LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER OF SCIENCE IN
MANAGEMENT AND INDUSTRIAL STRATEGY

MASTER'S FINAL WORK
DISSERTATION

CLUSTERS AND THE CONTEXT FOR COMPETITIVE ADVANTAGE: A STRATEGIC ANALYSIS OF THE ENGINEERING & TOOLING CLUSTER

LUÍS PAULO RAMOS NETO

OCTOBER – 2019

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When I first started this research, I was aware of the complexity of the endeavour but could not foresee that, more often than not, more questions would be raised than answers would be given. I was reminded of what André Gide once said: 'one does not discover new lands without consenting to lose sight of the shore for a very long time.' Now that this journey is about to end, I realise that reaching the destination is not nearly as important as what I have learned and become by getting there.

Therefore, I thank my supervisor Professor Jaime Andrez for his support, critical remarks and for allowing this study to be my own work. I first came across the Engineering & Tooling cluster when the Professor handed me a brochure on the Portuguese clusters at the start of a lecture on Industrial Organisation. The existence of multiple types of positioning strategies, along with the alleged strong interplay between local institutions and firms serving global markets urged me to examine the sources of competitive advantage in this particular cluster.

I extend my thanks to the questionnaire respondents as well as to the business leaders and political decision-makers who generously contributed with their time during interviews. Learning from your first-hand experience and knowledge was one of the most enjoyable aspects of writing this dissertation. A special word of gratitude must also be expressed to Mrs Ana Amaral and Mrs Rita Pereira, librarians at the Lisbon School of Economics and Management, for having granted me access to otherwise unavailable materials that proved crucial to this study. I am equally grateful to my friends and family who have, either directly or indirectly, encouraged me throughout this journey.

My special tribute goes to my parents who have supported me in every possible way during my education, to my sister for her kindness and open arms, to my grandfather Joaquim Ramos whose memory still warms my heart during difficult times, and to Luís Grou for being the older brother I have always wanted to have. I am deeply grateful to my soulmate Daniela Pérez, who figuratively held my hands during this lengthy endeavour, for the love and inspiration she has brought into my life. I cannot thank you all enough for your care. I dedicate this dissertation to these six extraordinary human beings.

ABSTRACT

This dissertation illustrates an empirical application of Porter's (1990, 2004) Diamond Model using the Partial Least Squares Structural Equation Modelling (PLS-SEM; Wold, 1975, 1982) method in order to assess the effects of the microeconomic business environment on firms' competitive advantage and the government's supportive role in improving such an environment. It follows a concurrent triangulation design and takes firms in the Portuguese Engineering & Tooling cluster as the basic unit of analysis.

The findings from the path analysis derive from a total number of 168 questionnaire responses obtained from firms in the cluster, which were subsequently triangulated with secondary data and interviews conducted with several cluster stakeholders. These findings reveal a positive effect of the related and supporting industries, the context for firm strategy and rivalry, and the factor (input) conditions at the cluster level on firms' competitive advantage. Government action has also been shown to have a positive effect on the four determinants of the Diamond Model. Conversely, respondents' perceptions do not support a positive effect of the demand conditions at the cluster level on firms' competitive advantage.

The positive and negative effects of the Engineering & Tooling cluster's environment on the competitive edge of firms highlight the catalytic roles of the government and collective action in cluster upgrading.

Keywords: Cluster; Cluster Policies; Competitive Advantage; Diamond Model; Engineering & Tooling Cluster; Mixed-methods Research; Partial Least Squares Structural Equation Modelling (PLS-SEM).

RESUMO

A presente dissertação ilustra uma aplicação empírica do Modelo do Diamante de Porter (1990, 2004) recorrendo ao método de modelação de equações estruturais com base nos mínimos quadrados parciais (PLS-SEM; Wold, 1975, 1982), com vista a avaliar os efeitos da envolvente microeconómica na vantagem competitiva das empresas e do apoio governamental na melhoria desta envolvente. A investigação adota um *design* de triangulação simultânea e toma como unidade de análise as empresas do *cluster Engineering & Tooling*.

Os resultados da análise de equações estruturais (*path analysis*) decorrem de um número total de 168 de respostas obtidas através de um questionário dirigido às empresas do *cluster*, os quais foram subsequentemente triangulados com dados secundários e entrevistas realizadas com vários intervenientes do *cluster*. Estes resultados revelam um efeito positivo tanto das indústrias relacionadas e de suporte, como do contexto para a estratégia e rivalidade empresarial, e das condições de fatores ao nível do *cluster* na vantagem competitiva das empresas. Também foi demonstrado que a ação do governo tem um efeito positivo nos quatro fatores determinantes do Modelo do Diamante. Contrariamente, as perceções dos respondentes não suportam um efeito positivo das condições da procura do *cluster* na vantagem competitiva empresarial.

Os efeitos positivos e negativos da envolvente do *cluster Engineering & Tooling* na vantagem competitiva das empresas realçam o papel catalisador do governo e da ação coletiva na melhoria das condições do *cluster*.

Palavras-chave: *Cluster*; Políticas de Clusterização; Vantagem Competitiva; Modelo do Diamante; *Cluster Engineering & Tooling*; Investigação por Métodos Mistos; Modelação de Equações Estruturais com base nos Mínimos Quadrados Parciais (PLS-SEM).

RESUMEN

La presente disertación ilustra una aplicación empírica del Modelo del Diamante de Porter (1990, 2004) recurriendo al método de modelación de ecuaciones estructurales con mínimos cuadrados parciales (PLS-SEM; Wold, 1975, 1982), con el objetivo de evaluar los efectos del contexto microeconómico en la ventaja competitiva de las empresas y del apoyo gubernamental en la mejora de dicho contexto. La investigación adopta un diseño de triangulación simultánea y toma como unidad de análisis las empresas del *cluster Engineering & Tooling*.

Los resultados del análisis de ecuaciones estructurales (*path analysis*) provienen de un número total de 168 respuestas obtenidas a través de un cuestionario dirigido a las empresas del *cluster*, los cuales fueron subsecuentemente triangulados con datos secundarios y entrevistas realizadas a varios integrantes del *cluster*. Estos resultados revelan un efecto positivo tanto de las industrias relacionadas y de soporte, como del contexto para la estrategia y rivalidad empresarial, y de las condiciones de factores a nivel del *cluster* en la ventaja competitiva de las empresas. También fue demostrado que la acción del gobierno tiene un efecto positivo en los cuatro factores determinantes del Modelo del Diamante. Por el contrario, las percepciones de los encuestados no corroboran un efecto positivo de las condiciones de demanda del *cluster* en la ventaja competitiva empresarial.

Los efectos positivos y negativos del contexto del *cluster Engineering & Tooling* en la ventaja competitiva de las empresas destacan el rol catalizador del gobierno y de la acción colectiva en la mejora de las condiciones del *cluster*.

Palabras Clave: *Cluster*; Políticas de *Clusters*; Ventaja Competitiva; Modelo del Diamante; *Cluster Engineering & Tooling*; Investigación de Métodos Mixtos; Modelación de Ecuaciones Estructurales con Mínimos Cuadrados Parciales (PLS-SEM).

EPIGRAPH

Disruption of the status quo is strategic behaviour, not mischief. The ability constantly to 'break the mould' could be a core competence.

Johnson, Scholes & Whittington, in *Exploring Corporate Strategy*, 2008, p. 239

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GLOSSARY OF TERMS AND ABBREVIATIONS

APIP – *Associação Portuguesa da Indústria de Plásticos*[1]

BCa – Bias-corrected and Accelerated Bootstrap

CAE (Rev.3) – *Classificação Portuguesa de Atividades Económicas (Revisão 3)*[2]

CCDR-C – *Comissão de Coordenação e Desenvolvimento Regional do Centro*[3]

CCDR-N – *Comissão de Coordenação e Desenvolvimento Regional do Norte*[4]

CEFAMOL – *Associação Nacional da Indústria de Moldes*[5]

CENTIMFE – *Centro Tecnológico da Indústria de Moldes, Ferramentas Especiais e Plásticos*[6]

Centro 2020 – *Programa Operacional Regional do Centro* (2014-2020)[7]

CES – Collective Efficiency Strategies

COMPETE 2020/ PO CI – *Programa Operacional "Competitividade e Internacionalização"* (2014-2020)[8]

DC – Demand Conditions

esp. – Especially

E&T Cluster – Engineering & Tooling Cluster

EU – European Union

FC – Factor (Input) Conditions

FDI – Foreign Direct Investment

GSI – Global Single Item

GVCs – Global Value Chains

IAPMEI – *Agência para a Competitividade e Inovação, I.P.*[9]

I&D+i – *Investigação, Desenvolvimento e Inovação*[10]

I&DT – *Investigação e Desenvolvimento Tecnológico*[11]

[1] Portuguese Plastics Industry Association
[2] Portuguese Classification of Economic Activities (CAE Rev.3)
[3] Centro Portugal Regional Coordination and Development Commission
[4] Norte Portugal Regional Coordination and Development Commission
[5] Portuguese Association for the Mouldmaking Industry
[6] Portuguese Technological Centre for the Mouldmaking, Special Tooling and Plastics Industries
[7] Centro Portugal Regional Operational Programme (2014-2020)
[8] Operational Programme 'Competitiveness and Internationalisation' (2014-2020)
[9] Portuguese Agency for Competitiveness and Innovation
[10] Research, Development and Innovation (RD&I)
[11] Research and Technological Development (RTD)

INPI – *Instituto Nacional da Propriedade Industrial, I.P.*[12]

IPAC – *Instituto Português de Acreditação, I.P.*[13]

IPQ – *Instituto Português da Qualidade, I.P.*[14]

MSc – Master of Science

n/a – Not Applicable

n.e.c. – Not Elsewhere Classified

No – Number

Norte 2020 – *Programa Operacional Regional do Norte* (2014-2020)[15]

NS – Not Significant

NUTS – *Nomenclature des Unités Territoriales Statistiques*[16]

OLS – Ordinary Least Squares

PIEP – *Pólo de Inovação em Engenharia de Polímeros*[17]

PLS-SEM – Partial Least Squares Structural Equation Modelling

Pool-net – Portuguese Tooling & Plastics Network

QREN 2007-2013 – *Quadro de Referência Estratégico Nacional 2007-2013*[18]

RBV – Resource-based View of the Firm

RIS3 – Research and Innovation Strategies for Smart Specialisation

RSI – Related and Supporting Industries

SBUs – Strategic Business Units

SCTN – *Sistema Científico e Tecnológico Nacional*[19]

SMEs – Small and Medium-sized Enterprises

SSR – Firm Strategy, Structure and Local Rivalry

[12] Portuguese Institute of Industrial Property
[13] Portuguese Institute for Accreditation
[14] Portuguese Institute for Quality
[15] Norte Portugal Regional Operational Programme (2014-2020)
[16] Nomenclature of Territorial Units for Statistics
[17] Portuguese Hub of Innovation in Polymer Engineering
[18] Portuguese National Strategic Reference Framework (NSRF)
[19] Portuguese National Scientific and Technological System

1. INTRODUCTION

In the past, the internal analysis of an organisation was at the core of strategic thinking (Porter, 2000a). Yet, the prevalence of industrial agglomerations in economies over the centuries has long puzzled scholars, especially since Alfred Marshall (1920 [1890]) first drew a link between production costs and the strategic co-location of related and specialised industries.

In a 'world [that has gone] flat' (Friedman, 2007, p. 5) as a result of the ever-deepening globalisation, a surge of interest in the local dimension from the 1990s onwards (Pyke & Sengenberger, 1992; Cruz & Teixeira, 2009) has paved the way for new theoretical accounts, amongst which the cluster literature. Following the trail laid down by Marshall (1920 [1890]), Michael Porter (1990) coined the term 'cluster' to refer to the geographical agglomeration of interconnected companies and associated institutions that compete but also cooperate in a particular field (Porter, 2000b).

In stark contrast to the resource-based view of the firm (RBV; *i.a*., Selznick, 1957; Penrose, 1959), cluster theory has highlighted that competitive advantage, to a large extent, '(…) lies outside companies and even outside their industries, residing instead in the locations at which their business units are based' (Porter, 2000b, p.16). This led to the so-called 'location paradox' (Porter, 1998a; Ketels, 2006; Pisano & Shih, 2012) according to which, in a global economy, location still plays a key role in firms' innovative capacity due to the constant interplay with other actors, agglomeration economies, knowledge spillovers and the transfer of tacit knowledge (Porter, 1994; Tinguely, 2013).

In line with these theoretical developments, the quest for competitive advantage gained prominence amongst academics, politicians and business leaders during the 1990s, at both the European and national levels (Fórum para a Competitividade, 1995). In the Portuguese case, it culminated in the publication of *Building Competitive Advantages in Portugal* (Fórum para a Competitividade, 1994), commissioned by the Portuguese government and under the direction of Michael Porter, in which clusters were deemed instrumental in attaining a national competitive edge. Today, more than 20 years later, the legacy of this movement is still found in the European and Portuguese cluster policies.

Consistent with previous research on clusters, this study draws on the Diamond Model proposed by Porter (1990, 2004) with a view to analysing the effects of clusters

on competitive advantage. Put simply, the model maintains that firms' competitive advantages in a cluster depend on the microeconomic business environment, particularly on the factor (input) conditions, the context for firm strategy and rivalry, the demand conditions, as well as related and supporting industries at the cluster level (Porter, 2004).

This research nevertheless departs from previous studies in two fundamental ways. First, the unit of analysis is not the overall economy but firms in the Portuguese Engineering & Tooling (E&T) cluster. Second, this study goes beyond a qualitative analysis of the effects of clusters on firms' competitive edge as in prior research. Rather, based on a questionnaire administered to cluster firms, it operationalises the Diamond Model using the PLS-SEM method and thereafter triangulates the estimated relationships with secondary data and interviews conducted with cluster stakeholders.

The objective of this study is twofold. On the one hand, it aims to assess empirically the effects of the determinants of the microeconomic business environment (formalised in the Diamond Model) on the competitive advantage of firms in the E&T cluster. On the other hand, it seeks to examine empirically the government's supportive role in improving such determinants. In this endeavour, the contribution of the Portuguese Tooling & Plastics Network (Pool-net cluster association) has also been taken into account given its intermediary role between the private sector and government institutions, as well as due to its contribution to upgrading the conditions of the cluster.

The dissertation is structured as follows. The next section presents the results of the systematic review of the literature conducted. Section three describes the research design and the methodological procedures employed. Section four briefly characterises the unit of analysis as an introduction to the data analysis and results presented in section five. The final section summarises the argument of the study in five broad conclusions with implications for academia, public policy and management practice.

2. LITERATURE REVIEW

This section presents the results of the literature review carried out. The question 'in the global economy, does the co-location of firms play a role in competition?' served as a starting point for identifying relevant studies. The literature was thereafter assessed for its relevance to the study's hypotheses, as suggested by Lewis, Saunders & Thornhill (2012).

2.1. Theoretical Framework

This study draws upon the contributions of the Positioning School of Thought (*i.a.*, Hatten & Schendel, 1977; Porter, 1980, 1985) and the Resource-based View of the Firm (RBV; *i.a.*, Penrose, 1959; Barney, 1991, 2001; Grant, 1991), which have been deemed complementary in many respects (see Cockburn, Henderson & Stern, 2000).

The literature on industrial agglomeration has evolved through several theoretical approaches, such as (i) the industrial districts (*i.a*., Becattini, 1979, 1990; Belussi, 1996; De Bernardy, 1999), (ii) *les milieux innovateurs* (*i.a*., Aydalot, 1986; Aydalot & Keeble, 1988; Camagni, 1995) and (iii) the industrial clusters (Porter, 1990). All these accounts share the idea that many of a firm's competitive advantages are rooted in the locations where they operate (Porter, 1990). However, it is beyond the scope of this research to pay full tribute to all theories. Instead, focus will be placed on the cluster theory due to its contribution to understanding the sources of competitive advantage.

2.2. Location and Competition

2.2.1. From a Static to a Dynamic View of Competition

In the first half of the 20th century, a static view of competition based on cost-based competition was pervasive in the mainstream literature. In a context where economies were closed to foreign trade and following Adam Smith's ideas, neoclassical scholars postulated that successful firms would need to have the lowest production costs or the greatest economies of scale (Goddard, Lipczynski & Wilson, 2005).

By that time, Alfred Marshall (1920 [1890]) was the first economist to draw the link between production costs and the agglomeration of related and specialised industries. The author pointed out a triad of external economies of scale: (i) an immediate pool of qualified and specialised labour, (ii) a quick dissemination of knowledge through knowledge spillovers, and (iii) an easier access to 'non-traded local inputs' provided by specialist suppliers (Marshall, 1920 [1890]; McCann & Shefer, 2004; Karlsson, 2008).

After the mid-1970s, however, changes in the competitive factors pushed the boundaries of competition beyond the price/cost paradigm associated with the mass production system (Hayes *et al.*, 2005). In addition, the advent of the 'New World Economy', characterised by globalisation, technology-intensive activities and the role of network partnerships in tapping into immobile knowledge-based sources (Hayes *et al.*,

2005), in tandem with advances in transportation and communications technologies (Grossman & Rossi-Hansberg, 2008; Rouvinen *et al*., 2011), introduced increased dynamism in competition. But before diving into the effects of this dynamism on firms' competitive advantage, it is first necessary to unravel the concept at issue.

2.2.2. The Quest for Competitive Advantage

In spite of earlier references dating back to Penrose (1959), the concept of competitive advantage was to be coined by Michael Porter a few decades later:

> Competitive advantage grows out of the value a firm is able to create for its buyers that exceeds the firm's cost of creating it. Value is what buyers are willing to pay, and superior value stems from offering lower prices than competitors for equivalent benefits or providing unique benefits that more than offset a higher price. There are two basic types of competitive advantage: cost leadership and differentiation.
>
> In Porter (1985), p. 3

Hence, firms can either offer clients similar value but perform activities more efficiently than their rivals (*i.e.*, cost leadership), or perform activities differently so as to create greater client value and command a premium price (*i.e.*, differentiation) (Porter, 1990; The Economist, 2008). Many researchers argue that, as a result of the shift from a static to a dynamic approach to competition (Porter, 1994), the effect of location on competitive advantage has become less reliant on higher (static) productivity, but more on firms' productivity growth (Porter, 2000a), *i.e.*, on the rate of dynamic improvement through ongoing innovation and by upgrading their skills and technologies (Porter, 1994). Both productivity and innovation ultimately rely on the sophistication of a firm's approach to competition in terms of (i) operational effectiveness and (ii) strategic positioning, in other words, the type of competitive strategy pursued (Porter, 2000a).

Whilst an external analysis of competitive advantage entails making choices about the types of positioning strategy (cost leadership or differentiation) and competitive scope (focusing on a narrow segment or targeting broad segments; Porter, 1990), an internal analysis involves deciding how firms attain (or develop) and protect their resources[20] and

[20] In line with Hitt, Hoskisson & Ireland (2016), 'resources' are distinguished from 'capabilities' in the sense that the former are combined to create the latter.

capabilities (Barney, 1991, 2001; Conner, 1991), as well as how activities are internally performed and managed (Porter, 1990, 2000a; Grant, 1991). In this regard, the Value Chain Analysis (Porter, 1985; Appendix A) provides a means for categorising the set of activities performed within and around a firm (Johnson, Scholes & Whittington, 2008) into primary and ancillary activities. Once firms' activities are disaggregated in this way, the model allows for a clear understanding of the behaviour of existing and potential sources of competitive advantage in each activity (Porter, 1985, 1990; Tinguely, 2013).

Competition takes place at the strategic business unit level (SBU; Johnson, Scholes & Whittington, 2008), which implies that firms' processes for creating competitive advantages ultimately depend on the location of their business units (Porter, 2000b). Thus, the contribution of a SBU to the competitive advantage of the respective firm is influenced by (i) the quality of the microeconomic business environment (section 2.3.) and (ii) the state of cluster development (section 2.4.3.; Snowdon & Stonehouse, 2006; Tinguely, 2013).

2.3. The Quality of the Microeconomic Business Environment

The quality of the microeconomic business environment affects firms' degree of sophistication by means of a system of four interrelated determinants (Clancy *et al*., 2001) that together make up the so-called 'Diamond Model' (Porter, 1990, 2004; Appendix B):

Factor (Input) Conditions (FC) refer to the quantity, cost, quality and specialisation of the available factor endowments in a given business environment that are required to gain competitive advantage in a specific industry (Porter, 1990; Huggins & Izushi, 2015). Basic factors, such as natural resources or unskilled labour, are readily available in a given location (Porter, 1990). Advanced factors, by contrast, require investments in human and physical capital by firms and governments, and include skilled and specialised labour, information, scientific and technological infrastructure, as well as capital resources (Porter, 2000b). Such factors may be either generalised in the sense that can be deployed in different industries, or specialised when restricted to a small number of industries (Porter, 1990). According to Porter (1990), the more advanced and specialised these factors are, the more sustained a firm's competitive advantage will be.

Firm Strategy, Structure and Local Rivalry (SSR) relate to the types of strategies and organisational structures adopted by firms, as well as the context for firm strategy

and rivalry. Both dimensions are closely interrelated since the sophistication of firms' operations and strategies depends chiefly on the rules, incentives and norms dictating the type and intensity of local competition (Porter, 1998c). Thus, the business environment affects how firms are created, organised and managed, the nature of local rivalry, as well as the processes of strategy and capability development (Porter, 1990).

Related and Supporting Industries (RSI) concern the availability and technical quality of specialist local suppliers and related firms sharing the same technological or scientific basis (Porter, 1990). Such companies provide downstream industries with raw materials, components, machinery and services (*e.g.*, accounting, law and advertising; Karlsson, 2008). Non-captive, world-class suppliers in the local area may also be a driver of innovation since the insights gained from their international activities often challenge client firms and assist them in their improvement efforts (Porter, 1990).

Demand Conditions (DC) refer to downstream industries, both clients and distribution channels (Porter, 2000a), locally-based firms and subsidiaries of foreign companies (Porter, 1990). According to Porter (1990), the extent to which local demand boosts the ability of firms to gain and sustain a competitive edge depends on (i) its degree of sophistication, (ii) its absolute size and rate of growth which affect firms' investment behaviour, (iii) its degree of internationalisation to pull firms' products abroad, and (iv) its ability to anticipate global and not just local needs, particularly lead users[21] who may help to develop well-targeted products when entering new markets (Ketels, 2006). The key features of the local demand are those providing a sustained stimulus to innovative investments and to compete in more sophisticated market segments (Porter, 1990).

Government (G) and Chance affect the process of creating competitive advantages by influencing at least one of the four determinants of the quality of the business environment (Porter, 1990; Fórum para a Competitividade, 1994; Ketels, 2006; Fornahl & Menzel, 2009; Tinguely, 2013). On the one hand, chance events (*e.g.*, technological discontinuities or unexpected changes in demand and input costs) are exogenous factors that give rise to discontinuities responsible for changing the 'diamond conditions' (Porter,

[21] Lead users can be seen as '(…) users whose present strong needs will become general in a marketplace months or years in the future' (von Hippel, 1986, p.791).

1990). On the other hand, government bodies play a role in upgrading the business environment as a means of bolstering productivity growth (Delgado & Ketels, 2012).

2.4. Clusters and Competitive Advantage

Although clusters correspond to related and supporting industries, the interactions amongst all four determinants of the Diamond Model provide a more accurate representation of cluster dynamics (Porter, 2000a; Brakman & van Marrewijk, 2013).

2.4.1. Defining Clusters

Far broader in scope than the so-called 'industrial districts' (De Marchi & Grandinetti, 2014; Gereffi & Lee, 2018), (industrial) clusters have been defined as '(…) geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (…) in a particular field that compete but also cooperate' (Porter, 2000b, p. 15). These are non-random spatial agglomerations (Karlsson, 2008) of local suppliers, related firms (Porter, 2000a), supporting institutions (*e.g.*, cluster organisations, research, academic and financial institutions) and government bodies (Porter, 1998a,b; Ketels, Lindqvist & Sölvell, 2012).

Clusters operate as systems linked by complementarities and commonalities (Simmie, 2008) that influence firms' value-creating activities (Ketels, 2006). Such linkages are embedded in social relationships and networks, involving vertical chains of upstream and downstream industries with different but complementary capabilities and activities, as well as horizontal chains of related industries sharing similar capabilities, activities (Maskell, 2001) and/ or supply-side linkages, such as the use of similar specialised inputs and technologies (Porter, 1998a; Simmie, 2008).

Therefore, clusters embody a form of spatial organisation of economic activity rooted in 'coopetition' (Rees, 2005; Tinguely, 2013), in which competition for clients amongst rivals coexists with strategic cooperation (Porter, 1998b, 2000a). This is because many cluster firms serve different segments of the same client industry (and, thus, do not compete directly) and share many competitive threats and opportunities in the external environment (Porter, 2000a; Goddard, Lipczynski & Wilson, 2005).

Although some scholars (*i.a.*, Gordon & McCann, 2000; Martin & Sunley, 2003; McCann & Sheppard, 2003) have criticised the concept's porous boundaries, it has been

argued that cluster analysis has the upper hand over traditional sectoral analyses when explaining the changing nature of competition and the sources of competitive advantage.

2.4.2. Clusters and Competitive Advantage

Whilst the effects of some economy-wide aspects of the business environment cut across all industries, others are cluster specific (Porter, 2000a). Many scholars (*i.a.*, Porter, 1985, 2000a; Pisano & Shih, 2009) have contended that, paradoxically, the cluster-specific aspects of the business environment have been instrumental in creating sustained competitive advantages in the global economy (Porter, 1990). A firm's competitive edge is increasingly a function of how well it manages intra-cluster linkages within its value system (Porter, 1990; Appendix A), *i.e.*, how a firm combines and integrates its activities with those from the value chains of upstream and downstream industries (Porter, 1990). Firms have therefore tended to focus on a few core activities and outsource to specialist suppliers those activities that are weakly linked to their core knowledge base and do not fit well into their competitive advantages (Dunning, 1997; den Hertog & Roelandt, 1998).

As a result, cluster firms have been claimed to achieve greater sophistication (and hence higher productivity and innovation) vis-à-vis their non-clustered counterparts, both in terms of (i) operational effectiveness and (ii) strategic positioning, based on specialisation and competitive differentiation (Porter, 2000a). Several accounts, however, have argued against the benefits of specialisation and differentiation in clusters, stressing the path dependency underlying cluster development (Malmberg & Maskell, 2002; Sonderegger & Täube, 2010; Damgaard & Ingstrup, 2013) and the dangers of firms getting locked-in when chance events render the knowledge-base obsolete, the prevailing routines inefficient and the institutional framework inflexible (Cornwall & Cornwall, 2001; Barnes, Gartland & Stack, 2004; Malmberg & Maskell, 2007). This highlights the importance of upgrading the conditions in clusters.

2.4.3. Cluster Development and Upgrading

As discussed in section 2.3, the state of cluster development is related to the quality of the microeconomic business environment because it depends on the efficiency of the relationships between the determinants of the Diamond Model (Porter, 1998a).

Cluster development initiatives are key to cluster upgrading as they catalyse the efforts of industries, government bodies and local institutions into the design of concrete

actions that tackle clusters' systemic imperfections (Lloyd & Peck, 2008), which are at the root of any constraints and inefficiencies in the 'diamond conditions' (Porter, 1998a).

With regard to the private sector, cluster initiatives are best carried out when collective efficiency[22] is in place (Gereffi & Lee, 2018). Since local constraints are often related to incidental externalities and the need to develop specialised training (Schmitz, 1995) and public goods (Porter, 1998a), it is appropriate to do it via supporting institutions such as cluster associations (Schmitz, 1995; Giuliani, 2005; Gereffi & Lee, 2018).

Cluster associations, in addition to representing clusters and not particular industries, aim to build up trust and a platform for cooperation between rival firms (Mesquita, 2007; Damgaard & Ingstrup, 2013). These associations act as cluster facilitators and intend to raise awareness, foster commitment and create an efficient flow of resources (Bourgeois *et al*., 2010), technological and market knowledge (Coletti, 2010) around a cluster-wide strategy (Zagorsek *et al*., 2008; Damgaard & Ingstrup, 2013).

As for public policy, cluster theory suggests a horizontal, systemic and market-facilitating role for the government (Desrochers, Hospers & Sautet, 2008; den Hertog & Roelandt, 1998) in upgrading the 'diamond conditions', which usually requires a long-term commitment (Porter, 1990; Lloyd & Peck, 2008). Whilst this form of intervention concerns all levels of government, it should draw on place-specific knowledge and be implemented at the local level (Karlsson, 2008). Although this role is still a matter of debate in the literature due to a number of potential pitfalls (see den Hertog & Roelandt, 1998; Desrochers, Hospers & Sautet, 2008), Warwick (2013) notes that it is consistent with the so-called 'systems approach' that has been adopted in industrial policy.

In the context of the global economy, global value chains (GVCs) also play a role in cluster upgrading on at least two accounts. First, leading companies in decentralised production systems (*e.g.*, global buyers), international organisations and trade agreements have facilitated the diffusion of international standards (Gereffi *et al*., 2005; Gereffi & Lee, 2018). Second, the 'Smiling Curve' model (see Shih, 1996) suggests that firms can expect increases in profitability arising from chain upgradings, in other words, by moving up the GVC towards related industries performing higher value-added activities (Gereffi, 2005a; Fernandez-Stark & Gereffi, 2018; Gereffi & Lee, 2018). Profitability is a key issue

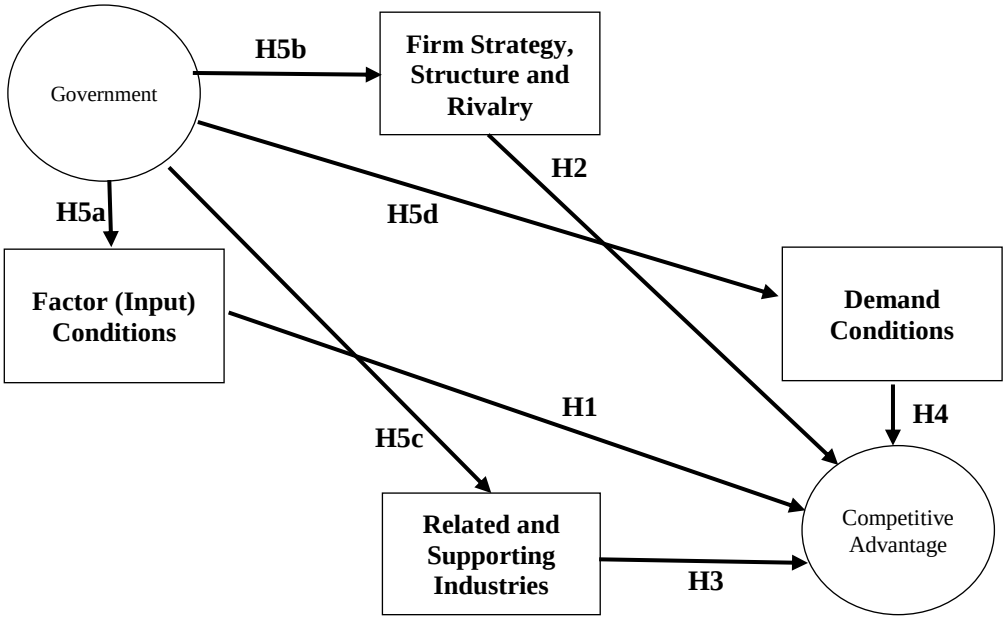
[22] Collective efficiency refers to those advantages stemming from strategically pursued joint action and also from Marshall's (1920 [1890]) external economies of scale (Schmitz, 1999).

due to the need for ongoing investment in innovation and cluster upgrading in order to allow firms to sustain a competitive edge (Porter, 1990).

2.5. Research Hypotheses and Conceptual Model

As noted by Hulland (1999), any causal-modelling process study begins at the conceptual level. The conceptual model proposed below is an adaptation of the Diamond Model (Porter, 1990, 2004). The effects of chance events have been dismissed given the focus of this study on the sources of competitive advantage that can be controlled or at least influenced by firms. Consistent with Mboya (2015), the concept of 'Competitive Advantage' has also been added as an outcome variable. As depicted in Figure 1, eight research hypotheses have been formulated, whose rationale is presented below.

FIGURE 1 – Conceptual Model



Source: Author based on Porter (1990, 2004).

Clusters are typically associated with the development of high-quality and highly specialised factors conducive to innovation (Porter, 2000b), such as human resources, applied technology and scientific, administrative and information infrastructure, as well as capital resources tailored to the needs of cluster industries (Council on Competitiveness *et al.*, 2001a). These theoretical arguments lead to the following hypothesis:

H1. Factor conditions positively influence the competitive advantage of cluster firms.

The context for firm strategy and rivalry in clusters comprises a set of rules, incentives and pressures that give rise to sophisticated forms of competition and intense local rivalry. Such a context thus promotes appropriate types of investment and sustained upgrading that foster productivity growth (Porter, 2000b; Council on Competitiveness *et al.*, 2001a). These theoretical arguments lead to the following hypothesis:

H2. The context for firm strategy and rivalry positively influences the competitive advantage of cluster firms.

Local sourcing from skilled suppliers boosts firms' productivity and innovative capacity by allowing quicker and less expensive communication, promoting the flow of ideas and enhancing flexibility via outsourcing (Council on Competitiveness *et al.*, 2001a). In this regard, specialisation of production and division of labour enable firms to reap the benefits of economies of scale and scope (Cruz & Teixeira, 2009). These theoretical arguments lead to the following hypothesis:

H3. Related and supporting industries positively influence the competitive advantage of cluster firms.

The development and improvement of products and services benefit from sophisticated and demanding clients and distribution channels in the local area (Porter, 2000b; Council on Competitiveness *et al.*, 2001a). Similarly, lead users (von Hippel, 1986) and a distinctive local demand in specialised segments capable of serving international markets may offer insights into both existing and future needs, and compel firms to improve (Council on Competitiveness *et al.*, 2001a). These theoretical arguments lead to the following hypothesis:

H4. Demand conditions positively influence the competitive advantage of cluster firms.

Governments are responsible for providing and improving the quality (Council on Competitiveness *et al.*, 2001a) of specialised education and training programmes, fostering local academic research in cluster-related technologies, supporting in compiling cluster-specific information and enhancing specialised transportation, communications and other relevant infrastructure (Porter, 2000b). Public incentives may also contribute to

firms' innovation efforts (Council on Competitiveness *et al.*, 2001a). These theoretical arguments lead to the following hypothesis:

H5a. The government positively influences the factor conditions in a cluster.

The public sector is accountable for setting up rules, regulations and incentives aimed at removing barriers to local competition (Porter, 2000a) in order to stimulate innovation and cluster upgrading (Council on Competitiveness *et al.*, 2001a). Government bodies may influence the competitive conditions under which firms compete by means of regulations, tax policies and competition law (Council on Competitiveness *et al.*, 2001a). The public sector may also be organised so that relevant departments can efficiently assist clusters, for instance, by supporting joint export promotion and by channelling efforts to attract foreign direct investment (FDI) inflows around clusters (Porter, 2000b). These theoretical arguments lead to the following hypothesis:

H5b. The government positively influences the context for firm strategy and rivalry in a cluster.

Governments are expected to play a facilitating role in sponsoring forums to bring together cluster members and undertake cluster-specific efforts to attract suppliers and service providers in other locations (Porter, 2000b). These theoretical arguments lead to the following hypothesis:

H5c. The government positively influences the related and supporting industries of a cluster.

The public sector is responsible for creating simplified and pro-innovation regulation in order to (i) mitigate uncertainty, (ii) stimulate the early adoption of new products and technologies, and (iii) encourage ongoing skill and technology upgrades (Porter, 1994). In addition, government bodies are accountable for sponsoring independent testing and the certification of products and services developed by cluster firms (Porter, 2000b). These theoretical arguments lead to the following hypothesis:

H5d. The government positively influences the demand conditions in a cluster.

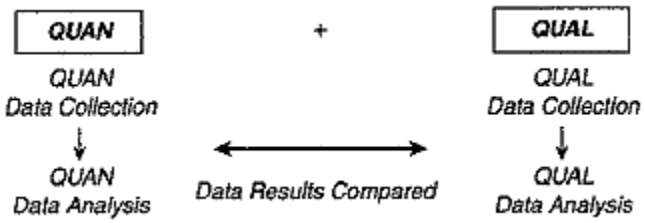
3. RESEARCH METHODOLOGY

This section delves into the rationale behind the research design and methodological choices. It also devotes a few words to enlighten the reader on the overarching philosophical assumptions embedded in this dissertation.

3.1. Research Design and Philosophy

The philosophical stance underpinning this study is called Pragmatism (James, 1907; Peirce, 1984), according to which researchers may choose multiple methods, techniques and procedures for data collection and analysis in order to better understand the research problem (Creswell, 2009). In line with the research philosophy embraced, this study follows a mixed-methods approach and adopts a concurrent triangulation design (Creswell, 2009), as illustrated schematically in Figure 2.

FIGURE 2 – Concurrent Triangulation Design[23]



Source: Creswell (2009) based on Creswell *et al*. (2003).

This research design allows for (i) corroboration via triangulation, (ii) a more detailed analysis of the research hypotheses, and (iii) finding new research avenues based on surprises or paradoxes (Rossman & Wilson, 1984, 1991; Huberman & Miles, 1994). A final remark on the research design is related to the explanatory purpose of the study. Following a deductive research approach (Lewis, Saunders & Thornhill, 2012), quantitative data were statistically analysed (via path analysis) to explain, based on respondents' perceptions, the relationships between the government, the cluster's microeconomic business environment and firms' competitive advantage. Qualitative data were collected from a broader range of stakeholders to validate these relationships.

[23] QUAN = Quantitative; QUAL = Qualitative.

3.2. Sampling Technique

A concurrent mixed-methods sampling (Teddlie & Yu, 2007) was employed. Accordingly, a probability sampling technique was used to meet the representativeness requirement for the quantitative strand of the research (section 3.3.1.). With regard to the qualitative counterpart, a purposive sampling technique was used to meet the data saturation requirement (section 3.4.1.).

3.3. Quantitative Strand

3.3.1. Sampling Procedures

As regards the quantitative strand of the research, the sampling plan followed the steps[24] pointed out by Hair *et al.* (2010). First, the target population was defined as the group of industrial companies operating in Portugal that carry out nuclear and support activities in the E&T cluster, including both members and non-members of the Pool-net association (*vide* Appendix C).

A sampling frame was thereafter generated by complementing the business directory provided by Informa D&B Portugal (Gomes, 2017) with missing e-mail addresses published on Pool-net's website[25]. The directory targeted all sectors of the cluster. It covered the period from 2010 to 2015 (the latest available data at the time of request) and included the following information: firms' activity status, turnover, number of employees and values of exports and imports. In order to ensure that the sampling frame was precise, duplicates were removed as well as addresses of firms belonging to industries that fell outside the target population, such as institutions and engineering firms. From an initial number of 3728 firms, a final number of 980 firms was reached.

The minimum sample size required was thereafter computed by means of a prospective multiple regression power analysis (Ellis, 2010) using the G*Power v. 3.1.9.2 software (Buchner *et al*., 2009) in order to ensure that the statistical tests performed in section 5.4. would have sufficient statistical power. For a medium effect size $f^2 = 0.15$, according to Cohen's (1988) guidelines, and following the five-eighty convention (*i.e.*, $\alpha = 0.05$ and $1-\beta = 0.8$; Cohen, 1988; Ellis, 2010), Table 1 indicates that the sample size should be no fewer than 55 cases.

[24] The statistical method used to analyse the quantitative data (PLS-SEM) will be presented in section 5.4.
[25] See <http://www.toolingportugal.com/index.php?lang=en>, last accessed on the 2nd of August 2019.

TABLE 1 – Determination of the Minimum Sample Size

Type of Model	Predicted Variable	No Predictors	Minimum Sample Size required
Structural Model	CA[26]	4	43
Measurement Models	G	12	55
	FC	6	55
	SSR	4	55
	RSI	4	55
	DC	4	55
	CA	9	55

Source: Author's calculations using G*Power (v. 3.1.9.2).

3.3.2. Questionnaire Design and Piloting

As recommended by Churchill (1979), ordinal closed-ended questions were adapted from previous studies (see Appendix D). General instructions were provided and respondents were asked how strongly they agreed or disagreed with a series of statements using Likert-type rating scales. Jargon and unfamiliar concepts were avoided, yet some of them had to be used for purposes of convergent validity assessment, as will be discussed later. In such cases, the literature has urged the use of a concise description (Cheah *et al*., 2018) or examples so that respondents understand the questions in the same way (Rasinski, Rips & Tourangeau, 2000; Lee *et al*., 2003). In order to increase the validity of responses and minimise dropout rates, a 'do not know' category was added to policy-related questions and, as suggested by de Vaus (2002), a filter question was added to ensure that only firms having local clients could answer demand-related questions.

Pretesting was carried out based on a two-staged pilot study. First, the questionnaire was checked for its structure and the suitability of its questions by two academics acquainted with the business environment of the E&T cluster. Prior research (*i.a.*, Converse & Presser, 1986; Oksenberg *et al*., 1991; Fowler, 1993; Czaja & Blair, 1996; Czaja, 1998) has supported that a questionnaire must also be tested under field conditions. Hence, 12 think-aloud interviews (Czaja, 1998; see Appendix E) were conducted with respondents from the target population, both in Marinha Grande and Oliveira de Azeméis on the 27th of July 2017, 3rd and 9th of August 2017. As suggested by Czaja (1998), respondents were asked to fill in a draft questionnaire, report any

[26] In accordance with the guidelines provided by Hair *et al.* (2014, p. 21), the highest number of arrows (4) in the structural/path model (Figure 3, p. 28) points at the construct 'Competitive Advantage' (*CA*).

difficulties encountered and were queried about their understandings of the questions. The refined questionnaire can be found in Appendix F.

3.3.3. Construct Development and Measurement

Construct development was performed on the basis of a thorough literature review, as recommended by Churchill (1979) and Rossiter (2002). Gudergan *et al.* (2016) point out that the process of construct definition also involves determining constructs' dimensionality. Given the conceptual comprehensiveness of this study's constructs, these were conceptualised as multidimensional and measured by a set of formative indicators.

As regards the indicators' measurement scales, 5-point Likert-type scales with a balanced number of positive and negative categories (Hair *et al.*, 2010) were used[27]. Appendix D enumerates the items adapted from Porter & Schwab (2008), Mboya (2015), the Council on Competitiveness *et al*. (2001a, b) and the European Cluster Observatory (2012) to measure the various dimensions of the constructs. A study carried out by Hair *et al.* (2012b) examined the use of PLS-SEM in 37 papers in the field of Strategic Management and reported that, on average, the number of formative indicators per construct is 3.6. Accordingly, each construct in this study contains at least 4 indicators.

3.3.4. Questionnaire Administration

Data were collected using a self-administered, web-based questionnaire (Lewis, Saunders & Thornhill, 2012) for several reasons, including the low cost per completed questionnaire and fast data collection (Christian, Dillman & Smyth, 2014).

On the 17th of August 2017, an e-mail (Appendix G) presenting the research and providing an URL for the questionnaire was sent out using the Qualtrics online survey software (Qualtrics LLC, 2017) to a simple random sample[28] drawn from the sampling frame. Since most firms in the E&T cluster are family-owned small and medium-sized enterprises (SMEs), questionnaires were administered in Portuguese and were primarily addressed to owner-managers and those managers involved in the strategic decision-making process and/or who had a holistic understanding of their firms' value chains.

[27] For instance, 5-point Likert-type scales ranging from *Strongly Disagree* (1) to *Strongly Agree* (5).
[28] In line with Silva (2011) – a PLS-SEM study that also relied on a small sampling frame – the size of this sample made up 65% of the sampling frame's total size (*i.e.*, 637 out of 980 firms).

Two follow-up reminders (Appendix H) were sent out at two-week intervals in order to encourage non-respondents and respondents who had not yet completed the questionnaire. The data collection period ended on the 15th of September 2017. Of the 637 eligible respondents, a total of 304 responses were collected, yielding a response rate of 47.7%, which is substantial when compared to the likely response rate for web-based questionnaires that tends to be 11% or lower (de Vaus, 2002; Baruch & Holtom, 2008; Lewis, Saunders & Thornhill, 2012).

3.4. Qualitative Strand

3.4.1. Sampling Procedures

Members of the target population were selected using criterion sampling. This non-probability, purposive sampling technique requires participants to be selected on the basis of some predetermined criterion (Patton, 2002; Teddlie & Yu, 2007; Patton, 2015). Bearing in mind the role of institutions in improving the 'diamond conditions', the selection criterion was defined as being a cluster institution, governmental or otherwise, involved in managing the process of cluster development.

In the context of the E&T cluster, three institutions met this criterion: the Pool-net cluster association, responsible for coordinating the cluster's strategy; and the Regional Coordination and Development Commissions of the Norte and Centro regions (CCDR-N and CCDR-C, respectively), where most cluster firms are based. These decentralised agencies of the Portuguese government (Lämmer-Gamp & zu Köcker, 2017) affect the execution of the cluster's strategy through (i) its role in coordinating the regional research and innovation strategies (RIS3) and (ii) the application of the European Union (EU) funds falling under their operational programmes (Koehler, 2015; CCDR-C, 2017).

Consistent with prior recommendations, the determination of sample size was based on the principle of theoretical saturation (Bryman, 2012; Lewis, Saunders & Thornhill, 2012), *i.e.*, when an additional interview only provided redundant information.

3.4.2. Selection and Access Strategy to Participants

Once the relevant institutions had been selected, a preliminary search within their respective websites was carried out in an attempt to access to their organisational charts. This made it possible to determine the departments or individuals involved in the process of cluster upgrading. Both Rui Tocha, general manager of the Pool-net association, and

Alexandra Rodrigues and Rui Monteiro, heads of the CCDR-C and CCDR-N Departments for Regional Development, respectively, were deemed the most appropriate participants. Initial contacts were made both in person and via e-mail. Rui Tocha was approached on the 25th of November 2016 in Lisbon at the end of a lecture at ISCTE Business School. Alexandra Rodrigues was approached on the 6th of July 2017 at the end of a RIS3 conference held in Torres Vedras. Rui Monteiro was contacted by e-mail on the 18th of July 2017. Prospective participants were briefly introduced to the research and interview requests were made thereafter.

3.4.3. Data Preparation Procedures

Interviews were scheduled and, as recommended by Cooper, Cronin & Reimann (2007), a thorough search of secondary data were conducted for the purpose of devising the interview guides. This was done by consulting publications, reports and studies available on each organisation's website, as well as on other official online sources. There was a need to tailor the guides in order to adapt the research topic to the specific organisational contexts encountered (Lewis, Saunders & Thornhill, 2012).

3.4.4. Data Collection Procedures

Once informed consent[29] had been given, primary data were obtained via semi-structured interviews (Appendix E), which are useful when '(…) highly sensitive and subtle matters need to be covered, and where long and detailed responses are required to understand the matter the respondent is reporting on' (Ackroyd & Hughes, 1992, p. 104).

By adopting a conversational interviewing approach (Kvale, 1996; Kvale & Brinkmann, 2008; Patton, 2015), the researcher was able to learn about participants' views in their own words. Interviews were conducted in accordance with the protocols in Appendices J and K, which display both the list of questions and the procedure followed in the interview process (Furgerson & Jacob, 2012). Questions were followed up by probes aimed at tapping into more contextual data (Lewis, Saunders & Thornhill, 2012).

Two complementary sources of qualitative data were considered. On the one hand, follow-up probes used in pretest interviews with firm managers yielded contextual data.

[29] In addition to an oral consent, interviewees were asked to fill in and sign the consent form set out in Appendix I.

On the other hand, secondary data were obtained from a variety of interview articles in *O Molde*, *Jornal de Leiria* and *Região de Leiria* magazines.

3.4.5. Data Analysis Procedure

Interviews were fully transcribed and analysed using the Template Analysis technique proposed by King (2012), which is appropriate for studies examining the views of different groups in a given context and involves the following steps (King, 2012):

1. Read through the transcripts for familiarisation purposes and to detect any errors;
2. Given the deductive approach of this study, a template (*i.e.*, a list) of six themes[30] was built, each one representing the constructs/ latent variables in the conceptual model;
3. Coding process, *i.e.*, attach a single code or multiple codes to each section of text deemed relevant to the research hypotheses. Coded data were thereafter grouped into the six themes mentioned in the previous step;
4. Modify the initial template whilst working through the set of transcripts;
5. Data interpretation and analysis by looking at the frequency of themes and their distribution patterns. As recommended by King (2012), the most frequently mentioned themes across all transcripts and those which were constantly occurring in a single transcript (*i.e.*, key exceptions) were both taken into account;
6. Discuss the relationships between the selected themes and draw illustrative quotations from transcripts. As suggested by Lewis, Saunders & Thornhill (2012), counterexamples not conforming to the relationships underlying the research hypotheses were considered for validation purposes.

3.5. Research Quality Assurance

In order to ensure the validity and reliability of the information obtained, the following procedures were put in place (see Table 2).

TABLE 2 – Reliability and Validity Assessment

Criteria for Assessing Quantitative/Qualitative Research	**Actions Taken by the Researcher**	
	Quantitative Strand (Questionnaire)	**Qualitative Strand** (Interviews)
Internal Validity/ Credibility	- Literature review and pilot study (content validity). - Redundancy analysis (convergent validity).	-Pattern recognition amongst interviews and explanation of the existing relationships.

[30] According to King (2012, p. 431), *themes* in qualitative analysis concern '(…) the recurrent and distinctive features of participants' accounts in interviews (…) that characterize perceptions and/or experiences, seen by the researcher as relevant to (…) a particular study.'

	- Non-response bias analysis (Appendix L). - Triangulation of methods and data sources.	- Interview guides provided before interviews.
External Validity/ Transferability	- Simple random sampling technique. - The use of a filtering question to tackle heterogeneity in the sample. - Broad generalisations at the cluster level followed by warnings about the heterogeneity in the cluster, when appropriate.	- Description of data collection and analysis procedures to enable replication.
Reliability/ Dependability	- Pilot testing under field conditions. - The questionnaire was addressed to respondents involved in firms' strategic decision-making processes. - Appropriate number of items per construct.	- The use of interview protocols. - Interviews were audio-recorded. - Data from interviews were compared with recent secondary data.
Objectivity/ Confirmability	- Compliance with the guidelines and rules of thumb reported in the literature about data preparation and analysis.	- Search for counterexamples to test the remarks that were made. - Storage of audio recordings and transcriptions.

Source: Author based on Arora, Donnelly & Trochim (2015).

4. EMPIRICAL SETTING: THE PORTUGUESE E&T CLUSTER

4.1. The Competitive Environment of the Cluster

The Portuguese Engineering & Tooling cluster is the unit of analysis in this study. The cluster encompasses the mouldmaking, plastics and special tools industries (Tocha, 2017a), which are mostly clustered around Marinha Grande (Centro region) and Oliveira de Azeméis (Norte region; Castro & Mota, 2004). The cluster's value chain consists of four main activities (Sociedade Portuguesa de Inovação, 2008): (i) mould design and engineering; (ii) prototyping; (iii) mould and tool manufacturing; and, (iv) injection moulding to produce parts and components.

There is a wide range of competitive positions in the cluster, which is typically determined by a firm's size (Sociedade Portuguesa de Inovação, 2008). Small-sized firms tend to be restricted to mould manufacturing, and many of these companies approach the market via mould-trading firms that act as distribution channels. Large-sized firms, by contrast, offer a greater variety of value-added activities beyond mould manufacturing, and make use of their commercial teams to approach the market (Sociedade Portuguesa de Inovação, 2008).

4.2. Cluster Policies in Portugal

The Collective Efficiency Strategies (CES) were the first cluster initiative launched in Portugal under the National Strategic Reference Framework (QREN 2007-2013; Sociedade Portuguesa de Inovação & inno TSD, 2013a). In July 2009, 11 poles and 8 clusters were formally recognised in light of their relevance to the Portuguese economy

(Sociedade Portuguesa de Inovação & inno TSD, 2013b). A second cycle was launched in 2015 (Diário da República, 2015) for the 2017-2023 time frame (European Cluster Collaboration Platform, 2019). In February 2017, 20 'competitiveness clusters' were recognised under the coordination of the Portuguese Agency for Competitiveness and Innovation (IAPMEI, I.P.; Diário da República, 2015; IAPMEI, 2019).

The E&T cluster was recognised in both cycles and it has been managed by Pool-net, a private association representing the cluster's value chain from mould design to plastic parts and tool manufacturing (European Cluster Observatory, 2019). In partnership with the Portuguese Association for the Mouldmaking Industry (CEFAMOL) and the Portuguese Technological Centre for the Mouldmaking, Special Tooling and Plastics Industries (CENTIMFE; Tocha, 2017b), it coordinates a set of projects that implement the cluster's action plan (Bagchi-Sen & Farinha, 2019; Pool-net Association, 2019a,b).

Government support to the E&T cluster stems largely from the EU funding allocated by the regional (esp. Centro 2020 and Norte 2020) and thematic (esp. COMPETE 2020) operational programmes under the Portugal 2020 Partnership Agreement, the successor of QREN 2007-2013. Despite the importance of thematic, nation-wide incentives, OECD research has emphasised incentive-based competitive processes that '(…) foster valuable regional specialisations (…) and promote regional clustering experiences, in a relatively small country like Portugal' (OECD, 2008, p. 85).

Given the current place-based approach to the EU cohesion policy (McCann & Ortega-Argilés, 2013; Moodysson, Trippl & Zukauskaite, 2017), firms' compliance with RIS3 strategies has been an *ex-ante* conditionality (Koehler, 2015; CCDR-C, 2018) during the programming period of 2014-2020 for the approval of investment projects geared towards research, development and innovation (RD&I) and information technology. The Research and Innovation Strategies for Smart Specialisation (RIS3) aim to provide a systemic and strategic vision to the cluster policy by structuring public and private investments in the process of cluster upgrading (Lämmer-Gamp & zu Köcker, 2017). The regional development policy in Portugal is organised at the NUTS II level (Hassink & Marques, 2016) and the CCDRs are responsible for assessing whether or not firms' projects comply with the RIS3 priorities of each region (Ecorys *et al*., 2014).

5. DATA ANALYSIS AND RESULTS

This section looks at the sample profile, the appropriateness of the parameter estimation technique employed (PLS-SEM; Wold, 1975, 1982) to the type of statistical distribution, as well as the results of the statistical and qualitative data analyses.

5.1. Data Preparation and Descriptive Statistics

Prior to running any statistical analysis, questionnaire responses were entered directly from the Qualtrics survey platform (Qualtrics LLC, 2017) into the IBM SPSS® Statistics v.23 software (IBM Corporation, 2018) for analysis purposes. The data set was thereafter reviewed line by line for accuracy.

Out of the 304 responses collected, 136 contained at least 8 unanswered questions (over 15% missing values) and, as recommended by Hair *et al.* (2014), were removed from the data set. An exception was made for respondents who had reported having no local clients who were filtered out on demand-related questions. As for the remaining 168 responses containing less than 5% of missing values per indicator, the mean value replacement procedure was employed as suggested by Hair *et al.* (2014). This has resulted in a total of 168 valid responses, which complies with the sample size required (55 cases).

Once the final sample had been defined, an inspection of the indicators' descriptive statistics was conducted. A visual examination of their boxplots revealed 27 mild outliers[31] with a marginal effect on the measures of central tendency and dispersion shown in Appendix L. Eriksson, Kettaneh & Wold (2010) have argued that mild outliers have a small impact on PLS-SEM models; thus, these cases were retained in the sample.

Although PLS-SEM's statistical properties provide robust model estimations when using either normally or non-normally distributed data (Hair *et al*., 2014), the degree of non-normality was assessed due to the combined effects of a small sample size and the tendency of PLS-SEM to underestimate the structural model relationships (Hui & Wold, 1982; Hair *et al*., 2012b). This was done through visual inspection of the normal Q-Q plots, along with the Shapiro-Wilk and Kolmogorov-Smirnov tests, which produced a *p-value* < 0.05 for all indicators. This suggests that the null hypothesis of normally distributed data should be rejected at the 0.05 level of significance (see Appendix L). Yet,

[31]A mild or extreme outlier is any case that lies between 1.5 times and 3 times or more than 3 times the interquartile range (IQR) below the 1st quartile or above the 3rd quartile, respectively.

these tests provide limited guidance for determining whether any substantial deviation from normality exists (Hair *et al*., 2014). Thus, two tests of normality proposed by Hair *et al.* (2010) were also performed, taking into account the size of the final sample (*N = 168*), the skewness and kurtosis values obtained from SPSS and the following formulas:

(1) $$z_{\,skewness} = \frac{skewness}{\sqrt{\frac{6}{N}}}, (N = 168)$$

(2) $$z_{\,kurtosis} = \frac{kurtosis}{\sqrt{\frac{24}{N}}}, (N = 168)$$

Appendix L shows that all indicators have at least one *z-score* greater or smaller than the critical values of $z_{0.05/2} = \pm 1.96$ for the skewness and kurtosis statistics (Hair *et al.*, 2010), meaning that the skewness and/or peakedness of the indicators' distributions differ, albeit not extremely, from the normal distribution at the 0.05 level of significance.

5.2. Final Sample Profile

The productive fabric of the E&T cluster is dominated by SMEs. Based on the NUTS III nomenclature, firms in the sample were based in Leiria (40.5%), Aveiro (27.4 %), Oporto Metropolitan Area (19.6%) or in any other Portuguese sub-region (12.5%). Also, 31.0% of the firms were members and 69.0% non-members of the Pool-net Association. The core activities of most firms (85.8%) were 'CAE 25734 – Metal moulds' (53.6%), 'CAE 22292 – Manufacture of other plastic products, n.e.c.'(16.7%) and 'CAE 29320 – Manufacture of other parts and accessories for motor vehicles' (15.5%). Most firms had less than 50 employees (54.2%) and 35.7% of the firms reported having between 50 and 249 employees. Only 10.1% of the sample had at least 250 employees.

With regard to firms' turnover at the end of 2016, 41.1% of the firms had a turnover between €5,000,001 and €10,000,000, 40.5% of the firms had up to €5,000,000 and 14.3% of the sample reached a turnover between €10,000,001 and €20,000,000. Only 4.1% of the firms passed the €20,000,000 mark. The share of direct exports in firms' turnover at the end of 2016 was between 50% and 90% for 36.3% of the firms and over 90% for 31% of the sample. Only 22% of the sample reported having a share of up to 49%, whereas 10.7% of firms did not export at all. The three main client industries were the automotive (64.9%), other non-listed industries (20.2%) and the packaging industry

(6.0%). For 81.5% of the sample, the share of the main client industry in terms of a firm's turnover was over 50%, whilst for the remaining firms it was up to 50%.

5.3. Characteristics of Respondents

The positions occupied by respondents in their respective companies ranged from functional area managers (33.9%), administrators (33.3%), general managers (26.8%) to other roles (6.0%). As regards the job seniority of respondents in their firms, 54.8% of them had held their current position for over 10 years, 27.4% of them mentioned up to 5 years and the remainder (17.8%) reported between 6 and 10 years.

5.4. Model Estimation and Analysis

The Partial Least Squares Structural Equation Modelling (PLS-SEM; Wold, 1975, 1982) was chosen as the most suitable method for analysing quantitative data in this study. This OLS regression-based estimation technique (Hair *et al*., 2014) is well suited '(…) for strategic management research that often deals with small sample sizes, complex models, and formative measures, especially when analyzing the sources of competitive advantage' (*i.a.*, Hulland, 1999; Henseler, Ringle & Sarstedt, 2012; Hair *et al*., 2012b, p. 333). Given the PLS-SEM's nonparametric nature, the estimated coefficients were tested for their significance through a nonparametric bootstrap procedure, based on 5,000 subsamples and using the SmartPLS software (v. 3.2.7; Becker, Ringle & Wende, 2015).

The PLS-SEM method follows a two-step process. It begins with the assessment of the measurement/outer models. Once evidence is provided that the indicators used to measure each construct are valid and reliable, the second step involves the examination of the structural/ inner model, which enables the researcher to test statistical hypotheses (Hulland, 1999; Hair, Ringle & Sarstedt, 2011; Hair *et al.*, 2014).

5.4.1. Measurement Models Assessment

A measurement model represents the relationships between indicators and their corresponding construct (Hair *et al.*, 2014). There are two different approaches to determine how constructs are measured by indicators: the reflective and formative measurement perspectives (Diamantopoulos, Riefler & Roth, 2008; Hair *et al*., 2012a), whose choice depends on whether the indicators are best thought of as determinants that

cause/ define a construct (formative model), or as consequences/ reflections of a construct (reflective model) (Hulland, 1990; Bollen & Lennox, 1991; Bollen & Ting, 2000). Prior literature (*i.a.*, Albers, 2010; Henseler, Ringle & Sarstedt, 2012; Hair *et al*., 2012b) has suggested that the drivers of competitive advantage should be measured formatively and, accordingly, the constructs in this study were operationalised in the formative mode.

5.4.1.1. Confirmatory Tetrad Analysis

In an effort to avoid measurement model misspecifications (Roos, 2014), the Confirmatory Tetrad Analysis (CTA-PLS; Gudergan *et al.*, 2008) could be performed using the SmartPLS software (v.3.2.7; Becker, Ringle & Wende, 2015) since each construct had met the requirement of at least four items per construct (Hair *et al.*, 2017).

The CTA-PLS results show that, at least for one tetrad in each measurement model, the 90% Bonferroni-corrected and bias-adjusted confidence intervals did not include the parameter value specified by the null hypothesis (*i.e.*, $H_0: \tau = 0$; see grey-shaded confidence intervals in Appendix M). Thus, the null hypothesis of a reflective measurement model was rejected for these tetrads at the 0.1 level of significance, providing empirical evidence in support of the formative mode (Gudergan *et al.*, 2008) to operationalise the six constructs under study (FC, SSR, RSI, DC, G and CA).

5.4.1.2. Formative Measurement Models Assessment

According to Hair *et al.* (2014, 2017), the assessment of formative measurement models involves three consecutive steps: assess (i) the convergent validity of the formative measurement models; (ii) the multicollinearity levels; and, (iii) the significance and relevance of the formative indicators.

First, convergent validity concerns the extent to which an indicator correlates positively with other indicators of the same construct, and it can be tested by means of redundancy analysis (Chin, 1998; Hair *et al.*, 2017). Following Hair *et al.*'s (2017) guidelines, each construct was modelled as an exogenous latent variable predicting an endogenous latent variable measured by a reflective global single item (*e.g.*, $FC \rightarrow FC_{GSI}$). The results of the redundancy analysis (see Appendix N) show that the magnitude of all path coefficients linking both constructs was above the 0.7 cut-off value (Hair *et al.*, 2017), which is indicative of the (convergent) validity of the set of formative indicators in tapping the constructs in the path model.

Second, each formative measurement model was assessed for multicollinearity issues via the Variance Inflation Factor (VIF), which expresses the extent to which the standard error of a formative indicator has been increased due to collinearity. According to the results in Appendix O, the item *CA4* had the highest VIF value (3.002). Hence, the outer VIF values were uniformly below the conservative threshold of 3.3 (Fraß, 2016) and it could therefore be concluded that the measurement models did not suffer from high correlation. This is desirable since formative indicators are supposed to explain the different dimensions of a given construct and should be mutually independent.

As the degree of collinearity between indicators did not reach a critical level, it was possible to proceed with the analysis of the significance of the outer weights and the interpretation of formative indicators' absolute and relative contribution, and thereby their relevance (Hair *et al*., 2017). The results in Appendix O show that 22 outer weights were significant, and thereby the respective indicators had relative relevance in explaining the related constructs, whereas the remaining 17 outer weights were nonsignificant.

A subsequent analysis of the loadings of such indicators was conducted since nonsignificant outer weights do not automatically imply that the indicators are irrelevant (Fraß, 2016). Out of the 17 nonsignificant indicator weights, 8 had outer loadings above 0.5. These indicators were, therefore, retained due to their absolute (but not relative) relevance in explaining the corresponding constructs (Hair *et al.*, 2017). As for the remaining 9 indicators, although not having relevance in relative and absolute terms, were also retained on theoretical grounds since 'omitting (a formative) indicator is omitting a part of the construct' (Bollen & Lennox, 1991, p. 308). Thus, before dropping a formative indicator, its relevance has to be assessed from a content validity point of view. In other words, it has to be theoretically justified rather than being discarded based on statistical outcomes[32] (Diamantopoulos & Winklhofer, 2001; Diamantopoulos & Siguaw, 2006; Albers, 2010). Since the measurement models evaluation had provided evidence of reliability and validity, it was possible to proceed with the structural model assessment.

5.4.2. Structural Model Assessment

According to Hair *et al.* (2017), the structural model evaluation involves assessing (i) the multicollinearity levels; (ii) the significance and (relative) relevance of the

[32] For instance, if items *CA3*, *CA4* and *CA8* were discarded, the Value Chain Model (see Appendix A) would be represented by a number of activities smaller than the one reported in the literature.

path/structural model relationships; (iii) the R^2; (iv) the f^2 effect size; (v) the predictive relevance Q^2; and, (vi) the q^2 effect size. The last two criteria were disregarded as these do not apply to formatively-measured endogenous constructs (Hair *et al*., 2014).

First, all predictor constructs exhibited VIF values below the conservative threshold of 3.3. Based on the results presented in Appendix P, the construct *FC* had the highest VIF value of the structural model (2.350). Consequently, all inner VIF values were uniformly below the conservative threshold of 3.3 (Fraß, 2016). It could therefore be concluded that the structural model did not suffer from multicollinearity issues.

Second, the coefficient of determination (R^2) was used to gauge the amount of explained variance of the endogenous latent variables in the structural model (Hair *et al*., 2014). As a rule of thumb, R^2 thresholds of 0.75, 0.5 and 0.25 are indicative of substantial, moderate and weak predictive accuracy, respectively (Hair, Ringle & Sarstedt, 2011; Fraß, 2016). All endogenous latent variables exhibited sufficient R^2 values (see Appendix P). The constructs *DC* (R^2=0.303) and *SSR* (R^2=0.491) had the lowest R^2 values, which are weak but satisfactory. The constructs *FC* and *RSI* had moderate predictive accuracy, whereas the construct *CA* showed a substantial predictive accuracy of R^2=0.833.

Third, the f^2 effect size determines the impact of an omitted predictor construct on a given endogenous latent variable (Götz, Krafft & Liehr-Gobbers, 2010; Fraß, 2016). Thresholds of 0.02, 0.15 and 0.35 suggested by Cohen (1988) were used to express small, medium and large effect sizes, respectively (Henseler, Ringle & Sarstedt, 2012; Hair *et al*., 2014). Hence, values below 0.02 suggest that an exogenous latent variable has no effect whatsoever (Hair *et al.*, 2017). The results set out in Appendix P indicate that the construct *DC* exhibited a small effect size of 0.02 on *CA*; *SSR* and *RSI* had medium effect sizes of 0.248 and 0.278, respectively, on *CA*; and *FC* had a large effect size of 0.489 on *CA*. Finally, the construct *G* showed large effect sizes on *FC*, *SSR*, *RSI* and *DC*.

5.4.3. Path Analysis and Hypothesis Testing

In order to estimate the standardised path coefficients (β) for the hypothesised relationships amongst the constructs in the structural model, a bootstrap routine was run in the SmartPLS software (v. 3.2.7; Becker, Ringle & Wende, 2015). The results of the significance tests (see Table 3) are graphically summed up in Figure 3.

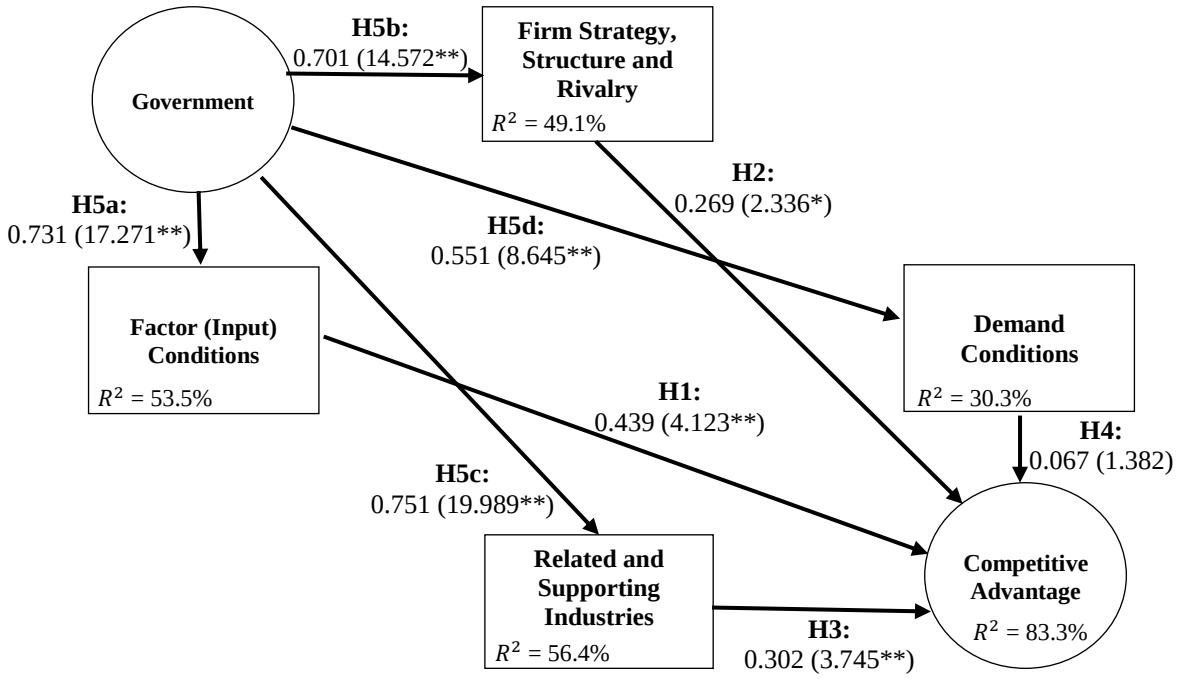
TABLE 3 – Overview of Hypothesis Testing

	Path Coefficients (β)	*t* Values	*p-values*	95% BCa Confidence Intervals*	Empirically Supported?
H1: FC → CA	0.439	4.123**	0.000	[0.257, 0.610]	Yes
H2: SSR → CA	0.269	2.336*	0.010	[0.087, 0.465]	Yes
H3: RSI → CA	0.302	3.745**	0.000	[0.170, 0.435]	Yes
H4: DC → CA	0.067	1.382	0.084	[-0.012, 0.145]	No
H5a: G → FC	0.731	17.271**	0.000	[0.616, 0.777]	Yes
H5b: G → SSR	0.701	14.572**	0.000	[0.587, 0.760]	Yes
H5c: G → RSI	0.751	19.989**	0.000	[0.662, 0.797]	Yes
H5d: G → DC	0.551	8.645**	0.000	[0.408, 0.631]	Yes

Significant at the *p<0.01, **p<0.001 level (one-tailed test; 5,000 bootstrap subsamples, as recommended by Hair *et al.*, 2017).
***Note**: BCa = Bias-corrected and accelerated bootstrap.

Source: Author.

FIGURE 3 – Path Model: Overview of Hypothesis Testing



Source: Author.

5.4.3.1. Have factor (input) conditions positively influenced the competitive advantage of cluster firms?

Based on respondents' perceptions, the hypothesis of a positive effect of the factor (input) conditions at the cluster level on the competitive advantage of firms (H1) is not

rejected and it is considered highly significant ($\beta = 0.439$; $p < 0.001$). When compared with other statistically significant determinants of the business environment (SSR and RSI), respondents placed, as the largest path coefficient suggests, the highest relative relevance on factor conditions for attaining competitive advantages.

This bootstrap result is, to some extent, backed up by interviews and secondary data because having a skilled and specialised labour force has generally been recognised as the main driver of the cluster's competitive advantage. Yet, from the point of view of most cluster stakeholders, the growing shortage of this advanced factor is also becoming the main constraint on the future development of the cluster. Indeed, it is already showing systemic effects on other determinants of the microeconomic business environment. A prominent example is the stiff competition amongst mouldmaking firms for qualified personnel, such as mould-repair technicians (Mariana Febra, 2017).

In the face of this challenge and the stringent demand requirements, most firms recognise the importance of ongoing investment, but the understanding of what a 'competitive investment' is varies widely between companies. A common response has been capital-intensive investments in physical capital and new technologies to increase automation. As noted by Nuno Silva (2017), 'if a company does not invest at least 10% of its yearly turnover (in cutting-edge technologies), it runs the risk of being out of the market.' Many firms have targeted almost exclusively operational improvements through the integration of 'best practices' related to production processes, technologies and management techniques. Others have also expanded their investment efforts beyond factor conditions to other related and support industries, venturing into higher value-added activities, both upstream and downstream from mould production.

5.4.3.2. Have firm strategy, structure and rivalry positively influenced the competitive advantage of cluster firms?

Based on respondents' perceptions, the hypothesis of a positive effect of the context for firm strategy and rivalry at the cluster level on the competitive advantage of firms (H2) is not rejected ($\beta = 0.269$; $p < 0.01$). However, when compared with other statistically significant determinants of competitive advantage (FC and RSI), respondents placed the lowest relative relevance on firm strategy, structure and rivalry, which is reflected in the smallest path coefficient.

This finding conforms to the qualitative data collected due to a series of paradoxical effects of 'coopetition' on firms' competitive advantage. Despite the productivity and innovation-related advantages accruing from competition, the cluster's labour supply has not increased sufficiently to meet firms' needs, as opposed to what Porter (2000a) advocates. As a result, competition for skilled employees has had a detrimental effect on firms' competitive edge.

With respect to cooperation, the cluster's historical development has been conducive to cooperative behaviour. Apart from the sharing of cutting tools and technical knowledge, the involvement of both single-unit firms and vertically-integrated groups in more advanced forms of cooperation highlights the importance of sharing specialised technologies and supporting institutions (*e.g.*, CENTIMFE) at the cluster level. An assessment of Pool-net's business directory shows that cooperation takes place between business groups engaged in several value-chain activities and single-unit firms focused on particular activities, such as mould or plastic parts manufacturing.

5.4.3.3. Have related and supporting industries positively influenced the competitive advantage of cluster firms?

Based on respondents' perceptions, the hypothesis of a positive effect of the cluster's related and supporting industries on the competitive advantage of firms (H3) is not rejected ($\beta = 0.302;\ p < 0.001$). Indeed, when compared to other statistically significant determinants of competitive advantage (FC and SSR), respondents considered such industries, as the relative size of the path coefficient suggests, the second major driver of competitive advantage.

This bootstrap result conforms to prior empirical evidence by Baptista & Costa (2015), which suggested that firms in the E&T cluster have historically achieved competitive advantages thanks to their privileged access to subcontracted producers or traders at the regional level. Secondary data collected from cluster firms nevertheless indicate that this result should be interpreted with caution due to the varying contributions of different suppliers (*i.e.*, supporting industries) to competitive advantage.

Downstream firms have highlighted those competitive advantages stemming from the geographical proximity to mouldmakers, as well as from their technical expertise and support. In the words of a representative of a motor vehicle body spare parts

manufacturer, Fernando Ramos (2015) underlined the quality of locally produced tools, reduced transportation costs, the absence of customs duties and '(…) the ease with which repairs or modifications can be made during a tool's lifespan (…)(especially when) the time span for these interventions is limited.' As regards local plastics manufacturers, Pedro Colaço (2019) lays emphasis on the quality of local moulds since '(…) most of our production problems are mould-related nonconformities.'

As far as the mouldmaking industry is concerned, many accounts suggest that, in addition to product quality, competitive advantages arising from local suppliers rely on their ability to provide innovative (IESE, 2005), tailored solutions and, in this vein, there are mixed opinions. In the context of Industry 4.0 and the resulting migration towards ever-increasing levels of automation, mouldmakers often show a strong preference for local integrators of automated production cells over international players that provide turnkey solutions. As reported by a panel of experts[33], local suppliers usually cooperate with mouldmakers in developing customised softwares that render these cells more flexible and tailored to firms' production contexts. By contrast, João Frade (2017) and Eugénio Santos (2017) argue that many local cutting-tools suppliers have reduced the stocks of some worst-selling tools used in the mouldmaking industry, which represents a relatively small share of these suppliers' total sales. In line with Maskell (2001), such suppliers have failed to deliver a more solid source of competitive advantage to their clients. Thus, mouldmakers often opt for foreign suppliers, based for example in Germany or Japan, when purchasing standard tools that are globally available (João Frade, 2017).

5.4.3.4. Have demand conditions positively influenced the competitive advantage of cluster firms?

Based on respondents' perceptions, the hypothesis of a positive effect of the demand conditions at the cluster level on the competitive advantage of firms (H4) is rejected ($\beta = 0.067$; NS).

Dating back to 2011, a study requested by CEFAMOL (see Monteiro *et al*., 2011) pointed out that over 70% of the output of all value-chain activities of the E&T cluster served the automotive industry. The bootstrap results suggest that this trend has not changed since, based on the interviews conducted with business leaders of the Portuguese

[33] Alberto Ribeiro (2018), António Pina (2018), Fernando Conde (2018) and Vítor Pires (2018).

plastic injection moulding industry, most firms have built a specialised knowledge base to serve the automotive industry, for which Portugal has a very small domestic market (Fravel *et al.*, 2002). Such dependency has meant increased exposure to demand volatility (Rui Rodrigues, 2017) and severe liquidity problems caused by extended payment terms (Gonçalo Cordeiro, 2017). This, combined with the continuous pressure to monitor and invest in new technology in order to maintain or increase differentiation (Joaquim Menezes, 2017), has forced firms to become more competitive. As a result, the Portuguese mouldmaking industry challenges the Diamond Model by putting into question the role of a dynamic local demand to become and remain competitive in the global economy.

In contrast to the prevalent export orientation of the mouldmaking industry, Isabel Costa (2015), president of the Portuguese Plastics Industry Association (APIP), draws a distinction between two realities within the plastics industry. On the one hand, some firms produce low value-added products, such as plastic bags and bulky products for the construction (*e.g.*, plastic pipes) and industrial packaging industries, for which low transportation costs are a key source of competitive advantage (Luís Carvalho, 2015; Pedro Faria, 2015). On the other hand, firms close to the mouldmaking industry have been compelled to target innovation-driven, high value-added industries, esp. technical plastic injection firms supplying parts for the automotive industry (Isabel Costa, 2015).

Overall, the data collected from interviews are congruent with the path analysis results in the sense that demand conditions have had a small effect on firms' competitive edge. This is because, with a view to competing globally, firms have had to rely on foreign clients due to the lack of a sophisticated domestic client base. Rui Tocha (2017c) notes that Pool-net members, which are integrated into global value chains, have targeted more advanced segments and 'the main priority of Pool-net (…) [has been] the international promotion of the cluster's collective brand *Engineering & Tooling from Portugal*.'

5.4.3.5. Has the government positively influenced the cluster's microeconomic business environment?

Based on respondents' perceptions, the hypothesis of a positive effect of the government on the factor conditions at the cluster level (H5a) is not rejected and it is highly significant ($\beta = 0.731$; $p < 0.001$). The bootstrap results concerning the role of government in promoting the context for firm strategy and rivalry (H5b; $\beta = 0.701$; $p <$

0.001), related and supporting industries (H5c; $\beta = 0.751$; $p < 0.001$), and the demand conditions at the cluster level (H5d; $\beta = 0.551$; $p < 0.001$) are also highly significant.

Interviews with cluster firms corroborate the bootstrap results by disclosing an overall positive effect of the government on the 'diamond conditions'. An examination of the government's outer weights (Appendix O) suggests that, from the standpoint of firms, the incentive schemes under the Portugal 2020 Partnership Agreement have been the most relevant form of government assistance ($G3 = 0.304$; $p < 0.001$) to enhance their international presence (Carlos Silva, 2017), undertake investments in human capital, technology and innovation (João Faustino, 2015), and develop '(…) a distinctive strategic positioning in the mouldmaking and plastics industries' (Luís Febra, 2018).

In this regard, Alexandra Rodrigues (2017) pointed out that Pool-net's prior involvement in determining the RIS3 Centro priorities has been a key factor in approving firms' projects since '(…) the E&T cluster's projects are almost always aligned (with these priorities).' Rui Monteiro (2017), in turn, highlighted the strong synergies between the E&T cluster, the Portuguese Hub of Innovation in Polymer Engineering (PIEP) and the Production Technologies Cluster (PRODUTECH) in the field of mobility and environment industries, which is a priority area of RIS3 Norte.

Notwithstanding the above, the interviews were also instrumental in uncovering two government failures pinpointed by Acocella (2005). The first of these refers to bureaucracy, which has created major operational inefficiencies. Interviewees mentioned the overly bureaucratic procedures for applying for projects under the Portugal 2020 framework and the delayed approval of the funding instruments. This has led firms to outsource many consulting services since '(…) no firm has the expertise or structure to internalise that knowledge because the red tape is tremendous' (Jorge Laranjeira, 2017).

The second government failure concerns the 'political business cycle', in other words, changes in economic policies that result from the alternation of parties in government. In this regard, Rui Tocha (2017c) argues that '(…) the occurrence of breaks between cycles often puts the existing strategic goals and development strategies at risk.' The cluster manager drew attention to the removal of specific budget allocations to fund the collective efficiency strategies. Accordingly, Alexandra Rodrigues (2017) notes that '(…) the incentive schemes are at the disposal of cluster firms (…)' but acknowledges that these '(…) are perhaps less appropriate to support cluster management because, in

the past, in the context of QREN, there were specific (open) calls to fund the structures of the cluster.'

6. CONCLUDING REMARKS

The purpose of this section is to set forth the main conclusions of this dissertation and their contribution to academia, public policy and management practice. The limitations of the study are also presented, as well as new avenues for future research.

6.1. Implications for Academia, Public Policy and Management Practice

This research drew on firms' views in the E&T cluster regarding the effects of the determinants of the microeconomic business environment on their competitive advantage, and the government's supportive role in improving such determinants. Based on the questionnaire responses, this dissertation operationalised Porter's (1990, 2004) Diamond Model using the PLS-SEM method (Wold, 1975, 1982). The estimated relationships were thereafter triangulated with secondary data and interviews with several cluster stakeholders, which led to the following conclusions:

1. The hypothesis of a positive effect of the factor (input) conditions at the cluster level on firms' competitive advantage has been empirically supported. Indeed, cluster firms attached the greatest importance to this determinant of competitive advantage, especially due to the key role and the ever-increasing shortage of highly skilled and specialised labour;

2. Respondents support a positive effect of the context for firm strategy and rivalry at the cluster level on firms' competitive advantage. Yet, it was considered the least important determinant of competitive advantage due to a series of paradoxical effects. More specifically, although coopetition has boosted innovation and productivity, the cluster's labour supply has not met the needs of many firms, as opposed to what Porter (2000a) advocates. As a result, competition for specialised labour has also had a detrimental effect on firms' competitive edge;

3. Likewise, the hypothesis of a positive effect of the cluster's related and supporting industries on firms' competitive advantage has been empirically supported. Overall, respondents have emphasised the role of suppliers in providing tailored solutions and

technical assistance. Such competitive advantages are closely related to the division of labour taking place within the cluster and firms' privileged access to outsourced services, thereby substantiating Baptista & Costa's (2015) study;

4. By contrast, respondents do not support a positive effect of the demand conditions at the cluster level on firms' competitive advantage. This is because most cluster firms, especially in the mouldmaking industry, have had to rely on foreign clients in order to become international players due to the lack of a sophisticated domestic client base. This finding challenges the Diamond Model, which stresses the importance of a dynamic local demand when competing in more sophisticated markets and attempting to succeed in the global marketplace;

5. Finally, the hypotheses of a positive effect of the government on each of the four determinants of the business environment have been empirically supported. The incentive schemes under the Portugal 2020 framework were deemed the most important means of support since such incentives have financed investments across several determinants of the Diamond Model. However, bureaucracy and the 'political business cycle' were two sizeable government failures mentioned by the interviewees.

6.2. Limitations and Future Research

As with any study, this research is not without some shortcomings that open up opportunities for future research. In an effort to increase the validity of the PLS-SEM results, Hair *et al.* (2014, 2017) have suggested using the PLS Multi-Group Analysis (PLS-MGA). This method could, for example, shed light on whether there are significant differences between the parameter estimates of the sub-groups 'Pool-net non-members' (which comprises many domestic-oriented firms) and 'Pool-net members' (which are likely to have a stronger export orientation). However, it could not be performed since the power analysis, for this study's model specification, dictates a minimum sample size greater than the number of Pool-net members in the sample. To circumvent this limitation, the qualitative analysis provided some account of the heterogeneity in the E&T cluster.

A final shortcoming is related to the research design. As noted by Jick (1979, p. 609), 'replicating a mixed-methods package, including idiosyncratic techniques, is a nearly impossible task (…).' Despite this, efforts were made to provide an explicit account of the assumptions, methods and procedures employed in this dissertation.

BIBLIOGRAPHICAL REFERENCES

Ackroyd, S. & Hughes, J. (1992). *Data Collection in Context*. London: Longman.

Acocella, N. (2005). *Economic Policy in the Age of Globalisation*. Cambridge: Cambridge University Press.

Albers, S. (2010). PLS and Success Factor Studies in Marketing. In: Vinzi, V. E., Chin, W. W., Henseler, J. and Wang, H. (Eds.). *Handbook of Partial Least Squares Concepts, Methods and Applications*, Dordrecht, Heidelberg, London, New York: Springer–Verlag, pp. 409–425.

Ali-Yrkkö, J., Rouvinen, P., Seppälä, T. & Ylä-Anttila, P. (2011). Who Captures Value in Global Supply Chains? Case Nokia N95 Smartphone. *Journal of Industry, Competition and Trade*, 11(3), 263–278.

Armstrong, R. A. (2014). When to Use the Bonferroni Correction. *Ophthalmic and Physiological Optics*, 34(5), 502–508.

Arora, K., Donnelly, J. P. & Trochim, W. (2015). *Research Methods: the Essential Knowledge Base*. Boston, Massachusetts: Cengage Learning.

Aydalot, P. (1986). *Milieux Innovateurs en Europe – Innovative Environments in Europe*. Paris: GREMI.

Aydalot, P. & Keeble, D. (1988). *High Technology Industry and Innovative Environments*. New York: Routledge.

Bagchi-Sen, S. & Farinha, L. (2019). Following the Footprints of SME Competitiveness in a High-Technology Sector. In: Ferreira, J. J., Lindahl, J. M. M. and Peris-Ortiz, M. (Eds.). *Knowledge, Innovation and Sustainable Development in Organizations: a Dynamic Capabilities Perspective*, Cham: Springer International Publishing, pp. 77–95.

Baptista, R. & Costa, C. (2015). Organizational Heritage and Entrepreneurship: Steven Klepper's Theories Reflected in the Emergence and Growth of the Plastic Molds Industry in Portugal. In: Baptista, R. and Leitão, J. (Eds.). *Entrepreneurship, Human Capital, and Regional Development: Labor Networks, Knowledge Flows, and Industry Growth*, Cham, Heidelberg, New York, Dordrecht, London: Springer International Publishing, pp. 281–293.

Barnes, W., Gartland, M. & Stack, M. (2004). Old Habits Die Hard: Path Dependency and Behavioral Lock-in. *Journal of Economic Issues*, 38(2), 371–377.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99–120.

Barney, J. (2001). Resource-based Theories of Competitive Advantage: A Ten-year Retrospective on the Resource-Based View. *Journal of Management*, 27(6), 643–650.

Becattini, G. (1979). Dal Settore Industriale al Distretto Industriale. Alcune Considerazioni Sull'unità d'Indagine Dell'Economia Industriale. *Rivista di Economia e Politica Industriale*, 5(1), 7–21.

Becattini, G. (1990). The Marshallian Industrial District as a Socio-Economic Notion. In: Becattini, G., Pyke, F. and Sengenberger, W. (Eds.). *Industrial Districts and Inter-firm Cooperation in Italy*, Geneva: International Institute for Labour Studies, pp. 37–51.

Becker, J.–M., Ringle, C. M. & Wende, S. (2015). *SmartPLS (v.3.2.7)* [Computer Programme]. Available from: http://www.smartpls.com [Accessed: 07/10/2018].

Belussi, F. (1996). Local Systems, Industrial Districts and Institutional Networks: Towards a New Evolutionary Paradigm of Industrial Economics? *European Planning Studies*, 4(1), 5–26.

Bollen, K. & Lennox, R. (1991). Conventional Wisdom on Measurement: A Structural Equation Perspective. *Psychological Bulletin*, 110(2), 305–314.

Bollen, K. & Ting, K. (2000). A Tetrad Test for Causal Indicators. *Psychological Methods*, 5(1), 3–22.

Bourgeois, I., Gagné, M., Hart, R. E. & Townsend, S. H. (2010). Technology Cluster Evaluation and Growth Factors: Literature Review. *Research Evaluation*, 19(2), 82–90.

Brakman, S. & van Marrewijk, C. (2013). Reflections on Cluster Policies. *Cambridge Journal of Regions, Economy and Society*, 6(2), 217–231.

Bryman, A. (2012). *Social Research Methods*, 4th Ed. Oxford: Oxford University Press.

Buchner, A., Erdfelder, E., Faul, F. & Lang, A.–G. (2009). Statistical Power Analyses Using G*Power 3.1: Tests for Correlation and Regression Analyses. *Behavior Research Methods*, 41, 1149–1160.

Camagni, R. (1995). Global Network and Local Milieux: Towards a Theory of Economic Space. In: Conti, S., Malecki, E. and Oinas, P. (Eds.). *The Industrial Enterprise and Its Environment: Spatial Perspective*, Aldershot: Avebury, pp.195–216.

Carvalho, L. (2015). Fornecer Valor Acrescentado, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1628, 24 September, p. 24.

Castro, L. M. & Mota, J. (2004). A Capabilities Perspective on the Evolution of Firm Boundaries: A Comparative Case Example from the Portuguese Moulds Industry. *Journal of Management Studies*, 41(2), 295–316.

CCDR-C (2017). *Centro 2020: Programa Operacional Regional do Centro 2014–2020* [Online]. Available from: https://www.portugal2020.pt/sites/default/files/plano_de_avaliacao_do_por_centro_-_2017.pdf [Accessed: 14/01/2019]

CCDR-C (2018). *Portugal 2020 na Região Centro, Monitorização Semestral No 5* [Online]. Available from: http://www.ccdrc.pt/index.php?option=com_docman&view=download&alias=4647-portugal-2020-na-regiao-centro-n-5-dezembro-de-2018&category_slug=146&Itemid=739 [Accessed: 08/03/2019]

Cheah, J.–H., Sarstedt, M., Ringle, C. M., Ramayah, T. & Ting, H. (2018). Convergent Validity Assessment of Formatively Measured Constructs in PLS-SEM. *International Journal of Contemporary Hospitality Management*, 30 (11), 3192–3210.

Chin, W.W. (1998). The Partial Least Squares Approach to Structural Equation Modeling. In: Marcoulides, G. A. (Ed.). *Modern Methods for Business Research*. Mahwah, New Jersey: Lawrence Erlbaum Associates, pp. 295–336.

Christian, L. M., Dillman, D.A. & Smyth, J. D. (2014). *Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method*, 4th Ed. Hoboken, New Jersey: John Wiley & Sons, Inc.

Churchill, G. A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research*, 16(1), 64–73.

Clancy, P., O'Malley, E., O'Connell, L. & Van Egeraat, C. (2001). Industry Clusters in Ireland: an Application of Porter's Model of National Competitive Advantage to Three Sectors. *European Planning Studies*, 9(1), 7–28.

Cockburn, I. M., Henderson, R. M. & Stern, S. (2000). Untangling the Origins of Competitive Advantage. *Strategic Management Journal*, 21(10-11), 1123–1145.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences*, 2nd Ed. Hillsdale, New Jersey: Lawrence Erlbaum Associates Inc.

Colaço, P. (2019). Empresas de Plásticos Registam Crescimento em 2018 e Optam por Moldes Portugueses, *O Molde* (O Molde Ed.), 120, 30 January, p. 43.

Coletti, M. (2010). Technology and Industrial Clusters: How Different Are They to Manage? *Science and Public Policy*, 37(9), 679–688.

Conde, F. (2018). O Sector Fala de… Automação, *Especial: Automação* (O Molde Ed.), 118, 29 July, p. 52.

Conner, K. R. (1991). A Historical Comparison of Resource-Based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of the Firm? *Journal of Management*, 17(1), 121–154.

Cooper, A, Cronin, D. & Reimann, R. (2007). *About Face 3.0: the Essentials of Interaction Design*. Indianapolis: Wiley Publishing, Inc.

Cordeiro, G. (2017). Interview with Gonçalo Cordeiro, 9th August.

Costa, I. (2015). A Proximidade à Indústria de Moldes Obrigou o Plástico a Reagir, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1628, 24 September, p. 26.

Council on Competitiveness, Monitor Group & Porter, M. E. (2001a). *Clusters of Innovation Initiative: Research Triangle*. Washington, D.C.: Council on Competitiveness.

Council on Competitiveness, Monitor Group & Porter, M. E. (2001b). *Clusters of Innovation Initiative: Atlanta-Columbus*. Washington, D.C.: Council on Competitiveness.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 3rd Ed. Thousand Oaks, California: SAGE Publications, Inc.

Cruz, S. C. S. & Teixeira, A. A. C. (2009). The Evolution of the Cluster Literature: Shedding Light on the Regional Studies–Regional Science Debate. *Regional Studies*, 44(9), 1263–1288.

Czaja, R. (1998). Questionnaire Pretesting Comes of Age. *Marketing Bulletin*, 9 (5), 52–66.

Damgaard, T. & Ingstrup, M. B. (2013). Cluster Facilitation from a Cluster Life Cycle Perspective. *European Planning Studies*, 21(4), 556–574.

De Bernardy, M. (1999). Reactive and Proactive Local Territory: Co-operation and Community in Grenoble. *Regional Studies*, 33(4), 343–352.

Delgado, M. & Ketels, C. (2012). Assessing Country Competitiveness: Case of Spain. In: Cooke, P., Curbelo, J. L. and Parrilli, M. D. (Eds.). *Innovation, Global Change and Territorial Resilience*. Cheltenham: Edward Elgar, pp. 185–212.

den Hertog, P. & Roelandt, T. J. A. (1998). *Cluster Analysis and Cluster-based Policy in OECD Countries, Various Approaches, Early Results and Policy Implications*. Draft Synthesis Report on Phase 1, OECD-Focus Group on Industrial Clusters, The Hague/Utrecht.

Desrochers, P., Hospers, G. & Sautet, F. (2008). Silicon Somewhere: Is There a Need for Cluster Policy?. In: Karlsson, C. (Ed.). *Handbook of Research on Innovation and Clusters: Cases and Policies*, Cheltenham, UK and Northampton, Massachusetts, USA: Edward Elgar, pp. 430–446.

de Vaus, D. (2002). *Surveys in Social Research*. London: Routledge.

Diamantopoulos, A., Riefler, P. & Roth, K. P. (2008). Advancing Formative Measurement Models. *Journal of Business Research*, 61(12), 1203–1218.

Diamantopoulos, A. & Siguaw, J. A. (2006). Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. *British Journal of Management*, 17(4), 263–282.

Diamantopoulos, A. & Winklhofer, H. M. (2001). Index Construction with Formative Indicators: An Alternative to Scale Development. *Journal of Marketing Research*, 38(2), 269–277.

Diário da República (2015). Order No 2909/2015, 23th March. *Regulamento de Reconhecimento dos Clusters de Competitividade* [Online]. Available from: https://dre.pt/home/-/dre/66807933/details/maximized?serie=II&dreId=66807928 [Accessed: 14/09/2019]

Dunning, J. H. (1997). *Alliance Capitalism and Global Business*. London, UK and New York, USA: Routledge.

Ecorys, Instituto do Ambiente e Desenvolvimento & Sociedade Portuguesa de Inovação (2014). *Avaliação Ex-ante e Avaliação Ambiental Estratégica do Programa*

Operacional Competitividade e Internacionalização, Relatório Final. Lisbon: PO CI.

Ellis, P. D. (2010). *The Essential Guide to Effect Sizes: Statistical Power, Meta-Analysis, and the Interpretation of Research Results*. Cambridge: Cambridge University Press.

Eriksson, L., Kettaneh, N. & Wold, S. (2010). PLS in Data Mining and Data Integration. In: Vinzi, V. E., Chin, W. W., Henseler, J. and Wang, H. (Eds.). *Handbook of Partial Least Squares Concepts, Methods and Applications*, Dordrecht, Heidelberg, London, New York: Springer–Verlag, pp. 327–357.

European Cluster Collaboration Platform (2019). *Portugal Clusters Network* [Online]. Available from: https://www.clustercollaboration.eu/cluster-networks/portugal-clusters-network [Accessed: 14/09/2019]

European Cluster Observatory (2012). *Scoreboard Methodology* [Online]. Available from:http://www.clusterobservatory.eu/eco/uploaded/pdf/1368191396040.pdf [Accessed: 14/04/2017]

European Cluster Observatory (2019). *Portuguese Engineering & Tooling Cluster* [Online]. Available from: http://www.clusterobservatory.eu/index.html [Accessed: 14/09/2019]

Faria, P. (2015). Fornecer Valor Acrescentado, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1628, 24 September, p. 25.

Faustino, J. (2015). A Indústria de Moldes Será Apetecível para Investidores, *Moldes Nova Geração 2015* (Região de Leiria), 4064, 5 February, p. 20.

Febra, L. (2018). Projeto SM 4.0 – Smart Manufacturing, *Especial: Reologia* (O Molde Ed.), 117, 29 April, p. 56.

Febra, M. (2017). Interview with Mariana Febra, 3rd August.

Fernandez-Stark, K. & Gereffi, G. (2018). Global Value Chain Analysis: A Primer Second Edition. In: Gereffi, G. (Ed.). *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*, New York: Cambridge University Press, pp. 305–342.

Fornahl, D. & Menzel, M.–P. (2009). Cluster Life Cycles–Dimensions and Rationales of Cluster Evolution. *Industrial and Corporate Change*, 19(1), 205–238.

Fórum para a Competitividade (1994). *Construir as Vantagens Competitivas de Portugal*. Lisbon: Monitor Company.

Fórum para a Competitividade (1995). *A Competitividade da Economia Portuguesa*. Lisbon: Fórum para a Competitividade.

Fraß, A. (2016). *Achieving Brand Loyalty in China through After-sales Services: with a Particular Focus on the Influences of Cultural Determinants*. Wiesbaden: Springer Gabler.

Frade, J. (2017). O Setor Fala de… Ferramentas de Corte, *Especial: Ferramentas de Corte* (O Molde Ed.), 28 January, p. 22–23.

Fravel, D., Lenchitz, H., Colby-Oizumi, H., DeSapio, V., Fan, Q., Greene, W., Sykes, H., Taylor, K., Tsuji, K., Webster, J. & Yost, C. (2002). *Tools, Dies, and Industrial Molds: Competitive Conditions in the United States and Selected Foreign Markets*. Washington: U.S. International Trade Commission.

Friedman, T. L. (2007). *The World is Flat 3.0: A Brief History of the Twenty-first Century*. New York: Picador.

Furgerson, S. P. & Jacob, S. A. (2012). Writing Interview Protocols and Conducting Interviews: Tips for Students New to the Field of Qualitative Research. *The Qualitative Report*, 17(42), 1–10.

Gereffi, G. & Lee, J. (2018). Economic and Social Upgrading in Global Value Chains and Industrial Clusters Why Governance Matters. In: Gereffi, G. (Ed.). *Global Value Chains and Development: Redefining the Contours of 21st Century Capitalism*. New York: Cambridge University Press, pp. 276–302.

Giuliani, E. (2005). Cluster Absorptive Capacity. *European Urban and Regional Studies*, 12(3), 269–288.

Goddard, J., Lipczynski, J. & Wilson, J. (2005). *Industrial Organization*, 2nd Ed. Harlow: Pearson Education Limited.

Gomes, N. (2017). *Base de Dados Segmentada pelo CAE para Investigação Académica* [Data Set]. Lisbon: Informa D&B Portugal. [Accessed: 4th August]

Gordon, I. R. & McCann, P. (2000). Industrial Clusters: Complexes, Agglomeration and/or Social Networks? *Urban Studies*, 37(3), 513–532.

Götz, O., Liehr-Gobbers, K. & Krafft, M. (2010). Evaluation of Structural Equation Models Using the Partial Least Squares (PLS) Approach. In: Vinzi, V. E., Chin, W.

W., Henseler, J. and Wang, H. (Eds.), *Handbook of Partial Least Squares Concepts, Methods and Applications*. Dordrecht, Heidelberg, London, New York: Springer–Verlag, pp. 691–711.

Grant, R. M. (1991). The Resource-Based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114–135.

Gudergan, S. P., Hair, J. F., Ringle, C. M., Sarstedt, M. & Thiele, K. O. (2016). Estimation Issues with PLS and CBSEM: Where the Bias Lies! *Journal of Business Research*, 69(10), 3998–4010.

Gudergan, S. P., Ringle, C. M., Wende, S. & Will, A. (2008). Confirmatory Tetrad Analysis in PLS Path Modeling. *Journal of Business Research*, 61(12), 1238–1249.

Hair, J. F., Black, W. C., Babin, B. J. & Anderson, R. E. (2010). *Multivariate Data Analysis*, 7th Ed. Upper Saddle River, New Jersey: Pearson Prentice Hall Publishing.

Hair, J. F., Hult, T., Ringle, C. M. & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*, 1st Ed. Thousand Oaks, California: Sage Publications, Inc.

Hair, J. F., Hult, T., Ringle, C. M. & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling*, 2nd Ed. Thousand Oaks, California: Sage Publications, Inc.

Hair, J. F., Mena, J. A., Ringle, C. M. & Sarstedt, M. (2012a). An Assessment of the Use of Partial Least Squares Structural Equation Modeling in Marketing Research. *Journal of the Academy of Marketing Science*, 40(3), 414–433.

Hair, J. F., Pieper, T. M., Ringle, C. M. & Sarstedt, M. (2012b). The Use of Partial Least Squares Structural Equation Modeling in Strategic Management Research: a Review of Past Practices and Recommendations for Future Applications. *Long Range Planning*, 45 (5/6), 320–340.

Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. *Journal of Marketing Theory and Practice*, 19(2), 139–152.

Hassink, M. & Marques, P. (2016). The Regional Innovation Paradox Revisited. In: Hilpert, U. (Ed.). *Routledge Handbook of Politics and Technology*. London, UK and New York, USA: Routledge, pp. 120–131.

Hatten, K. J. & Schendel, D. E. (1977). Heterogeneity Within an Industry: Firm Conduct in the U.S. Brewing Industry, 1952–71. *The Journal of Industrial Economics*, 26(2), 97–113.

Hayes, R. H., Pisano, G. P., Upton, D. M. & Wheelwright, S. C. (2005). *Operations, Strategy, and Technology: Pursuing the Competitive Edge*. Indianapolis: John Wiley & Sons.

Henseler, J., Ringle, C. M. & Sarstedt, M. (2012). Using Partial Least Squares Path Modeling in International Advertising Research: Basic Concepts and Recent Issues. In: Okazaki, S. (Ed.). *Handbook of Research in International Advertising*. London: Edward Elgar, pp. 252–276.

Huberman, A. M. & Miles, M. B. (1994). *Qualitative Data Analysis: an Expanded Sourcebook*, 2nd Ed. Thousand Oaks, California: SAGE Publications.

Huggins, R. & Izushi, H. (2015). The Competitive Advantage of Nations: Origins and Journey. *Competitiveness Review*, 25(5), 458–470.

Hulland, J. (1999). Use of Partial Least Squares (PLS) in Strategic Management Research: a Review of Four Recent Studies. *Strategic Management Journal*, 20(2), 195–204.

IAPMEI (2019). *Clusters de Competitividade* [Online]. Available from: https://www.iapmei.pt/PRODUTOS-E-SERVICOS/Empreendedorismo-Inovacao/Eficiencia-Coletiva-e-Clusters.aspx [Accessed: 14/09/2019]

IBM Corporation (2018). *IBM SPSS® Statistics (v.23)* [Computer Programme]. Available from: https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-23 [Accessed: 12/10/2019]

IESE (2005). *Estudo Sobre a Utilização da Propriedade Industrial nos Sectores dos Plásticos e dos Moldes*. Lisbon: Instituto Nacional da Propriedade Industrial.

James, W. (1907). Pragmatism's Conception of Truth. *The Journal of Philosophy, Psychology and Scientific Methods*, 4(6), 141–155.

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, 24(4), 602–611.

Johnson, G., Scholes, K. & Whittington, R. (2008). *Exploring Corporate Strategy Text and Cases*, 8th Ed. Harlow: Prentice Hall.

Karlsson, C. (2008). Introduction. In: Karlsson, C. (Ed.). *Handbook of Research on Innovation and Clusters: Cases and Policies*. Cheltenham, UK and Northampton, Massachusetts, USA: Edward Elgar, pp. 1–16.

Ketels, C. H. M. (2006). Michael Porter's Competitiveness Framework – Recent Learnings and New Research Priorities. *Journal of Industry, Competition and Trade*, 6(2), 115–136.

Ketels, C. H. M., Lindqvist, G. & Sölvell, Ö. (2012). *Strengthening Clusters and Competitiveness in Europe: the Role of Cluster Organisations*. *The Cluster Observatory Report*. Stockholm: Stockholm School of Economics.

King, N. (2012). Doing Template Analysis. In: Symon, G. and Cassell, C. (Eds.). *Qualitative Organizational Research: Core Methods and Current Challenges*. London: SAGE Publications, pp. 426–450.

Koehler, T. (2015). *Report of the Pre-Assessment of Regional Cluster Policy Centro, Coimbra, Portugal*. European Cluster Observatory.

Lämmer–Gamp, T. & zu Köcker, G. M. (2017). *Summary Policy Briefing: Lessons from Six Model Demonstrator Regions*. European Cluster Observatory.

Laranjeira, J. (2017). Interview with Jorge Laranjeira, 28th July.

Lee, J.–Y., MacKenzie, S. B., Podsakoff, N. P. & Podsakoff, P. M. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology*, 88(5), 879–903.

Lewis, P., Saunders, M. & Thornhill, A. (2012). *Research Methods for Business Students*, 6th Ed. Harlow: Pearson Education Limited.

Lilliefors, H. W. (1967). On the Kolmogorov-Smirnov Test for Normality with Mean and Variance Unknown. *Journal of the American Statistical Association*, 62(318), 399–402.

Lloyd, C. E. & Peck, F. (2008). Cluster Policies and Cluster Strategies. In: Karlsson, C. (Ed.). *Handbook of Research on Innovation and Clusters: Cases and Policies*. Cheltenham, UK and Northampton, Massachusetts, USA: Edward Elgar, pp. 393–410.

Malmberg, A. & Maskell, P. (2002). The Elusive Concept of Localization Economies: Towards a Knowledge-Based Theory of Spatial Clustering. *Environment and Planning A*, 34(3), 429–449.

Malmberg, A. & Maskell, P. (2007). Myopia, Knowledge Development and Cluster Evolution. *Journal of Economic Geography*, 7(5), 603–618.

Mann, H. B. & Whitney, D. R. (1947). On a Test of Whether one of Two Random Variables is Stochastically Larger than the Other. *The Annals of Mathematical Statistics*, 18(1), 50–60.

Marshall, A. (1920 [1890]). *Principles of Economics: An Introductory Volume*, 8th Ed. London: Macmillan and Co.

Martin, R. & Sunley, P. (2003). Deconstructing Clusters: Chaotic Concept or Policy Panacea? *Journal of Economic Geography*, 3(1), 5–35.

Maskell, P. (2001). Towards a Knowledge-based Theory of the Geographical Cluster. *Industrial and Corporate Change*, 10(4), 921–943.

Mboya, J. R. (2015). *Determinants of Competitive Advantage in Textiles and Apparel Industry in Tanzania*: *Application of Structural Equation Modelling*. Doctoral Thesis, Dar es Salaam, Open University of Tanzania.

McCann, P. & Ortega–Argilés, R. (2013). Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy. *Regional Studies*, 49(8), 1291–1302.

McCann, P. & Shefer, D. (2004). Location, Agglomeration and Infrastructure. *Papers in Regional Science*, 83(1), 177–196.

McCann, P. & Sheppard, S. (2003). The Rise, Fall and Rise Again of Industrial Location Theory. *Regional Studies*, 37(6–7), 649–663.

Menezes, J. (2017). Empresas Entram em Indústrias Mais Exigentes: Voos Mais Altos, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1733, 28 September, p. 18.

Mesquita, L. F. (2007). Starting Over When the Bickering Never Ends: Rebuilding Aggregate Trust Among Clustered Firms Through Trust Facilitators. *Academy of Management Review*, 32(1), 72–91.

Monteiro, A., Reis, L., Silva, H. & Teixeira, A. (2011). *Estudo de Mercado das Principais Indústrias Clientes do Sector de Engineering and Tooling – Indústria Automóvel*. CEIIA – Centro para a Excelência e Inovação na Indústria Automóvel.

Monteiro, R. (2017). Interview with Rui Monteiro, 28th July.

Moodysson, J., Trippl, M. & Zukauskaite, E. (2017). Policy Learning and Smart Specialization: Balancing Policy Change and Continuity for New Regional Industrial Paths. *Science and Public Policy*, 44(3), 382–391.

OECD (2008). *OECD Territorial Reviews, Portugal*. Paris: OECD Publishing.

Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods Integrating Theory and Practice*, 4th Ed. Thousand Oaks, California: SAGE Publications.

Peirce, C. S. (1984). *Writings of Charles S. Peirce: A Chronological Edition 1*. Bloomington: Indiana University Press.

Penrose, E. (1959). *The Theory of the Growth of the Firm*. Oxford: Basil Blackwell.

Pina, A. (2018). O Sector Fala de… Automação, *Especial: Automação* (O Molde Ed.), 118, 29 July, p. 52.

Pires, V. (2018). O Sector Fala de… Automação, *Especial: Automação* (O Molde Ed.), 118, 29 July, p. 52.

Pisano, G. P. & Shih, W. C. (2009). Restoring American Competitiveness, *Harvard Business Review*, July–August, 114–125.

Pisano, G. P. & Shih, W. C. (2012). *Producing Prosperity: Why America Needs a Manufacturing Renaissance*. Boston: Harvard Business Review Press.

Pool-net Association (2019a). *Anchor Projects* [Online]. Available from: http://www.toolingportugal.com/index.php?option=com_content&view=category&id=22&Itemid=330&lang=en [Accessed: 14/09/2019]

Pool-net Association (2019b). *Complementary Projects* [Online]. Available from: http://www.toolingportugal.com/index.php?option=com_content&view=category&id=23&Itemid=331&lang=en [Accessed: 14/09/2019]

Porter, M. E. (1980). *Competitive Strategy Techniques for Analyzing Industries and Competitors*. New York: Free Press.

Porter, M. E. (1985). *The Competitive Advantage: Creating and Sustaining Superior Performance*. New York: Free Press.

Porter, M. E. (1990). *The Competitive Advantage of Nations*. New York: Free Press.

Porter, M. E. (1994). The Role of Location in Competition. *International Journal of the Economics of Business*, 1(1), 35–40.

Porter, M. E. (1998a). Clusters and Competition: New Agendas for Companies, Governments and Institutions. In: Porter, M. E. (Ed.), *On Competition*. Boston: Harvard Business School Press, pp. 197–287.

Porter, M. E. (1998b). Clusters and the New Economics of Competition, *Harvard Business Review*, November–December, 77–90.

Porter, M. E. (1998c). The Adam Smith Address: Location, Clusters, and the 'New' Microeconomics of Competition. *Business Economics*, 33(1), 7–14.

Porter, M. E. (2000a). Location, Clusters, and Company Strategy. In: Clark, G., Feldman, M. and Gertler, M. (Eds.). *Oxford Handbook of Economic Geography*. Oxford: Oxford University Press, pp. 253–274.

Porter, M. E. (2000b). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, 14(1), 15–34.

Porter, M. E. (2004). Building the Microeconomic Foundations of Prosperity: Findings from the Business Competitiveness Index. In: Porter, M. E., Sala-i-Martin, X. and Schwab, K. (Eds.). *The Global Competitiveness Report 2003-2004*. Oxford: Oxford University Press, pp. 29–56.

Porter, M. E. & Schwab, K. (2008). *Executive Opinion Survey 2008 Global Competitiveness Report 2008-2009 of the World Economic Forum* [Online]. Available from: http://www.kadin-indonesia.or.id/enm/images/dokumen/KADIN-117-2573-29022008.pdf [Accessed: 16/04/2017]

Programa Operacional Competitividade e Internacionalização (2010). *Estratégias de Eficiência Colectiva: Tipologia – Clusters: Enquadramento Sectorial e Territorial*. [Online]. Available from: http://healthportugal.com/noticias/ambitosectorregiao-pct-oc-vs2final2010.pdf [Accessed: 28/06/2017]

Qualtrics LLC (2017). *Qualtrics* [Online Survey Software]. Available from: https://www.qualtrics.com [Accessed: 16/09/2017]

Ramos, F. (2015). A Diferença de Preço Dilui-se, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1628, 24 September, p. 34.

Ribeiro, A. (2018). Automação: a Experiência das Empresas, *Especial: Automação* (O Molde Ed.), 118, 29 July, p. 43.

Rodrigues, A. (2017). Interview with Alexandra Rodrigues, 10th July.

Rodrigues, R. P. (2017). Interview with Rui Paulo Rodrigues, 13th September.

Roos, J. M. (2014). The Vanishing Tetrad Test: Another Test of Model Misspecification. *Measurement: Interdisciplinary Research and Perspectives*, 12(3), 109–114.

Rossiter, J. R. (2002). The C-OAR-SE Procedure for Scale Development in Marketing. *International Journal of Research in Marketing*, 19(4), 305–335.

Santos, E. (2017). O Setor Fala de… Ferramentas de Corte, *Especial: Ferramentas de Corte* (O Molde Ed.), 28 January, p. 22.

Schmitz, H. (1995). Collective Efficiency: Growth Path for Small-scale Industry. *The Journal of Development Studies*, 31(4), 529–566.

Schmitz, H. (1999). Collective Efficiency and Increasing Returns. *Cambridge Journal of Economics*, 23(4), 465–483.

Shih, S. (1996). *Me-Too Is Not My Style*. Taipei: Acer Foundation.

Silva, C. (2017). À Conquista da Cadeia de Valor, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1733, 28 September, p. 146.

Silva, G. (2011). *Impacte da Qualidade e Inovação do Produto nas Exportações Nacionais*. Doctoral Thesis, Lisbon, Universidade Nova de Lisboa.

Silva, N. (2017). Cada Vez Será Mais Difícil Trabalhar de Forma Isolada, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1733, 28 September, p. 78.

Simmie, J. (2008). The Contribution of Clustering to Innovation: From Porter I Agglomeration to Porter II Export Base Theories. In: Karlsson, C. (Ed.), *Handbook of Research on Innovation and Clusters*. Cheltenham, UK and Northampton, Massachusetts, USA: Edward Elgar, pp. 19–32.

Snowdon, B. & Stonehouse, G. (2006). Competitiveness in a Globalised World: Michael Porter on the Microeconomic Foundations of the Competitiveness of Nations, Regions, and Firms. *Journal of International Business Studies*, 37(2), 163–175.

Sociedade Portuguesa de Inovação (2008). *Plano Estratégico para o Sector de Moldes em Portugal*. Oporto: Sociedade Portuguesa de Inovação.

Sociedade Portuguesa de Inovação & inno TSD (2013a). *Estudo de Avaliação da Estratégia e do Processo de Implementação das Estratégias de Eficiência Colectiva – Tipologia Clusters (Documentos de Suporte, Volume III)*. Oporto: Observatório do QREN.

Sociedade Portuguesa de Inovação & inno TSD (2013b). *Estudo de Avaliação da Estratégia e do Processo de Implementação das Estratégias de Eficiência Colectiva – Tipologia Clusters (Relatório Final)*. Oporto: Observatório do QREN.

Statistics Portugal (2019). *Enterprises (No), data for 2017* [Online]. Available from: https://www.ine.pt/xportal/xmain?xpgid=ine_tema&xpid=INE&tema_cod=1313 [Accessed: 14/01/2019]

Teddlie, C. & Yu, F. (2007). Mixed-Methods Sampling. *Journal of Mixed Methods Research*, 1(1), 77–100.

The Economist (2008). *Competitive Advantage* [Online]. Available from: https://www.economist.com/news/2008/08/04/competitive-advantage [Accessed: 21/08/2019]

Tinguely, X. (2013). *The New Geography of Innovation: Clusters, Competitiveness and Theory*. Basingstoke: Palgrave MacMillan.

Tocha, R. (2017a). Antecipar Tendências e Desenvolver o Futuro, *Moldes & Plásticos* (Jornal de Leiria Ed.), 1733, 28 September, p. 158.

Tocha, R. (2017b). Cooperar no Seio de um Cluster é uma Questão de Convicção e de Cultura e Não uma Moda, *Especial: MOLDPLÁS* (O Molde Ed.), 115, 28 October, p. 73.

Tocha, R. (2017c). Interview with Rui Tocha, 9th January.

von Hippel, E. (1986). Lead Users: A Source of Novel Product Concepts. *Management Science*, 32 (7), 791–806.

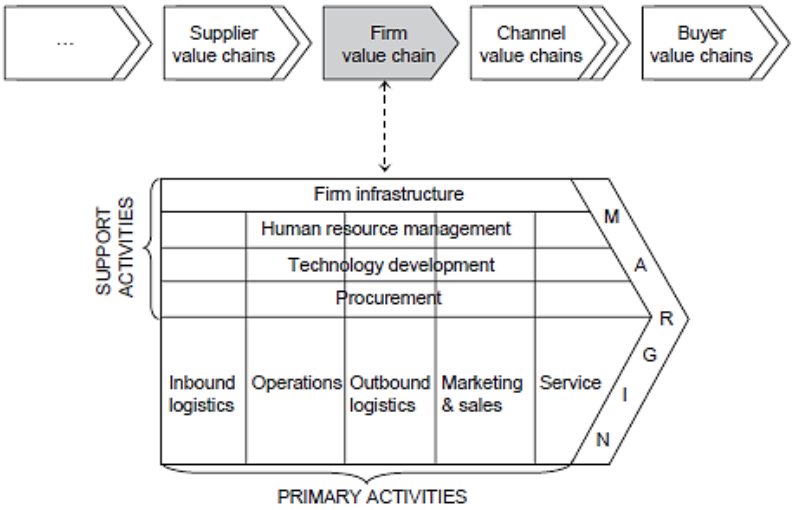
Warwick, K. (2013). Beyond Industrial Policy: Emerging Issues and New Trends, *OECD Science, Technology and Industry Policy Papers*, 2, OECD Publishing.

Wold, H. (1975). Soft Modelling by Latent Variables: Non-linear Iterative Partial Least Squares (NIPALS) Approach. In: Gani, M. S. B. (Ed.). *Perspectives in Probability and Statistics*. London: Academic Press, pp. 117–142.

Wold, H. (1982). Soft Modeling: The Basic Design and Some Extensions. In: Jöreskog, K.G. and Wold, H. (Eds.). *Systems Under Indirect Observations: Part II*. Amsterdam: North-Holland, pp. 1–54.

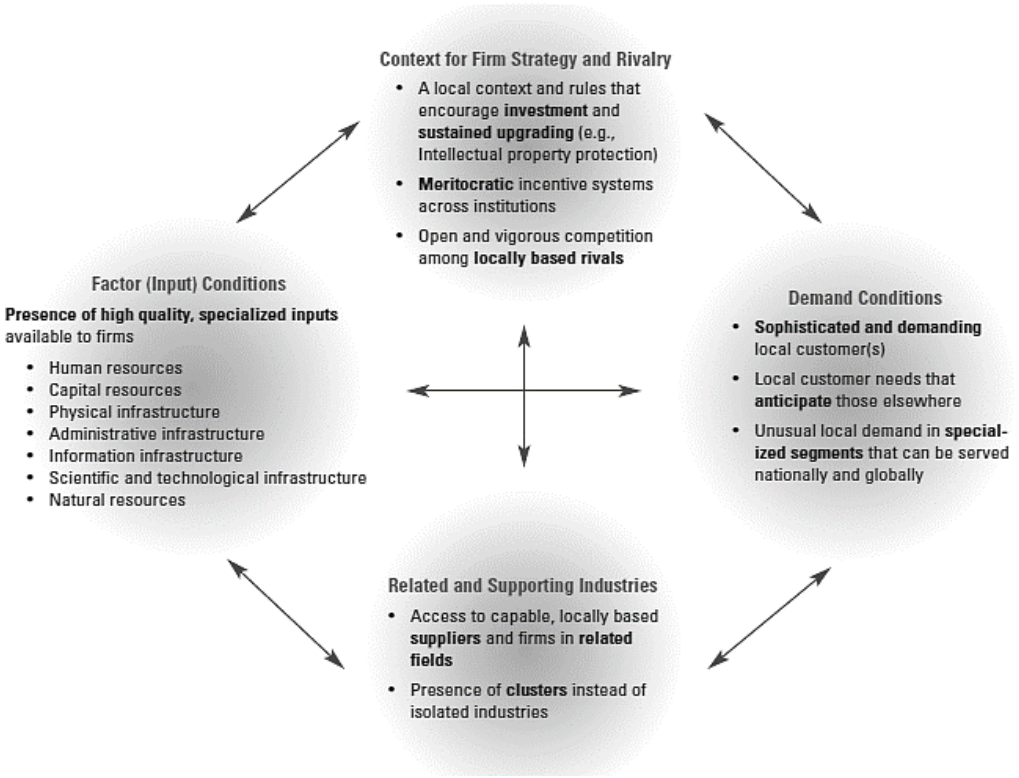
APPENDICES

Appendix A – Firm's Value Chain and the Value System



Source: Tinguely (2013) based on Porter (1985).

Appendix B – The Diamond Model



Source: Porter (2004).

Appendix C – Nuclear and Support Activities of the E&T Cluster

	CAE Rev.3	Firms (No)
Nuclear Activities	CAE 22292 – Manufacture of other plastic products, n.e.c.	572
	CAE 25732 – Manufacture of mechanical tools	91
	CAE 25734 – Manufacture of metal moulds	773
	CAE 28293 – Manufacture of other general-purpose machinery, n.e.c.	255
	CAE 29320 – Manufacture of other parts and accessories for motor vehicles	465
Support Activities	CAE 28291 – Manufacture of packing and wrapping machinery	17
	CAE 28991 – Manufacture of machinery for construction, ceramics and glass	31
	CAE 29310 – Manufacture of electrical and electronic equipment for motor vehicles	25
	CAE 32996 – Other miscellaneous manufacturing activities, n.e.c.	728
	TOTAL (Industrial Companies)	2,957
	CAE 71120 – Engineering activities and related technical consultancy	17,815
	CAE 72190 – Other research and experimental development on natural sciences and engineering	691
	TOTAL (Research Organisations and Engineering Companies)	18,506
	TOTAL	21,463

Source: Programa Operacional Competitividade e Internacionalização (2010), adapted; Statistics Portugal (2019), data for 2017.

Appendix D – Constructs and Respective Indicators

Research Hypothesis	Construct	Indicator Label	Question Number (see Appendix F)	Source
H1	Factor (Input) Conditions (FC)	Quality of the scientific and technical expertise of specialised workers (FC1)	No 1.	Council on Competitiveness *et al*. (2001b)
H1	Factor (Input) Conditions (FC)	Regional availability of specialised workers (FC2)	No 2.	Council on Competitiveness *et al*. (2001b)
H1	Factor (Input) Conditions (FC)	General access to specialised infrastructure (FC3)	No 3.	Council on Competitiveness *et al*. (2001a)
H1	Factor (Input) Conditions (FC)	Overall quality of transportation (FC4)	No 4.	Council on Competitiveness *et al*. (2001a, b)
H1	Factor (Input) Conditions (FC)	Degree of access to financial instruments (FC5)	No 5.	Council on Competitiveness *et al*. (2001b)
H1	Factor (Input) Conditions (FC)	Research cooperation between businesses and higher education institutions in the regional area (FC6)	No 6.	Council on Competitiveness *et al*. (2001b)
H2	Firm Strategy, Structure and Local Rivalry (SSR)	Cooperation in employer-employee relationships (SSR1)	No 8.	Porter & Schwab (2008)
H2	Firm Strategy, Structure and Local Rivalry (SSR)	Degree of rivalry between regional competitors (SSR2)	No 9.	Council on Competitiveness *et al.* (2001a); Porter & Schwab (2008)

H2	Firm Strategy, Structure and Local Rivalry (SSR)	Intensity of mergers and acquisitions in the regional area (SSR3)	No 10.	Council on Competitiveness *et al*. (2001b)
H2	Firm Strategy, Structure and Local Rivalry (SSR)	Degree of cooperation between regional competitors (SSR4)	No 11. to 15.*	Council on Competitiveness *et al.* (2001a); Porter & Schwab (2008); Pilot interviews
H3	Related and Supporting Industries (RSI)	Quality of the scientific and technical expertise of regional suppliers (RSI1)	No 17.	Council on Competitiveness *et al*. (2001b)
H3	Related and Supporting Industries (RSI)	Regional availability of specialist suppliers (RSI2)	No 18.	Porter & Schwab (2008); Council on Competitiveness *et al*. (2001b)
H3	Related and Supporting Industries (RSI)	Quality of the assistance provided by specialist suppliers (RSI3)	No 19.	Porter & Schwab (2008); Council on Competitiveness *et al*. (2001b)
H3	Related and Supporting Industries (RSI)	Cooperation with industries in other clusters (RSI4)	No 20.	European Cluster Observatory (2012)
H4	Demand Conditions (DC)	Sophistication of regional clients' technical specifications (DC1)	No 23.	Porter & Schwab (2008); Council on Competitiveness *et al*. (2001b)
H4	Demand Conditions (DC)	Quality of the feedback from regional clients to improve firms' products and services (DC2)	No 24.	Council on Competitiveness *et al*. (2001a)
H4	Demand Conditions (DC)	Size of the regional market (DC3)	No 25.	Council on Competitiveness *et al*. (2001a)
H4	Demand Conditions (DC)	Regional market growth rate (DC4)	No 26.	Council on Competitiveness *et al*. (2001a)
H5a	Government (G)	Improvements in the provision of specialised infrastructure (G1)	No 28.	Porter & Schwab (2008); Council on Competitiveness *et al*. (2001b)
H5a	Government (G)	Foster cooperation networks between businesses and institutions of the SCTN (G2)	No 29.	European Cluster Observatory (2012)
H5a	Government (G)	Financial incentive schemes under the Portugal 2020 framework (G3)	No 30.	European Cluster Observatory (2012)
H5a	Government (G)	Venture capital, mutual guarantee schemes and other funding instruments (G4)	No 31.	Council on Competitiveness *et al*. (2001b)
H5b	Government (G)	Tax incentive systems (G5)	No 32.	European Cluster Observatory (2012); Council on Competitiveness *et al*. (2001b)
H5b	Government (G)	Stringent enforcement of policies concerning the protection of industrial property by the INPI (G6)	No 33.	Porter & Schwab (2008)
H5c	Government (G)	Simplify bureaucratic procedures (*e.g.*, to encourage entrepreneurship) (G7)	No 34.	Porter & Schwab (2008)
H5b	Government (G)	Foster cooperation networks between industries within the cluster (G8)	No 35.	European Cluster Observatory (2012)
H5b	Government (G)	Support firms' internationalisation (G9)	No 36.	Council on Competitiveness *et al*. (2001b)

H5c	Government (G)	Cooperation with industries and institutions in other clusters (G10)	No 37.	European Cluster Observatory (2012)
H5d	Government (G)	Stringent enforcement of policies concerning the quality, safety and environmental standards by the IPQ and IPAC (G11)	No 38.	Porter & Schwab (2008); Council on Competitiveness *et al*. (2001b)
H5d	Government (G)	Public procurement of components and integrated solutions (G12)	No 39.	European Cluster Observatory (2012)
n/a	Competitive Advantage (CA)	Ability to manage inbound logistics (CA1)	No 41.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage operational activities (CA2)	No 42.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage outbound logistics (CA3)	No 43.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage marketing and sales processes (CA4)	No 44.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage after-sales services (CA5)	No 45.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage firm infrastructure (CA6)	No 46.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage human resources (CA7)	No 47.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage technological development processes (CA8)	No 48.	Mboya (2015)
n/a	Competitive Advantage (CA)	Ability to manage procurement processes (CA9)	No 49.	Mboya (2015)
***Note**: the scores of questions 11–15 related to several types of collaborative business relationships were transformed into a single composite variable 'SSR4: Degree of cooperation between regional competitors' in order to gain insight into respondents' overall perception towards regional business cooperation.				

Source: Author.

Appendix E – Overview of Interviews Conducted

No	Interviewee	Position	Interview Type	Location	Organisation(s)
1.	Alexandra Rodrigues	Head of the Regional Development Services	Semi-structured Interview	Coimbra	CCDR-C
2.	António Santos	General Manager	Think-aloud Interview (Questionnaire Pretesting)	Barrocas (Oliveira de Azeméis)	Moldoplástico
3.	Arnaldo Matos	Administrator	Think-aloud Interview (Questionnaire Pretesting)	Cós (Alcobaça)	TOPO
4.	Gonçalo Cordeiro	Chief Operating Officer (COO)	Think-aloud Interview (Questionnaire Pretesting)	Pataias (Alcobaça)	Moldegama
5.	Idálio Silva	General Manager	Think-aloud Interview (Questionnaire Pretesting)	Martingança (Alcobaça)	UEpro
6.	João Faustino	Administrator/ President	Think-aloud Interview (Questionnaire Pretesting)	Marinha Grande	TJ Moldes/ CEFAMOL Association
7.	Jorge Laranjeira	Innovation Manager	Think-aloud Interview (Questionnaire Pretesting)	Loureiro (Oliveira de Azeméis)	MOLDIT
8.	Mariana Febra	Sales & Marketing Director	Think-aloud Interview (Questionnaire Pretesting)	Maceira (Leiria)	GECO Plastic Injection Moulds (GECO Group)
9.	Paulo Bastos	Human Resources Director	Think-aloud Interview (Questionnaire Pretesting)	Oliveira de Azeméis	Simoldes Plastics Division
10.	Pedro Pereira	Sales Manager	Think-aloud Interview (Questionnaire Pretesting)	Marinha Grande	SETsa. (Iberomoldes Group)

11.	Rui Duarte	General Manager	Think-aloud Interview (Questionnaire Pretesting)	Picassinos (Marinha Grande)	Aníbal H. Abrantes (Iberomoldes Group)
12.	Rui Monteiro	Head of the Regional Development Services	Semi-structured Interview	Oporto	CCDR-N
13.	Rui Paulo Rodrigues/ Ana Azevedo	Vice President/ Human Resources Technician	Think-aloud Interview (Questionnaire Pretesting)	Oliveira de Azeméis	Simoldes Group/ Simoldes Tooling Division
14.	Rui Tocha	E&T Cluster Manager	Semi-structured Interview	Lisbon	Pool-net Association
15.	Telmo Ferraz	Administrator	Think-aloud Interview (Questionnaire Pretesting)	Marinha Grande	Planimolde

Source: Author.

Appendix F – Questionnaire

No âmbito do mestrado em Gestão e Estratégia Industrial do Instituto Superior de Economia e Gestão (ISEG) da Universidade de Lisboa, o presente questionário visa recolher informação para efeitos do meu trabalho final de mestrado. A investigação tem como objetivo analisar os efeitos da envolvente microeconómica e da política pública na vantagem competitiva das indústrias de moldes, plásticos e de ferramentas especiais (*Engineering & Tooling cluster*).

Não é requerida a partilha de informações sensíveis sobre a sua empresa. Os objetivos do questionário são exclusivamente académicos. As respostas são anónimas, confidenciais e serão tratadas de forma agregada, não permitindo, por conseguinte, a identificação dos respondentes. Não existem respostas certas ou erradas, apenas a sua opinião será relevante. O tempo estimado para o preenchimento do questionário é de **12 a 15 minutos**. Agradeço a sua colaboração.

Luís Neto
Contacto: [*RESEARCHER'S E-MAIL*]

Observação: São elegíveis para o preenchimento do questionário as empresas que integrem qualquer das seguintes atividades: CAE 22292: "Fabricação de outros artigos de plástico, n.e.";CAE 25732: "Fabricação de ferramentas mecânicas";CAE 25734: "Fabricação de moldes metálicos";CAE 28291: "Fabricação de máquinas de acondicionamento e de embalagem";CAE 28293: "Fabricação de outras máquinas diversas de uso geral, n.e.";CAE 28991: "Fabricação de máquinas para as indústrias de materiais de construção, cerâmica e vidro";CAE 29310: "Fabricação de equipamento elétrico e eletrónico para veículos automóveis";CAE 29320: "Fabricação de outros componentes e acessórios para veículos automóveis";CAE 32996: "Outras indústrias transformadoras diversas, n.e."

Grupo I – Efeitos da Envolvente Microeconómica na Vantagem Competitiva do *Cluster*

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo dos **fatores regionais** para a vantagem competitiva da sua empresa:		1 Discordo Totalmente	2 Discordo	3 Indiferente	4 Concordo	5 Concordo Totalmente
1.	Qualidade técnico-científica dos trabalhadores especializados (p. ex. operadores técnicos e engenheiros).					
2.	Disponibilidade regional de trabalhadores especializados (p.ex. operadores técnicos e engenheiros).					
3.	Acesso geral a infraestruturas especializadas (p.ex. universidades e centros de I&DT).					

4.	Qualidade geral dos transportes (rodovias, ferrovias, transportes aéreos e portos).					
5.	Grau de acesso a instrumentos de financiamento (p.ex. empréstimos e capital de risco).					
6.	Cooperação entre empresas e instituições de Ensino Superior (universidades e institutos politécnicos) em matéria de investigação.					

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
7.	Em termos gerais, qual o seu grau de concordância com o contributo das condições regionais de fatores[34] para a vantagem competitiva da sua empresa?					

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo da **estratégia, estrutura e rivalidade empresarial a nível regional** para a vantagem competitiva da sua empresa:		1 Discordo Totalmente	2 Discordo	3 Indiferente	4 Concordo	5 Concordo Totalmente
8.	A cooperação nas relações trabalhador-empregador na sua empresa.					
9.	O grau de rivalidade entre empresas concorrentes regionais.					
10.	A intensidade de fusões e aquisições na sua região.					

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo da **cooperação com concorrentes regionais** para a vantagem competitiva da sua empresa:		1 Discordo Totalmente	2 Discordo	3 Indiferente	4 Concordo	5 Concordo Totalmente
11.	Partilha de conhecimentos relevantes para inovações de produto/serviço, de processo, de *Marketing* e de métodos organizacionais.					
12.	Oferta de soluções integradas mediante consórcios.					
13.	Fornecimento de componentes individuais (p.ex. moldes e peças plásticas).					
14.	Redução nos custos de mobilização de pessoas e de ideias.					
15.	Partilha do risco de investimento em I&DT e/ou outras atividades mediante parcerias.					

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
16.	Em termos gerais, qual o seu grau de concordância com o contributo da estratégia, estrutura e rivalidade empresarial[35] a nível regional para a vantagem competitiva da sua empresa?					

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo dos **fornecedores regionais** para a vantagem competitiva da sua empresa:		1 Discordo Totalmente	2 Discordo	3 Indiferente	4 Concordo	5 Concordo Totalmente
17.	Qualidade técnico-científica dos fornecedores regionais especializados de materiais,					

[34] Entende-se por "condições regionais de fatores" a quantidade, custo, qualidade e especialização dos fatores de produção disponíveis numa determinada região.
[35] Entende-se por "estratégia, estrutura e rivalidade empresarial" o grau sofisticação das operações e estratégias das empresas, bem como as regras e incentivos que condicionam a rivalidade entre empresas numa região.

	componentes, maquinaria ou serviços de I&DT e de formação.					
18.	Disponibilidade regional de fornecedores especializados de materiais, componentes, maquinaria ou serviços de I&DT e de formação.					
19.	Qualidade do apoio concedido pelos fornecedores regionais especializados de materiais, componentes, maquinaria ou serviços de I&DT e de formação.					
20.	Colaboração com outras indústrias que não as de moldes, plásticos e de ferramentas especiais.					

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
21.	Em termos gerais, qual o seu grau de concordância com o contributo das indústrias relacionadas e de suporte[36] para a vantagem competitiva da sua empresa?					

22. A sua empresa tem clientes regionais?		
1	Sim	
2	Não	

(Se respondeu "**Sim**" à questão n.º 22): Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo dos **clientes regionais** para a vantagem competitiva da sua empresa:		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
23.	Exigência/ sofisticação das especificações dos clientes regionais.					
24.	Qualidade do *feedback* concedido pelos clientes regionais para a melhoria dos produtos/serviços.					
25.	Dimensão do mercado regional.					
26.	Taxa de crescimento do mercado regional.					

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
27.	Em termos gerais, qual o seu grau de concordância com o contributo das condições regionais da procura[37] para a vantagem competitiva da sua empresa?					

Grupo II – Efeitos das Políticas Públicas na Envolvente Microeconómica do *Cluster*

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o **contributo da ação do governo** na promoção da envolvente microeconómica da sua empresa:		1	2	3	4	5	6
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente	Não Sabe
28.	Melhoria da dotação de infraestruturas especializadas (p.ex. universidades e centros de						

[36] Entende-se por "indústrias relacionadas e de suporte" a disponibilidade e qualidade técnica de fornecedores especializados de matérias-primas, componentes, maquinaria e de empresas com a mesma base tecnológica presentes numa região.
[37] Entende-se por "condições regionais da procura" o conjunto de clientes e de canais de distribuição presentes numa região, tanto de origem regional como estrangeira.

	I&DT) e da oferta de serviços (p.ex. formação profissional).						
29.	Apoio à dinamização de redes de cooperação de empresas com entidades do Sistema Científico e Tecnológico Nacional (SCTN).						
30.	Sistemas de incentivos financeiros de apoio ao investimento no âmbito do Portugal 2020 (p.ex. SI I&DT, SI Inovação, SI Q/I – Qualificação e Internacionalização PME).						
31.	Sistemas de incentivos fiscais (p.ex. SIFIDE – Sistema de Incentivos Fiscais à I&D Empresarial).						
32.	Parceria com instituições privadas na concessão de capitais de risco, garantia mútua e outros instrumentos financeiros (p.ex. soluções de financiamento com intervenção do IAPMEI).						
33.	Simplificação de procedimentos administrativos/burocráticos.						
34.	Apoio à dinamização de redes de cooperação com outras empresas do *cluster* (p.ex. projetos conjuntos de inovação).						
35.	Apoio à internacionalização das empresas (p.ex. participação da CCDR da sua região em conferências e projetos comunitários).						
36.	Rigor na implementação de normas técnicas de qualidade, de segurança e de ambiente por parte dos organismos nacionais de normalização (IPQ) e de acreditação (IPAC).						
37.	Consolidação da relação das empresas com indústrias e instituições (*e.g.*, centros I&DT e entidades gestoras) de outras indústrias, p.ex. sessões de capacitação da RIS3.						
38.	Rigor na execução de políticas de proteção da Propriedade Industrial (marcas registadas, patentes e *designs* industriais) por parte do INPI.						
39.	Contratação para fornecimento de componentes ou soluções integradas da sua empresa por parte de entidades públicas (p.ex. municípios).						

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
40.	Em termos gerais, qual o seu grau de concordância com o contributo do governo[38] na promoção da envolvente microeconómica regional?					

Grupo III – Contributo das Atividades Internas para a Vantagem Competitiva das Empresas do *Cluster*

Indique, por favor, o seu grau de concordância com as seguintes afirmações sobre o contributo das **atividades desenvolvidas internamente** para a vantagem competitiva da sua empresa:		1 Discordo Totalmente	2 Discordo	3 Indiferente	4 Concordo	5 Concordo Totalmente
41.	Capacidade de gestão de processos de logística interna (p.ex. compra de matérias-primas, gestão de materiais).					

[38] Por "governo" entende-se o grupo relevante de ministérios e agências governamentais que promovem a envolvente microeconómica das empresas do *cluster*.

42.	Capacidade de gestão das operações (p.ex. processos de engenharia, produção, simulação e testes).					
43.	Capacidade de gestão de processos de logística externa (p.ex. processamento de encomendas, envio de moldes ou peças plásticas, planos de entrega especializados).					
44.	Capacidade de gestão de Marketing e vendas (p. ex. força de vendas, atividades de promoção de produtos).					
45.	Capacidade de gestão de serviços pós-venda (p.ex. apoio técnico-comercial).					
46.	Capacidade de gestão infraestrutural da empresa (p.ex. processos de planeamento e de financiamento).					
47.	Gestão de Recursos Humanos (p.ex. atividades de recrutamento e de treino especializado).					
48.	Gestão de processos de desenvolvimento tecnológico (p.ex. *design* de produtos e processos, prospeção de mercado).					
49.	Gestão de compras (p.ex. aquisição de maquinaria e de serviços de suporte).					

		1	2	3	4	5
		Discordo Totalmente	Discordo	Indiferente	Concordo	Concordo Totalmente
50.	Em termos gerais, qual o seu grau de concordância com o contributo das atividades da cadeia de valor[39] para a vantagem competitiva da sua empresa?					

Grupo IV – Caracterização da Empresa Participante

51. Em que região (NUTS III) se localiza a sua empresa?

Região de Leiria		1
Área Metropolitana do Porto		2
Região de Aveiro		3
Outra		4

52. Qual foi a principal atividade desenvolvida pela sua empresa no ano de 2016?

CAE 22292: "Fabricação de outros artigos de plástico, n.e."		1
CAE 25732: "Fabricação de ferramentas mecânicas"		2
CAE 25734: "Fabricação de moldes metálicos"		3
CAE 28291: "Fabricação de máquinas de acondicionamento e de embalagem"		4
CAE 28293: "Fabricação de outras máquinas diversas de uso geral, n.e."		5
CAE 28991: "Fabricação de máquinas para as indústrias de materiais de construção, cerâmica e vidro"		6
CAE 29310: "Fabricação de equipamento elétrico e eletrónico para veículos automóveis"		7
CAE 29320: "Fabricação de outros componentes e acessórios para veículos automóveis"		8
CAE 32996: "Outras indústrias transformadoras diversas, n.e."		9

53. Qual foi o número total de empregados da sua empresa no final de 2016?

Menos de 10		1
Entre 10 e 49		2
Entre 50 e 99		3
Entre 100 e 249		4
250 ou mais		5

[39] Entende-se por "cadeia de valor" o conjunto de atividades executadas por uma empresa que determinam a sua vantagem competitiva.

54. No final de 2016, qual foi o volume de negócios da sua empresa?

Menos de 200.000 €		1
Entre 200.000 € e 1.000.000 €		2
Entre 1.000.001 € e 5.000.000 €		3
Entre 5.000.001 € e 10.000.000 €		4
Entre 10.000.001 € e 20.000.000 €		5
Mais de 20.000.000 €		6

55. No ano de 2016, qual foi a percentagem (%) das exportações diretas no volume de negócios da sua empresa?

A empresa não exportou		1
Até 49%		2
Entre 50% e 79%		3
Entre 80% e 90%		4
Mais de 90%		5

56. Qual foi a principal indústria cliente da sua empresa em 2016?

Indústria Automóvel		1
Indústria Eletrónica/Telecomunicações		2
Indústria de Embalagens		3
Indústria de Energia Elétrica		4
Indústria de Equipamentos para Escritório		5

Indústria de Eletrodomésticos		6
Indústria de Dispositivos Médicos		7
Indústria de Brinquedos		8
Indústria Aeronáutica		9
Outra		10

57. Considerando a indústria cliente assinalada na questão anterior, qual foi a sua percentagem (%) no volume de negócios da sua empresa em 2016?

Até 25%		1
Entre 26% e 50%		2
Entre 51% e 75%		3
Mais de 75%		4

Grupo V – Perfil do Respondente

58. Qual a função que desempenha atualmente na sua empresa?

Diretor(a) Geral		1
Administrador(a)		2
Gestor(a) de uma área funcional (p.ex. Marketing, Finanças, Recursos Humanos, Operações)		3
Outra		4

59. Há quanto tempo desempenha a sua atual função (assinalada na questão anterior)?

Menos de 1 ano		1
De 1 a 2 anos		2
De 3 a 5 anos		3
De 6 a 10 anos		4
Mais de 10 anos		5

Grato pela sua colaboração.

Appendix G – First E-mail

A/C do(a) Diretor(a) Geral, Administrador(a) da [COMPANY] ou outro(a) gestor(a) interveniente no processo de decisão estratégica,

Exmo(a). Senhor(a),

Venho solicitar a sua colaboração para um projeto de investigação realizado no âmbito do Mestrado em Gestão e Estratégia Industrial do Instituto Superior de Economia e Gestão (ISEG), Universidade de Lisboa. O questionário que se apresenta visa recolher informação relativa aos efeitos da envolvente microeconómica e da política pública na vantagem competitiva das empresas de moldes, plásticos e ferramentas especiais (*Engineering & Tooling cluster*).

A sua colaboração é fundamental para o sucesso deste estudo, pelo que solicito o preenchimento do questionário que poderá aceder através da seguinte hiperligação:

[*QUESTIONNAIRE'S URL*]

Solicito que na resposta às questões assuma como referência a organização que integra atualmente. Os objetivos do questionário são exclusivamente académicos, visando recolher os dados necessários para a concretização do trabalho final de mestrado que me encontro a desenvolver. As respostas são anónimas, confidenciais e serão tratadas de forma agregada, não permitindo, por conseguinte, a identificação dos respondentes.

O tempo estimado para o preenchimento do questionário é de **12 a 15 minutos**.

Agradeço a sua colaboração e encontro-me ao dispor para qualquer eventual esclarecimento através do *e-mail*: [*RESEARCHER'S E-MAIL*]

Atentamente,

Luís Neto

Appendix H – Follow-up E-mail

Exmo(a). Senhor(a),

Venho solicitar novamente a sua colaboração para um projeto de investigação realizado no âmbito do Mestrado em Gestão e Estratégia Industrial do Instituto Superior de Economia e Gestão (ISEG), Universidade de Lisboa.

O questionário que se apresenta visa recolher informação relativa aos efeitos da envolvente microeconómica e da política pública na vantagem competitiva das empresas de moldes, plásticos e ferramentas especiais (*Engineering & Tooling cluster*).

Caso ainda não tenha respondido, apelo, por favor, a sua colaboração pois é absolutamente essencial para a concretização deste estudo académico, na medida em que, até ao momento, o número de respostas obtidas não me permite realizar uma análise de resultados rigorosa, invalidando assim o estudo.

Mais informo que o questionário estará disponível até sexta-feira (15/09/2017) e que, após a referida data, não será possível a recolha de respostas. Venho, uma vez mais, solicitar o preenchimento do questionário que poderá aceder através da seguinte hiperligação:

[*QUESTIONNAIRE'S URL*]

Solicito que na resposta às questões assuma como referência a organização que integra atualmente. Os objetivos do questionário são exclusivamente académicos, visando recolher os dados necessários para a concretização do trabalho final de mestrado que me encontro a desenvolver. As respostas são anónimas, confidenciais e serão tratadas de forma agregada, não permitindo, por conseguinte, a identificação dos respondentes.

O tempo estimado para o preenchimento do questionário é de **12 a 15 minutos**.

Agradeço a sua colaboração e encontro-me ao dispor para eventuais esclarecimentos através do *e-mail*: [*RESEARCHER'S E-MAIL*]

Atentamente,

Luís Neto

Appendix I – Consent Form

Consent Form

Dissertation Title:

Clusters and the Context for Competitive Advantage: a Strategic Analysis of the Engineering & Tooling Cluster

Researcher:

Luís Neto, master's degree finalist in Management and Industrial Strategy, Lisbon School of Economics & Management, University of Lisbon

1. I confirm that I understood the information provided about the study before the interview and that I had the opportunity to ask questions.	Please tick the box below ☐
2. I am aware that my participation is voluntary and that I am free to withdraw at any time without giving reasons.	Please tick the box below ☐
3. I agreed to take part in the study.	Please tick the appropriate box Yes ☐ No ☐
4. I agreed to the interview being audio-recorded.	Please tick the appropriate box Yes ☐ No ☐
5. I agreed to the use of my personal identification, if necessary, when using quotations in the dissertation to be published.	Please tick the appropriate box Yes ☐ No ☐
6. I reiterate my interest in receiving the final version of the dissertation.	Please tick the appropriate box Yes ☐ No ☐

Name of participant: Date: Signature:

Luís Neto (researcher) Date: Signature:

Source: Lewis, Saunders & Thornhill (2012), adapted.

Appendix J – Interview Protocol (Pool-net)

Interviewee's Profile	Interviewee: Rui Tocha, MSc Position: General Manager Organisation: Pool-net – Portuguese Tooling & Plastics Network Date: 09/01/2017
Introduction	This research seeks to understand the ways in which the microeconomic business environment and public policy have promoted competitive advantages in the Engineering & Tooling cluster. This interview aims to grasp the effects of the Pool-net association on the cluster's competitive advantage, as well as to gain insight into its viewpoint on the quality of the microeconomic business environment and the external effects of government policies.
Group I: Effects of the Pool-net Association on the Cluster's Competitive Advantage **(H3)**	• Have the relationships between the Pool-net association and cluster firms been of great importance to the R&D efforts of the latter? Why? • Why cannot the activities of a cluster association, like Pool-net's, be performed efficiently by governments or firms? • What factors have hindered Pool-net's ability to efficiently manage the public-private funds? • In the last 4 years, which types of cluster initiatives have been the focus of the Pool-net association with a view to promoting firms' competitive advantage?
Group II: Effects of the Microeconomic Business Environment on Firms' Competitive Advantage **(H1-H4)**	• Is the Engineering & Tooling cluster characterised by intense rivalry between firms? Why? • Has the set of specialised facilities in the E&T cluster been sufficient to meet the needs expressed by cluster firms? Why? • Have business associations in the E&T cluster, such as CEFAMOL, fostered firms' competitive advantage? Why? • In your view, which RTD, engineering, and manufacturing capabilities have enabled the Engineering & Tooling cluster to sustain its innovative capacity? ○ In your opinion, how can these capabilities support the cluster in overcoming two major obstacles, particularly its strong dependence on the automotive industry and the price-based competition imposed by East Asian toolmakers?
Group III: Effects of the Government Policy on the Cluster's Microeconomic Business Environment **(H5a-d)**	• In general, what is the degree of alignment between firms' projects, approved under the Portugal 2020 framework, and the cluster's action plan? • How has the Pool-net association improved the alignment between firms' projects, approved under the Portugal 2020 framework, and the cluster's action plan? • Do cluster firms typically have trust in the activities undertaken by the government? Why? • Has government policy been stable and predictable? Why? • Have cluster policies been a core element of the regional development policy? Why? • Have the financial instruments been made available in a timely manner in order to meet Pool-net's operational needs? Why?

Source: Author.

Appendix K – Interview Protocol (CCDRs)

Interviewees' Profile

Interviewees: Alexandra Rodrigues/ Rui Monteiro, MScs
Positions: Heads of the Regional Development Services
Organisations: CCDR-C/ CCDR-N
Dates: 10-07-2017/ 28-07-2017

Introduction

A presente investigação pretende analisar os efeitos da envolvente microeconómica e das políticas públicas na vantagem competitiva do *cluster Engineering & Tooling*. A presente entrevista, para efeitos do meu trabalho final de mestrado, visa avaliar a perspetiva e o contributo da CCDR-C/ CCDR-N relativamente aos efeitos referidos.

Group I: 'Efeitos das Políticas Públicas na Envolvente Micro-económica do *Cluster*' **(H5a-d)**

Quanto à perspetiva da CCDR-C/CCDR-N em relação aos efeitos das políticas públicas na envolvente microeconómica do *cluster*:

CCDRs

- As políticas públicas temáticas e regionais têm sido importantes para a vantagem competitiva do *cluster*? Porquê?
- Os sistemas de incentivos do Portugal 2020 (p.ex. ao abrigo do Programa Operacional Regional Centro 2020/ Norte 2020) e outros instrumentos de financiamento têm sido suficientes para promover as atividades e projetos de suporte à vantagem competitiva do *cluster*? Porquê?

CCDR Centro

No âmbito das políticas públicas regionais, alinhadas com a estratégia de desenvolvimento regional (CRER 2020) e sob coordenação da CCDR-C:

- Os domínios prioritários e linhas de ação do plano de ação regional promovem a vantagem competitiva do *cluster*? Porquê?
- Existe um forte alinhamento entre as opções assumidas em termos da estratégia de especialização inteligente da região Centro (RIS3 Centro) e o tipo de projetos de investimento em I&D+i estruturantes para a vantagem competitiva do *cluster*? Porquê?
- Os instrumentos e atividades de suporte à vantagem competitiva das indústrias (intensivas em tecnologia) do *cluster* são insuficientes face ao elevado peso de indústrias de baixa intensidade tecnológica na estrutura empresarial da região Centro? Porquê?

CCDR Norte

No que concerne às políticas públicas regionais enquadradas no programa operacional Norte 2020:

- Os objetivos temáticos e prioridades de investimento mobilizados pelo programa Norte 2020 promovem a vantagem competitiva empresarial do *cluster*? Porquê?
- Existe um forte alinhamento entre os domínios de especialização inteligente da região Norte e o tipo de projetos de investimento em I&D+i adequados às necessidades do *cluster*? Porquê?
- A RIS3 Norte tem promovido a vantagem competitiva do *cluster* mediante o desenvolvimento de sinergias intersetoriais (variedade relacionada)? Porquê?
- Uma vez que a estrutura produtiva da região Norte é dominada por indústrias de média-baixa intensidade tecnológica, os instrumentos de suporte à vantagem competitiva das indústrias do *cluster* têm sido suficientes? Porquê?

CCDRs

- Caso existam, que constrangimentos impedem o alinhamento entre as candidaturas de projetos do *cluster* em I&D+i e as linhas de ação da RIS3 Centro/Norte?
- Existe um esforço de coordenação entre a CCDR-C e a CCDR-N na implementação de políticas de suporte à vantagem competitiva do *cluster*?
- Observa-se alguma relação de conflitualidade entre os efeitos das políticas de suporte à vantagem competitiva do *cluster* implementadas pela CCDR-C e pela CCDR-N?

Group II: 'Efeitos dos Programas e Iniciativas de Suporte à Vantagem Competitiva do *Cluster* Dinamizados pela Pool-net' **(H3)**	**CCDRs**	Quanto à perspetiva da CCDR-C/CCDR-N em relação à eficácia dos programas e iniciativas de suporte à vantagem competitiva empresarial dinamizados pela associação Pool-net: • A relação entre a gestão da associação Pool-net e a base empresarial do *cluster* tem sido importante para a vantagem competitiva das empresas? Porquê? • As atividades desenvolvidas pela entidade gestora do *cluster* (Associação Pool-net) são mais eficazmente coordenadas pela entidade referida do que seriam pelo governo ou pelas empresas? Porquê? • Na sua opinião, existem obstáculos que comprometam a eficácia das atividades e iniciativas dinamizadas pela Associação Pool-net? Se sim, quais?

Source: Author.

Appendix L – Descriptive Statistics of Indicators and Statistical Tests

	(Univariate) Descriptive Statistics (Outliers Included)										**Normality Tests**						**Outlier Detection Results**		**Non-response Bias Analysis**	
	N	Mean		Std. Dev.	Variance	Skewness		Kurtosis		Shape Descriptors (α = .05; 2-tailed)		Shapiro-Wilk Test (α = .05; 2-tailed)			Kolmogorov-Smirnov Test* (α = .05; 2-tailed)			Mild	Extreme	Mann-Whitney U Test** (α = .05; 2-tailed)	
		Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error	Zskewness	Zkurtosis	Observed *W* value	df	Sig. value	Observed *D* value	df	Sig. value	No Cases	No Cases	Observed *U* value	Exact Sig. value
FC																					
FC1	168	3.55	.081	1.054	1.111	-.530	.187	-.625	.373	-2.804	-1.654	.858	168	0.000	.297	168	0.000	4	0	2280.500	.154
FC2	168	3.25	.092	1.188	1.410	-.280	.187	-1.125	.373	-1.482	-2.976	.864	168	0.000	.278	168	0.000	0	0	2529.000	.656
FC3	168	3.52	.860	1.111	1.233	-.550	.187	-.716	.373	-2.910	-1.894	.851	168	0.000	.305	168	0.000	0	0	2377.000	.296
FC4	168	3.45	.083	1.077	1.159	-.574	.187	-.592	.373	-3.037	-1.566	.853	168	0.000	.308	168	0.000	8	0	2289.500	.161
FC5	168	3.41	.089	1.160	1.345	-.479	.187	-.888	.373	-2.535	-2.349	.854	168	0.000	.301	168	0.000	0	0	2580.000	.805
FC6	168	3.32	.097	1.254	1.573	-.298	.187	-1.188	.373	-1.577	-3.143	.863	168	0.000	.271	168	0.000	0	0	2615.500	.909
SSR																					
SSR1	168	3.66	.080	1.043	1.088	-.852	.187	.034	.373	-4.508	.090	.824	168	0.000	.336	168	0.000	6	0	2291.500	.157
SSR2	168	3.21	.087	1.122	1.259	-.175	.187	-.977	.373	-.926	-2.585	.893	168	0.000	.234	168	0.000	0	0	2245.500	.127
SSR3	168	3.14	.091	1.180	1.393	-.037	.187	-1.028	.373	-.196	-2.720	.904	168	0.000	.195	168	0.000	0	0	2454.500	.472
SSR4	168	3.59	.062	.799	.639	-1.060	.187	1.607	.373	-5.457	4.136	.914	168	0.000	.154	168	0.000	9	0	2378.500	.324
RSI																					
RSI1	168	3.24	.093	1.201	1.443	-.293	.187	-1.069	.373	-1.550	-2.828	.877	168	0.000	.265	168	0.000	0	0	2217.500	.101
RSI2	168	3.29	.093	1.211	1.465	-.455	.187	-.972	.373	-2.408	-2.572	.856	168	0.000	.298	168	0.000	0	0	2260.500	.135
RSI3	168	3.26	.091	1.180	1.392	-.279	.187	-1.137	.373	-1.476	-3.008	.860	168	0.000	.282	168	0.000	0	0	2415.500	.374
RSI4	168	3.24	.088	1.140	1.299	-.370	.187	-.904	.373	-1.958	-2.392	.877	168	0.000	.270	168	0.000	0	0	2291.000	.173
DC																					
DC1	168	2.92	.083	1.080	1.167	.167	.187	-1.160	.373	.884	-3.069	.856	168	0.000	.266	168	0.000	0	0	2355.000	.259
DC2	168	3.24	.087	1.133	1.284	-.306	.187	-1.006	.373	-1.619	-2.662	.871	168	0.000	.273	168	0.000	0	0	2328.500	.222
DC3	168	3.14	.087	1.128	1.273	-.159	.187	-1.004	.373	-.841	-2.656	.891	168	0.000	.235	168	0.000	0	0	2358.000	.274

DC4	168	3.34	.088	1.136	1.291	-.277	.187	-1.019	.373	-1.466	-2.696	.877	168	0.000	.261	168	0.000	0	0	2148.000	.056
G																					
G1	168	3.14	.096	1.249	1.560	-.050	.187	-1.277	.373	-.265	-3.379	.874	168	0.000	.236	168	0.000	0	0	2572.500	.784
G2	168	3.24	.092	1.196	1.431	-.355	.187	-1.172	.373	-1.878	-3.101	.834	168	0.000	.314	168	0.000	0	0	2545.000	.693
G3	168	3.49	.091	1.179	1.389	-.538	.187	-.821	.373	-2.847	-2.172	.853	168	0.000	.299	168	0.000	0	0	2439.500	.428
G4	168	3.12	.094	1.218	1.483	-.150	.187	-1.332	.373	-.794	-3.524	.840	168	0.000	.289	168	0.000	0	0	2534.500	.666
G5	168	3.38	.090	1.162	1.351	-.390	.187	-1.014	.373	-2.064	-2.683	.856	168	0.000	.292	168	0.000	0	0	2448.000	.446
G6	168	3.26	.092	1.199	1.437	-.296	.187	-1.101	.373	-1.566	-2.913	.869	168	0.000	.274	168	0.000	0	0	2488.000	.545
G7	168	3.17	.091	1.182	1.397	-.020	.187	-1.189	.373	-.106	-3.146	.881	168	0.000	.224	168	0.000	0	0	2483.000	.531
G8	168	3.33	.091	1.182	1.397	-.321	.187	-1.086	.373	-1.699	-2.873	.864	168	0.000	.279	168	0.000	0	0	2524.000	.639
G9	168	3.26	.092	1.195	1.428	-.158	.187	-1.248	.373	-.836	-3.302	.862	168	0.000	.261	168	0.000	0	0	2537.500	.680
G10	168	3.26	.096	1.239	1.536	-.148	.187	-1.269	.373	-.783	-3.357	.868	168	0.000	.248	168	0.000	0	0	2521.000	.634
G11	168	3.15	.091	1.177	1.385	-.070	.187	-1.270	.373	-.370	-3.360	.858	168	0.000	.259	168	0.000	0	0	2430.500	.408
G12	168	2.95	.089	1.157	1.339	.164	.187	-1.224	.373	.868	-3.238	.857	168	0.000	.271	168	0.000	0	0	2337.500	.238
CA																					
CA1	168	3.32	.093	1.209	1.463	-.320	.187	-1.165	.373	-1.693	-3.082	.851	168	0.000	.292	168	0.000	0	0	2469.000	.497
CA2	168	3.48	.089	1.148	1.317	-.473	.187	-.855	.373	-2.503	-2.262	.862	168	0.000	.287	168	0.000	0	0	2579.500	.796
CA3	168	3.04	.085	1.102	1.214	.026	.187	-1.302	.373	.138	-3.445	.839	168	0.000	.262	168	0.000	0	0	2555.500	.725
CA4	168	3.38	.092	1.188	1.411	-.233	.187	-1.129	.373	-1.233	-2.987	.879	168	0.000	.241	168	0.000	0	0	2398.000	.348
CA5	168	3.46	.087	1.126	1.268	-.508	.187	-.798	.373	-2.688	-2.111	.854	168	0.000	.302	168	0.000	0	0	2616.500	.902
CA6	168	3.34	.090	1.168	1.363	-.256	.187	-1.135	.373	-1.355	-3.003	.866	168	0.000	.268	168	0.000	0	0	2262.000	.141
CA7	168	3.27	.094	1.221	1.491	-.267	.187	-1.147	.373	-1.413	-3.035	.870	168	0.000	.267	168	0.000	0	0	2400.500	.349
CA8	168	3.29	.091	1.175	1.381	-.228	.187	-1.086	.373	-1.206	-2.873	.881	168	0.000	.250	168	0.000	0	0	2279.000	.163
CA9	168	3.43	.088	1.140	1.300	-.582	.187	-.781	.373	-3.080	-2.066	.831	168	0.000	.329	168	0.000	0	0	2411.000	.354

Notes:

*** 1.** Lilliefors Significance Correction (Lilliefors, 1967);

**** 2.** The Mann-Whitney test (Mann & Whitney, 1947) was performed for all indicators to test whether the first 126 respondents (75% of the final sample) had the same distribution as the last 42 respondents (25% of the final sample). The results reported above reveal a *p-value* > 0.05 for all indicators. Thus, the null hypothesis of equality of distributions is not rejected at the 0.05 level of significance and it can therefore be concluded that the non-response bias is not an issue in this research.

Source: Author's calculations using IBM SPSS Statistics (v.23).

Appendix M – CTA-PLS Results

Tetrads of constructs' measurement models	Residual Values	Bootstrap Standard Errors (SE)	Bootstrap *t* Values	*p-values*	90% Confidence Intervals*
FC:					
$\tau_{FC1,FC2,FC3,FC4}$	0.282	0.085	3.307*	0.001	[0.067, 0.499]
$\tau_{FC1,FC2,FC4,FC3}$	0.317	0.086	3.671*	0.000	[0.100, 0.538]
$\tau_{FC1,FC2,FC3,FC5}$	0.278	0.083	3.345*	0.001	[0.069, 0.491]
$\tau_{FC1,FC3,FC5,FC2}$	0.020	0.029	0.693	0.488	[-0.052, 0.094]
$\tau_{FC1,FC2,FC3,FC6}$	0.391	0.104	3.776*	0.000	[0.132, 0.658]
$\tau_{FC1,FC2,FC4,FC5}$	0.305	0.091	3.368*	0.001	[0.078, 0.539]
$\tau_{FC1,FC2,FC5,FC6}$	0.533	0.128	4.158*	0.000	[0.214, 0.865]
$\tau_{FC1,FC3,FC4,FC6}$	-0.089	0.064	1.384	0.166	[-0.253, 0.073]
$\tau_{FC1,FC3,FC6,FC5}$	0.178	0.087	2.055*	0.040	[-0.039, 0.401]
SSR:					
$\tau_{SSR1,SSR2,SSR3,SSR4}$	0.074	0.033	2.268*	0.012	[0.012, 0.139]
$\tau_{SSR1,SSR2,SSR4,SSR3}$	0.054	0.038	1.411	0.079	[-0.020, 0.130]
RSI:					
$\tau_{RSI1,RSI2,RSI3,RSI4}$	-0.269	0.114	2.361*	0.018	[-0.495, -0.048]
$\tau_{RSI1,RSI2,RSI4,RSI3}$	0.092	0.066	1.406	0.160	[-0.034, 0.224]
DC:					
$\tau_{DC1,DC2,DC3,DC4}$	0.167	0.062	2.696*	0.007	[0.048, 0.292]
$\tau_{DC1,DC2,DC4,DC3}$	0.154	0.066	2.333*	0.020	[0.027, 0.285]
G:					
$\tau_{G1,G10,G11,G12}$	-0.214	0.106	2.028*	0.043	[-0.548, 0.110]
$\tau_{G1,G10,G12,G11}$	-0.182	0.105	1.732*	0.083	[-0.512, 0.141]
$\tau_{G1,G10,G11,G2}$	0.502	0.152	3.294*	0.001	[0.039, 0.988]
$\tau_{G1,G11,G2,G10}$	-0.034	0.092	0.370	0.711	[-0.321, 0.255]
$\tau_{G1,G10,G11,G4}$	0.160	0.141	1.140	0.254	[-0.275, 0.601]
$\tau_{G1,G10,G11,G5}$	0.316	0.120	2.625*	0.009	[-0.055, 0.695]
$\tau_{G1,G10,G6,G11}$	0.272	0.117	2.322*	0.020	[-0.089, 0.640]
$\tau_{G1,G10,G7,G11}$	0.051	0.110	0.465	0.642	[-0.287, 0.395]
$\tau_{G1,G11,G8,G10}$	0.100	0.076	1.321	0.187	[-0.132, 0.340]
$\tau_{G1,G11,G9,G10}$	0.069	0.074	0.940	0.347	[-0.159, 0.301]
$\tau_{G1,G10,G12,G3}$	0.072	0.105	0.688	0.491	[-0.250, 0.403]
$\tau_{G1,G12,G3,G10}$	-0.014	0.050	0.286	0.775	[-0.170, 0.139]
$\tau_{G1,G10,G12,G6}$	0.032	0.115	0.282	0.778	[-0.324, 0.390]
$\tau_{G1,G10,G12,G7}$	0.264	0.113	2.342*	0.019	[-0.082, 0.621]
$\tau_{G1,G10,G8,G12}$	0.201	0.111	1.818*	0.069	[-0.138, 0.552]
$\tau_{G1,G10,G2,G4}$	0.300	0.130	2.319*	0.020	[-0.098, 0.709]
$\tau_{G1,G10,G5,G2}$	0.330	0.137	2.418*	0.016	[-0.089, 0.762]
$\tau_{G1,G10,G2,G6}$	0.169	0.134	1.257	0.209	[-0.247, 0.590]

$\tau_{G1,G10,G2,G8}$	0.151	0.140	1.077	0.282	[-0.285, 0.588]
$\tau_{G1,G3,G5,G10}$	-0.072	0.052	1.398	0.162	[-0.234, 0.089]
$\tau_{G1,G10,G3,G7}$	-0.195	0.111	1.766*	0.077	[-0.542, 0.147]
$\tau_{G1,G10,G4,G7}$	0.026	0.123	0.209	0.834	[-0.356, 0.411]
$\tau_{G1,G4,G7,G10}$	0.111	0.065	1.718*	0.086	[-0.089, 0.316]
$\tau_{G1,G4,G9,G10}$	0.090	0.074	1.225	0.221	[-0.137, 0.321]
$\tau_{G1,G11,G12,G5}$	-0.093	0.094	0.997	0.319	[-0.383, 0.200]
$\tau_{G1,G11,G2,G8}$	-0.073	0.074	0.982	0.326	[-0.305, 0.158]
$\tau_{G1,G11,G9,G2}$	-0.092	0.092	0.998	0.318	[-0.383, 0.192]
$\tau_{G1,G3,G5,G11}$	0.010	0.072	0.138	0.891	[-0.212, 0.236]
$\tau_{G1,G11,G8,G3}$	0.181	0.087	2.079*	0.038	[-0.085, 0.457]
$\tau_{G1,G11,G3,G9}$	0.063	0.078	0.800	0.424	[-0.180, 0.308]
$\tau_{G1,G11,G5,G4}$	0.013	0.077	0.164	0.870	[-0.226, 0.256]
$\tau_{G1,G8,G9,G11}$	-0.071	0.072	0.987	0.324	[-0.295, 0.151]
$\tau_{G1,G12,G3,G5}$	0.114	0.075	1.527	0.127	[-0.119, 0.346]
$\tau_{G1,G4,G8,G12}$	0.162	0.077	2.106*	0.035	[-0.075, 0.405]
$\tau_{G1,G12,G6,G8}$	0.218	0.106	2.051*	0.040	[-0.112, 0.550]
$\tau_{G1,G8,G9,G12}$	-0.024	0.059	0.410	0.682	[-0.207, 0.157]
$\tau_{G1,G3,G8,G2}$	0.058	0.065	0.900	0.368	[-0.142, 0.261]
$\tau_{G1,G4,G7,G2}$	-0.033	0.077	0.426	0.670	[-0.273, 0.208]
$\tau_{G1,G2,G7,G9}$	-0.023	0.070	0.327	0.744	[-0.242, 0.196]
$\tau_{G1,G2,G9,G8}$	0.166	0.098	1.687*	0.092	[-0.138, 0.475]
$\tau_{G1,G5,G6,G3}$	0.134	0.069	1.938*	0.053	[-0.080, 0.350]
$\tau_{G1,G3,G8,G5}$	0.161	0.086	1.869*	0.062	[-0.104, 0.431]
$\tau_{G1,G4,G8,G6}$	0.345	0.130	2.657*	0.008	[-0.056, 0.752]
$\tau_{G1,G4,G8,G7}$	-0.003	0.082	0.036	0.971	[-0.256, 0.252]
$\tau_{G10,G11,G4,G3}$	0.027	0.084	0.319	0.750	[-0.233, 0.291]
$\tau_{G10,G11,G5,G6}$	0.253	0.100	2.542*	0.011	[-0.054, 0.566]
$\tau_{G10,G11,G6,G7}$	-0.029	0.081	0.365	0.715	[-0.283, 0.220]
$\tau_{G10,G11,G6,G8}$	0.316	0.128	2.470*	0.014	[-0.079, 0.718]
$\tau_{G10,G2,G6,G9}$	0.010	0.070	0.137	0.891	[-0.209, 0.228]
$\tau_{G10,G3,G8,G4}$	-0.022	0.071	0.318	0.751	[-0.244, 0.195]
$\tau_{G11,G4,G8,G9}$	0.077	0.096	0.802	0.422	[-0.219, 0.377]
$\tau_{G11,G7,G9,G5}$	0.080	0.060	1.329	0.184	[-0.107, 0.269]
$\tau_{G12,G2,G9,G5}$	-0.103	0.074	1.406	0.160	[-0.334, 0.124]
$\tau_{G12,G2,G6,G7}$	-0.026	0.033	0.782	0.434	[-0.130, 0.078]
CA:					
$\tau_{CA1,CA2,CA3,CA4}$	0.258	0.078	3.288*	0.001	[0.036, 0.491]
$\tau_{CA1,CA2,CA4,CA3}$	0.156	0.095	1.639	0.101	[-0.116, 0.435]
$\tau_{CA1,CA2,CA3,CA5}$	0.066	0.097	0.680	0.496	[-0.212, 0.353]
$\tau_{CA1,CA3,CA5,CA2}$	0.015	0.084	0.176	0.861	[-0.233, 0.256]
$\tau_{CA1,CA3,CA6,CA2}$	-0.092	0.067	1.377	0.169	[-0.289, 0.097]
$\tau_{CA1,CA2,CA3,CA7}$	0.116	0.072	1.604	0.109	[-0.089, 0.331]
$\tau_{CA1,CA2,CA3,CA8}$	0.363	0.087	4.175*	0.000	[0.117, 0.622]

$\tau_{CA1,CA2,CA9,CA3}$	-0.039	0.062	0.625	0.532	[-0.219, 0.141]
$\tau_{CA1,CA2,CA5,CA4}$	-0.009	0.050	0.182	0.856	[-0.153, 0.135]
$\tau_{CA1,CA2,CA7,CA4}$	0.277	0.100	2.756*	0.006	[-0.011, 0.572]
$\tau_{CA1,CA2,CA8,CA4}$	0.605	0.129	4.681*	0.000	[0.240, 0.990]
$\tau_{CA1,CA4,CA9,CA2}$	0.297	0.083	3.588*	0.000	[0.060, 0.540]
$\tau_{CA1,CA2,CA8,CA5}$	-0.180	0.094	1.916*	0.055	[-0.455, 0.091]
$\tau_{CA1,CA2,CA7,CA6}$	-0.161	0.083	1.934*	0.053	[-0.405, 0.078]
$\tau_{CA1,CA2,CA6,CA8}$	0.042	0.081	0.522	0.601	[-0.191, 0.277]
$\tau_{CA1,CA6,CA8,CA2}$	-0.074	0.070	1.054	0.292	[-0.278, 0.130]
$\tau_{CA1,CA7,CA8,CA2}$	-0.067	0.071	0.945	0.344	[-0.274, 0.140]
$\tau_{CA1,CA4,CA5,CA6}$	-0.052	0.071	0.739	0.460	[-0.260, 0.151]
$\tau_{CA1,CA4,CA7,CA5}$	0.118	0.067	1.765*	0.078	[-0.075, 0.311]
$\tau_{CA1,CA4,CA7,CA9}$	0.053	0.071	0.742	0.458	[-0.153, 0.258]
$\tau_{CA1,CA4,CA9,CA8}$	-0.581	0.127	4.571*	0.000	[-0.957, -0.220]
$\tau_{CA1,CA5,CA8,CA7}$	0.106	0.073	1.449	0.147	[-0.105, 0.321]
$\tau_{CA1,CA5,CA7,CA9}$	-0.096	0.089	1.071	0.284	[-0.355, 0.163]
$\tau_{CA1,CA6,CA9,CA7}$	0.190	0.089	2.140*	0.032	[-0.063, 0.452]
$\tau_{CA1,CA8,CA9,CA6}$	0.042	0.072	0.577	0.564	[-0.169, 0.251]
$\tau_{CA2,CA4,CA6,CA3}$	-0.173	0.068	2.563*	0.010	[-0.373, 0.020]
$\tau_{CA2,CA6,CA8,CA4}$	0.506	0.119	4.258*	0.000	[0.170, 0.860]

Significant at the $*p < 0.1$ level (two-tailed test, following the general convention, as pointed out by Gudergan *et al*., 2008; 5,000 bootstrap subsamples, as recommended by Hair *et al.*, 2017).

Notes:

1. The CTA-PLS test draws upon the concept of tetrads (τ), *i.e*., the difference between the product of a random pair of covariances and the product of another random pair (Bollen & Ting, 2000);

***2.** The adjustment of the 90% bias corrected bootstrap (two-tailed) confidence interval limits uses the Bonferroni correction due to the increased risk of a type I error when performing multiple statistical tests. This method of multiple testing correction adjusts the *p-values* associated with each individual test in order to maintain the $\propto = 0.1$ level in all tests (Armstrong, 2014).

Source: Author's calculations using SmartPLS (v. 3.2.7) and based on the guidelines provided by Hair *et al.* (2017) and Gudergan *et al.* (2008).

Appendix N – Redundancy Analysis

	Path Coefficients (β)	*t* Values	*p-values*	95% BCa Confidence Intervals
$G \rightarrow G_{GSI}$	0.821	17.656*	.000	[0.706, 0.895]
$FC \rightarrow FC_{GSI}$	0.850	35.055*	.000	[0.785, 0.888]
$SSR \rightarrow SSR_{GSI}$	0.787	22.774*	.000	[0.701, 0.843]
$RSI \rightarrow RSI_{GSI}$	0.865	43.213*	.000	[0.818, 0.898]
$DC \rightarrow DC_{GSI}$	0.815	32.028*	.000	[0.751, 0.855]
$CA \rightarrow CA_{GSI}$	0.876	42.001*	.000	[0.819, 0.906]

Significant at the $*p < 0.001$ level (two-tailed test and 5,000 bootstrap subsamples, following the general convention, as recommended by Hair *et al.*, 2017).

Notes: GSI = global single item; BCa = Bias-corrected and accelerated bootstrap.

Source: Author's calculations using SmartPLS (v. 3.2.7).

Appendix O – Overview of the Formative Measurement Models Evaluation

Formative Measurement Models Evaluation

Construct	Indicator	Outer VIF Values (<3.3)	Outer Weights Significance Testing			
			Outer Weight (Outer Loading)	*t* Value	*p-value*	95% BCa Confidence Interval
Factor (Input) Conditions (FC)	FC1	1.652	0.134 (0.429)	1.619	0.106	[-0.029, 0.299]
	FC2	1.538	0.007 (0.333)	0.092	0.927	[-0.142, 0.164]
	FC3	1.572	0.085 (0.645)	1.007	0.314	[-0.080, 0.251]
	FC4	1.496	0.348 (0.706)	3.599***	0.000	[0.161, 0.547]
	FC5	1.756	0.137 (0.729)	1.439	0.150	[-0.055, 0.314]
	FC6	1.777	0.612 (0.882)	5.627***	0.000	[0.398, 0.812]
Firm Strategy, Structure and Local Rivalry (SSR)	SSR1	1.156	0.579 (0.782)	5.946***	0.000	[0.381, 0.762]
	SSR2	1.186	0.326 (0.607)	2.997**	0.003	[0.126, 0.556]
	SSR3	1.056	0.508 (0.674)	4.965***	0.000	[0.302, 0.694]
	SSR4	1.034	0.093 (0.073)	1.196	0.232	[-0.054, 0.254]
Related and Supporting Industries (RSI)	RSI1	2.260	0.361 (0.830)	3.443***	0.001	[0.155, 0.570]
	RSI2	1.912	-0.020 (0.655)	0.184	0.854	[-0.239, 0.191]
	RSI3	1.744	0.290 (0.756)	3.698***	0.000	[0.132, 0.442]
	RSI4	1.722	0.570 (0.867)	6.062***	0.000	[0.386, 0.752]
Demand Conditions (DC)	DC1	1.240	0.091 (0.426)	0.586	0.558	[-0.218, 0.398]
	DC2	1.186	0.326 (0.476)	2.012*	0.044	[0.007, 0.637]
	DC3	1.127	0.555 (0.769)	3.980***	0.000	[0.279, 0.819]
	DC4	1.150	0.512 (0.741)	3.790***	0.000	[0.246, 0.766]
Government (G)	G1	2.249	-0.015 (0.609)	0.217	0.828	[-0.162, 0.118]
	G2	1.870	0.132 (0.663)	1.536	0.125	[-0.036, 0.299]
	G3	1.417	0.304 (0.693)	4.378***	0.000	[0.173, 0.445]
	G4	1.444	0.165 (0.595)	2.767**	0.006	[0.057, 0.287]
	G5	1.638	0.160 (0.593)	2.451*	0.014	[0.035, 0.293]
	G6	1.588	-0.031 (0.428)	0.431	0.667	[-0.166, 0.109]
	G7	1.235	0.124 (0.333)	1.997*	0.046	[0.002, 0.246]
	G8	2.005	0.151 (0.641)	2.099*	0.036	[0.002, 0.286]
	G9	1.280	0.129 (0.523)	1.845	0.065	[0.000, 0.278]
	G10	2.175	0.238 (0.691)	2.899**	0.004	[0.080, 0.396]
	G11	2.121	0.204 (0.742)	2.486*	0.013	[0.032, 0.356]
	G12	1.284	0.034 (0.288)	0.512	0.609	[-0.097, 0.162]
Competitive Advantage (CA)	CA1	1.855	0.372 (0.822)	3.720***	0.000	[0.200, 0.588]
	CA2	2.713	-0.052 (0.679)	0.650	0.515	[-0.212, 0.103]
	CA3	1.535	0.017 (0.323)	0.345	0.730	[-0.076, 0.118]
	CA4	3.002	0.065 (0.479)	0.648	0.517	[-0.108, 0.290]
	CA5	1.996	0.342 (0.661)	3.870***	0.000	[0.169, 0.519]
	CA6	1.695	0.160 (0.609)	1.946	0.052	[0.009, 0.329]
	CA7	1.755	0.264 (0.736)	3.376***	0.001	[0.119, 0.428]
	CA8	2.942	0.020 (0.371)	0.256	0.798	[-0.153, 0.165]
	CA9	1.952	0.229 (0.730)	2.650**	0.008	[0.082, 0.424]

Significant at the $*p < 0.05$, $**p < 0.01$, $***p < 0.001$ level (two-tailed test and 5,000 bootstrap subsamples, following the general convention, as recommended by Hair *et al.*, 2017).

Note: BCa = Bias-corrected and accelerated bootstrap.

Source: Author's calculations using SmartPLS (v. 3.2.7).

Appendix P – Overview of the Structural Model Evaluation

Structural Model Evaluation			
Criteria:	Inner VIF Values	R^2	f^2
Requirement Level / Construct	<3.3	Min. >0.25; >0.5; >0.75	Min. ≥0.02; ≥0.15; ≥0.35
Factor (Input) Conditions (FC)	2.350	0.535	0.489
Firm Strategy, Structure and Local Rivalry (SSR)	1.737	0.491	0.248
Related and Supporting Industries (RSI)	1.963	0.564	0.278
Demand Conditions (DC)	1.319	0.303	0.020
Competitive Advantage (CA)	n/a	0.833	n/a
Government (G)	→ FC: 1.000 → SSR: 1.000 → RSI: 1.000 → DC: 1.000	n/a	→ FC: 1.149 → SSR: 0.964 → RSI: 1.295 → DC: 0.436

Source: Author's calculations using SmartPLS (v. 3.2.7) and based on Fraß (2016).