

## **What drives the development of intellectual capital? A longitudinal study**

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## **CHAPTER 4**

### **What drives the development of intellectual capital? A longitudinal study**

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#### **Abstract**

The beneficial consequences that intellectual capital exerts on various aspects of organizational performance have become well established facts demonstrated in a wide range of empirical studies. However, little knowledge exists on what drives the development of intellectual capital itself. To bridge this gap in the current understanding, this chapter examines the different organisational aspects that enhance or hinder the development of intangible value drivers. It is posited that two key groups of organisational factors are likely to impact the development of intellectual capital: strategic and structural. The theoretical model specifying these and their influence on the essential aspects of intellectual capital is tested with partial least squares (PLS)-based structural modelling, analysing a longitudinal dataset collected via two waves of surveys in 2013 and 2017 from 96 Finnish organisations. The chapter contributes to the literature on intellectual capital from a dynamic-temporal perspective and helps to inform managers and policymakers about the strategic and structural factors that influence the development of intellectual capital in organisations.

#### **4.1 Introduction**

With the advent of the globalized knowledge-based economy, intangible resources, such as multi-skilled employees, sophisticated information systems and well-handled customer and societal relationships, have become important drivers of value creation for organisations. These intangible value drivers are often grouped under the larger concept of ‘intellectual capital’ (Edvinsson and Malone, 1997; Sveiby, 1997). In recent years, an increasing number of studies have shown that intellectual capital strongly influences the performance of organisations (Subramaniam and Youndt,

2005; Buenechea-Elberdin et al., 2018; Cabrilo et al., 2018; Hussinki et al., 2018), regions (Pöyhönen and Smedlund, 2004; Bonfour and Edvinsson, 2005;) and nations (Lin and Edvinsson, 2010; Käpylä et al., 2012; Seleim and Bontis, 2013) alike.

However, there has been little research to date about the different organisational aspects that enhance or hinder the development of such intangible value drivers. In other words, what kinds of organisational antecedents lead to increases in various aspects of intellectual capital? To bridge this gap in the literature, the current paper sought to discover what drives the development of intellectual capital in firms.

We posit that two key groups of organisational factors are likely to impact the development of intellectual capital: strategic and structural. In the rest of this chapter, we explain the essential aspects of intellectual capital and the strategic and structural factors that could potentially influence it. Then we use longitudinal data, collected via two waves of surveys in 2013 and 2017 from 96 Finnish organisations, to examine the observed development of intellectual capital variables. These data on intellectual capital development were then combined with data on the strategic and structural characteristics of these companies, drawn from the survey datasets and public databases. We used partial least squares (PLS)–based structural modelling to examine the causalities between the strategic and structural aspects and intellectual capital development. Our results contribute to the literature on intellectual capital from a dynamic-temporal perspective and will help inform managers and policymakers about the strategic and structural factors that influence the development of intellectual capital in organisations.

## **4.2 Theoretical background**

### **4.2.1 The components of intellectual capital**

The resource-based view of the firm maintains that an organisation's competitive advantage is based on the valuable, rare, inimitable and non-substitutable (VRIN) resources and capabilities that the firm governs (Barney, 1991). The knowledge-based view of the firm, on the other hand, argues that intangible factors, such as knowledge and a firm's capabilities to manage it, are likely to possess the VRIN qualities and can thus be sources of sustained competitiveness (Grant, 1996). Based on these arguments, the academic debate about the value of intangibles has flourished over the last few decades. In addition, theory development, a plethora of empirical studies have examined the nature, composition and performance drivers of intangibles.

Typically, the value creating intangibles have been coined under the heading of intellectual capital (Edvinsson & Malone, 1997; Sveiby, 1997). Intellectual capital of a firm consists of three elements: human capital, structural capital, and relational capital (e.g. Bontis, 1998; Petty and Guthrie, 2000; Inkinen, 2015).

Human capital includes the value-creating capacities embedded in and available through the people working for a company. These relate to the skills, knowledge and capacities of organisational agents and their motivation, attitudes and various types of personal characteristics, such as creativity and self-efficacy beliefs (Edvinsson and Malone, 1997; Sveiby, 1997; Bontis, 1998). An organisation's stock of employee competencies, experience, knowledge and social and personality attributes forms the basis from which it can effectively and efficiently solve problems and realize its strategic goals.

Structural capital refers to those aspects of an organisation that support employees in their work, such as information systems, tools, facilities, databases and documents (Edvinsson and Malone, 1997), as well as 'softer' enabling factors like organisational culture and values, leadership philosophy and collaboration climate (Roos et al., 1997; Sveiby, 1997). Structural capital is thus not dependent on or carried by individual employees, and, from an organisation's perspective, is arguably a more collective and stable resource than human capital. The conversion of human capital to structural capital is therefore considered paramount for securing an organisation's long-term competitiveness (Sullivan, 2000).

Finally, an organisation's relational capital can be divided into two main types: internal and external relational capital (Inkinen et al., 2017). Internal relational capital includes the extent and quality of relationships among the actors within an organisation (Tsai and Ghoshal, 1998). These relate to the relationships among employees, relationships between employees and their supervisors and managers at various levels of the organisation and relationships between organisational units and functions (Nahapiet and Ghoshal, 1998; Yang and Lin, 2009). External relational capital, in contrast, refers to the knowledge and value available through the relationships that a firm has with its key external stakeholders, such as customers, suppliers and distributors (Cabrita and Bontis, 2008); in some firms, relationships with funding institutions and an investment community can also be highly significant. An organisation's image and brand also are crucial facets of its external relational capital (Roos et al., 1997; Bontis, 1998).

### 4.2.2 Drivers of intellectual capital

As noted previously, while there is a significant volume of academic literature on intellectual capital, most studies have concentrated on either the identification and reporting of current levels of intellectual capital in firms or on the influence of intellectual capital on various types of organisational performance indicators. Very little is known about how firms' intellectual capital changes over time and what kinds of factors explain any changes. We therefore tackle this topic in this exploratory study and argue that, in an organisational context, there are two main types of change factors: those associated with an organisation's strategic choices, and those associated with its structural characteristics.

*Strategic choices* are related to four key issues. First, organisations exhibit varying degrees of knowledge intensity, which reflects the relative importance of knowledge resources (as opposed to other types of resources) as the inputs in a firm's productive processes (Starbuck, 1992). In knowledge-intensive firms, a firm's main activities are based on intangible resources, and intellectual capital and its management mechanisms are key sources of competitive advantage (Autio et al., 2000).

Second, another crucial facet of strategic choice concerns a firm's research and development (R&D) intensity. R&D investments are a fundamental way to create new knowledge (Youndt et al., 2004), and their magnitude in any given firm reflects the importance attached to rapid learning and the application of new knowledge (Bierly and Chakrabati, 1996). This choice is manifested in the resources that a firm allocates to speeding up learning processes, such as the proportion of manpower directed to R&D activities.

Third, an organisation's strategic choices also include the extent to which it focuses on tacit and/or codified knowledge as sources of value. Hansen et al. (1999) conceptualized this as a choice between personalization and codification. Personalization is a knowledge strategy that seeks to link people to each other to foster the 'person-to-person' sharing of tacit knowledge. Codification, on the other hand, seeks to capture and store knowledge in an explicit form for subsequent transfer and reuse by others within the organisation. The choice between these two strategies is not necessarily mutually exclusive, and most organisations mix personalization and codification in different proportions (Scheepers et al., 2004)

Fourth and finally, an organisation can direct its activities toward producing either products or services for the market. A firm's degree of servitization is firm- rather than industry-dependent because firms operating within the same industry can choose the extent to which they concentrate on product or

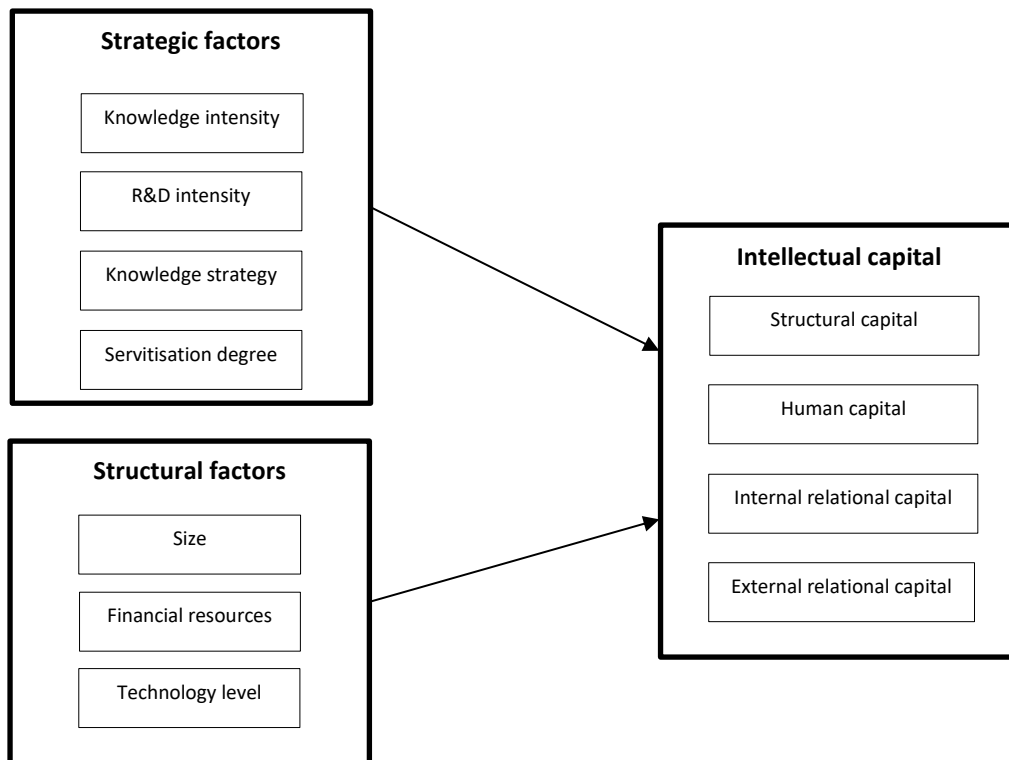
service output. There is some evidence that the relative importance of particular types of intellectual capital may differ for service- versus production-oriented companies (Kianto et al., 2010). A service orientation has also been found to influence the managerial mechanisms of knowledge governance that yield the most beneficial results (Kianto and Andreeva, 2014). Consequently, this strategic choice factor is also expected to impact the development of an organisation's intellectual capital over time.

Moving on to *structural features*, first, company size may impact an organisation's willingness and ability to develop its intellectual capital. Larger organisations may need to formalize their activities by developing standardized guidelines and codes of conduct to build various elements of intellectual capital. This is also linked to the classic problem of the 'liability of smallness' (Freeman et al., 1983), in which small firms often need to invest a lot of resources in survival and may not be able to develop their intellectual capital as systematically as larger firms.

Second, the financial resources available for an organisation's use are another important structural factor. Profitable firms have more opportunities to innovate and to invest in the development of intellectual capital than do firms that have not been able to generate a profit (Surroca et al., 2010). Thus, we propose that the financial resources an organisation has in its use could also function as an explanatory factor for the development of intellectual capital.

Third and finally, the technological level of an industry is likely to impact an organisation's need to develop intellectual capital (Buenchea-Elberdin et al., 2017; 2018). For example, firms that operate in high-technology industries deal with more complex knowledge than firms that operate in low-technology industries, and this is also reflected by higher levels of intellectual capital among high-technology firms. In addition, high-technology industries require a faster pace of knowledge renewal.

Figure 1 visualizes these arguments and demonstrates the overall research model of the present study.



**Figure 4.1:** Research model

## 4.3 Methods

### 4.3.1 Sample and data collection

In order to test the model with true causal logic (i.e., time lag between independent and dependent variables), we utilized two datasets that we collected in 2013 ( $N = 259$ ) and 2017 ( $N = 221$ ) from Finnish firms with at least 100 employees. The data for independent variables (strategic and structural factors) were collected in 2013 and the data for dependent variables (the change in intellectual capital) were collected in 2013 and 2017. After merging the two datasets, we ended up with a cross-industry dataset of 96 companies, as this was the number of firms that responded to both surveys. In both data collection phases, all firms were contacted by telephone by an external research company and the person in charge of the firm's human resources was asked to respond to the questionnaire.

A key-informant technique was used to collect data from one respondent per company. The most heavily represented industries in our dataset were manufacturing (37.2%) and wholesale and retail trade (18.1%), followed by transportation and storage (8.5%), services (8.5%), professional, scientific and technical activities (7.4%), and construction (7.4%). Most respondents held key positions related to issues of intellectual capital: 71.9% of them were human resources directors or managers, 11.5% other directors or managers, and 7.3% managing directors.

### 4.3.2 Measures

Item wording and scale response anchors for all measures are presented in Appendix 4.1.

**Independent variables.** Independent variables were categorized as the strategic and structural factors that drive the development of intellectual capital in organisations. Four strategic factors were assessed: *knowledge intensity* was measured as the proportion of tangible versus intangible resources used by a company in its operations; *R&D intensity* was reported by respondents as the percentage of R&D staff compared to all company employees in 2012 (we used a natural logarithmic transformation of the variable for the analysis); *knowledge strategy* was reported by respondents as the extents to which tacit versus codified knowledge functioned as sources of the company's competitive ability; and *servitization degree* was measured as the proportion of products versus services in the company's net sales in 2012.

Three structural factors were assessed in our survey: *company size* was operationalized as both the number of employees and sales turnover; *financial resources* were measured by a company's return on assets (ROA) and return on equity (ROE) in 2013; and *technology level* was assessed by assigning companies to high-technology or low-technology groups based on the Statistical Classification of Economic Activities in the European Community. Data concerning structural factors was obtained from the Amadeus database.

**Dependent variables.** The scales for the four dimensions of intellectual capital (human, structural and internal and external relational capital) were based on work by Inkinen et al. (2017). The measurement items in both surveys were identical, with the only difference being that the 2013 survey utilized a 5-point Likert-type scale while the 2017 employed a 7-point scale. On all scales, respondents were asked to assess how different statements regarding the dimensions of intellectual capital applied to the organisation they represented. Human, internal relational and external relational capital were assessed by three items while structural capital was assessed by four. For each dependent variable, we calculated the change in intellectual capital dimensions by subtracting the 2013 levels from the 2017 levels after adjusting the data to account for the different Likert-type scales used in 2013 and 2017. This adjustment was done by converting the 7-point scale used in 2017 to a 5-point scale that corresponded to the 2013 scale.

**Control variables.** We used the 2013 levels of intellectual capital for each dimension as control variables in order to control for the possibility that initial levels of intellectual capital could affect their change rate.



## 4.4 Results

We used Partial Least Squares (PLS) for the analyses (version 3.2.7 of SmartPLS; see Ringle et al., 2015) and followed the process suggested in the literature (see, e.g., Hair et al., 2014). According to Hair et al. (2014), PLS-based structural modelling can be utilized with smaller sample sizes, and a sample size of 96 was determined to be enough for our research model. The first step was to assess the reliability and validity of the measurement models. We then used the structural model to test our hypotheses.

### 4.4.1 Measurement model

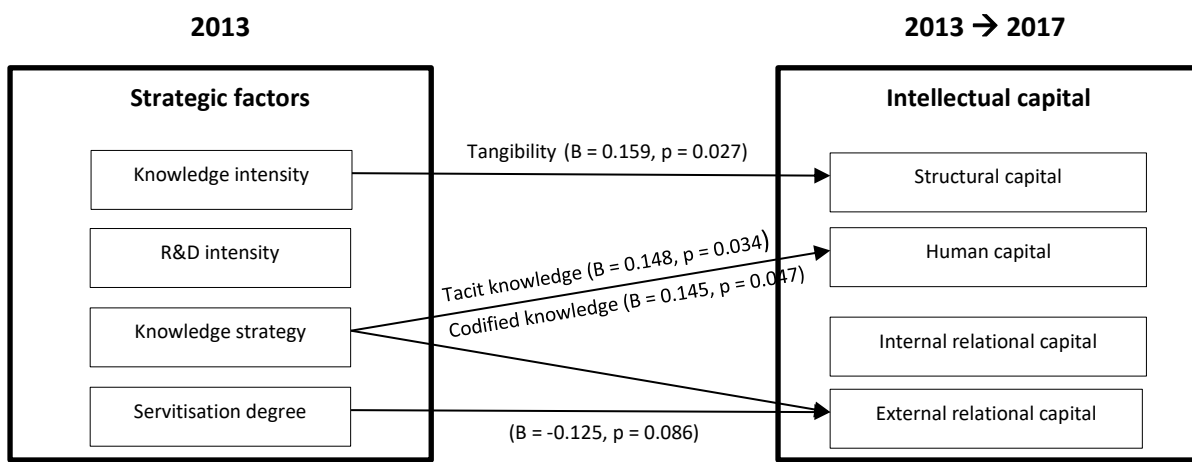
To test the measurement model, we assessed both internal consistency and discriminant validity. According to a series of tests, the model demonstrated good validity and reliability for the operationalization of the concepts of intellectual capital.

First, the construct reliabilities (CR) for all of our constructs were above the recommended threshold of 0.7 (Bagozzi and Yi, 1991). Second, the factor loading of each item was high and statistically significant, indicating that they were all related to their specific constructs and thereby verifying the relationship posited among the indicators and constructs. Third, the measure of average variance extracted (AVE) exceeded the cut-off point of 0.5 (e.g., Fornell and Larcker, 1981) for all of our intellectual capital constructs. Fourth and finally, the tests of discriminant validity showed that each construct's AVE was greater than the squared correlation between other constructs (i.e., the shared variance between a given construct and other constructs in the model). In addition, we tested discriminant validity using the Heterotrait-Monotrait (HTMT) ratio by following the procedure suggested in the methodological literature (e.g., Henseler et al., 2016; Hair et al., 2017). The results showed that the HTMT values for all pairs of constructs were under the threshold value of 0.90; furthermore, based on a computed bootstrapping procedure, all HTMT values were also significantly different from 1. These results indicated that the constructs in the model differed from each other. See Appendix 1 for the factor loadings, CRs and AVEs.

### 4.4.2 Research model

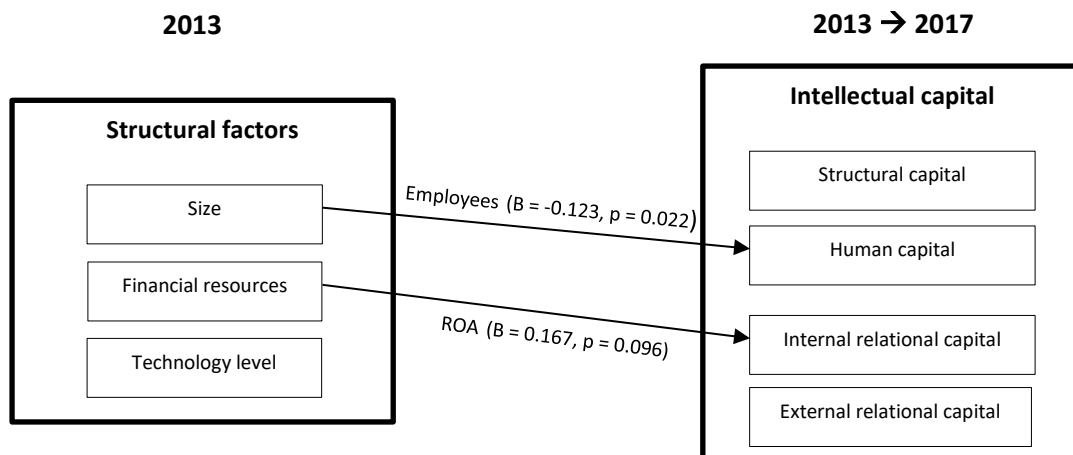
Our model was able to explain about 46% of the variance in human capital over time, 43% for structural capital, 27% for internal relational capital and 53% for external relational capital. The statistically significant paths are presented in Figures 2 and 3; for clarity, strategic and structural factors are presented separately.

Model results suggest that three of the four strategic factors functioned as drivers of intellectual capital development: knowledge intensity, knowledge strategy and servitization degree. First, regarding knowledge intensity, resource tangibility was connected to changes in structural capital ( $B = 0.159, p = 0.027$ ). Second, in terms of knowledge strategy, both tacit and codified knowledge resources had positive effects on intellectual capital: the paths from tacit knowledge to changes in human capital ( $B = 0.148, p = 0.034$ ) and from codified knowledge to changes in external relational capital ( $B = 0.145, p = 0.047$ ) were both positive and statistically significant. Third, higher degrees of servitization led to negative changes in external relational capital ( $B = -0.125, p = 0.086$ ).



**Figure 4.2:** Results for the strategic factors

In addition, two of the three structural factors influenced changes in intellectual capital. First, a company's size had a negative effect on human capital: the path from number of employees to changes in human capital was negative and significant ( $B = -0.123, p = 0.022$ ). Second, a company's financial resources, and more specifically its ROA, had a positive effect on changes in internal relational capital ( $B = 0.167, p = 0.096$ ).



**Figure 4.3:** Results for the structural factors

## 4.5 Discussion

Our study used a unique longitudinal dataset that was collected through two rounds of surveys in 2013 and 2017. The use of longitudinal data allowed us to examine changes in the levels of intellectual capital of 96 Finnish firms over a 4-year period, as well as to examine factors that might explain why some firms were able to increase their intellectual capital over time while other firms' intellectual capital decreased. We divided our analysis into two types of antecedents: strategic and structural factors.

The strategic factors included four important antecedents that we expected to play roles in the development of firms' intellectual capital. First, we examined knowledge intensity in terms of a firm's key tangible and intangible resources. Our results showed that firms with high tangibility (i.e. those that rely heavily on property, equipment and machinery in their operations) significantly increased their structural capital during the 4-year study period. This was in contrast to firms that relied more heavily on intangible resources (e.g. information, expertise, contacts and processes) which witnessed reduced levels of structural capital during the study period. Interestingly, this indicates that knowledge-intensive firms, which could benefit greatly from structural capital (e.g., well-functioning information systems and databases), are not necessarily as prone to utilizing them as firms that are already good at utilizing other types of tangible resources. In addition, this finding suggests that knowledge-intensive firms, which are at the forefront of the digital revolution, may find it difficult to be satisfied with their structural capital (e.g. information systems, collaboration tools and databases),

as it is difficult for these firms to keep up with the requirements and demands of modern knowledge-workers.

Second, we found no relationship between a firm's R&D intensity (the share of R&D staff out of all company employees) and the change of any of the four dimensions of intellectual capital. This suggests that R&D investments do not explain how well a firm can develop its intellectual capital; R&D investments are instead demonstrated by a firm's improved products and services.

Third, we examined firms' knowledge strategies (Hansen et al., 1999) and whether firms' competitive abilities were based on tacit or codified knowledge. We found that firms relying on tacit knowledge-based strategies improved their human capital while firms relying on codified knowledge improved their external relational capital. These findings provide strong support for the distinctive merits of both strategies. On the one hand, tacit knowledge is likely to improve employees' and teams' skills and competence over time. Since tacit knowledge is embedded predominantly in a firm's employees, firms that rely on it as their primary source of competitiveness cannot survive without improving their human capital. On the other hand, focusing more on codified knowledge helps firms to develop their external relationships and collaborations, given the easier transferability and the coordination benefits it offers in inter-organisational exchanges (Mowery et al., 1996; Simonin, 1999).

Fourth, we examined whether a firm's degree of servitization (the proportion of net sales from services vs. products) influenced changes in its intellectual capital. We found that servitization led to decreases in firms' external relational capital. This may be due to the difficulties that service-oriented firms face in trying to establish external relationships. Service businesses typically rely on intangible, heterogeneous and perishable features (see, e.g., Ritala et al., 2013), which may make it more difficult for them to engage external actors in comparison to firms that operate with more concrete products.

We also examined three structural factors that we hypothesized might influence firms' abilities and willingness to develop their intellectual capital. Among these, we found that firm size (the number of employees) had a negative effect on firms' levels of human capital, whereas financial resources (and more specifically their ROA) increased their levels of internal relational capital. The finding that larger firms' human capital decreased while smaller firms' increased over the 4-year study window can perhaps be explained by external factors. Between 2013 and 2017, the wider European economy did not perform very well, and, as part of the European market, larger Finnish firms may have suffered disproportionately to smaller firms that were less tied to the wider markets; their relative levels of human capital over this period may reflect this. In addition, the finding that a firm's ROA contributed to its development of internal relational capital can be understood as a source of necessary 'slack' –

in other words, as a resource that helps a firm's employees and departments increase the frequency and quality of their communication and collaboration efforts. Conversely, when financial resources are tight and a firm lacks a positive ROA, it might not be able to invest in internal processes and collaboration, needing instead to focus on operational optimization and profit generation.

Overall, our findings provide interesting insights into how strategic and structural factors affect changes in firms' intellectual capital. These findings improve the field's understanding of different types of firms' abilities to develop their intellectual capital. As such, our study provides a unique contribution to the literature on intellectual capital by exploring the antecedents of changes in several dimensions of intellectual capital over time. We expect that the results will be useful for intellectual capital scholars and practitioners and will provide new research avenues for future studies to explore. Our results also complement those of previous research that examined the development of strategic management activities related to intangibles (Kianto et al., 2013). Future studies should examine more systematically how firms' strategic choices allow them to develop different dimensions of intellectual capital and how this eventually relates to value creation and firm performance. Another potential subject for future research is further exploration of how different strategic and structural drivers influence the development of other types of intellectual capital elements, such as renewal, trust or entrepreneurial capital (Buenechea-Elberdin et al., 2017; Inkinen et al., 2017).

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## Appendix 4.1. Measurement items.

Concept	Item						
Knowledge intensity	In your evaluation, to what extent do tangible resources (such as machinery, equipment and property) and intangible resources (such as information, expertise, contacts and processes) represent the resources your company uses in its operations? ((1 = operations are completely based on tangible resources, 10 = operations are completely based on intangible resources)						
R&D share	The proportion of research and development staff of all employees in 2011 (estimate)						
Knowledge strategy:	To what extent can the following be described as the sources of your company's information-based competitive ability? (1 = not at all, 5 = very much)						
Tacit	Tacit knowledge and special expertise represented by teams and individuals.						
Codified	Documented information and standardised expertise that can be reproduced quickly and efficiently.						
Servitisation	In 2012, our company's net sales consisted of: (1=100% product sales, 10 =100% service sales)						
Concept	Item	Factor loadings		CR		AVE	
	To what extent do the following statements apply to your company (1=completely disagree, 5*=completely agree); *(7 in 2017)	2013	2017	2013	2017	2013	2017
Human capital	Our employees are highly skilled at their jobs.	0.827***	0.858***	.87	.87	.68	.69
	Our employees are highly motivated in their work.	0.749***	0.806***				
	Our employees have a high level of expertise.	0.896***	0.829***				
Structural capital	Our company has efficient and relevant information systems to support business operations	0.620***	0.727***	.83	.84	.56	.56
	Our company has tools and facilities to support cooperation between employees.	0.715***	0.576***				
	Our company has a great deal of useful information in documents and databases.	0.843***	0.869***				
	Older documents and solutions are easily accessible.	0.792***	0.798***				
Internal relational capital	Different units and functions within our company – such as R&D, marketing and production – understand each other well..	0.647***	0.816***	.81	.91	.59	.78
	Our employees frequently collaborate to solve problems.	0.851***	0.912***				
	Internal cooperation in our company runs smoothly.	0.797***	0.909***				
External relational capital	Our company and its external stakeholders – such as customers, suppliers and partners – understand each other well.	0.805***	0.764***	.87	.88	.70	.70
	Our company and its external stakeholders frequently collaborate to solve problems.	0.869***	0.928***				
	Cooperation between our company and its external stakeholders runs smoothly.	0.833***	0.813***				

**Notes:** \*\*\* Statistically significant at 0.005 significance level.