# Extended Summary

It is important to measure Innovative Capability (IC) through multidimensional constructs, which are more reliable than using one generic concept, since it enables the capture of complementarities among ICs key dimensions (Vicente et al. 2015).

The aim of this thesis is to obtain a theoretical model that accommodates these multidimensional constructs with the variables tested in the literature. It enables the identification and modelling of ICs that drive firms' innovation performance (IP) by presenting the building blocks, assumptions, and validity of the firm's capability-based model (Alves et al. 2017). Capabilities are complex patterns of routines, skills and accumulated knowledge that over time come to be embedded as organisational routines and practices (Teece et al., 1997).

This study defines IC as the skills and knowledge needed to effectively absorb, master and improve existing technologies, and to create new ones **(A)** (e.g. Romijn & Albaladejo, 2002) by aligning the strategic orientation **(B)** with innovative behaviours and technological processes (e.g. Vicente et al. 2015). It involves internal capabilities to interpret market, to respond and interact appropriately with the external environment (e.g. Alves et al. 2017) and with technological knowledge **(C)**. Additionally, it also includes coordination of all internal and external stakeholders, resources and capabilities within the innovation process **(D)** (e.g. Zawislak et al. 2012). Each of these elements is necessary, to create a superior IC (Teece et al. 1997, Zawislak et al. 2012). In other words, IC is a complementary capability supported by Technology Development Capability (A); Strategy Capability (B); Transactional Capability (C); and Management Capability (D).

IP measurements should consider how these internal capabilities contribute to the firm's IP (Alves et al. 2017) and how important is their complementary nature for a greater IP (Zawislak et al. 2012). IP corresponds to economic gains that arise from the introduction of new products, processes, equipment, organizational forms, and commercial market approaches that lead to extraordinary profits (Alves et al. 2017). This is measured by the increase of net income, market-share and sales (Alves et al. 2017).

Regarding the relationship between IC and IP, this study follows literature suggestions arguing that the first will positively and directly influence the latter (Calantone et al. 2002, Yam et al. 2011, Alves et al. 2017, Ferreira et al. 2018, etc.).

Firm's IC and IP vary according to different firm's characteristics. Older firms are more likely to employ knowledge learned and convert it into innovation activities, while the challenge is for young firms, starting from scratch, to quickly set up not only everyday operating routines but also higher-level ICs (Coad et al. 2016).

There is evidence on the positive effect of firm age on the likelihood of superior and innovative outcomes (Calantone et al. 2002) because older firms tend to perform worst due to organizational inertia which constrains the firm's ability to change, potentially hindering learning effects (Coad et al. 2016).

On the other hand, smaller firms can better understand, assimilate knowledge flows and have fluid communication between managers and lower level employees; thus, IC is more likely to increase directly via close employee–manager relationships (Çakar & Ertürk 2010). In larger companies' IC is more likely to be facilitated and increased through formal procedures of employee participation and knowledge sharing (Çakar & Ertürk 2010). Regarding IP, smaller firms have less human and financial resources, yet the benefits of innovation projects in small firms could not be identified easily (Yam et al. 2004).

The population surveyed is the Portuguese Transformation Industry and the instrument is an anonymous questionnaire written in Portuguese. The questionnaire is divided in 3 blocks (see Table I): first block consisted of four descriptive questions such as firm's age, sector, number of employees and job position of the respondent; the second block is divided in 4 expected factors with 35 items in total; and fourth block consisted of 3 questions regarding IP (Alves et al. 2017). The questionnaire reached 381 responses with an average response rate of 7%.

The sample is non-parametric as expected, since all items represent qualitive variables (Marôco 2014). Afterwards, Spearman correlation was obtained in order to flag problems regarding multicollinearity and non-significant correlations.

Factor analysis was performed and used to describe variations among observed variables in terms of fewer unobserved variables called factors (Um et al. 2011). The extracted method is the Principal Axis Factor and is recommended when the data violate the assumption of multivariate normality (Yong & Pearce, 2013). Then, the rotation method used was Direct Oblimin, which is an oblique method that allows the factors to correlate (Yong & Pearce, 2013). This facilitates and enables the interpretation of factors.

The final solution of EFA was obtained and it identified the items that corresponded to each underlying factor (Table II). They were used to test if there were any distribution differences across different groups of age and dimensions of the sampled firms. Regarding age, Mann-Whittney (MW) test was performed, while the Kruskal-Wallis (KW) test was performed for firm's size.

The EFA showed that all the initial expected factors are significant except for the MC. This result confirms that the ability to implement new managerial regulations, systems, methods, social and cognitive developments, through the task of coordination, it is not always present in enterprise settings (Teece, 2007). This is a common result in dynamic capabilities' literature (Alves et al. 2017) and the same happened for the surveyed firms.

All IC factors are positively correlated, meaning that the degree of interdependence between these capabilities is a source of competitive advantage due to synergies resulting from their joint implementation (Teece et al., 1997). In other words, DC, SC and TC are complementary because, in order to improve firm's innovative capabilities, the firm must enhance all innovative capabilities instead of focusing only in one of these capabilities (Zawislak et al. 2012, 2013).

However, the association between IC and IP is weak but positive. It might indicate that there are other ways to improve IP, e.g. resources. One possible explanation is that the consequences of the difficulties of Portuguese companies to incorporate into their strategy innovations developed by them or in partnership might be one of the reasons why the sampled firms have weak innovative routines and abilities that would enable them to successfully design and develop innovations and perform better at innovation (Godinho, 2016). So, the characteristics of the sampled firms must be considered like the relative composition of the Portuguese business environment as a function of the number of SMEs with reduced capabilities, small number of large companies, etc (Laranja. 2007). This must be considered due to the number of smaller firms in the sample.

For firm's age there are differences in the DC. The mean ranks are higher for younger companies indicating that there is a stronger necessity to establish an efficient mechanism for rapidly internalizing knowledge (Calantone et al. 2002). So, absorptive capacity for young firms is more important because their stocks of firm-specific knowledge are fixed at zero (Coad et al. 2016). Regarding firm's dimension, the 2 factors (TC and IP) and the 2 SC items (B.2.2 and B.4.2) have differences in distribution with contrary directions: for TC and IP, larger the firm implies larger mean ranks; while for the SC items the smaller the firm the higher the rank.

Therefore, managers from the sampled firms should strategically encourage new ideas to channel the creative ability of employees in order to face their limitations and environment challenges (Çakar & Ertürk 2010). However, they must consider firm's age and size and think how they enhance their firm uniqueness and learning capability in relation to these characteristics. Finally, the merit of the thesis is the ability of including a wide range of variables that many authors proved their importance for firm's IC.

Table I Items of the questionnaire

| Factors | Variables | *Items* | Authors |
|---|---|---|---|
| Development of tehcnology Capability | R&D Capability | *A.1.1 Our company is fast converting ideas into marketable products / services.* | Iddris 2016 |
| | | *A.1.2 The company has the ability to develop its own products / services.* | Alves et al. 2017 |
| | Absorptive Capability | *A.2.1 The personnel of our company are able to quickly and meticulously acquire new knowledge required by the job.* | Liao 2007 |
| | | *A.2.2 Company employees have the ability to use the knowledge acquired.* | Liao 2007 |
| | Implementation | *A.3.1 We often develop ideas that drive radical changes in products / services.* | Wang et al. 2008, Bjorkdahl & Borjesson 2012 |
| | | *A.3.2 Often our company develops incremental improvements in its products / services.* | Wang et al. 2008, Bjorkdahl & Borjesson 2012 |
| | HR Skills | *A.4.1 The personnel of our company have superior work skills than those of our competitors.* | Liao 2007 |
| | | *A.4.2 Company employees have higher academic qualifications than our competitors.* | Liao 2007 |
| Strategy Capability | Shared Vision | *B.1.1 Our company's strategy is well understood by all workers.* | Bjorkdahl & Borjesson 2012 |
| | | *B.1.2 Employees see themselves as partners in outlining the direction / vision of the organization.* | Calantone et al. 2002 |
| | Leadership Style | *B.2.1 Top managers / supervisors actively support investment in innovation.* | Bjorkdahl & Borjesson 2012 |
| | | *B.2.2 If an employee wants to try new ways of doing things, he or she gets a lot of support from the supervisor / top manager.* | Iddris 2016 |
| | Strategic Planning | *B.3.1 The company has the ability to identify internal strengths and weaknesses as well as external opportunities and threats.* | Yam et al. 2004 |
| | | *B.3.2 Our company has a well-articulated innovation strategy.* | Bjorkdahl & Borjesson 2012 |
| | Strategic Human Management | *B.4.1 In our recruitment and training policies, we look for workers to be able to question how things are done in the company.* | Bjorkdahl & Borjesson 2012, Alves et al. 2017 |
| | | *B.4.2 Our company encourages employees to think "out of the box"* | Iddris 2016 |
| Transactional Capability | Marketing Capability | *C.1.1 Our company actively monitors the environment to identify key trends, factors and market threats.* | Bjorkdahl & Borjesson 2012 |
| | | *C.1.2 Our company tests the market for innovative ideas, product / service concepts and consumer preferences according to their requirements.* | Guan et al. 2003 |
| | Network/Interactions Capability | *C.2.1 Our company takes the opportunity to build and develop customer contacts.* | Bjorkdahl & Borjesson 2012 |
| | | *C.2.1 Our company takes the opportunity to build and develop contacts with suppliers.* | Bjorkdahl & Borjesson 2012 |
| | | *C.2.2 The company has the ability to learn and collaborate with universities, consultants, and R&D or Technology centers* | Wang et al. 2008, Iddris 2016 |
| | Entrepreneurial Orientation | *C.3.1 Our company is rapidly launching new products / services to export.* | Ribau et al. 2017 |
| | | *C.3.2 We often look for new foreign markets* | Vicente et al. 2015 |
| Management capability | Knowledge Sharing | *D.1.1 The Company Always Analyzes Less Successful Organizational Efforts and Broadly Communicates Lessons Learned* | Calantone et al. 2002 |
| | | *D.1.2 It is common practice to share know-how, experience and knowledge among company employees.* | Lin 2007, Kumar 2012, Akhavan 2015, Liao 2007 |
| | Empowerment | *D.2.1 I believe I can have a positive impact within the company.* | Çakar & Ertürk 2010 |
| | | *D.2.2 Decisions are usually made at the level where the best information is available.* | Çakar & Ertürk 2010 |
| | Uncertainty Avoidance | *D.3.1 The company sponsor projects even when technical and / or commercial uncertainty is high.* | Bjorkdahl & Borjesson 2012 |
| | | *D.3.2 In our company, the requirement for standardized work procedures is more important than providing opportunities to be innovative.* | Çakar & Ertürk 2010 |
| | System and decision rules | *D.4.1 Our company has established decision rules to withdraw funds and cancel projects.* | Bjorkdahl & Borjesson 2012 |
| | | *D.4.2 A business concept is agreed upon before any major investment in a project.* | Bjorkdahl & Borjesson 2012 |
| | Idea Management | *D.5.1 Our company has a structured way to gather and deal with ideas.* | Bjorkdahl & Borjesson 2012 |
| | | *D.5.2 All proposed ideas are accompanied by the company.* | Bjorkdahl & Borjesson 2012 |
| | Resource Allocation | *D.6.1 Our company has established criteria on how to allocate financial resources to projects.* | Bjorkdahl & Borjesson 2012 |
| | | *D.6.2 The company is prepared to direct new human and financial resources to support ventures that have resulted from our innovation path.* | Iddris 2016 |
| Innovation Performance | | *Our company has had positive net results in the last three years.* | Alves et al. 2017 |
| | | *Our company has seen an increase in market share over the last three years.* | Alves et al. 2017 |
| | | *Our company has experienced increased revenues over the past three years.* | Alves et al. 2017 |

Table II Factor loadings, Cronbach Alphas, AVE and CR

| Factors | Items | Loadings |
|---|---|---|
| Strategy Capability (nº1) | *B.2.1 Top management actively supports investment in innovation* | 0,62 |
| | *B.2.2 We get a lot of support from managers if we want to try new ways of doing things* | 0,788 |
| | *B.4.1 In our recruitment and training policies, we look for workers to be able to question how things are done in the company.* | 0,686 |
| | *B.4.2 Our company encourages employees to think "out of the box"* | 0,851 |
| | Alpha = 0,856 | |
| | AVE= 0,550; AVE^(1/2)= 0,792; CR= 0,821 | |
| Development Capability (nº4) | *A.2.1 The personnel of our company are able to quickly and meticulously acquire new knowledge required by the job.* | 0,746 |
| | *A.2.2 Company employees have the ability to use the knowledge gained* | 0,928 |
| | Alpha = 0,835 | |
| | AVE= 0,837; AVE^(1/2)=0,915 ;CR= 0,828 | |
| Transactional Capability (nº3) | *C.2.2. The company has the ability to learn and collaborate with universities, consultants, and R&D or Technology centers* | 0,439 |
| | *C.3.1 Our company quickly launches new products / services to export.* | 0,805 |
| | *C.3.2 We often look for new foreign markets* | 0,88 |
| | Alpha = 0,779 | |
| | AVE= 0,539; AVE^(1/2)=0,734; CR= 0,765 | |
| Innovation Performance (nº2) | *IP.1 Our company has had positive net results in the last three years.* | 0,649 |
| | *IP.2 Our company has seen an increase in market share over the last three years.* | 0,832 |
| | *IP.3 Our company has experienced increased revenues over the past three years.* | 0,872 |
| | Alpha = 0,826 | |
| | AVE= 0,625; AVE^(1/2)=0,791; CR= 0,831 | |