How much does firm-specific intellectual capital vary? Cross-industry and cross-national comparison

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Abstract: This study examines the level of firm-specific intellectual capital (IC) and then goes on to find out whether there are differences across national and industry contexts in this regard. The study focuses on firms in two European countries, Finland and Spain, and on low- and high-tech sectors. Utilizing survey data, we analyzed six different categories of intellectual capital with multiple-item scales, tested for their reliability and validity, and compared the means of IC categories between high- and low-tech firms in Finland and Spain. The findings show that the level of IC in high-tech firms is sufficiently similar in Finland and Spain, while in the low-tech sector there are major differences. Furthermore, we find that in Spain there are more major differences in IC between high- and low-tech firms than in the case of Finnish firms. Overall, this study provides new understanding of how IC varies across countries and industries.

Keywords: Intellectual capital, national differences, Finland, Spain, high-tech, low-tech.

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1. Introduction

Intellectual capital (IC) and its measurement have been increasingly discussed in both academia and practice, since knowledge-based resources are seen to be a main driving force behind organizational value creation (Nonaka and Takeuchi, 1995; Grant, 1996; Spender, 1996). For the purposes of this research, IC is defined as the sum of all knowledge firms use to achieve competitiveness and potential competitive advantage (Nahapiet and Ghoshal, 1998; Youndt et al., 2004; Subramanian and Youndt, 2005). In order to understand this phenomenon better, we will analyze empirically the levels of different IC categories between two demographically different countries (Finland and Spain), as well as two notably different industry sectors (low-tech and high-tech). We expect that socio-cultural differences between countries may influence firms' intellectual capital, since they affect many fundamental issues, such as autonomy, hierarchy and social relations (Hofstede et al., 2010). For technology-intensity, a common way to differentiate between high- and low-tech firms is their level of R&D (Hauknes and Knell, 2009; OECD, 2011). This links strongly to the intellectual capital discussion in that high level of R&D intensity is connected to firms' tendency to acquire, assimilate and apply knowledge (Cohen and Levinthal, 1990).

While the existing research on intellectual capital has provided understanding of the differences in IC in firms (e.g. Wu et al., 2008; Aramburu and Sáenz, 2011; Guo et al., 2011) and nations (e.g. Lin and Edvinsson, 2011; Seleim and Bontis, 2013; Chew et al., 2014), we still do not understand the phenomenon in its full complexity. In fact, we are missing the understanding of *how firm-specific intellectual capital varies when socio-cultural and technological contexts are taken into account*. Our study then proceeds to answer this research question. We will utilize survey data collected in the two countries and psychometrically robust scales developed to capture the essence of firm-specific intellectual capital in different categories. Our approach to intellectual capital covers a variety of classic and more recent dimensions, including human capital, internal and external relational capital, structural capital, renewal capital and entrepreneurial capital (see e.g. Edvinsson and Malone, 1997; Bontis, 1998; Erikson, 2002; Kianto et al., 2010).

Finland and Spain differ both economically and culturally. The selection is based on our aim to compare whether such factors make a difference in the intellectual capital of firms in these countries. In addition, as both are EU and Euro-area countries, this offers the chance to collect comparable data from firms from both high- and low-tech sectors. From an economic perspective, Finland and Spain differ considerably in terms of technology-orientation and R&D. Based on the latest OECD figures (OECD, 2015), Finland ranks no. 4 in the world in spending on R&D (3.31% of GDP in the year 2013), while Spain (1.24% of GDP) is well below the OECD average (2.4% of GDP). Furthermore, the Innovation Union Scoreboard 2015 (whose focus is mainly on technological innovation) places Finland among the EU28 innovation leaders (i.e. those countries whose innovation performance is well above the EU28 average), whereas Spain belongs to the group of "moderate innovators" (i.e. those countries whose innovation performance is below the EU28 average). As proof of this, Spain shows a much lower proportion of R&D investment in the business sector (49 points below the EU28 average) compared to Finland (which is 78 points above the average), and a much lower amount of PCT patent

applications. In this respect, Spain is 59 points below the EU28 average, whereas Finland is 148 points above this average (European Commission, 2015).

As the current economic crisis reveals, poor performance in the science and technology domain goes hand-in-hand with greater difficulties in coping with economic downturns and increasing pressure from emergent economies. Indeed, the relevance of knowledge and technology for economic growth has been long considered in the field of Economics (Schumpeter, 1934; Solow, 1957; Augier and Teece, 2005). Along these lines, those countries rich in terms of knowledge intensive activities should be the winners in terms of wealth creation (Edvinsson and Bounfour, 2004). In a recent study by Lin and Edvinsson comparing the national intellectual capital of 40 countries (both developed and emergent economies), these authors found a strong correlation between the level of national intellectual capital and GDP (Lin and Edvinsson, 2011), suggesting that such an index is not only an indicator of future wealth creation capabilities, but also has good explanation power for current financial performance. Likewise, in their study of 148 developing countries, Seleim and Bontis (2013) found that national intellectual capital explains 70% of the variance in economic performance in those countries.

In keeping with the above, although both Finland and Spain have been affected by the recent economic downturn, the situation in Spain is much more dramatic. The unemployment rate in June 2015 was 22.6%, compared to 9.5% in Finland and, according to the last data available (2012 and 2013, respectively) the relative poverty rate in Spain is double that of Finland (14% versus 7%). Moreover, the Central Government gross debt as a % of GDP for 2014 represented the extremely high amount of 115.81% in Spain, compared to only 71.05% in Finland (OECD, 2015). Based on these statistics, we expect that there could be major differences in terms of IC between firms in Finland and Spain in both low- and high-tech sectors.

In the remainder of the study, we will first discuss how intellectual capital can be assessed at the firm-level, followed by a discussion on the role of national culture (especially in Finland and Spain) as well as the high- vs. low-tech industry context on IC. This is followed by an empirical study exploring these differences. The study ends with a discussion of the results, and implications for theory, practice and policy, as well as recognition of limitations and suggestions for further research.

2. Intellectual capital and the role of cultural and industry context

2.1 Categorizing firm-specific intellectual capital

Organizational performance is increasingly based on knowledge-related issues. The greater complexity of intangible resources over tangible ones makes this type of resource more difficult to imitate and, therefore, a more likely basis for the generation of competitive advantages (e.g. Grant, 1996; Lerro et al., 2014). The seminal academic discussions addressing this phenomenon revolve around the concept of intellectual capital (IC). In most studies IC has been seen to consist of three elements – human capital, structural capital and relational capital – based on a sufficiently established categorization (e.g. Edvinsson and Malone, 1997; Bontis, 1998).

Human capital is thought of as being the living and thinking part of intangible resources (Marr, 2006). They do not appear on corporate balance sheets because people are not owned: they offer their services under employment contracts (Grant, 2008). It includes the knowledge, skills and abilities residing within and utilized by individuals (Schultz, 1961; Youndt et al., 2004), as well as their attitudes, motivation and commitment (Marr, 2006; Inkinen, 2015).

Conversely, structural capital refers to the knowledge and other intangible resources that stay within the company when the employees have left (Roos et al., 1997; Bontis et al., 2000; CIC, 2003). This category seems to overlap with the notion of organizational capital, as both concepts have been used interchangeably since early IC studies (Inkinen, 2015). The latter has been conceptualized as the institutionalized knowledge and codified experience (i.e. "explicit knowledge") residing within and utilized through databases, patents, manuals, structures, systems and processes (Youndt et al., 2004).

Thirdly, relational capital refers to all resources and activities linked to the company's relationships with different stakeholders (Meritum Project, 2002). This is very close to the notion of social capital, which refers to the knowledge embedded within, available through and utilized by interactions among individuals and their networks of interrelationships (Nahapiet and Ghoshal, 1998). In our case, both the knowledge available through internal relationships (i.e. internal relational capital) and external relationships (i.e. external relational capital) will be studied.

However, according to recent studies, there are also other dimensions that could be seen as parts of IC. Thus, we expand the focus further to include renewal capital and entrepreneurial capital. "Renewal capital" refers to the organization's potential to continuously renew its activities through learning, acquiring new skills and creatively changing its operations (Kianto et al., 2010), whereas "entrepreneurial capital" can be conceptualized as the competence and commitment related to entrepreneurial activities in the organization (see Erikson, 2002). As Lerro et al. (2014) point out, the dynamic and renewal potential are increasingly important aspects of intellectual capital.

While both concepts – renewal capital and entrepreneurial capital – have been coined earlier, they have been used very infrequently in IC research. In this study, our goal is to conceptualize and measure both of them within the broader IC framework, in an attempt to find a valid measurement of different facets of IC without overlaps between the concepts and their measurement. Thus, while both renewal capital and entrepreneurial capital have not been used in most IC frameworks, we expect them to be independent and important components that add value and explanatory power to the "traditional" 3-way categorization.

2.2 Intellectual capital and socio-cultural context

Cultural values are shared, abstract ideas about what a social collectivity views as good, right and desirable (Williams, 1970). Hence, they represent the broad goals that members of a collectivity are encouraged to pursue, and serve to justify actions taken in pursuit of these goals (Schwartz, 1999; Sagiv and Schwartz, 2007). Considering that organizations are embedded in societies, the surrounding societal or national culture is an important external influence on

organizational culture (Trice and Beyer, 1993; Dickson et al., 2000; Hofstede and Peterson, 2000; Sagiv and Schwartz, 2000, 2007). As a result, organizational cultures tend to develop and evolve in ways that are compatible with the societal culture in which they are embedded (Sagiv and Schwartz, 2007).

In accordance with this argumentation, it could be expected that the socio-cultural context of the firm could affect its IC. Along these lines, Long and Fahey (2000) suggest that, among other things, culture shapes assumptions about which knowledge is important, mediates the relationships between individual and organizational levels of knowledge, creates a context for social interaction and shapes the creation and adoption of new knowledge (Cegarra-Navarro and Sánchez-Polo, 2010).

Based on previous work that suggested that all societies face the same basic problems but differ in their answers to them (Inkeles and Levinson, 1969), Hofstede (1984) analyzed value differences in more than 50 countries and identified four basic dimensions of national culture that were closely related to the different ways of responding to those common basic problems worldwide: relation to authority, conception of self and the way of dealing with conflicts, including the control of aggression and the expression of feelings (Inkeles and Levinson, 1969; Hofstede et al., 2010). These cultural dimensions were named by Hofstede as power distance (from small to large), collectivism versus individualism, femininity versus masculinity and uncertainty avoidance (from weak to strong). Latter studies (e.g. Minkov, 2007) suggested the existence of two additional dimensions: long-term versus short-term normative orientation and indulgency versus restraint. An explanation of each dimension is provided below (Hofstede et al., 2010), together with the positioning of Finland and Spain in each of them (The Hofstede Centre, 2015) and their potential implications in terms of intellectual capital development.

Power distance refers to the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally. With a score of 57 in this dimension, Spain would be considered a hierarchical society (i.e. a society with high power distance), whereas with a score of 33 Finland would not be. From an organizational perspective, in large-power-distance countries there is a high dependence of subordinates on bosses, organizations centralize power as much as possible in a few hands, formal rules are extremely relevant and subordinates expect to be told what to do (actually, the ideal boss is a benevolent autocrat). Under these circumstances, there is little room for showing initiative and exploring new ways of doing things (i.e. entrepreneurial and renewal capital are harder to develop), while codification of knowledge in the form of rules and procedures (i.e. structural capital) would be largely encouraged. Conversely, in a small-power-distance situation, superiors and subordinates consider each other as existentially equal (the hierarchical system is just an inequality of roles established for convenience), managers facilitate and empower, there is a high degree of decentralization and there is a preference for consultation (i.e. subordinates expect to be consulted before a decision is made that affects their work). Thus, vertical relationships are encouraged, which should help to develop internal relational capital.

Moving on to the second dimension, individualistic societies are characterized by loose ties between individuals (people are expected to look only after him- or herself and after his or her immediate family), while in collectivist societies people from birth onward are integrated into

strong and cohesive in-groups, which throughout people's lifetime continue to protect them in exchange for loyalty. With a score of 51 in terms of individualism, Spain is considered to be the most collectivist country in Europe together with Portugal, while with a score of 63, Finland is a more individualistic society. From an organizational perspective, management in individualistic societies refers to the management of individuals, while in collectivist societies it refers to the management of groups. Teamwork is considered as something totally natural in such societies (i.e. collectivist societies) and there is a natural tendency to cooperate (i.e. relational capital develops naturally). As Hofstede et al. (2010) point out, in collectivist societies personal relationships prevail over the task and should be established first, whereas in individualistic societies the task is supposed to prevail over any personal relationship. As a result, poor performance of an employee in a collectivist society is no reason for dismissal, whereas in individualistic societies is a socially accepted reason for terminating a working relationship. Consistently with this idea, and according to Hofstede et al. (2010), in collectivist societies managers frequently feel very uncomfortable when they have to discuss performance appraisal openly with subordinates, as this could affect harmony at the workplace and may be felt by subordinates as an affront to their reputation. Hence, human capital development and improvement could be seriously hindered by this kind of attitudes. In the same vein, Hofstede et al. (2010) found that training programs have almost exclusively been developed in individualistic countries, which again affects human capital quality and its development.

Thirdly, a society is considered to be masculine when emotional gender roles are clearly distinct – in particular, when men are supposed to be assertive, tough and focused on material success and women are expected to be more modest, tender and concerned with quality of life. On the contrary, a society is considered to be feminine when emotional gender roles overlap (i.e. when both men and women are supposed to be modest, tender and concerned with quality of life). With a score of 42 and 26 respectively in terms of masculinity, both Spain and Finland are considered to be feminine societies, although this femininity is much more pronounced in the Finnish case. This dimension affects the way of handling conflicts at the workplace. In the case of masculine societies the approach is towards "may the best man win", while in feminine societies there is a preference for resolving conflicts by compromise and negotiation. In the same vein, feminine societies give great relevance to mutual help and social contacts at work. Thus, nurturing relational capital is a key aspect in such societies.

Turning now to the fourth dimension, uncertainty avoidance refers to the extent to which the members of a culture feel threatened by ambiguous or unknown situations. With a score of 86, this dimension defines Spain very clearly. The Finnish score in this domain is 59, which also reveals a preference for avoiding uncertainty, although not as extreme as in the case of the Spanish culture. According to Hofstede et al. (2010), in uncertainty avoiding societies, there is an emotional need for laws and regulations (which recalls the notion of codified knowledge and structural capital), although this could lead to rule-oriented behavior that is purely ritual, inconsistent or even dysfunctional. In such societies, people have been programmed since early childhood to feel comfortable in structured environments, while in low uncertainty avoiding countries, ambiguity and chaos are sometimes praised as conditions for creativity. Thus, it seems that in societies with high levels of uncertainty avoidance, where changes cause stress and security is an important element in individual motivation, entrepreneurial and renewal capital will find it more difficult to develop.

As for the fifth dimension, long-term orientation involves fostering pragmatic virtues oriented towards future rewards, such as perseverance, thrift and adapting to changing circumstances. Conversely, short-term orientation involves fostering virtues linked to the past and present, such as national pride, respect for tradition, preserving reputation and fulfilling social obligations. With a score of 48 and 38 respectively in terms of long-term orientation, both Spain and Finland are considered to be short-term- and normative-oriented cultures. As Hofstede et al. (2010) point out, values linked to long-term orientation support entrepreneurial activity. In particular, perseverance in the pursuit of goals is an essential asset for an entrepreneur; thrift leads to savings and the availability of funds for reinvestment; and adapting to changing and unexpected circumstances is essential when launching a new business. On the contrary, short-term-oriented decisions could lead to myopia and hasty adoption and quick abandonment of novel ideas. Similarly, sticking to tradition (another characteristic of short-term-oriented societies) could be another barrier for the development of entrepreneurial and renewal capital.

Lastly, indulgence involves a tendency to allow relatively free gratification of basic and natural human desires related to enjoying life and having fun, while restraint reflects a conviction that such gratification needs to be regulated by strict social norms. With a low score of 44 in terms of indulgency, Spain is closer to being a restrained society, whereas with a score of 57 in this dimension, Finland is considered to be an indulgent society. People in such societies (i.e. indulgent societies) show a positive attitude and have a tendency towards optimism, whereas people in restrained societies have a tendency towards cynicism and pessimism. Showing a positive attitude and being optimistic facilitates relationships with different people (i.e. developing relational capital) and trying new ventures (i.e. entrepreneurial capital), while the opposite does not. Additionally, a society that is indulgent with past mistakes makes it easier to face the risk of failure linked to new businesses.

Thus, according to the above, what differences could be expected between Finland and Spain in terms of IC development, based-on the socio-cultural characteristics of both countries? As far as human capital is concerned, the more individualistic nature of Finnish society could lead to superior development of human capital. In terms of structural capital, however, the heavier reliance of hierarchical and uncertainty avoiding societies (as is the case with Spain) on rules and procedures could lead to a greater emphasis on the promotion of codification processes, and hence on the development of structural capital. As for relational capital, the more collectivist nature of Spanish culture could translate into the natural development of such capital, although this could be partly offset by its high power distance and lower femininity and indulgence. Lastly, as far as renewal and entrepreneurial capital are concerned, the low power distance existing in Finnish culture, together with the greater tolerance towards uncertainty and the indulgent nature of such culture would involve higher levels of both renewal and entrepreneurial capital, although the more intense short-term orientation of Finnish society could partly offset this trend.

This paper will show whether IC differences between Finland and Spain (and the subsequent differences they imply in organizational practices) are consistent with national cultural differences between both countries.

2.3 Intellectual capital and the role of technology-intensity

In the context of this paper, the discussion of technology-intensity is closely linked to firm-specific activities in R&D (Research & Development). As a matter of fact, the classification of companies in medium-high and high technology firms (i.e. high-tech companies) and in medium-low and low technology firms (i.e. low-tech companies) utilized in this study is based on the technology-intensity classification of industries suggested by the OECD and EUROSTAT. To develop this classification, industries were ranked according to their average over 1991-99 against aggregate OECD R&D intensities (R&D expenditure divided by value added and R&D expenditure divided by production). Industries included in higher categories have a higher R&D average intensity for both indicators, whereas industries included in lower categories have a lower one (OECD, 2011).

Hence, given the R&D-based operationalization of technology-intensity, a clear connection could be established between technology-intensity as utilized in this paper and the generation and acquisition of new technological knowledge. According to Cohen and Levinthal (1990), R&D not only generates new knowledge, but also contributes to the firm's absorptive capacity (i.e. the ability of a firm to recognize the value of new, external information, assimilate it and apply it to commercial ends). Related to this, it is widely suggested that an organization's capability to innovate (i.e. to generate new knowledge) is closely related to its intellectual capital or its ability to use its knowledge resources (Nonaka and Takeuchi, 1995; Stewart, 1997; Madhavan and Grover, 1998; Subramaniam and Youndt, 2005). Thus, companies in which R&D and technological innovation play a more prominent role (i.e. high-tech firms) should place greater emphasis on nurturing their intellectual capital.

On the one hand, technology-intensive industries are characterized by rapid advances in science and technology requiring that firms move very quickly to sustain a technological edge and bring new products to the market (De Carolis, 2010). As a result, entrepreneurial capital (i.e. the ability to identify new opportunities, show initiative, and react and make quick and bold decisions) and renewal capital (i.e. the ability to learn new things) become highly relevant.

Moreover, technology-intensity usually involves knowledge of more complex and tacit nature. Complex knowledge refers to knowledge that has many underlying components, or many interdependencies between those components, or both (Schilling, 2011). Such knowledge requires a more skilled and qualified workforce (i.e. superior human capital) and could be made more understandable through codification (i.e. the development of structural capital). However, much technological knowledge remains tacit and only incompletely reflected in written and graphic explanations (Nelson and Wright, 1992; Rosenbloom, 2010). Under these circumstances, fostering interaction among individuals (i.e. developing social capital), both inside and outside the firm, becomes a crucial aspect, together with learning-by-using and learning-by-doing mechanisms (Rosenberg, 1982). For instance, knowledge that users of complex products gain from experience helps them to identify more clearly which features of a product are more valuable. For this then to be translated into design improvements, a two-way interaction between technology producers and users is needed (Rosenbloom, 2010). Additionally, collaborative research is especially relevant in high-tech industries, where it is unlikely that a single

organization will possess all the resources and capabilities necessary to develop and implement a significant innovation (Schilling, 2011).

3. Methods

3.1 Sample and data collection

We used two survey datasets using the same items. The first survey data was collected in Finland in 2013 by means of a structured questionnaire, using the key-informant technique. The initial population comprised a cross-industry sample of Finnish companies that included all firms with at least 100 employees. The Intellia database was utilized to identify the companies. A total of 1,523 companies were considered suitable for the initial sample. All the eligible firms were contacted by an external research company by telephone and the person in charge of the human resources was asked to respond to the questionnaire. Confidentiality was emphasized and a summary of the results was promised to the respondents. Out of the 1,523 companies 259 responses were received, representing a response rate of 17.0 per cent (259/1,523). Most of the respondents held positions such as HR director or manager (77.9 %), other director or manager (8.8 %) or managing director (6.9 %), indicating their expertise and key position regarding the issues of intellectual capital and performance. The companies in the sample represented a wide variety of industries, including manufacturing (37.8 %), wholesale and retail trade (16.2 %), miscellaneous services (9.7 %), transportation and storage (8.1%), administrative and support service activities (8.0 %), information and communication (6.9 %), and construction (6.9 %), as well as professional, scientific and technical activities (6.9 %). This distribution among different sectors corresponds quite closely to that of Finnish companies as a whole, and thus we believe that the sample is sufficiently representative.

The second dataset is composed of Spanish companies with at least 100 employees and the data collecting period extended from October 2013 to January 2015. SABI database was utilized to select the initial sample of companies, which amounted to a total of 1,289 firms, as well as to gather the necessary financial data. A junior researcher was appointed to conduct the data collection, using the same questionnaire as in Finland. Confidentiality was guaranteed to all potential participants, to whom clear instructions concerning the way in which the collected data would be used were always offered. Moreover, a summary of the results obtained was proffered to participants. Out of the 700 companies that were contacted, 180 took part in the project (response rate of 25.71%). A significant amount of companies took part through phone interviews, whereas other firms opted to send the completed questionnaire by email. The vast majority of respondents (89.44%) held a position of responsibility in their respective company, and among them, 3.89% were managing directors, 67.22% human resource managers and 18.33% headed other company departments. Regarding the set of economic sectors represented in the sample, manufacturing and services constitute the main categories in the dataset, accounting for 45.56% and 47.22% of the firms respectively. Education and health account for 4.44% of the companies, construction for 1.67%; and extractive industries, energy and water for 1.11%.

3.2 Measures

Measures for IC stocks were both adapted from the previous literature and developed by the authors. Firstly, we conducted a thorough review of the literature. After that, in order to confirm the operational validity and psychometric robustness of the scales, we pre-tested the initial scales by means of statistical analyses with the sample of managers (N=151) collected from Finnish companies. In addition, we used an international panel of experts to assess the content validity of the scales and give their insights. Their suggestions were incorporated into the final scales.

The scale for internal relational capital was adapted from Kianto (2008) and inspired by Yang and Lin (2009). The external relational capital scale (2008), as well as the scale for structural capital (2008; 2010), were adapted from Kianto and her colleagues. The scale for human capital was based on the insights of Bontis (1998) and Yang and Lin (2009). The scale for renewal capital is based on work by Hughes and Morgan (2007) as well as Kianto et al. (2010) and García-Morales et al. (2006). Lastly, entrepreneurial capital is measured by the scale inspired by Hughes and Morgan (2007).

We tested the measurement model for IC by means of confirmatory factor analysis (CFA) with LISREL 8.50, and PRELIS 2.50 was used to compute the covariance matrix. We used the maximum likelihood estimation method and the proposed six factor solution was supported. Firstly, the measurement models in both samples produced a good fit. According e.g. to Hair et al. (2006), RMSEA should be around 0.06 and GFI, CFI, NNFI and IFI should reach 0.90. In both of our samples these limits are met (see Appendix 1).

Secondly, the CFA found that the loadings of all the items were high and statistically significant in both samples (see Appendix 1). This means that they were all related to their specified constructs, verifying the posited relationships among the indicators and constructs. In terms of construct reliability and Cronbach's alpha, all constructs exceeded the level of 0.70, with the exceptions of structural (CR = 0.63; alpha = 0.62) and renewal capital (CR = 0.61; alpha = 0.60) in the Finnish sample. However, they reached the lowest acceptable level (0.60: Hair et al., 2006) and the results concerning those should be taken as suggestive.

The final model consists of 16 items that cover six IC stocks: internal (3 items) and external (3 items) relational capital, structural capital (3 items), human capital (2 items), renewal capital (2 items), and entrepreneurial capital (3 items). All of the measures were based on a five-point Likert scale (1-strongly disagree, 5-strongly agree). See Appendix 1 for the measures and the wording of the items.

4. Results

4.1 Correlation analyses

Tables 1 and 2 present the correlation matrices of the measures used in the two studies. It can be seen from the tables that the items are related to each other, which is intuitive since they are all

parts of overall IC. However, at the same time they are clearly independent factors, as none of the bivariate correlations could be considered as being particularly high.

INSERT TABLE 1 ABOUT HERE

INSERT TABLE 2 ABOUT HERE

4.2 Testing the mean differences

Firstly, we tested whether there are differences in general between medium-low and low technology (low-tech) and medium-high and high technology (high-tech) companies. For the classification we utilized the sector approach (i.e. a comprehensive list of the branches of activity) originally presented by OECD (see section 2.3). In the Finnish sample we applied the NACE coding and in the Spanish one the CNAE 2009 coding for classification of the companies. In the Finnish sample the majority of the companies (85 per cent: 219 out of 259) operate in low-tech and 15 per cent (40/259) in high-tech branches. In the Spanish sample the distribution of the companies was more balanced: 52 per cent (93/180) were from the low-tech and 48 per cent (87/180) from the high-tech ones.

While sector classification is based on established industry coding schemes, and thus reliable on its own terms, we also did a robustness check with R&D intensity data collected through the survey, to see whether this classification reflects the planned division between high- and low-tech firms. R&D intensity was collected from the survey respondents as the assessed share of R&D staff of all employees. In comparing the low- and high-tech firms with both the Spanish and Finnish sample, we found in both cases that R&D intensity was substantially higher (and the difference statistically significant) in high tech-firms. This confirms our expectation of the different profiles of the companies divided according to the industry classification approach.

After categorizing the firms in two categories, we utilized t-tests in order to statistically test the differences of means between low and high-tech firms (see Table 3).

INSERT TABLE 3 ABOUT HERE

The results obtained show that all IC stocks are statistically significantly higher in high-tech firms (i.e. generally speaking, high-tech companies possess more IC than low-tech firms). Most of the differences were under the 0.01 significance level. However, in internal relational (0.07) and structural capital (0.08), the significance level only reached the level of 0.10.

Next, in order to research in-depth the possible effect of the level of technology on IC, we tested the differences between low technology and high technology companies in Finland and Spain (see Tables 4 and 5).

INSERT TABLE 4 ABOUT HERE

INSERT TABLE 5 ABOUT HERE

In the Finnish sample, the only statistically significant difference between low- and high-tech companies was in entrepreneurial capital. It was evaluated as being 0.23 (sig. 0.014) higher by the representatives of high-tech companies.

In the Spanish sample, there were far more differences between low- and high-tech companies. Human, renewal as well as entrepreneurial capital were all higher in high-tech firms with significance levels of 0.000, 0.009, and 0.024, respectively. Overall, the results in Tables 4-5 suggest that firms in Spain are much more starkly separated in their level of IC when it comes to low- and high tech-firms, while in Finland these two sectors are closer to each other.

Furthermore, in order to see whether national context might have an effect on the level of IC in the two sectors, we tested the differences in both low technology and high technology companies between Finland and Spain (see Tables 6 and 7).

INSERT TABLE 6 ABOUT HERE

INSERT TABLE 7 ABOUT HERE

The results for the low technology companies show that for three of the studied six IC stocks there were statistically significant differences between Finland and Spain. Both internal and external relational capital were evaluated higher in Spain than in Finland. The mean for Spain was 0.28 (sig. 0.001) higher in internal and 0.23 (sig. 0.003) higher in external relational capital. On the other hand, human capital was evaluated higher by representatives of Finnish companies. The mean value for Finnish firms was 0.21 (sig. 0.002) higher. According to our analyses there were no significant differences in the structural, renewal or entrepreneurial capital between the low technology firms in the two countries. In short, it seems that low-tech companies evidence major differences between countries in terms of their level of IC.

In comparing high technology firms between Finland and Spain, there seems to be hardly any differences. External relational capital was evaluated 0.17 higher in Spain but only at the significance level of 0.08. Thus, it can be argued that the level of IC in high-tech companies is quite similar in both countries

5. Discussion

The level of intellectual capital (IC) defines the capabilities, competitiveness, and growth potential of firms (e.g. Edvinsson and Malone, 1997; Bontis, 1998). In this study, with the help of broad-based survey evidence, our goal has been to understand how IC varies between firms in

two different European countries and in two distinctively different sectors (high-tech and low-tech). Such an understanding is helpful for scholars and practitioners trying to understand the competitiveness of individual firms, but also the competitiveness in the national and industry context. In fact, our study departs from existing studies in that it provides a unique outlook on both industrial and socio-cultural differences in terms of firm-specific IC categories.

Our results are partially expected, and partially surprising. Firstly, we find that there is a difference between low- and high-tech companies in the whole dataset involving both countries, in that the level of all dimensions of IC is higher for high-tech firms. This was expected, as high-tech firms are typically more knowledge-intensive, and operate in more demanding and dynamic business environments (Lazonick, 2005; De Carolis, 2010; Schilling, 2011). However, when we examine datasets in each country separately, we find that in Spain there are more major differences in IC between high- and low-tech firms than in the case of Finnish firms. For Spain, human capital, renewal capital and entrepreneurial capital are significantly lower for low-tech firms, whereas for Finland, only entrepreneurial capital is significantly lower in such firms. This is an interesting finding showing that in Spain, industry differences are starker, while in Finland, the firms across sectors are more homogeneous and possess less industry-specific features. The rather similar level of IC in Finnish low- and high-tech firms might be due to the skilled and knowledgeable employee and manager base in Finnish firms, regardless of their R&D and technology intensity. For instance, the recent Human Capital Index study by the World Economic Forum (WEF, 2015) suggested that Finland ranks as number one in the level of human capital globally. According to the report, this is because the wide base of talent is equally developed and distributed through the Finnish educational and national system. In any case, this interesting finding warrants further studies.

Secondly, when comparing the level of IC in high-tech and low-tech firms, we find that in high-tech firms it is sufficiently similar in Finland and Spain, while in the low-tech sector there are major differences. This is a very interesting finding, since it suggests that in high-tech firms, the socio-cultural issues are not definitive for IC. This could be explained by the fact that high-tech, knowledge-intensive firms are often internationally oriented and highly specialized actors with very specific capabilities (McKinsey and Co., 1993; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Rialp et al., 2005). Furthermore, such firms are typically networked within and across different industries, business ecosystems, and technological platforms (Cantwell and Janne, 1999; Cantwell and Santangelo, 1999; Powell and Grodal, 2005; Mudamby and Swift, 2010; Schilling, 2011).

Thirdly, for low-tech firms, however, the results tell a different story, as there the differences are tied much more closely to the socio-cultural country context. Spanish low-tech firms possess more internal and external relational capital than their Finnish counterparts. This finding suggests that both intra- and inter-organizational communication, collaboration and networking are more prominent features of Spanish low-tech firms than of the Finnish equivalent. This result is consistent with the much more collectivist nature of Spanish culture compared to the Finnish one. It also shows that other Finnish characteristics that could reinforce relational capital (e.g. the non-hierarchical participation in decision making, or the search of consensus and negotiation that corresponds to a feminine culture) are not enough to overcome the inhibiting role of an individualistic attitude. Furthermore, Spanish low-tech firms possess less human capital than

their Finnish equivalents. This is perhaps partially due to the broad-based talent development system that exists in Finland. It might also be a consequence of the prevalence of personal relationships over the task in collectivist societies (as is the case with Spain), which may hamper the usage of personal development systems at the workplace. As previously highlighted in the theoretical section, in such culture managers feel uncomfortable when they have to discuss performance appraisal openly with subordinates, which hinders human capital development. However, renewal and entrepreneurial capital do not show significant differences between Spanish and Finnish low-tech companies. In this case, although uncertainty avoidance (a key socio-cultural characteristic that could affect entrepreneurial and renewal orientation) is much higher in Spain than in Finland, both countries are considered to be uncertainty avoiding societies. Furthermore, although Finnish culture is more indulgent and low power distance could favor decentralization and empowerment of employees to develop their own initiatives, the more pronounced short-term orientation of the Finnish culture could offset this advantage vis-à-vis Spanish firms. In any case, the level of entrepreneurial capital is much lower than other IC components, both in Finland and in Spain.

In the following sections we will discuss the specific theoretical, practical and policy-related implications of our study, followed by limitations and future research suggestions.

5.1 Theoretical implications

The results provide interesting theoretical implications for several streams of literature. Firstly, the results contribute to intellectual capital (IC) literature from both a measurement and substance perspective. The fact that the measures for the six categories of IC work in both samples shows that there is value in adding the elements of renewal and entrepreneurial capital to the examination of firm-level IC. Classic models typically examine just three elements: human, structural and relational capital (see for instance Bontis, 1998; Dumay et al., 2013; Inkinen, 2015). Additionally, identifying how socio-cultural aspects could affect the development of different IC components is another specific contribution of our research: to our knowledge no previous study has addressed this issue in the past. Furthermore, considering IC differences in terms of technology intensity constitutes another differential aspect of our study that has not been sufficiently addressed in previous research. Several studies exist that analyze IC in high technology firms (e.g. Guo et al., 2012; Aramburu et al., 2015), but comparisons between high and low technology companies remain fairly underdeveloped.

The results also contribute to the stream of studies in international business and cross-cultural management (e.g. Hofstede, 1983; Sagiv and Schwartz, 2007; Hofstede et al., 2010; Pauleen et al., 2010). In particular, the results show peculiar national differences in intellectual capital, and suggest that these differences are related to mostly low-tech firms. This result has broad implications for international business and cross-cultural management research. Firstly, they complement the stream of studies suggesting that management practices should be culturally informed (Cheng, 2007; Sagiv and Schwartz, 2007; Pauleen et al., 2010). Our findings support such notion especially in low-tech firms, which are by nature more static than high-tech firms (Von Tunzelmann and Acha, 2005), and are often tied to local conditions and cultural norms (Madsen and Servais, 1997; Knight and Cavusgil, 2004). Secondly, the finding that high-tech firms do not possess major cultural differences between the two examined countries is an equally

interesting notion. While it does not suggest that cultural awareness would not matter, it provides scholars with a more complex and dynamic picture in assessing how high-tech companies operate within a specific context. An interesting question for further research is in fact to study the micro-dynamics of high-tech firms in more depth, and to understand whether their intellectual capital is fully firm-specific, and what role national context plays.

5.2 Practical implications

Based on the results, we suggest that cultural differences (or lack thereof) may be very helpful in explaining differences in IC components across countries. For high-tech firms, the national differences did not matter that much. This suggests that when management and leadership practices are designed in such firms, the main focus should be on firm-specific culture and developing the idiosyncratic resources and capabilities of the firm towards creating competitive advantages based on them. In addition, such high-tech firms (over 100 employees in our sample) are likely to be involved in international markets, but also possess access to international labor, which further sets the goal of IC development to firm-specific, rather than cultural features.

Among low tech firms, however, we found significant differences in several IC categories for firms in Finland and Spain. Being aware of such cultural features and their implications could help managers to define organizational policies that could offset cultural characteristics that hinder the development of an appropriate set of resources (IC components) for company success. For example, especially in Spain, encouraging risk taking through empowerment, performance assessment and reward policies could be very helpful, whereas in the case of Finland, collaboration enhancing initiatives (such as cross-functional interfaces, communities of practice or project-based organization) could be helpful to relationally complement the Finnish individualistic working styles. Furthermore, as Finnish firms score significantly lower in internal and external relational capital, management practices could be designed to incorporate easy-access ways to tap both internal and external networks in order to make connectivity and knowledge sharing more fluent. In the case of Spain, however, the need exists to improve human resource management systems. In particular, the implementation of development-oriented performance appraisal and the design of training programs tailored to the specific needs of employees (as identified in the performance assessment process) could be of great relevance, together with the implementation of coaching and career development initiatives. As the implementation of such practices (especially development conversations) could be very counter-cultural and may give rise to important resistance among employees, specific training and awareness programs will be needed in order to prepare managers and employees to go successfully through this process.

5.3 Policy implications

The results bring many interesting policy implications. Part of the results can be connected to the existing understanding on national distinctions, and some of the results provide implications for developing the national policies in terms of education and economic development.

In our study Spain shows better scores in *external and internal relational capital* in low-tech sectors than firms in Finland. As previously stated, this may be related to the higher tendency

towards collectivism versus individualism that could be found in Spanish culture. In collectivist societies, people belong to groups that take care of them in exchange of loyalty. As a consequence, teamwork is considered as something totally natural and employees tend to work in this way with no need for strong motivation from management. As we are dealing with values, reducing individualism (or rather encouraging connectivity) in Finnish society is a long-term task, and could be achieved through educational and cultural policies. These could include promotion of teamwork-based teaching methods in primary and higher education, as well as facilitating group-based networking activities and collaborative games besides individual level ranking and promotion.

The lower score obtained by Spanish firms in *human capital* for low-tech sectors is consistent with macroeconomic data on human resources, as reported in the Innovation Union Scoreboard 2015. According to the latter, the number of new doctorate graduates (ISCED 6) per 1000 population aged 25-35 in Spain is 22 points below the EU28 average, whereas in Finland is 50 points above. In the same vein, the percentage of youth aged 20-24 that have attained at least upper secondary level education in Spain is 21 points below the EU28 average, while in the case of Finland is 6 points above. Similarly, recent editions of the PISA report have highlighted the weaknesses of the Spanish education system, whereas that of Finland is considered one of the best in the world. Hence, generally speaking, human capital in Finland is placed under heavier scrutiny than in Spain, and this development is also shown in the current study's results in terms of greater human capital. For Spanish firms, the low level of human capital might pose a challenge in the long-run in terms of competitiveness in both at the European and global level. In order to change this situation, educational policies are once more crucial. It would be necessary to undertake a transformation of the whole education system aimed at improving the quality of education at all levels (from primary school to university), facilitating the access to higher education to a greater amount of population, and especially reducing the rate of early school leavers at the highest levels of the education system. The rate of early school leavers in Spain for youth aged 18-24 is 21.9%, which is well above the EU28 average of 11.1% in 2014 (Eustat, 2015).

Lastly, increasing entrepreneurial capital in low-tech firms is another relevant challenge to be addressed both in Finland and Spain. Thus, economic policies are needed (national, regional, and local) that focus on the promotion of entrepreneurship in low-tech industries. These policies could be complemented by educational policies oriented to the development of the abilities and capabilities needed to support entrepreneurial activity (e.g. creativity, risk assumption or dealing with uncertainty).

5.4 Limitations and future research directions

An obvious limitation of our study relates to its representativeness. The firms in our sample do not necessarily represent the whole countries' population of firms, since they represent only firms with at least 100 employees, and also might deviate from the overall population in other ways as well (e.g. in Spain the sample includes relatively more high-tech firms than in the whole population). However, we believe that the research design allows us to approach the main aims of our research in a sufficiently reliable way – that is, to compare the levels of IC simultaneously across socio-cultural and industrial contexts.

While this study adopted an approach to assess the levels of IC in different categories, many authors argue that it is relevant to also understand the flow and dynamics of IC, rather than the level itself. In fact, it has been suggested that research could incorporate the dynamic dimension of IC (Kianto, 2007). The static view of IC adopted in this paper is closer to the "classic" resource-based view of the firm, where the main interest lies in possessing valuable, rare, inimitable and non-substitutable resources (Barney, 1991). However, research has shown that the main value creation factor is how resources are exploited and explored, rather than what they are *per se* (Grant, 2008; Kianto, 2007; Teece, 2007, 2009; Kianto et al., 2014). Thus, specific practices aimed at acquiring or internally producing intangible resources, as well as at sustaining and improving the existing ones, could be further analyzed.

Future studies could also try to tackle the in-built limitations connected to our research design. As we have measured IC at the organizational level, our approach is inherently a "top-down" view of the organization. However, some studies could dig deeper and incorporate responses from multiple organizational actors, or even whole organizations. While such studies are difficult to conduct, they could provide a more fine-grained view of the IC measurement and IC perceptions around of the organization.

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Table 1 Correlation matrix for the Finnish sample (N=259)

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*
1. Internal relational capital	3.43	0.59					
2. External relational capital	3.56	0.56	0.375**				
3. Structural capital	3.63	0.63	0.371**	0.350**			
4. Human capital	4.01	0.54	0.380**	0.246**	0.367**		
5. Renewal capital	3.52	0.73	0.439**	0.383**	0.420**	0.470**	
6. Entrepreneurial capital	3.17	0.68	0.426**	0.323**	0.372**	0.447**	0.595**

Notes: ** Correlation is significant at the 0.01 level

Table 2 Correlation matrix for the Spanish sample (N=180)

	Mean	*SD*	*1*	*2*	*3*	*4*	*5*
1. Internal relational capital	3.68	0.75					
2. External relational capital	3.79	0.61	0.348**				
3. Structural capital	3.70	0.76	0.465**	0.275**			
4. Human capital	3.93	0.58	0.384**	0.302**	0.354**		
5. Renewal capital	3.64	0.83	0.441**	0.414**	0.504**	0.371**	
6. Entrepreneurial capital	3.21	0.70	0.538**	0.401**	0.457**	0.444**	0.573**

Notes: ** Correlation is significant at the 0.01 level

Table 3 Results of testing the differences in means between low and high technology companies.

	Mean (low-tech, N=312)	*Mean* (high-tech, N=127)	*Mean Difference*	*Sig.*
1. Internal relational capital	3.49	3.62	-0.13[a]	0.070
2. External relational capital	3.60	3.77	-0.17**	0.006
3. Structural capital	3.62	3.75	-0.13[a]	0.083
4. Human capital	3,92	4.12	-0.20***	0.001
5. Renewal capital	3.50	3.76	-0.26***	0.001
6. Entrepreneurial capital	3.12	3.34	-0.22***	0.002

Notes: [a]p < 0.10:*p < 0.05; ** p < 0.01; *** p < 0.005.

Table 4 Results of testing the differences in means between low and high technology companies in Finland.

	Mean (low-tech, N=219)	*Mean* (high-tech, N=40)	*Mean Difference*	*Sig.*
1. Internal relational capital	3.41	3.51	-0.10 (n.s.)	0.350
2. External relational capital	3.53	3.66	-0.13 (n.s.)	0.132
3. Structural capital	3.62	3.70	-0.08 (n.s.)	0.450
4. Human capital	3.98	4.13	-0.15 (n.s.)	0.125
5. Renewal capital	3.50	3.66	-0.16 (n.s.)	0.219
6. Entrepreneurial capital	3.14	3.37	-0.23*	0.014

Notes: [a]p < 0.10:*p < 0.05; ** p < 0.01; *** p < 0.005.

Table 5 Results of testing the differences in means between low and high technology companies in Spain.

	Mean (low-tech, N=93)	*Mean* (high-tech, N=87)	*Mean Difference*	*Sig.*
1. Internal relational capital	3.69	3.68	0.01 (n.s.)	0.918
2. External relational capital	3.76	3.83	-0.07 (n.s.)	0.489
3. Structural capital	3.63	3.77	-0.14 (n.s.)	0.231
4. Human capital	3.77	4.11	-0.34***	0.000
5. Renewal capital	3.49	3.81	-0.32**	0.009
6. Entrepreneurial capital	3.09	3.33	-0.24*	0.024

Notes: [a]p < 0.10:*p < 0.05; ** p < 0.01; *** p < 0.005.

Table 6 Results of testing the differences in means between low technology companies in Finland and Spain.

	Mean (Finland, N=219)	*Mean* (Spain, N=93)	*Mean Difference*	*Sig.*
1. Internal relational capital	3.41	3.69	-0.28***	0.001
2. External relational capital	3.53	3.76	-0.23***	0.003
3. Structural capital	3.62	3.63	-0.01 (n.s.)	0.844
4. Human capital	3.98	3.77	0.21***	0.002
5. Renewal capital	3.50	3.49	0.01 (n.s.)	0.884
6. Entrepreneurial capital	3.14	3.09	0.05 (n.s.)	0.639

Notes: [a]p < 0.10:*p < 0.05; ** p < 0.01; *** p < 0.005.

Table 7 Results of testing the differences in means between high technology companies in Finland and Spain.

	Mean (Finland, N=40)	*Mean* (Spain, N=87)	*Mean Difference*	*Sig.*
1. Internal relational capital	3.51	3.68	-0.17 (n.s.)	0.133
2. External relational capital	3.66	3.83	-0.17[a]	0.083
3. Structural capital	3.70	3.77	-0.07 (n.s.)	0.608
4. Human capital	4.13	4.11	0.02 (n.s.)	0.920
5. Renewal capital	3.66	3.81	-0.15 (n.s.)	0.264
6. Entrepreneurial capital	3.37	3.33	0.04 (n.s.)	0.697

Notes: [a]p < 0.10:*p < 0.05; ** p < 0.01; *** p < 0.005.

Appendix 1: Measurement items

Concept	*Item*	*Factor loading (Finland)*	*CR (Finland)*	*Alpha (Finland)*	*Factor loading (Spain)*	*CR (Spain)*	*Alpha (Spain)*
Internal relational capital	Different units and functions within our company – such as R&D, marketing and production – understand each other well.	.635 [a]	.75	.75	.767 [a]	.86	.86
	Our employees frequently collaborate to solve problems.	.760***			.804***		
	Internal cooperation in our company runs smoothly.	.719***			.876***		
External relational capital	Our company and its external stakeholders – such as customers, suppliers and partners – understand each other well.	.626 [a]	.77	.76	.758 [a]	.82	.81
	Our company and its external stakeholders frequently collaborate to solve problems.	.745***			.708***		
	Cooperation between our company and its external stakeholders runs smoothly.	.800***			.850***		
Structural capital	Our company has efficient and relevant information systems to support business operations.	.518 [a]	.63	.62	.694 [a]	.78	.78
	Our company has tools and facilities to support cooperation between employees.	.598***			.784***		
	Our company has a great deal of useful information in documents and databases.	.683***			.741***		
Human capital	Our employees are highly skilled at their jobs.	.733 [a]	.80	.79	.782 [a]	.77	.76
	Our employees have a high level of expertise.	.892***			.794***		
Renewal capital	Our company has acquired a great deal of new and important information.	.585 [a]	.61	.60	.725 [a]	.80	.79
	Our company can be described as a learning organisation.	.739***			.896***		
Entrepreneurial capital	Our employees are excellent at identifying new business opportunities	.738 [a]	.79	.79	.632 [a]	.76	.75
	Our employees show initiative.	.750***			.764***		
	Our employees have the courage to make bold and difficult decisions.	.756***			.755***		

[a] Significance level is not available, because the coefficient is fixed at 1. *** Statistically significant at 0.01 significance level.

Measurement model for Finnish sample: Chi-square=124.47, df=89, P=0.0078, RMSEA=0.039, GFI=0.943, CFI=0.988, NNFI=0.983, IFI=0.988.
Measurement model for Spanish sample: Chi-square=160.04, df=89, P=0.00001, RMSEA=0.067, GFI=0.899, CFI=0.976, NNFI=0.967, IFI=0.976.