT Companies in Portugal? The third article examines whether there is any relationship between: customer knowledge management capability, strategic agility, absorptive capacity, financial performance and collaborative innovation capability.

5.1. Summary of the main findings

The objective of article 1 was to examine the impact of collaborative innovation on the financial performance of IT companies through the mediating role of absorptive capacity and the moderating role of intellectual capital. The study is based empirically on a sample of small and medium sized IT enterprises operating in Portugal. Due to the COVID-19 pandemic there has been rapid growth seen in small and medium sized IT companies as shown in the Organization for Economic Co-operation and Development (OECD) report 2020 (Lamichhane et al., 2021). For the current study, a simple random sampling technique was used, and data were obtained from both public and private project-based software organizations operating in different cities ((Lisbon, Porto, Coimbra and Braga) of Portugal from November 2020 to February 2021. Data were collected through a self-administered paper-and-pencil survey and in some cases through an online-survey due to the COVID-19 pandemic. The respondents are: programming managers, designers, project supervisors, operation managers working in different small and medium sized IT enterprises. This research follows a deductive approach, seeking to understand any causal connections between the variables selected. Evaluating absorptive capacity as a mediator between collaborative innovation and financial performance leads to the creation of a

range of hypotheses that also measures the role of intellectual capital as a second-order moderating variable in the three dimensions of: human capital, organizational capital, and social capital. All items were evaluated on a 5-point Likert scale.

The analysis was made using Smart PLS tools v.3.0 to measure structural equation modeling (SEM) (Hair et al., 2019). SEM is a multidisciplinary approach used commonly to research relationships between structures (Mai et al., 2021). It allows the simultaneous analysis of multiple variables in an integrated model (Hair et al., 2016). The bootstrapping method (5,000 sub-samples for the T-test) was used to assess load, weight and path coefficients for 308 cases (Hair et al., 2017). The results also support the statement that collaborative innovation is a crucial catalyst for the capacity to be absorptive. This means that the exploitation of knowledge acquisition, assimilation and change is made easier by having capable workers, effective organizational structures, and good relations with stakeholders. This study demonstrates that intellectual capital has a positive moderating effect on collaborative innovation and absorptive capability, which is in line with the results of previous research (Soo et al., 2017; Engelman et al., 2017; Ávila, 2021).

Article 2 explores the role of potential and realized absorptive capacity on project success through both the mediating role of strategic agility and the moderating role of project complexity. A simple random sampling was used to collect data from 285 respondents working in the IT sector of small-medium sized Portuguese enterprises (SMEs). SMEs have great employment potential. They are the main contributors to economic development and can be a major income source for Portugal IT companies. Therefore economies have concentrated on the successive role of SMEs in economic prosperity (Müller et al., 2021; Nyamrunda et al, 2021). Likewise, the IT sector of Portuguese SMEs contributes significantly to the country's GDP (Sousa et al., 2020). The ongoing development of this sector consequently has a major impact on different economic indicators. Taking the importance of this sector into account, we have chosen SMEs as a unit of analysis for this study. This research used a hypothesized model with a cross-sectional design. Data could not be collected from the entire population due to limited time and resources. Thus a simple random sampling technique was used for the collection and investigation of information (Taherdoost, 2016). During four months, from February 2022 to May 2022, data were collected. Due to the Covid-19 pandemic, data were collected through, and distributed across, several online channels (Gmail, Linked In, Twitter, and Facebook).

In order to measure five variables, the questionnaire used in the collection of data was taken from different reliable sources. The questionnaires were administered in English and Portuguese languages, using a Likert scale ranging from 1 to 5, 1 representing “strongly disagree” and 5 representing “strongly agree” respectively. Smart PLS-SEM, version 3.2.8 was used for the analysis. The results indicate that the two sub-dimensions, potential and realized absorptive capacity, of absorptive capacity not only directly affect a project’s success but also do so indirectly through the mediator of strategic agility. Although, the moderating role of project complexity has a positive and significant effect on the relation between potential absorptive capacity and strategic agility, it is insignificant concerning the relation between realized absorptive capacity and strategic agility. The results of the current study indicate that proactive companies scan their environment faster and can find more market prospects than other organizations. Under development possibilities, companies are more willing to acquire knowledge from foreign environments (customers, competitors, markets, etc.). Transforming this information efficiently leads to new services and products, improving innovation and boosting the success rate of projects in return. These findings reinforce the position that companies should build a proactive, risk-taking and innovation-driven, enterprise-driven environment to improve opportunities for successful projects. Strategic agility can provide further information to help organizations reform and renew strategically. Yet, organizations should also use AC as a source of knowledge.

The main objective of the last article of the thesis, number 3, is to identify the relationship between collaborative innovation and the financial performance of the Information technology (IT) sector through the mediating role of strategic agility and absorptive capacity. Customer knowledge management capability (CKMC) is also explored as a potential moderator. Today, it is widely acknowledged that a company’s IT capabilities and competencies may enhance a variety of aspects of its performance (Abbasi, & Malik, 2015). In fact, the widespread use of information technology in SMEs makes it easier for managers to communicate across functional and geographical boundaries (Lindner, Wald, 2011), as well as improve the coordination of activities in multiple countries that are associated with superior performance (Andersen and Foss, 2005). In the current study, information was collected from public and private sector, project-based IT organizations operating in different Portuguese cities between November 2020 and February 2021 using a simple random sampling technique (Meng, 2013). A self-administered paper-and-pencil survey was used and, in some cases, an online survey to gather information due to COVID-19 pandemic. Respondents include the managers of software development team, designers, project supervisors, and operation managers from a variety of small and medium sized IT enterprises.

The data was collected from 300 respondents (i.e. software development team, designers, project supervisors, and operation managers) working in different small medium IT enterprises operating in different cities ((Lisbon, Porto, Coimbra and Braga) of Portugal. The simple random sampling method was used for data collection and Smart partial least squares-structural equation modeling (Smart PLS-SEM version 3.0) was used to test the hypotheses. The findings demonstrate that collaborative innovation contributes significantly to the financial performance of IT firms in Portugal. The results also indicate that the absorptive capacity and strategic agility both positively and significantly affect the relationship between collaborative innovation and a company's financial performance. The moderating role of CKMC also has a positive and significant effect on the relation between collaborative innovation and strategic agility. However, CKMC only insignificantly moderates the relation between collaborative innovation and absorptive capacity. SA and AC enable companies to identify market possibilities and evaluate the applicability of their internal capabilities to capitalize on these opportunities. The management's continued commitment to working together also makes it easier for a company to adapt to changes in the environment. The research demonstrates that strategic agility is a fundamental requirement for innovation capabilities.

5.2. Main contributions

5.2.1. Theoretical contributions

The present study has provided a theoretical implication by providing further empirical evidence in the domain of resource-based theory, where collaborative innovation has been hypothesized as a resource to better understand the relationship of how intellectual capital might attain and maintain absorptive capacity. The results show that all IC dimensions have a direct influence on absorptive capacity and the willingness of a company to learn external information will boost the output effect of IC. There is, however, a lack of knowledge concerning their integrated relations. This study helps to comprehend the value of AC in boosting the efficiency of an organization. Moreover, AC helps businesses to obtain and use external information effectively, improve their learning capacity, respond to environmental changes, and innovate. Furthermore, the intervention of an absorptive capacity system nevertheless significantly enhances the link between collaborative innovation and financial performance. It can thus be concluded that the absorption of information by stakeholders, and its application by employees, affect company performance positively. This research could help the Portuguese IT sector to understand the importance of collaborative innovation in order to achieve financial objectives.

This study is a contribution to a new domain concerning the previous literature. The relation of strategic agility is tested and analyzed with variables such as PAC and RAC regarding project success. By providing additional empirical evidence in the area of project complexity theory, this research has provided theoretical implications. Significant aspects of project complexity have been analyzed as a moderating variable concerning PAC, RAC and so has SA as moderating mediation in relation to project success. The results of the current study indicate that proactive companies have faster environmental scanning and can find more market opportunities than other organizations. With regard to development possibilities, companies are more willing to acquire knowledge from a foreign environment (customers, competitors, markets, etc.). Transforming this information efficiently leads to new services and products, which improves innovation and boosts the success rate of projects in return. These findings reinforce the position that companies should build a proactive, risk-taking and innovation-driven, enterprise-driven environment to improve opportunities for successful projects. Strategic agility can provide further information to help organizations reform and renew strategically. Yet, organizations should also practice AC as a source of knowledge.

This research makes several contributions to the literature on: strategic agility, collaborative innovation capability, financial performance, CKMC, and absorptive capacity. What is more, it posits the theoretical implication (by providing additional empirical evidence from proven hypotheses) that strategic agility is a key resource. In unpredictable conditions, it enables an organization to respond to customer needs as well as creating, acquiring, and transforming knowledge into a competitive advantage quickly. Similarly, the findings demonstrate that strategic agility has a significant and favorable mediating impact on the relationship between collaborative innovation and financial performance. Since the studies on CKMC and strategic agility are limited in the KM literature, the results of this study should add to the literature and serve as a foundation for future research (Haider, & Kayani, 2020).

5.2.2. Managerial contributions

The findings of this investigation provide insights within the domain of project-based IT organizations in relation to SMEs which are confronted by the difficulty of dealing with intangible resources during the globalization period of an innovation and information-based economy (Mata et al., 2021). It could likewise help the managers of Portuguese IT companies to evaluate the variables linked to good financial performance (Martins et al., 2018). This study adds practical suggestions for businesses that, in order to diminish complexity, joint efforts from the whole team are necessary with significant communication when a situation is complex. In order to avoid misleading details, information sharing

with a joint decision-making strategy must be followed to lead the team members towards a successful outcome for the project. Portuguese IT companies have to spend more on intangible resources rather than putting resources into old style factors of productivity. Enterprises have to invest more in intellectual capital and its components for better productivity and profitability in the future.

Our findings also have some practical implications, which led us to conclude that the dimension of absorptive capacity also affects the performance of small and medium sized enterprises. Obtaining external information may not directly impact on company success, but it is necessary as a first step in the absorptive capacity process. This study explores the favorable effects of using absorptive capacity characteristics on strategic agility. Although there has been no research on this specific aspect, some studies have looked into the impact of knowledge reach, knowledge skills, strategic learning, and other aspects of strategic agility. An option for a future research would be to look into the impact of company stakeholders on strategic agility. Furthermore, studies on absorptive ability and strategic agility could assist managers to enhance their management success, especially in nations where changes to the business environment happen quickly, like in the IT industry (Lowry & Wilson, 2016). Companies must evaluate both absorptive capacity and strategic agility when protecting and developing existing market shares for various reasons, including fierce competition among enterprises and changing consumer and stakeholders' expectations. Therefore, they should be able to identify, incorporate the significance of external knowledge in their processes, and eventually apply that information to their products or services. All this will contribute to increased success rates for the project.

Moreover, SA and AC enable companies to identify market opportunities and evaluate the applicability of their internal capabilities in order to capitalize on them. A continued commitment of management to work together also makes it easier for a company to adapt to changes in the environment. This research demonstrates that strategic agility is fundamental to innovation capabilities. The capacity to integrate resources, which is essential for fostering innovation, is the most significant implicit characteristic of strategic agility. Innovation is the transformation of ideas into new methods or products, which is a dynamic skill that entails concentrating on current resources and processes while using new knowledge to adapt to a changing organizational context. The function of CKMC in this situation is to assess the nature of the environmental change and determine an appropriate reaction. In many instances; however, businesses are unable to meet the challenge of adapting to a change in their environment adequately. This demonstrates the significance of strategic agility, and the importance of AC and CKMC with regard to meeting market demands.

5.3. Limitations and further research

Any study will always have its limitations and this one is no different, restrictions concerning time and resources are responsible for some of the ones in the current research (Article 1). The study is focused only on Portuguese, project-based, small and medium sized IT enterprises and the results may not be generalizable to other sectors. Future studies could test this model in other fields i.e., the construction sector or the hotel industry. The data collection for the present study is cross-sectional due to time and resource limitations, future research might consider conducting a study by utilizing longitudinal study as it helps to illustrate causal relationships comprehensively. The model used in this study was analyzed with a single mediator and moderator, future research could also focus on the mediating role of other variables such as the relationship between collaborative innovation and financial performance i.e., organizational ambidexterity, collaborative strategies. Other variables of research could be, employee learning or social interactions as moderators between collaborative innovation and absorptive capacity. With the addition of other relevant variables, the existing grounds for the research in this particular field could be significantly increased.

Limitations exist in every research (Article 2). The current study also has some limitations which include time and resources constraints. For this research data were gathered from the project-based IT organization of Portugal. The outcomes of this research might have been different if the information had been gathered from different organizational domains in Portugal. The sample size may also be considered a limitation. Due to the Covid-19 pandemic, the data collected from 285 respondents is not particularly extensive. Future studies should test this model on a larger population. Moreover, we recommend further research to explore this phenomenon, which is not necessarily crucial to enhance a company success by capturing value ideas. The prior studies concerning local optimization should be investigated further, depending on the performance study of alternative configurations of business-model systems, such as via fuzzy-set analyses. However, its effectiveness is limited to the increase of short-term percentages by adopting such a business-model system in the long term to benefit performance.

Given to the scarcity of research on both topics (Article 3), future research could examine overall business success and various forms of performance (e.g., financial performance, customer knowledge management capability, innovation performance) in the sectors of IT, the manufacturing industry and other large and small tourism enterprises. New research is needed to explain agility-related concepts, distinguish strategic agility from other types and help businesses comprehend its value. The results of this research might contribute to the literature and serve as a basis for future research. Additionally, further studies on project complexity, strategic agility and project success need to be completed, because these variables should be studied further in other sectors. For example by analyzing different dimensions of complexity (i.e., technical complexity, environmental complexity, organizational complexity, resource complexity, etc.). This approach would be necessary in mega construction projects (i.e., dams, airports, railways, roads, etc.).

Since we were only able to obtain the views of workers from 24 Portuguese small and medium sized IT enterprises, it is possible that the sample data do not apply to all such enterprises in Portugal. As the environment of the software market is always evolving, it is possible that the present research may not reflect future business situations accurately, thus limiting its generalizability. Innovation measures are subjective in that they are based on the Likert-scale answers of the Portuguese IT workers in this study, so it may be relevant to add objective innovation data when assessing this construct. Future designs of studies could also take into account the different levels of innovation (radical and gradual) and other types of innovation, such as new business models. Despite its limitations, this work paves the way for more research in areas connected to agility. According to Mao et al. (2015), there is little data to suggest how much an organization's knowledge management skills influence its agility. Using conceptual works that attempt to establish the possible consequences of knowledge management and agility as a starting point, researchers should endeavor to link their research (Shams et al., 2019). Finally, in order to provide a set of ideas that lead to organizational growth, future research should attempt to establish the influence of strategic agility on managerial and economic variables, including entrepreneurial orientation, sustainable competitive advantage, and organizational development.

Bibliographic References

- Abbasi, A., & Malik, Q. A. (2015). Firms' size moderating financial performance in growing firms: An empirical evidence from Pakistan. *International Journal of Economics and Financial Issues*, 5(2), 334-339.
- Acharya, C., Ojha, D., Gokhale, R., & Patel, P. C. (2022). Managing information for innovation using knowledge integration capability: The role of boundary spanning objects. *International Journal of Information Management*, 62, 102438.582440211061388.
- Aditiawarman, A., & Wahyuni, S. (2022, July). Impact of Digital Capability on Competitive Advantage and Performance of Tourism SMEs in Indonesia: The Role of Strategic Agility and Absorptive Capacity. In *Proceedings of the 1st International Conference on Economic and Education, ICON 2021, 14-15 December 2021, Padang-West Sumatra, Indonesia*.
- Agger, A., & Lund, D. H. (2017). Collaborative Innovation in the Public Sector—new perspectives on the role of citizens?. *Scandinavian Journal of Public Administration*, 21(3), 17-38.
- Ahammad, M.F., Glaister, K.W. and Gomes, E. (2020), "Strategic agility and human resource management", *Human Resource Management Review*, Vol. 30 No. 1, p. 100700.
- Ahmad, S., Zulkurnain, N. N. A., & Khairushalimi, F. I. (2016). Assessing the validity and reliability of a measurement model in Structural Equation Modeling (SEM). *Journal of Advances in Mathematics and Computer Science*, 1-8.
- Akhtar, P., Khan, Z., Tarba, S. and Jayawickrama, U. (2018), "The internet of things, dynamic data and information processing capabilities, and operational agility", *Technological Forecasting and Social Change*, Vol. 136, pp. 307-316.
- Alam, M. M., & Murad, M. W. (2020). The impacts of economic growth, trade openness and technological progress on renewable energy use in organization for economic co-operation and development countries. *Renewable Energy*, 145, 382-390.
- Albort-Morant, G., Henseler, J., Cepeda-Carrión, G., & Leal-Rodríguez, A. L. (2018). Potential and realized absorptive capacity as complementary drivers of green product and process innovation performance. *sustainability*, 10(2), 381.
- Al-Qatawneh, N.A.W., Al-Tarawneh, S.J., Al-Qatawneh, N.A.W., Al- Adaileh, R.M. et al., (2019), "The impact of knowledge management processes on operational performance as mediated by it agility", *International Review of Management and Marketing*, Vol. 9 No. 1, pp. 36-43.
- AlTaweel, I. R., & Al-Hawary, S. I. (2021). The mediating role of innovation capability on the relationship between strategic agility and organizational performance. *Sustainability*, 13(14), 7564.
- Amit, R., & Schoemaker, P. J. (1993). Strategic assets and organizational rent. *Strategic management journal*, 14(1), 33-46.
- Andersén, J. (2015). The absorptive capacity of family firms: How familiness affects potential and realized absorptive capacity. *Journal of Family Business Management*. Vol. 5 No. 1, pp. 73-89. <https://doi.org/10.1108/JFBM-05-2014-0012>

- Anderson, A. R., & Hardwick, J. (2017). Collaborating for innovation: the socialised management of knowledge. *International Entrepreneurship and Management Journal*, 13(4), 1181–1197.
- Anderson, P. (1999). Perspective: Complexity theory and organization science. *Organization science*, 10(3), 216-232.
- Anderson, P. and Tushman, M.L. (2004), *Managing Strategic Innovation and Change: A Collection of Readings*, Oxford University Press.
- Antunes, M. G., Quirós, J. T., & Justino, M. D. R. T. F. (2018). Role of management control systems in quality, innovation and organizational performance in Portugal SMES companies. *International Journal of Innovation and Technology Management*, 15(02), 1850014.
- Apa, R., De Marchi, V., Grandinetti, R., & Sedita, S. R. (2020). University-SME collaboration and innovation performance: the role of informal relationships and absorptive capacity. *The Journal of Technology Transfer*, 1-28.
- Arokodare, M. A., & Asikhia, O. U. (2020). Strategic agility: Achieving superior organizational performance through strategic foresight. *Global Journal of Management and Business Research*, 20(3), 7-16.
- Ávila, M. M. (2021). Competitive advantage and knowledge absorptive capacity: the mediating role of innovative capability. *Journal of the Knowledge Economy*, 1-26.
- Ávila, M. M. (2022). Competitive advantage and knowledge absorptive capacity: The mediating role of innovative capability. *Journal of the Knowledge Economy*, 13(1), 185-210.
- Baima, G., Forliano, C., Santoro, G., & Vrontis, D. (2020). Intellectual capital and business model: a systematic literature review to explore their linkages. *Journal of Intellectual Capital*. Retrieved From: <https://doi.org/10.1108/JIC-02-2020-0055>
- Bakhshi, J., Ireland, V., and Gorod, A. (2016). Clarifying the project complexity construct: Past, present and future. *International journal of project management*, 34(7):1199–1213.
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99–120.
- Barney, J. B. (1996). The resource-based theory of the firm. *Organization science*, 7(5), 469-469.
- Baškarada, S., & Koronios, A. (2018). The 5S organizational agility framework: a dynamic capabilities perspective. *International Journal of Organizational Analysis*.
- Battistella, C., De Toni, A.F., De Zan, G. and Pessot, E. (2017), “Cultivating business model agility through focused capabilities: a multiple case study”, *Journal of Business Research*, Vol. 73, pp. 65-82.
- Belkahla, W. and Triki, A. (2011), “Customer knowledge enabled innovation capability: proposing a measurement scale”, *Journal of Knowledge Management*, Vol. 15 No. 4, pp. 648-674.
- Benbya, H., & McKelvey, B. (2006). Toward a complexity theory of information systems development. *Information Technology & People*, 19(1), 12–34.
- Benhayoun, L., Le Dain, M. A., Dominguez-Péry, C., & Lyons, A. C. (2020b). SMEs embedded in collaborative innovation networks: How to measure their absorptive capacity?. *Technological Forecasting and Social Change*, 159, 120196.

- Benhayoun, L., Le-Dain, M. A., & Dominguez-Péry, C. (2020a). Characterising absorptive capacity supporting SMEs' learnings within collaborative innovation networks: insights from multi-level case studies. *International Journal of Innovation Management*, 2150047.
- Benitez, J., Henseler, J., Castillo, A., & Schuberth, F. (2020). How to perform and report an impactful analysis using partial least squares: Guidelines for confirmatory and explanatory IS research. *Information & Management*, 57(2), 103168.
- Berends, H., Jelinek, M., Reymen, I., & Stultiëns, R. (2014). Product Innovation Processes in Small Firms: Combining Entrepreneurial Effectuation and Managerial Causation. *Journal of Product Innovation Management*, 31(3), 616–635
- Bjorvatn, T., & Wald, A. (2018). Project complexity and team-level absorptive capacity as drivers of project management performance. *International Journal of Project Management*, 36(6), 876-888.
- Bolívar-Ramos, M. T., García-Morales, V. J., & Martín-Rojas, R. (2013). The effects of Information Technology on absorptive capacity and organisational performance. *Technology Analysis & Strategic Management*, 25(8), 905-922.
- Bontis, N., Janošević, S., & Dženopoljac, V. (2015). Intellectual capital in Serbia's hotel industry. *International Journal of Contemporary Hospitality Management*, 27(6), 1365–1384.
- Braganza, A., Brooks, L., Nepelski, D., Ali, M. and Moro, R. (2017), "Resource management in big data initiatives: processes and dynamic capabilities", *Journal of Business Research*, Vol. 70, pp. 328-337.
- Bucic, T., & Ngo, L. V. (2012). Examining drivers of collaborative inbound open innovation: empirical evidence from Australian firms. *International Journal of Innovation Management*, 16(04), 1250017.
- Burita, L., & Yang, Y. (2022). Inter-organizational social capital of firms in developing economies and industry 4.0 readiness: the role of innovative capability and absorptive capacity. *Review of Managerial Science*, 1-22.
- Butler, C. W., Vijayasarathy, L. R., & Roberts, N. (2020). Managing software development projects for success: Aligning plan-and agility-based approaches to project complexity and project dynamism. *Project Management Journal*, 51(3), 262-277.
- Chan, A.T., Ngai, E.W. and Moon, K.K. (2017), "The effects of strategic and manufacturing flexibilities and supply chain agility on firm performance in the fashion industry", *European Journal of Operational Research*, Vol. 259 No. 2, pp. 486-499.
- Chan, J. I. L., & Muthuveloo, R. (2020). Vital organisational capabilities for strategic agility: an empirical study. *Asia-Pacific Journal of Business Administration*.
- Chang, S. C., Chiang, C. Y., Chu, C. Y., & Wang, Y. B. (2006). The study of social capital, organizational learning, innovativeness, intellectual capital, and performance. *The Journal of Human Resource and Adult Learning*, 64-71.
- Chatterjee, S., Chaudhuri, R., & Vrontis, D. (2022). Examining the Impact of Adoption of Emerging Technology and Supply Chain Resilience on Firm Performance: Moderating Role of Absorptive Capacity and Leadership Support. *IEEE Transactions on Engineering Management*.
- Chaudhary, S., and S. Batra. (2018). "Absorptive Capacity and Small Family Firm Performance: Exploring the Mediation Processes." *Journal of Knowledge Management*, 22 (6): 1201–1216.

- Cheah, S. L. Y., & Yuen-Ping, H. O. (2021). Commercialization performance of outbound open innovation projects in public research organizations: The roles of innovation potential and organizational capabilities. *Industrial Marketing Management*. Retrieved From: <https://doi.org/10.1016/j.indmarman.2021.02.012>
- Chen, X., Wei, S., Davison, R. M., & Rice, R. E. (2019). How do enterprise social media affordances affect social network ties and job performance?. *Information Technology & People*.
- Cheng, H., Huang, S., Yu, Y., Zhang, Z., & Jiang, M. (2022). The 2011 Collaborative Innovation Plan, University-Industry Collaboration and Achievement Transformation of Universities: Evidence from China. *Journal of the Knowledge Economy*, 1-26.
- Chernenko, I., Kelchevskaya, N., & Pelymskaya, I. (2021). Digital Intellectual Capital of Russian Companies and its Impact on Financial and Innovation Performance. In *SHS Web of Conferences* (Vol. 93). EDP Sciences.
- Clauss, T.; Kraus, S.; Kallinger, F.L.; Bican, P.M.; Brem, A.; Kailer, N. (2020). Organizational ambidexterity and competitive advantage: The role of strategic agility in the exploration-exploitation paradox. *J. Innov. Knowl.*
- Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*, Routledge Academic, New York, pp. 19-74.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative science quarterly*, 128-152.
- Costa, V. O., Rocha, R. R., & Madeira, M. J. (2021). Product and service innovation in Portugal: patterns and specificities. *International Journal of Innovation Science*. <https://doi.org/10.1108/IJIS-09-2020-0140>
- Cuevas-Vargas, H., Aguirre, J., & Parga-Montoya, N. (2022). Impact of ICT adoption on absorptive capacity and open innovation for greater firm performance. The mediating role of ACAP. *Journal of Business Research*, 140, 11-24.
- Cunha Filho, M. A. L. (2022). Configuring absorptive capacities through organizational practiced routines: evidence from Brazilian digital technology-based SMEs. *Journal of Small Business & Entrepreneurship*, 1-37.
- D'Angelo, A., Ganotakis, P., & Love, J. H. (2020). Learning by exporting under fast, short-term changes: The moderating role of absorptive capacity and foreign collaborative agreements. *International Business Review*, 29(3), 101687.
- D'Oria, L., Crook, T. R., Ketchen Jr, D. J., Sirmon, D. G., & Wright, M. (2021). The evolution of resource-based inquiry: A review and meta-analytic integration of the strategic resources–actions–performance pathway. *Journal of Management*, 47(6), 1383-1429.
- Davey, J., O'Brien, I., Ouschan, R., & Parkinson, J. (2022). Rethinking customer engagement design: Using customer-mobilized engagement (CME) to grow business networks. *Industrial Marketing Management*, 105, 453-466.
- De Jong, J. P., & Freel, M. (2010). Absorptive capacity and the reach of collaboration in high technology small firms. *research policy*, 39(1), 47-54.
- De Toni, A. F., & Pessot, E. (2021). Investigating organisational learning to master project complexity: An embedded case study. *Journal of Business Research*, 129, 541-554.

- Del Giudice, M., Della Peruta, M.R., (2016). The impact of IT-based knowledge management systems on internal venturing and innovation: a structural equation modeling approach to corporate performance. *J. Knowl. Manag.* 20 (3).
- Denizci, B., & Tasci, A. D. (2010). Modeling the commonly-assumed relationship between human capital and brand equity in tourism. *Journal of Hospitality Marketing & Management*, 19(6), 610–628.
- Dionísio, J. F. D. S. M. (2021). How luxury micro-enterprises ensure customer stewardship: case of Beesweet (Doctoral dissertation).
- Dove, R. (1991). The 21s Century Manufacturing Enterprise Strategy. Iacocca Institute, Lehigh University, AD-A257176.
- Doz, Y. (2020). Fostering strategic agility: How individual executives and human resource practices contribute. *Hum. Resour. Manag. Rev.* 30, 1–14.
- Doz, Y.L., Kosonen, M. (2010) Embedding Strategic Agility: A Leadership Agenda for Accelerating Business Model Renewal. *Long Range Plan.* 43, 370–382.
- Duan, Y., Liu, S., Cheng, H., Chin, T., & Luo, X. (2021). The moderating effect of absorptive capacity on transnational knowledge spillover and the innovation quality of high-tech industries in host countries: Evidence from the Chinese manufacturing industry. *International Journal of Production Economics*, 233, 108019.
- Dženopoljac, V., Janošević, S., & Bontis, N. (2016). Intellectual capital and financial performance in the Serbian ICT industry. *Journal of Intellectual Capital.* 17 (2), 373-396.
- Dziuban, C. D., & Shirkey, E. C. (1974). When is a correlation matrix appropriate for factor analysis? Some decision rules. *Psychological bulletin*, 81(6), 358.
- Eckstein, D., Goellner, M., Blome, C., & Henke, M. (2015). The performance impact of supply chain agility and supply chain adaptability: the moderating effect of product complexity. *International Journal of Production Research*, 53(10), 3028-3046.
- Endres, H., Helm, R., & Dowling, M. (2020). Linking the types of market knowledge sourcing with sensing capability and revenue growth: Evidence from industrial firms. *Industrial Marketing Management*, 90, 30-43.
- Engelman, R. M., Fracasso, E. M., Schmidt, S., & Zen, A. C. (2017). Intellectual capital, absorptive capacity and product innovation. *Management Decision.* 55 (3), 474-490.
- Esterhuizen, D., Schutte, C.S. and Du Toit, A.S.A. (2012), "Knowledge creation processes as critical enablers for innovation", *International Journal of Information Management*, Vol. 32 No. 4, pp. 354-364.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics*, 5(1), 1-4.
- European Commission (2005). The New SME Definition: User Guide and Model Declaration, European Commission Publications Office, Luxembourg.
- European Commission (2019). 2019 SBA fact sheet: Portugal https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKFwi_r7Ifnl7D6AhUt-

[DgGHRnKAVAQFnoECA0QAQ&url=https%3A%2F%2Fec.europa.eu%2Fdocsroom%2Fdocuments%2F38662%2Fattachments%2F23%2Ftranslations%2Ffen%2Frenditions%2Fnative&usq=AOvVaw3kX3Zv3yRiNAmYJZB4COt](https://ec.europa.eu/docsroom/documents/38662/attachments/23/translations/2fen/renditions/native&usq=AOvVaw3kX3Zv3yRiNAmYJZB4COt)

- Farhana, M.; Swietlicki, D. (2020). Dynamic Capabilities Impact on Innovation: Niche Market and Startups. *J. Technol. Manag. Innov.* 15, 83–96
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191.
- Felizardo, A., Elisabete, F., & Thomaz, J. (2017). Organizational Performance Measurement and Evaluation Systems in Smes: the case of the transforming industry in Portugal. *Centro de Estudos e Formação avançada em Gestão e Economia (CEFAGE)*.
- Feranita, F. (2021). The transaction cost approach to collaborative innovation in family firms: a process of internal collaboration through integration of human assets. *Journal for International Business and Entrepreneurship Development*, 13(1), 91-113.
- Feranita, F., Kotlar, J., & De Massis, A. (2017). Collaborative innovation in family firms: Past research, current debates and agenda for future research. *Journal of Family Business Strategy*, 8(3), 137–156.
- Fernandes, M. M. A. D. B. M. (2022). Analysis of Portugal' s macroenvironment in the view of digital transformation of SMEs using the peste framework-exploration of political factors (Doctoral dissertation).
- Flatten, T. C., Greve, G. I., & Brettel, M. (2011). Absorptive capacity and firm performance in SMEs: The mediating influence of strategic alliances. *European Management Review*, 8(3), 137-152.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50.
- Fosfuri, A., & Tribó, J. A. (2008). Exploring the antecedents of potential absorptive capacity and its impact on innovation performance. *Omega*, 36(2), 173-187.
- Galina, S., Carvalho, L., & Costa, T. (2016). Innovation management of internationalised IT companies in Brazil and Portugal. *International Journal of Knowledge-Based Development*, 7(4), 317-335.
- Galvão, A. R., Marques, C. S., Mascarenhas, C., Braga, V., & Pereira, R. (2021). Motivations and Barriers for the Sustainable Internationalization of the Portuguese Textile Sector. *Sustainability*, 13(23), 13147.
- Galvin, P., Burton, N., Singh, P. J., Sarpong, D., Bach, N., & Teo, S. (2020). Network rivalry, competition and innovation. *Technological Forecasting and Social Change*, 161, 120253.
- Gao, W., Zhang, Y., Ramanujan, D., Ramani, K., Chen, Y., Williams, C.B., Wang, C.C., Shin, Y.C., Zhang, S. and Zavattieri, P.D. (2015), "The status, challenges, and future of additive manufacturing in engineering", *Computer-Aided Design*, Vol. 69, pp. 65-89
- García-Sánchez, E., García-Morales, V. J., & Martín-Rojas, R. (2018). Influence of technological assets on organizational performance through absorptive capacity, organizational innovation and internal labour flexibility. *Sustainability*, 10(3), 770.
- Gatto, F., & Re, I. (2021). Circular bioeconomy business models to overcome the valley of death. A systematic statistical analysis of studies and projects in emerging bio-based technologies and trends linked to the SME instrument support. *Sustainability*, 13(4), 1899.

- Granados, M.L., Mohamed, S. and Hlupic, V. (2017), "Knowledge management activities in social enterprises: lessons for small and non-profit firms", *Journal of Knowledge Management*, Vol. 21 No. 2, pp. 376-396.
- Grandinetti, R. (2016). Absorptive capacity and knowledge management in small and medium enterprises. *Knowledge Management Research & Practice*, 14(2), 159-168.
- Guarda, T., Santos, M., Pinto, F., Augusto, M., & Silva, C. (2013). Business intelligence as a competitive advantage for SMEs. *International Journal of Trade, Economics and Finance*, 4(4), 187.
- Guerrero, M., Liñán, F., & Cáceres-Carrasco, F. R. (2021). The influence of ecosystems on the entrepreneurship process: a comparison across developed and developing economies. *Small Business Economics*, 57(4), 1733-1759.
- Gunarathne, N., & Lee, K. H. (2021). Corporate cleaner production strategy development and environmental management accounting: A contingency theory perspective. *Journal of Cleaner Production*, 308, 127402.
- Gupta, K., & Raman, T. V. (2021). Influence of Intellectual Capital on Performance: An Analysis of IT and Pharmaceutical Firms. *International Journal of Human Capital and Information Technology Professionals (IJHCITP)*, 12(2), 53-71.
- Gurca, A., Bagherzadeh, M., Markovic, S., & Koporcic, N. (2021). Managing the challenges of business-to-business open innovation in complex projects: A multi-stage process model. *Industrial Marketing Management*, 94, 202-215.
- Gürlek, M. (2021). Effects of high-performance work systems (HPWSs) on intellectual capital, organizational ambidexterity and knowledge absorptive capacity: evidence from the hotel industry. *Journal of Hospitality Marketing & Management*, 30(1), 38-70.
- Gürlek, M., & Uygur, A. (2020). Service-oriented high-performance human resource practices and employee service performance: A test of serial mediation and moderation models. *Journal of Management & Organization*, 1-37.
- Haider, S. A. (2019). Impact of Customer Knowledge Management Capability on Project Performance with Mediating Role of Agility and Moderating Role of Team Skills.
- Haider, S. A., & Kayani, U. N. (2021). The impact of customer knowledge management capability on project performance-mediating role of strategic agility. *Journal of Knowledge Management*. Vol. 25 No. 2, pp. 298-312. <https://doi.org/10.1108/JKM-01-2020-0026>
- Haider, S. A., & Tehseen, S. (2022). Role of Decision Intelligence in Strategic Business Planning. In *Decision Intelligence Analytics and the Implementation of Strategic Business Management* (pp. 125-133). Springer, Cham.
- Hair Jr, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial least squares structural equation modeling (PLS-SEM). *European business review*. 26 (2), 106-121. Retrieved From <https://doi.org/10.1108/EBR-10-2013-0128>
- Hair Jr, J. F., Sarstedt, M., Matthews, L. M., & Ringle, C. M. (2016). Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I—method. *European Business Review*.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, 31(1), 2-24.

- Hair, J.F., Hult, G.T.M., Ringle, C.M. & Sarstedt, M. (2017). A primer on partial least squares structural equation modeling (PLS-SEM)(2nd ed.). Thousand Oaks, CA: Sage.
- Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019). When to use and how to report the results of PLS-SEM, *European Business Review*. 31(1), 2-24.
- Hair, J.F., Sarstedt, M., Ringle, C.M. & Gudergan, S.P. (2018). Advanced issues in partial least squares structural equation modeling (3rd ed.). Thousand Oaks, CA: Sage.
- Hair, Jr., J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, 109, 101-110.
- Hair, Jr., J.F., Sarstedt, M., Matthews, L.M., & Ringle, C.M. (2016). Identifying and treating unobserved heterogeneity with FIMIX-PLS: part I – method. *European Business Review*, 28(1), 63-76. Retrieved From <https://doi.org/10.1108/EBR-09-2015-0094>
- Hanisch, B., Lindner, F., Mueller, A. and Wald, A. (2009), “Knowledge management in project environments”, *Journal of Knowledge Management*, Vol. 13 No. 4, pp. 148-160.
- Hansen, M. J., Vaagen, H., & Van Oorschot, K. (2020). Team collective intelligence in dynamically complex projects—A shipbuilding case. *Project Management Journal*, 51(6), 633-655.
- Harvey, G., Skelcher, C., Spencer, E., Jas, P., & Walshe, K. (2010). Absorptive capacity in a non-market environment: A knowledge-based approach to analysing the performance of sector organizations. *Public Management Review*, 12(1), 77-97.
- Henseler, J. (2017). Partial least squares path modeling. In *Advanced methods for modeling markets* (pp. 361-381). Springer, Cham.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43(1), 115-135.
- Hernandez-Espallardo, M., Osorio-Tinoco, F., & Rodriguez-Orejuela, A. (2018). Improving firm performance through inter-organizational collaborative innovations: The key mediating role of the employee's job-related attitudes. *Management Decision*. Retrieved From: <https://doi.org/10.1108/MD-02-2017-0151>
- Hong, J., Zheng, R., Deng, H., & Zhou, Y. (2019). Green supply chain collaborative innovation, absorptive capacity and innovation performance: Evidence from China. *Journal of Cleaner Production*, 241, 118377.
- Ibarra-Cisneros, M. A., del Rosario Demuner-Flores, M., & Hernández-Perlines, F. (2021). Strategic orientations, firm performance and the moderating effect of absorptive capacity. *Journal of Strategy and Management*.
- Iddris, F.; Baffour, G.A.; Abraha, D.G. (2014). The role of innovation capability in achieving supply chain agility. *Int. J. Manag. Comput. Sci.* 4, 104–112.
- Ind, N., Iglesias, O., & Markovic, S. (2017). The co-creation continuum: From tactical market research tool to strategic collaborative innovation method. *Journal of Brand Management*, 24(4), 310-321.
- Iranmanesh, M., Kumar, K. M., Foroughi, B., Mavi, R. K., & Min, N. H. (2021). The impacts of organizational structure on operational performance through innovation capability: innovative culture as moderator. *Review of Managerial Science*, 15(7), 1885-1911.
- Jahan, M.S., Riaz, M.T. and Abbas, M. (2019), “Software testing practices in IT industry of Pakistan”, *Proceedings of the 6th Conference on the Engineering of Computer Based Systems*, pp. 1-10.

- 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.
- Jaziri, D. (2019), "The advent of customer experiential knowledge management approach (CEKM): the integration of offline & online experiential knowledge", *Journal of Business Research*, Vol. 94, pp. 241-256.
- Jiao, M., Du, D., Shi, W., Hou, C., & Gui, Q. (2021). Dynamic absorptive capability and innovation performance: evidence from Chinese cities. *Sustainability*, 13(20), 11460.
- Johnsen, R.E. and Lacoste, S. (2016), "An exploration of the dark side associations of conflict, power and dependence in customer – supplier relationships", *Industrial Marketing Management*, Vol. 59, pp. 76-95.
- Junni, P., Sarala, R. M., Tarba, S. Y., & Weber, Y. (2015). The role of strategic agility in acquisitions. *British Journal of Management*, 26(4), 596-616.
- Kafourous, M., Love, J. H., Ganotakis, P., & Konara, P. (2020). Experience in R&D collaborations, innovative performance and the moderating effect of different dimensions of absorptive capacity. *Technological Forecasting and Social Change*, 150, 119757.
- Kale, E., Aknar, A., & Başar, Ö. (2019). Absorptive capacity and firm performance: The mediating role of strategic agility. *International Journal of Hospitality Management*, 78, 276-283.
- Kamboj, S., Goyal, P., & Rahman, Z. (2015). A resource-based view on marketing capability, operations capability and financial performance: An empirical examination of mediating role. *Procedia-Social and Behavioral Sciences*, 189, 406-415.
- Kang, H. (2021). Sample size determination and power analysis using the G* Power software. *Journal of educational evaluation for health professions*, 18.
- Kasemsap, K. (2020). Utilizing complexity theory and complex adaptive systems in global business. In *Foreign direct investments: Concepts, methodologies, tools, and applications* (pp. 474-500). IGI Global.
- Khalique, M., Bontis, N., bin Shaari, J. A. N., & Isa, A. H. M. (2015). Intellectual capital in small and medium enterprises in Pakistan. *Journal of Intellectual Capital*, 16(1), 224–238.
- Khan, S. H., Majid, A., & Yasir, M. (2020). Strategic renewal of SMEs: the impact of social capital, strategic agility and absorptive capacity. *Management Decision*.
- Kianto, A., Sáenz, J., & Aramburu, N. (2017). Knowledge-based human resource management practices, intellectual capital and innovation. *Journal of Business Research*, 81, 11–20.
- Kietzmann, J. H., Hermkens, K., McCarthy, I. P., & Silvestre, B. S. (2011). Social media? Get serious! Understanding the functional building blocks of social media. *Business horizons*, 54(3), 241-251.
- Kilu, E., Milani, F., Scott, E. and Pfahl, D. (2019), "Agile software process improvement by learning from financial and fintech companies: LHV bank case study", *International Conference on Software Quality*, Springer, Cham, pp. 57-69.
- Kohtamäki, M., Heimonen, J., Sjödin, D., & Heikkilä, V. (2020). Strategic agility in innovation: Unpacking the interaction between entrepreneurial orientation and absorptive capacity by using practice theory. *Journal of Business Research*, 118, 12-25.

- Korhonen-Sande, S., & Sande, J. B. (2016). Improving customer knowledge transfer in industrial firms: how does previous work experience influence the effect of reward systems?. *Journal of Business & Industrial Marketing*.
- Kosasi, S., & Yuliani, I. D. A. E. (2017, November). Improving organizational agility of micro, small, and medium enterprises through digital marketing strategy. In *2017 2nd International conferences on Information Technology, Information Systems and Electrical Engineering (ICITISEE)* (pp. 68-72). IEEE.
- Kostopoulos, K., Papalexandris, A., Papachroni, M., & Ioannou, G. (2011). Absorptive capacity, innovation, and financial performance. *Journal of Business Research*, 64(12), 1335–1343.
- Kotabe, M., Jiang, C. X., & Murray, J. Y. (2011). Managerial ties, knowledge acquisition, realized absorptive capacity and new product market performance of emerging multinational companies: A case of China. *Journal of World Business*, 46(2), 166-176.
- Kraus, S., Breier, M., & Dasí-Rodríguez, S. (2020). The art of crafting a systematic literature review in entrepreneurship research. *International Entrepreneurship and Management Journal*, 16(3), 1023-1042.
- Kraus, S., Clauss, T., Breier, M., Gast, J., Zardini, A., & Tiberius, V. (2020). The economics of COVID-19: initial empirical evidence on how family firms in five European countries cope with the corona crisis. *International Journal of Entrepreneurial Behavior & Research*. Vol. 26(5), 1067-1092. <https://doi.org/10.1108/IJEBr-04-2020-0214>
- Kraus, S., Mahto, R. V., & Walsh, S. T. (2021). The importance of literature reviews in small business and entrepreneurship research. *Journal of Small Business Management*, 1-12.
- Ladyman, J., Lambert, J., & Wiesner, K. (2013). What is a complex system?. *European Journal for Philosophy of Science*, 3(1), 33-67.
- Laitinen, K., & Sivunen, A. (2020). Enablers of and constraints on employees' information sharing on enterprise social media. *Information Technology & People*, 34(2), 642-665.
- Lamichhane, S., Eğilmez, G., Gedik, R., Bhutta, M. K. S., & Erenay, B. (2021). Benchmarking OECD countries' sustainable development performance: A goal-specific principal component analysis approach. *Journal of Cleaner Production*, 287, 125040.
- Larsen-Freeman, D. (2013). Complexity theory. In *The Routledge handbook of second language acquisition* (pp. 91-106). Routledge.
- Larsen-Freeman, D. (2017). Complexity theory: The lessons continue. In *Complexity theory and language development* (pp. 11-50). John Benjamins.
- Lawless, M., Martinez-Cillero, M., O'Toole, C. O. N. O. R., Gargan, E., Cantwell, L., & McGoldrick, P. (2020). SME investment report 2019. Economic and Social Research Institute (ESRI) Research Series, 1-56.
- Leal-Rodríguez, A. L., Roldán, J. L., Ariza-Montes, J. A., & Leal-Millán, A. (2014). From potential absorptive capacity to innovation outcomes in project teams: The conditional mediating role of the realized absorptive capacity in a relational learning context. *International journal of project management*, 32(6), 894-907.
- Li, H., Ali, M., Amin, M. W., & Liang, H. (2022). A Moderated Mediation Model Linking Excessive Enterprise Social Media Usage With Job Performance. *Frontiers in Psychology*, 13.

- Li, L., Lin, J., Ouyang, Y., & Luo, X. R. (2022). Evaluating the impact of big data analytics usage on the decision-making quality of organizations. *Technological Forecasting and Social Change*, 175, 121355.
- Lichtenthaler, U. (2016). Absorptive capacity and firm performance: an integrative framework of benefits and downsides. *Technology Analysis & Strategic Management*, 28(6), 664-676.
- Lichtenthaler, U. (2016). The Role of Unabsorbed Slack in Internal and Collaborative Innovation Processes—A Resource-Based Framework. *International Journal of Innovation and Technology Management*, 13(03), 1640007.
- Limone, P., Toto, G. A., Guarini, P., & di Furia, M. (2022). Online Quantitative Research Methodology: Reflections on Good Practices and Future Perspectives. In *Science and Information Conference* (pp. 656-669). Springer, Cham.
- Lin, C., Tan, B., & Chang, S. (2002). The critical factors for technology absorptive capacity. *Industrial Management & Data Systems*.
- Lindner, F. and Wald, A. (2011), "Success factors of knowledge management in temporary organizations", *International Journal of Project Management*, Vol. 29 No. 7, pp. 877-888.
- Liu, F., Dutta, D. K., & Park, K. (2021). From external knowledge to competitive advantage: absorptive capacity, firm performance, and the mediating role of labour productivity. *Technology Analysis & Strategic Management*, 33(1), 18-30.
- Liu, H., Ke, W., Wei, K. K., & Hua, Z. (2013). The impact of IT capabilities on firm performance: The mediating roles of absorptive capacity and supply chain agility. *Decision Support Systems*, 54(3), 1452–1462.
- Liu, X., Shen, M., Ding, W., & Zhao, X. (2017). Tie strength, absorptive capacity and innovation performance in Chinese manufacturing industries. *Nankai Business Review International*, 8(4), 475–494. <https://doi.org/10.1108/NBRI-01-2017-0002>
- Lo, C., Wang, C., & Chen, Y. C. (2020). The mediating role of intellectual capital in open innovation in the service industries. *Sustainability*, 12(12), 5220.
- Lowry, P. B., & Wilson, D. (2016). Creating agile organizations through IT: The influence of internal IT service perceptions on IT service quality and IT agility. *The Journal of Strategic Information Systems*, 25(3), pp. 211-226.
- Lu, Y., Luo, L., Wang, H., Le, Y., & Shi, Q. (2015). Measurement model of project complexity for large-scale projects from task and organization perspective. *International journal of project management*, 33(3), 610-622.
- Luo, L., Zhang, L., & He, Q. (2020). Linking project complexity to project success: a hybrid SEM–FCM method. *Engineering, Construction and Architectural Management*.
- Lyver, M. J., & Lu, T. J. (2018). Sustaining innovation performance in SMEs: Exploring the roles of strategic entrepreneurship and IT capabilities. *Sustainability*, 10(2), 442.
- Ma, F., Khan, F., Khan, K. U., & XiangYun, S. (2021). Investigating the Impact of Information Technology, Absorptive Capacity, and Dynamic Capabilities on Firm Performance: An Empirical Study. *SAGE Open*, 11(4), 21582440211061388.
- Ma, L., Zhang, X., & Wang, G. (2021). The impact of enterprise social media use on employee performance: a grounded theory approach. *Journal of Enterprise Information Management*.

- Mahmood, T., & Mubarik, M. S. (2020). Balancing innovation and exploitation in the fourth industrial revolution: Role of intellectual capital and technology absorptive capacity. *Technological forecasting and social change*, 160, 120248.
- Mai, R., Niemand, T., & Kraus, S. (2021). A tailored-fit model evaluation strategy for better decisions about structural equation models. *Technological Forecasting and Social Change*, 173, 121142.
- 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.
- Manik, H. F. G. G., & Lukito-Budi, A. S. (2020). Revisiting Collaboration Model for Process Innovation: Promoting Absorptive Capacity, Open Culture, and Trust. *Advances in Social Sciences Research Journal*, 7(10).
- Mansell, R., & Wehn, U. (1998). *Knowledge societies: information technology for sustainable development*. Oxford University Press.
- Marcucci, G., Antomarioni, S., Ciarapica, F. E., & Bevilacqua, M. (2021). The impact of Operations and IT-related Industry 4.0 key technologies on organizational resilience. *Production Planning & Control*, 1-15.
- Marnewick, C., Erasmus, W., & Nazeer, J. (2017). The symbiosis between information system project complexity and information system project success (p. 184). *AOSIS*.
- Marrucci, L., Iannone, F., Daddi, T., & Iraldo, F. (2022). Antecedents of absorptive capacity in the development of circular economy business models of small and medium enterprises. *Business Strategy and the Environment*, 31(1), 532-544.
- Martín-de Castro, G. (2015). Knowledge management and innovation in knowledge-based and high-tech industrial markets: The role of openness and absorptive capacity. *Industrial marketing management*, 47, 143-146.
- Martinez-Conesa, I., Soto-Acosta, P. and Carayannis, E.G. (2017), "On the path towards open innovation: assessing the role of knowledge management capability and environmental dynamism in SMEs", *Journal of Knowledge Management*, Vol. 21 No. 3, pp. 553-570.
- Martinez-Sanchez, A. and Lahoz-Leo, F. (2018), "Supply chain agility: a mediator for absorptive capacity", *Baltic Journal of Management*, Vol. 13 No. 2, pp. 264-278.
- Martins, M. M., Morais, A. I., Isidro, H., & Laureano, R. (2018). Intellectual capital disclosure: The Portuguese case. *Journal of the Knowledge Economy*, 9(4), 1224-1245.
- Masur, P. K., DiFranzo, D., & Bazarova, N. N. (2021). Behavioral contagion on social media: Effects of social norms, design interventions, and critical media literacy on self-disclosure. *Plos one*, 16(7), e0254670.
- Mata, M.N., Sohail, M., Haider, S.A., Martins, J.M., Sheraz, F., Rita, J.X., Dantas, R.M. and Correia, A.B. (2021). The relationship between time management, work stress and work performance-a quantitative study in Portugal. *Academy of Strategic Management Journal*, 20, 1-11.
- Meng, X. (2013, May). Scalable simple random sampling and stratified sampling. In *International Conference on Machine Learning* (pp. 531-539). PMLR.
- Merono-Cerdan, A.L., Soto-Acosta, P., López-Nicolás, C., (2007). Analyzing collaborative technologies' effect on performance through intranet use orientations. *J. Enterp. Inf. Manag.* 21 (1), 39–51.

- Migdadi, M. M. (2021). Impact of knowledge management processes on organizational performance: the mediating role of absorptive capacity. *Business Process Management Journal*.
- Mikalef, P., Boura, M., Lekakos, G., & Krogstie, J. (2019). Big data analytics capabilities and innovation: the mediating role of dynamic capabilities and moderating effect of the environment. *British Journal of Management*, 30(2), 272-298.
- Mikkelsen, M. F. (2020). Perceived project complexity: a survey among practitioners of project management. *International Journal of Managing Projects in Business*.
- Miroshnychenko, I., Strobl, A., Matzler, K., & De Massis, A. (2020). Absorptive capacity, strategic flexibility, and business model innovation: Empirical evidence from Italian SMEs. *Journal of Business Research*.
- Mondal, A., & Ghosh, S. K. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital*, 13(4), 515–530.
- Morcov, S., Pintelon, L., & Kusters, R. J. (2021). A Practical Assessment of Modern IT Project Complexity Management Tools: Taming Positive, Appropriate, Negative Complexity. *International Journal of Information Technology Project Management (IJITPM)*, 12(3), 90-108.
- Morton, J., Stacey, P., & Mohn, M. (2018). Building and maintaining strategic agility: an agenda and framework for executive IT leaders. *California management review*, 61(1), 94-113.
- Mosca, L., Gianecchini, M., & Campagnolo, D. (2021). Organizational life cycle models: a design perspective. *Journal of Organization Design*, 10(1), 3-18.
- Müller, J. M., Buliga, O., & Voigt, K. I. (2021). The role of absorptive capacity and innovation strategy in the design of industry 4.0 business Models-A comparison between SMEs and large enterprises. *European Management Journal*, 39(3), 333-343.
- Murovec, N., & Prodan, I. (2009). Absorptive capacity, its determinants, and influence on innovation output: Cross-cultural validation of the structural model. *Technovation*, 29(12), 859–872.
- Nabeel-Rehman, R., & Nazri, M. (2019). Information technology capabilities and SMEs performance: an understanding of a multi-mediation model for the manufacturing sector. *Interdisciplinary Journal of Information, Knowledge and Management*, 14, 253-277.
- Najafi-Tavani, S., Najafi-Tavani, Z., Naudé, P., Oghazi, P., & Zeynaloo, E. (2018). How collaborative innovation networks affect new product performance: Product innovation capability, process innovation capability, and absorptive capacity. *Industrial marketing management*, 73, 193-205.
- Nelson, M. E. (2018). Enterprise Social Media-enabled Transactive Memory Encoding. Michigan State University.
- Noblet, J. P., Simon, E., & Parent, R. (2015). Absorptive capacity: a proposed operationalization. In *The Essentials of Knowledge Management* (pp. 111-130). Palgrave Macmillan, London.
- Nyamrunda, F. C., & Freeman, S. (2021). Strategic agility, dynamic relational capability and trust among SMEs in transitional economies. *Journal of World Business*, 56(3), 101175.
- Ofoegbu, O.E. and Akanbi, P.A. (2012), "The influence of strategic agility on the perceived performance of manufacturing firms in Nigeria. The international", *International Business & Economics Research Journal* (Iber), Vol. 11 No. 2, p. 153

- Olfat, M., Ahmadi, S., Shokouhyar, S., & Bazeli, S. (2021). Linking organizational members' social-related use of enterprise social media (ESM) to their fashion behaviors: the social learning and stimulus-organism-response theories. *Corporate Communications: An International Journal*.
- Otman, K. (2021). Small and Medium Enterprises in the Middle East and North Africa Region. *International Journal of Business and Management*, 16(5).
- Oyedijo, A. (2012), "Competitive strategy orientations of small and medium business owners and their performance impacts: the case of paint manufacturing SMEs in South-Western Nigeria", *Journal of Asian Business Strategy*, Vol. 2 No. 1, pp. 1-8.
- Papazoglou, M. E., & Spanos, Y. E. (2021). Influential knowledge and financial performance: The role of time and rivals' absorptive capacity. *Technovation*, 102, 102223.
- Parchoma, G. (2014). The contested ontology of affordances: Implications for researching technological affordances for collaborative knowledge production. *Computers in Human Behavior*, 37, 360-368.
- Pereira, D., & Leitão, J. C. C. (2016). Absorptive capacity, coopetition and generation of product innovation: contrasting Italian and Portuguese manufacturing firms. *Int. J. Technol. Manag.*, 71(1/2), 10-37.
- Pereira, V., Budhwar, P., Temouri, Y., Malik, A., & Tarba, S. (2021). Investigating Investments in agility strategies in overcoming the global financial crisis-The case of Indian IT/BPO offshoring firms. *Journal of International Management*, 27(1), 100738.
- Perez-Luno, A., Gopalakrishnan, S., & Cabrera, R. V. (2014). Innovation and performance: The role of environmental dynamism on the success of innovation choices. *IEEE Transactions on Engineering Management*, 61(3), 499–510.
- Petrakis, P. E., Kostis, P. C., & Valsamis, D. G. (2015). Innovation and competitiveness: Culture as a long-term strategic instrument during the European Great Recession. *Journal of Business Research*, 68(7), 1436–1438.
- Petronio, S., & Child, J. T. (2020). Conceptualization and operationalization: Utility of communication privacy management theory. *Current Opinion in Psychology*, 31, 76-82.
- Petronio, S., Child, J. T., & Hall, R. D. (2021). Communication privacy management theory: Significance for interpersonal communication. In *Engaging theories in interpersonal communication* (pp. 314-327). Routledge.
- Ping, T. A., Chinn, C. V., Yin, L. Y., & Muthuveloo, R. (2018). The impact of information technology capability, business intelligence use and collaboration capability on organizational performance among public listed companies in Malaysia. *Global Business and Management Research*, 10(1), 293-312.
- Pinheiro, J., Lages, L. F., Silva, G. M., Dias, A. L., & Preto, M. T. (2021). Effects of absorptive capacity and innovation spillover on manufacturing flexibility. *International Journal of Productivity and Performance Management*.
- Pitafi, A. H., Kanwal, S., Ali, A., Khan, A. N., & Ameen, M. W. (2018). Moderating roles of IT competency and work cooperation on employee work performance in an ESM environment. *Technology in Society*, 55, 199-208.
- Pollanen, R., Abdel-Maksoud, A., Elbanna, S. and Mahama, H. (2017), "Relationships between strategic performance measures, strategic decision-making, and organizational performance: empirical evidence from Canadian public organizations", *Public Management Review*, Vol. 19 No. 5, pp. 725-746.

- Popa, S., Soto-Acosta, P., & Perez-Gonzalez, D. (2018). An investigation of the effect of electronic business on financial performance of Spanish manufacturing SMEs. *Technological Forecasting and Social Change*, 136, 355-362.
- Priya, S. S., Cuce, E., & Sudhakar, K. (2021). A perspective of COVID 19 impact on global economy, energy and environment. *International Journal of Sustainable Engineering*, 14(6), 1290-1305.
- Pu, G., Qamruzzaman, M., Mehta, A. M., Naqvi, F. N., & Karim, S. (2021). Innovative finance, technological adaptation and SMEs sustainability: the mediating role of government support during COVID-19 pandemic. *Sustainability*, 13(16), 9218.
- Purwanto, A. (2021). Partial Least Squares Structural Equation Modeling (PLS-SEM) Analysis for Social and Management Research: A Literature Review. *Journal of Industrial Engineering & Management Research*, 2(4), 114-123.
- Purwanto, A., Asbari, M., & Santoso, T. I. (2021). Analisis Data Penelitian Marketing: Perbandingan Hasil antara Amos, SmartPLS, WarpPLS, dan SPSS Untuk Jumlah Sampel Besar. *Journal of Industrial Engineering & Management Research*, 2(4), 216-227.
- Queiroz, M., Tallon, P.P., Sharma, R. and Coltman, T. (2018), "The role of it application orchestration capability in improving agility and performance", *The Journal of Strategic Information Systems*, Vol. 27 No. 1, pp. 4-21.
- Rai, A., Arikan, I., Pye, J. and Tiwana, A. (2015), "Fit and misfit of plural sourcing strategies and it-enabled process integration capabilities: consequences of firm performance in the us electric utility industry", *Mis Quarterly*, Vol. 39 No. 4, pp. 865-885.
- Rasoolimanesh, S. M. (2022). Discriminant validity assessment in PLS-SEM: A comprehensive composite-based approach. *Data Analysis Perspectives Journal*, 3(2), 1-8.
- Ravichandran, T. (2018). Exploring the relationships between it competence, innovation capacity and organizational agility. *The Journal of Strategic Information Systems*, 27(1):22–42.
- Rehman, K. U., Aslam, F., Mata, M. N., Martins, J. M., Abreu, A., Morão Lourenço, A., & Mariam, S. (2021). Impact of Entrepreneurial Leadership on Product Innovation Performance: Intervening Effect of Absorptive Capacity, Intra-Firm Networks, and Design Thinking. *Sustainability*, 13(13), 7054.
- Rehman, N., Nor, M. N. M., Taha, A. Z., & Mahmood, S. (2018). Impact of information technology capabilities on firm performance: Understanding the mediating role of corporate entrepreneurship in SMEs. *Academy of Entrepreneurship Journal*, 24(3), 1-19.
- Rehman, N., Razaq, S., Farooq, A., Zohaib, N. M., & Nazri, M. (2020). Information technology and firm performance: mediation role of absorptive capacity and corporate entrepreneurship in manufacturing SMEs. *Technology Analysis & Strategic Management*, 32(9), 1049-1065.
- Rezaei, F., Khalilzadeh, M., & Soleimani, P. (2021). Factors affecting knowledge management and its effect on organizational performance: Mediating the role of human capital. *Advances in Human-Computer Interaction*, 2021.

- Rojo, A., Stevenson, M., Montes, F. J. L., & Perez-Arostegui, M. N. (2018). Supply chain flexibility in dynamic environments: The enabling role of operational absorptive capacity and organisational learning. *International Journal of Operations & Production Management*.
- Rosita, Ghazali, I., Harto, P., Susanto, H., & Zainuddin, F. (2020). Intellectual capital and financial performance of state-owned banking: evidence from Indonesia. *International Journal of Learning and Intellectual Capital*, 17(1), 47-60.
- Ruoslahti, H. (2020). Complexity in project co-creation of knowledge for innovation. *Journal of Innovation & Knowledge*, 5(4), 228-235.
- Saenz, M. J., Revilla, E., & Knoppen, D. (2014). Absorptive capacity in buyer–supplier relationships: empirical evidence of its mediating role. *Journal of Supply Chain Management*, 50(2), 18-40.
- Salojärvi, H., Saarenketo, S., & Puumalainen, K. (2013). How customer knowledge dissemination links to kam. In *Journal of Business & Industrial Marketing*: Vol. 28(5) (pp. 383–395).
- Sancho-Zamora, R., Hernández-Perlines, F., Peña-García, I., & Gutiérrez-Broncano, S. (2022). The Impact of Absorptive Capacity on Innovation: The Mediating Role of Organizational Learning. *International Journal of Environmental Research and Public Health*, 19(2), 842.
- 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, 102040.
- Santoro, G., Vrontis, D., Thrassou, A. and Dezi, L. (2018), “The internet of things: building a knowledge management system for open innovation and knowledge management capacity”, *Technological Forecasting and Social Change*, Vol. 136, pp. 347-354.
- Sarstedt, M., Hair Jr, J. F., Cheah, J. H., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal (AMJ)*, 27(3), 197-211.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial least squares structural equation modeling. *Handbook of market research*, 26(1), 1-40.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling. In *Handbook of market research* (pp. 587-632). Cham: Springer International Publishing.
- Senivongse, C., Mariano, S., Bennet, A., & Tsui, E. (2020). Absorptive capacity efficacy in SMEs: evidence from multiple case studies in the information technology industry. *Knowledge Management Research & Practice*, 1-14.
- Shams, R., Vrontis, D., Belyaeva, Z., Ferraris, A., & Czinkota, M. R. (2021). Strategic agility in international business: A conceptual framework for “agile” multinationals. *Journal of International Management*, 27(1), 100737.
- Shashi, Centobelli, P., Cerchione, R., & Singh, R. (2019). The impact of leanness and innovativeness on environmental and financial performance: Insights from Indian SMEs. *International Journal of Production Economics*. 212, 111-124.

- Shehzad, M. U., Zhang, J., Le, P. B., Jamil, K., & Cao, Z. (2022). Stimulating frugal innovation via information technology resources, knowledge sources and market turbulence: a mediation-moderation approach. *European Journal of Innovation Management*.
- Sheppard, J. M., & Young, W. B. (2006). Agility literature review: Classifications, training and testing. *Journal of sports sciences*, 24(9), 919-932.
- Siachou, E., Vrontis, D., & Trichina, E. (2021). Can traditional organizations be digitally transformed by themselves? The moderating role of absorptive capacity and strategic interdependence. *Journal of Business Research*, 124, 408-421.
- Silva, L. F., & Moreira, A. C. (2021). Alignment in collaborative new product development. Comparing small and large firms. *International Journal of Business Innovation and Research*, 24(2), 167-196.
- Silva, P. M., Moutinho, V. F., & Vale, V. T. (2021). A new approach of innovation and network on export in trade fair context: evidence from Portuguese SMEs. *Journal of Business & Industrial Marketing*.
- Sindakis, S., Depeige, A., & Anoyrkati, E. (2015). Customer-centered knowledge management: challenges and implications for knowledge-based innovation in the public transport sector. *Journal of Knowledge Management*.
- Singh Sandhawalia, B. and Dalcher, D. (2011), "Developing knowledge management capabilities: a structured approach", *Journal of Knowledge Management*, Vol. 15 No. 2, pp. 313-328.
- Singh, B. and Rao, M.K. (2016). Effect of intellectual capital on dynamic capabilities, *Journal of Organizational Change Management*, 29(2), 129-149.
- Škare, M., & Soriano, D. R. (2021). A dynamic panel study on digitalization and firm's agility: What drives agility in advanced economies 2009–2018. *Technological Forecasting and Social Change*, 163, 120418.
- Soo, C., Tian, A. W., Teo, S. T., & Cordery, J. (2017). Intellectual capital-enhancing HR, absorptive capacity, and innovation. *Human Resource Management*, 56(3), 431–454.
- Soto-Acosta, P., Popa, S., Palacios-Marqués, D., (2015). E-business, organizational innovation and firm performance in manufacturing SMEs: an empirical study in Spain. *Technol. Econ. Dev. Econ.* 1–20.
- Sousa, R. D., Carvalho, J. Á., do Amaral, L. A. M., & Palvia, P. (2020). Information Technology Issues in Portugal. In *The World IT Project: Global Issues in Information Technology* (pp. 355-367).
- Southern, N. L. (2005). Creating cultures of collaboration that thrive on diversity: A transformational perspective on building collaborative capital. In *Collaborative capital: Creating intangible value*. Emerald Group Publishing Limited. 11, 33–72
- Spithoven, A., Clarysse, B., & Knockaert, M. (2010). Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation*, 30(2), 130-141.
- Stojčić, N. (2020). Collaborative innovation in emerging innovation systems: Evidence from Central and Eastern Europe. *The Journal of Technology Transfer*, 1-32.
- Suid, I. S., Nor, N. A. M., & Omar, H. (2017). A review on Islamic tourism and the practical of Islamic attributes of destination in tourism business. *International Journal of Academic Research in Business and Social Sciences*, 7(12), 255-269.

- Sun, P. Y., & Anderson, M. H. (2010). An examination of the relationship between absorptive capacity and organizational learning, and a proposed integration. *International journal of management reviews*, 12(2), 130-150.
- Sun, Y., Wu, L., & Jeyaraj, A. (2022). Moderating role of enterprise social media use in work engagement. *Information Processing & Management*, 59(1), 102793.
- Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in science education*, 48(6), 1273-1296.
- Taherdoost, H. (2016). Sampling methods in research methodology; how to choose a sampling technique for research. *How to Choose a Sampling Technique for Research* (April 10, 2016).
- Tallon, P. P., & Pinsonneault, A. (2011). Competing perspectives on the link between strategic information technology alignment and organizational agility: insights from a mediation model. *Mis Quarterly*, pp. 463-486.
- Tallon, P. P., Queiroz, M., Coltman, T., & Sharma, R. (2018). Information technology and the search for organizational agility: A systematic review with future research possibilities. *The Journal of Strategic Information Systems*. (2), pp. 218-237.
- Tang, Y.E. and Marinova, D. (2020), "When less is more: the downside of customer knowledge sharing in new product development teams", *Journal of the Academy of Marketing Science*, Vol. 48 No. 2, pp. 288-307.
- Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS quarterly*, 311-334.
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education*, 2, 53.
- Tehseen, S., Ramayah, T., & Sajilan, S. (2017). Testing and controlling for common method variance: A review of available methods. *Journal of Management Sciences*, 4(2), 142-168.
- Tehseen, S., Sajilan, S., Gadar, K., & Ramayah, T. (2017). Assessing cultural orientation as a reflective-formative second order construct-a recent PLS-SEM approach. *Review of Integrative Business and Economics Research*, 6(2), 38.
- Thomas, A., Morris, W., Haven-Tang, C., Francis, M., & Byard, P. (2021). Smart Systems and Collaborative Innovation Networks for Productivity Improvement in SMEs. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(1), 3.
- Tosi Jr, H. L., & Slocum Jr, J. W. (1984). Contingency theory: Some suggested directions. *Journal of management*, 10(1), 9-26.
- Tzokas, N., Kim, Y. A., Akbar, H., & Al-Dajani, H. (2015). Absorptive capacity and performance: The role of customer relationship and technological capabilities in high-tech SMEs. *Industrial Marketing Management*, 47, 134-142.
- Un, C. A., Cuervo-Cazurra, A., & Asakawa, K. (2010). R&D collaborations and product innovation. *Journal of Product Innovation Management*, 27(5), 673-689.
- Valentim, L., Lisboa, J. V., & Franco, M. (2016). Knowledge management practices and absorptive capacity in small and medium-sized enterprises: is there really a linkage?. *R&D Management*, 46(4), 711-725.

- Van Osch, W., Steinfield, C. W., & Balogh, B. A. (2015, January). Enterprise social media: Challenges and opportunities for organizational communication and collaboration. In 2015 48th Hawaii International Conference on System Sciences (pp. 763-772). IEEE.
- Van Zoonen, W., Treem, J. W., & Sivunen, A. (2022). An analysis of fear factors predicting enterprise social media use in an era of communication visibility. *Internet Research*, 32(7), 354-375.
- Varajão, J., Dominguez, C., Ribeiro, P. M. G. D. A., & Paiva, A. (2014). Failures in software project management—are we alone? A comparison with construction industry. *Journal of Modern Project Management*. <http://hdl.handle.net/1822/35418>
- Verma, V., Bharadwaj, S. S., & Nanda, M. (2017). Comparing agility and absorptive capacity for superior firm performance in dynamic environment. *International Journal of Business Environment*, 9(1), 1-17.
- Vidal, L. A., & Marle, F. (2008). Understanding project complexity: implications on project management. *Kybernetes*.
- 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.
- Voorhees, C. M., Brady, M. K., Calantone, R., & Ramirez, E. (2016). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. *Journal of the academy of marketing science*, 44(1), 119-134.
- Wan, Y., Gao, Y., & Hu, Y. (2022). Blockchain application and collaborative innovation in the manufacturing industry: Based on the perspective of social trust. *Technological Forecasting and Social Change*, 177, 121540.
- Wang, F., Zhao, J., Chi, M., & Li, Y. (2017). Collaborative innovation capability in IT-enabled inter-firm collaboration. *Industrial Management & Data Systems*.
- Wang, Z., Ling, J., & Chok, J. I. (2020). Relational embeddedness and disruptive innovations: The mediating role of absorptive capacity. *Journal of Engineering and Technology Management*, 57, 101587.
- Watanabe, C. S., Tereso, A. P., Fernandes, A. G. G., Jespersen, L., & Vestgaard, J. (2021, March). Project management practice in SMEs: a comparative study of the Portuguese and danish economic context. In *World Conference on Information Systems and Technologies* (pp. 96-105). Springer, Cham.
- Weqar, F., Khan, A. M., Raushan, M., & Haque, S. M. (2021). Measuring the impact of intellectual capital on the financial performance of the finance sector of India. *Journal of the Knowledge Economy*, 12(3), 1134-1151.
- Williams, P., Ashill, N.J., Naumann, E. and Jackson, E. (2015), "Relationship quality and satisfaction: customer perceived success factors for on-time projects", *International Journal of Project Management*, Vol. 33 No. 8, pp. 1836-1850.
- Wong, K. K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 24(1), 1-32.
- Wu, C., Zhang, Y., Huang, S., & Yuan, Q. (2021). Does enterprise social media usage make the employee more productive? A meta-analysis. *Telematics and Informatics*, 60, 101578.
- Xie, X., Zou, H. and Qi, G. (2018), "Knowledge absorptive capacity and innovation performance in high-tech companies: a multi-mediating analysis", *Journal of Business Research*, Vol. 88, pp. 289-297.

- Xu, J., & Liu, F. (2021). Nexus between intellectual capital and financial performance: an investigation of Chinese manufacturing industry. *Journal of Business Economics and Management*, 22(1), 217-235.
- Xue, J., & Swan, K. S. (2020). An investigation of the complementary effects of technology, market, and design capabilities on exploratory and exploitative innovations: Evidence from micro and small-sized tech enterprises in China. *Creativity and Innovation Management*, 29, 27-50.
- Yafi, E., Tehseen, S., & Haider, S. A. (2021). Impact of green training on environmental performance through mediating role of competencies and motivation. *Sustainability*, 13(10), 5624.
- Yang, T. M., & Maxwell, T. A. (2011). Information-sharing in public organizations: A literature review of interpersonal, intra-organizational and inter-organizational success factors. *Government information quarterly*, 28(2), 164-175.
- Yaseen, S. G. (2019, August). Potential absorptive capacity, realized absorptive capacity and innovation performance. In *International Conference on Human Interaction and Emerging Technologies* (pp. 863-870). Springer, Cham.
- Yeoh, P. L. (2009). Realized and potential absorptive capacity: Understanding their antecedents and performance in the sourcing context. *Journal of marketing theory and practice*, 17(1), 21-36.
- Yoo, S. J., Sawyerr, O., & Tan, W. L. (2016). The mediating effect of absorptive capacity and relational capital in alliance learning of SMEs. *Journal of Small Business Management*, 54, 234-255.
- Yousaf, S., Rasheed, M. I., Kaur, P., Islam, N., & Dhir, A. (2022). The dark side of phubbing in the workplace: Investigating the role of intrinsic motivation and the use of enterprise social media (ESM) in a cross-cultural setting. *Journal of Business Research*, 143, 81-93.
- Yu, H., Zhang, J., Zhang, M., & Fan, F. (2022). Cross-national knowledge transfer, absorptive capacity, and total factor productivity: The intermediary effect test of international technology spillover. *Technology Analysis & Strategic Management*, 34(6), 625-640.
- Yuan, C., Xue, D., & He, X. (2021). A balancing strategy for ambidextrous learning, dynamic capabilities, and business model design, the opposite moderating effects of environmental dynamism. *Technovation*, 103, 102225.
- Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27(2), 185-203.
- Zhang, F., Zhu, L., & Lyu, C. (2021). Geographic search, potential absorptive capacity and radical innovation performance: the moderating role of collaborative network. *European Journal of Innovation Management*. Retrieved From: <https://doi.org/10.1108/EJIM-11-2019-0348>
- Zhang, Z. and Sharifi, H. (2007), "Towards theory building in agile manufacturing strategy—a taxonomical approach", *IEEE Transactions on Engineering Management*, Vol. 54 No. 2, pp. 351-370.
- Zhen, J., Xie, Z., & Dong, K. (2021). Impact of IT governance mechanisms on organizational agility and the role of top management support and IT ambidexterity. *International Journal of Accounting Information Systems*, 40, 100501.
- Zhou, J., Mavondo, F.T. and Saunders, S.G. (2018), "The relationship between marketing agility and financial performance under different levels of market turbulence", *Industrial Marketing Management*, Vol. 83.

- Zhu, J. and Mostafavi, A. (2017). Discovering complexity and emergent properties in project systems: A new approach to understanding project performance. *International journal of project management*, 35(1):1–12.
- Zutshi, A., Mendy, J., Sharma, G. D., Thomas, A., & Sarker, T. (2021). From challenges to creativity: enhancing SMEs' resilience in the context of COVID-19. *Sustainability*, 13(12), 6542.