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Impact of intellectual capital on the performance of the Finnish publicly listed companies.

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Traditionally, researchers and economists have identified two types of resources that facilitate the productivity and economic activity of companies. These resources are physical and human capital. However, knowledge has been recently recognized as a valuable resource as well. All the concepts related to knowledge and the knowing capabilities of organizations and companies have been named as "intellectual capital" (hereafter IC).

The objective of the research was to examine whether there was any significant relationship between IC and Finnish companies' performance. Corporations were selected from the Nasdaq OMX Helsinki, and the companies' sector was Information Technology (hereafter IT) and Telecommunications. There were two IC measurement methods selected: the Economic Value Added (hereafter EVA), and the Value Added Intellectual Coefficient (hereafter VAIC). As for the company performance, it was measured with the help of three financial indicators, such as Return on Assets (hereafter ROA), Return on Equity (hereafter ROE), Earning per Share (hereafter EPS), and two market indicators, such as Market Capitalization (hereafter MCap), and the Market-Book ratio (hereafter MB).

The study applied quantitative research methods. Financial data was collected for a period of 5 years, 2013-2017. The key source of information was the companies' financial statements and the Nasdaq OMX Helsinki web page. The analysis of the data included three major parts: descriptive analysis, correlation analysis, and regression analysis.

The findings of the study showed that there was no significant relationship between IC and company performance for the studied period. The Human Capital Efficiency (part of the VAIC method) was the only one having a strong influence on the market performance. Moreover, the influence of the EVA was negligible. The research, however, did not study the reasons why a significant relationship was missing. Thus, it was difficult to understand whether IC exceptionally did not have a strong relationship with the company performance. On the other hand, it could be IC is weakly present in the Finnish IT and Telecommunication sector.

Keywords/tags (subjects)
Intellectual capital, Human Capital, Structural Capital, Relational Capital, Economic Value Added, Value Added Intellectual Coefficient

Miscellanous

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1 Introduction

1.1 The research background

Throughout the 20th century, it was considered that the three major production forces driving the economy were labor, land and financial capital. These financial and physical factors were traditionally used by organizations in order to demonstrate their success. However, recently scientists have derived the IC as the fourth production force for its increased role in achieving high business performance and for its enormous advancements in the areas of research, technology and overall economic advancement (Komnenic & Pokrajcic 2012, 106).

In the late 1980s, large multinational companies understood the future role and significance of IC and thus, became involved in creating measurement and management methods for IC. For example, the Skandia Group turned its focus towards IC because they thought it was able to provide an affective mechanism in both achieving company's goal and vision and comparing its performance against the one of other companies (Edvinsson 1997, 366).

The increased role of IC has been directly connected to the fact that the global economy is moving towards a knowledge economy. According to Hodgins (2014), Drucker points out that knowledge is a relevant resource, though its importance might be different to the one of workforce, real estate and monetary assets (Hodgins 2014, 1). Moreover, Teece argues that in the era of knowledge economy the cost on information flow has decreased, and that at the same time, there has been a rise in the liberalization of the product and labor markets in many parts of the world (Teece 2000, 3). As a result of the above mentioned statement, "the deregulation of international financial flows is stripping away many traditional sources of competitive differentiation and exposing a new fundamental core as the basis for the wealth creation". (ibid.) The core that Teece refers to is related to the development of intangible assets, including knowledge, competence, customer relationships, and reputation. According to Lim and his colleagues, intangible assets represent one third of the USA corporate assets and one half of the annual investments (Lim et al. 2017, 5).

However, it is not enough for a company to be aware of IC. Instead, tools to measure and evaluate the company's innovative capabilities need to be applied. For that reason, companies have invested their resources not only in studying the phenomenon of IC but on creating and improving measurement methods as well. The most frequently used method has been EVA. This measurement tool has a direct connection to the creation of shareholders' profit (Alsoboa 2017, 2). Besides, current methods takes into consideration the importance of value creation done by the management team of the enterprise (Shil 2009, 169).

As far as the measurement of company performance is concerned, the VAIC method could be applied. The key advantage of the method is its simplicity. The data required for calculation is already available in the balance sheet and business reports. In addition, the results can be easily benchmarked with the results of other enterprises.

1.2 Research motivation

Having recently studied published articles on IC, the author of the research realized that the role of intellectual capital and its influence on company performance has been under research in many countries. For example, relevant studies were found in Hong Kong (Wong et al., 2015), India (Singh et al., 2016), Iran (Mollabashi & Sendani, 2014), and Serbia (Komnenic & Pokrajcic, 2012). At the same time, similar type of research on the Finnish companies has not been found. Thus, the author considered that it would be relevant to study the phenomenon of IC and its influence on the Finnish publicly listed companies.

According to Sveiby and Stewart, "intellectual capital has been considered by many, defined by some, understood by a select few, and formally valued by no one" (Bontis 1998, 63). Thus, as for personal motivation, the author aimed at understanding the chosen research topic. Additionally, it could be beneficial for the author's future career path to receive both theoretical and practical knowledge of IC and its measurement methods, since the author is employed in an intensively growing IT company.

1.3 Research questions

The current research was conducted in order to answer the following research questions:

Research question 1: Did the Value Added Intellectual Coefficient have an impact on the performance of the Finnish publicly listed companies?

- Sub-question 1: Did the Human Capital Efficiency (hereafter HCE) have an impact on the performance of the Finnish publicly listed companies?
- Sub-question 2: Did the Capital Employed Efficiency (hereafter CEE) have an impact on the performance of the Finnish publicly listed companies?
- Sub-question 3: Did the Structural Capital Efficiency (hereafter SCE) have an impact on the performance of the Finnish publicly listed companies?

Research question 2: Did the Economic Value Added have an impact on the performance of the Finnish publicly listed companies?

In order to answer the research questions, the author collected data from 42 Finnish publicly listed companies, which belonged to the telecommunication and information technology sectors. All companies are listed on the Nasdaq OMX Helsinki. Data was collected for five financial years from 2013 to 2017.

Secondary financial and accounting data was collected from the annual reports of the companies and other corporate documents. As for market-related data, it was obtained from the Nasdaq OMX Helsinki website. Key variables, which were analyzed, were the VAIC and the EVA. Analysis of the data was performed with the help of the SPSS software.

1.4 Structure of the thesis

The present thesis consists of five chapters: an introduction, a literature review, the methodology chapter, the results of the research and the discussion. The introduction chapter briefly describes the phenomenon of IC and its impact on company performance. In addition, the research questions are formulated in Chapter 1. Chapter 2, the literature review, introduces IC in more detail by providing definitions, key components, and measurement methods. After that, Chapter 3 (Methodology) describes what research philosophies, approaches, and time horizon were selected. Moreover, the author explains the data collection and the data analysis methods employed. Chapter 4 (Results) provides the results of data analysis as well as the verifications of the research results. Chapter 5 (Discussion) gives the conclusions on

the research and answers to the research questions, explains the limitations of the study, and provides recommendations for future research.

2 Literature review

This chapter explores the theoretical framework of the research. The aim of the literature review was to study the IC concepts. It is important to understand what IC is, which elements it consists of, and how IC is measured. Paper and electronic versions of books, academic journals and other types of publications were used as sources of information.

2.1 Intellectual capital

The rapid development of the high technology industry accelerated the world's economy move towards the era of knowledge (Serenko & Bontis 2004, 185). The management lexicon of academia, business and government were enriched with two new concepts, which are "knowledge management" and "intellectual capital". Bounfour defines the concept of knowledge management "as a set of procedures, infrastructures, technical and managerial tools, designed towards creating, circulating (sharing) and leveraging information and knowledge within and around organizations" (Durst and Leyer 2014, 301).

As for the concept of IC was popularized worldwide after the publication of Thomas Stewart's article in Fortune 1991 ("Brain Power: how intellectual capital is becoming America's most valuable asset"). The target of this subchapter is to discuss the concept of IC in more detail by providing its definition as well as outlining its components and measurement methods.

2.1.1 Definition and its role

Etalon definition of IC was formulated by Thomas Stewart in the Fortune article in 1991. He defined it as follows: "the intellectual material that has been formalized, captured and leveraged to produce a higher-valued asset" (Bontis 1996, 43). Despite Stewart's definition, there is still little consensus on what is considered "a good definition" of the concept of IC.

Scholars identify two necessary conditions that every definition of IC should include. The first condition is clear break-down of its components: the company's culture, the company's reputation and intellectual property rights (Marr & Moustagfir 2005, 1119).

The second condition for the definition is the clarification of the role which IC plays in the company. Scholars distinguish three main categories for this condition:

- "strategy management", which includes the role of managing strategy formulation and execution of the company strategy;
- "influence behavior", which underlines the role of monitoring progress and rewarding behavior;
- "external validation", which comprises the role of internal and external communication and the compliance of the company's processes with external regulations. (ibid., 1121).

Based on the second condition, Sveiby describes IC as a combination of three components, namely external structure, internal structure and employee competence (Choong 2008, 610). Nowadays, these components are known as structural capital (internal structure), relational capital (external structure), and human capital (human competence).

Brooking added a fourth category into the IC classification – intellectual properties assets (Wisniewski 2010, 644). It played an integral role in the value chain process since it was needed for the implementation of products and services.

Rich Hall defined IC for the field of strategic management. According to Hall, IC is a value driver that is capable to convert the resources, which are used in producing goods and developing services, into the value added assets. (ibid.) IC is divided into two categories, including intellectual property (or assets) and skills (or knowledge assets). Furthermore, IC has three key characteristics:

- no physical form;
- a result of past events;
- legally protected by a right of use (Gioacasi 2014, 59).

Sullivan defines IC as “knowledge that can be converted into profit” (Choong 2008, 615). At the same time, a company is dependent on IC, including reputation, leadership, and customer loyalty. (ibid.) Sullivan, like Sveiby, also adopted a three-category model of IC and included human capital, organizational capital and customer capital in the model.

In accordance with Edvinsson (1997), IC is explained as a synthesis of enhanced knowledge, skills, organizational technology and relationships with the customers. All this provides the company with a competitive advantage in the market. (368.)

Finally, Bontis describes IC as the collection of intangible resources and their flows. Intangible resources are seen as the ones bringing a value added component into the company (Choong 2008, 614). Bontis also divides IC into three types.

Table 1 summarizes a wide range of definitions of IC gathered by Marr and his colleagues.

Table 1. Definition of intellectual capital, synthesized from resources Marr et al. 2004, 554 and Choong 2008, 614).

Authors	Intellectual capital
Hall (1992)	Value driver divided into “assets” (e.g. brand, trademark, contracts, databases) and “skills” (e.g. know-how of employees, organizational culture)
Brooking (1996)	Consists of four main components: market assets, human-centered assets, intellectual property assets and infrastructure assets
Sveiby (1997)	Consists of three categories of intangible assets: a structural capital, i.e. an internal structure; a relational capital, i.e. an external structure; and a human capital, i.e. a human competence.
Roos et al. (1997)	It is composed of a thinking part, i.e. the human capital, and a non-thinking part, i.e. the structural capital
Stewart (1997)	Intellectual material that has been formalized, captured, and leveraged to produce a higher-valued asset

Edvinsson and Malone (1997)	It is the sum of human capital and structural capital. It involves applied experience, organizational technology, customer relationships and professional skills that provide an organization with a competitive advantage
Bontis et al. (1999)	It is a concept that classifies all intangible resources as well as their interconnections
Sullivan (2000)	Knowledge that can be converted into profit
Lev (2001)	Sources of future benefits (value), which are generated by innovation, unique organizational designs, or human resource practices
Marr and Schiuma (2001)	It is composed of all knowledge-based assets, distinguished between organizational actors (relationships, HR) and infrastructure (virtual and physical)

As the summary of the definitions shows, the term IC is closely associated with intangible assets. Intangible assets have determined both the companies' value and rapid development (Sällebrant 2007, 1471). Companies with a high level of intangible assets are usually called "knowledge firms". They heavily rely on white-collar workers and the management of knowledge assets, which then bring more value to their products and relationships with the customers. Thus, IC plays a significant role in a company's collective knowledge, which includes personnel, organizational routines and network that the company is embedded in. (Meihami et al. 2014, 43).

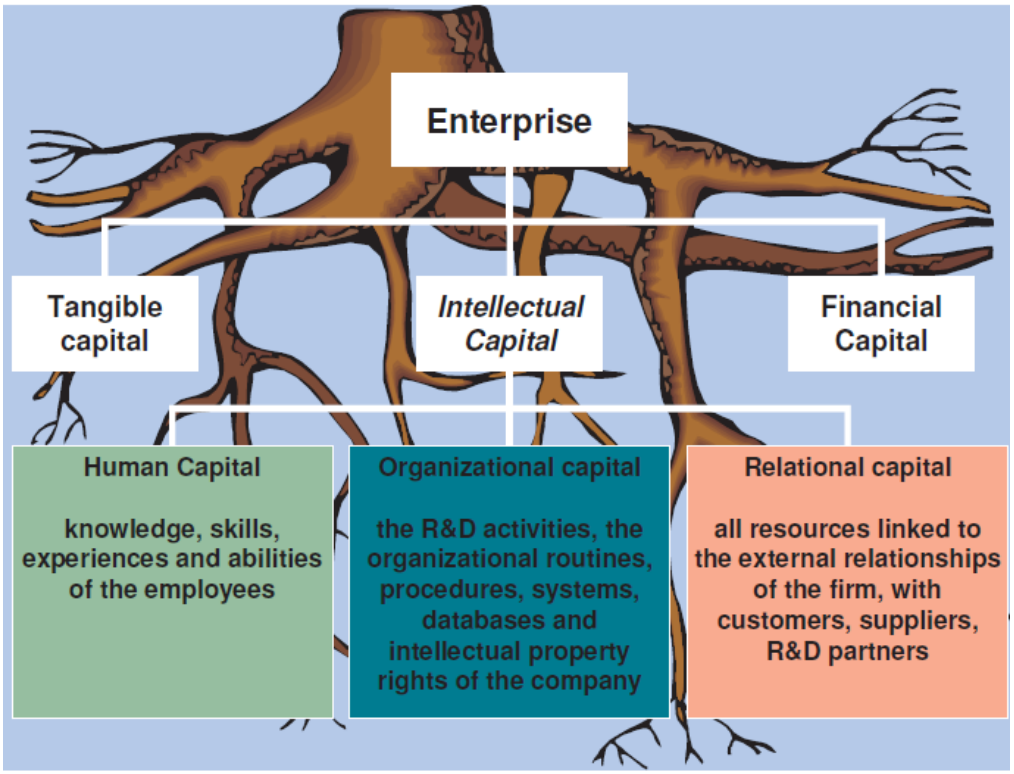

Figure 1. The intellectual capital roots of the enterprise (Reporting intellectual capital to augment research, development and innovation in SMEs 2006, 17)

Having provided the definitions of the IC, the thesis proceeds with a description of the intellectual capital role in a company's overall structure. According to Figure 1, some researchers see the IC as the tree root that nourishes the growth of a tree in present and in the coming times (Reporting intellectual capital to augment research, development and innovation in SMEs 2006, 17).

One of the measurements that shows the future success of a company is its ability to handle intangible assets, including knowledge resources. Intellectual capital has a dominant influence on the performance of an enterprise, and it plays a key role in reducing operating costs and providing a diverse range of products in order to meet the clients' demands (Chen et al. 2004, 208). The OECD and the World Bank support the idea that the role of intangible assets is increasing. The World Bank estimates that intangible capital will be a prevalent form of prosperity for most of the countries (Matos 2013, 339). The estimation of OECD was that two thirds of the growth in labor productivity could be explained by the companies' investment programs in intangible resources and multifactor production (ibid., 339).

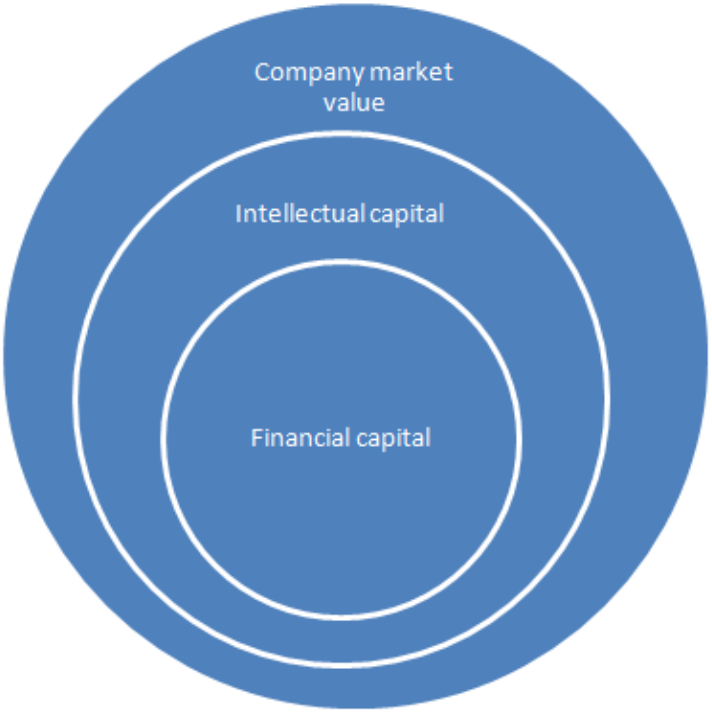

Figure 2. Company market value, synthesized from Edvinsson (1997, 367) and Johnson (1999, 565)

According to Edvinsson (Figure 2), the market value of a company consists of financial capital and IC (1997, 367). Financial capital is an asset item, which is visible in the balance sheet and SCFP (statement of changes in financial position). As for IC, it cannot be accurately measured, since the majority of its components are not reflected in the balance sheet (Berzkalne & Zelgalve 2014, 888). For example, the IC categories, which are recognized in financial documentation, are R&D, software licenses, brands and patents (Marr 2008, 27).

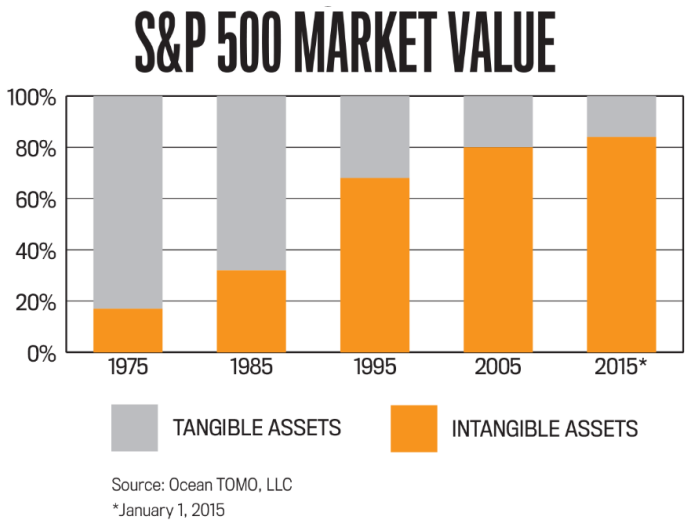

Figure 3. S&P 500 market value (Cokins & Shepherd, 2017)

Based on Figure 3, the share of IC in the market value of the publicly listed companies has been constantly increasing between 1975 and 2015. In 1975, the financial and IC ratio was 80 to 20, but in 2015 it was already 20 to 80 (Cokins & Shepherd, 2017). It shows that in knowledge-based companies, intangibles assets play a more significant role than the financial capital.

2.1.2 Intellectual capital components

Based on the definitions discussed in the previous chapter, the author concluded that researchers lack a common understanding on the IC components. Edvinsson refers to the Skandia Model, which underlines two elements: human capital and structural capital (1997, 368). Chen et al. underline four major elements, including human capital, structural capital, innovation capital, and customer capital (2004, 201). Finally, Seetharman et al. (2004, 524), Walsh, Enz, and Canina (2008, 6), Wang and Chang (2005, 223) use three elements of IC in their studies, namely human capital, relational capital, and structural capital. The author decided to apply the three elements model (human capital, structural capital and relational capital) in this study. Figure 3 provides a clear overview on all three elements that IC contains.

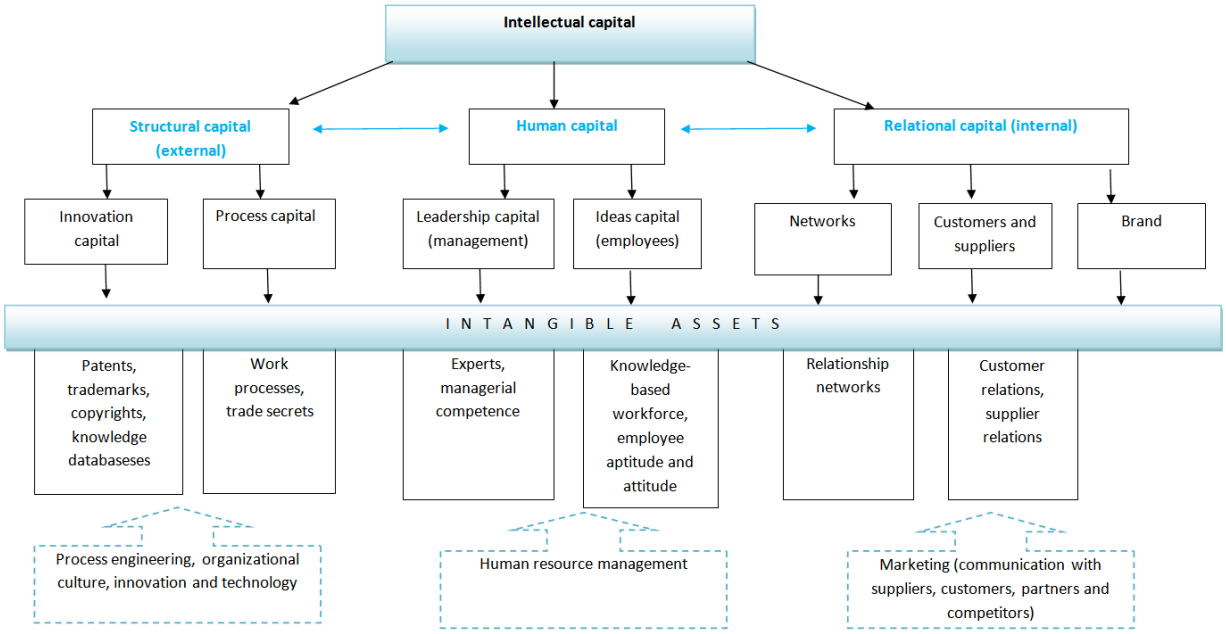

Figure 4. Intellectual capital components, synthesized from Sällebrant (2007, 1446), Johnson (1999, 565), and Shakina & Bykova (2011, 4)

Human capital

A primary element of IC is human capital. According to scholars, it helps to perform the IC functions, since its key contributors are "education, experience, skills, training and expertise" (Hundal 2016, 336). In addition, in the IC framework, human resources are understood as drivers in value creation process during day-to-day activities, which contribute to the development of the firm's best performances (Budiarti 2017, 150).

From the perspective of the employee, human capital is observed as a competence of the worker and his/her ability to take part in different types of company activities in order to create tangible and intangible assets. At the same time, from the point of view of the employer, human capital is seen as an enterprise's capability to make the best decisions and implementations by using the knowledge of its employees (Bontis 1996, 43). For example, company executives can work efficiently, if they acquire high level of human and relational capital (Hundal 2016, 342).

Unfortunately, it is often the case that companies do not highly value human capital and approach it as the company's own property. However, human capital can only be "rented" or leased from the employee (Edvinsson 1997, 369). Thus, when certain key

employees, such as the CEO or any Executive Manager, realize that the company has misused their human capital, the resignation of these key figures can lead to the company's stock price falling down. (Seetharman et al. 2004, 524.) As a result of the human capital misuse, company might end up in a situation, when employee turnover is high. At the same time, it leads to the wastage of manpower and a lack of know-how experts (Duong 2013, 21).

Furthermore, human capital plays a significant role in creating the hard and soft part of IC. Workers' competence stands for the hard part, which includes the employees' knowledge, skills, and talents. At the same time, knowledge itself includes technical and academic skills, which are mainly obtained through school education. As for the soft part of IC, it is identified with the workers' attitudes. According to Chen and his colleagues, these attitudes include both motivation and satisfaction with work. (2004, 203.)

Structural capital

Some scholars describe structural capital as what is left in the company and its premises after the employees have gone home for the night. In other words, it is an internal element, which includes the company's internal system, policies, procedures, and structure (Walsh et al. 2008, 7). Ferreira and Martinez define structural capital as "all non-human stocks of codified knowledge in an organization" (2011, 252). According to Budiarti, structural capital plays a supportive element for human capital (2017, 151).

Strong structural capital allows the company to solve different problems or challenges. For example, it allows the company to meet the marketing requirement by using the company's structure, which might afterward assist the workers' quests for business and optimum intellectual performance. Thus, companies with a strong structural capital will be able to create sufficient conditions for using human capital at its fullest potential, and afterward boost customer capital (Chen et al. 2004, 204).

Customer capital

Being opposite to structural capital, relational capital, also called as customer capital, is linked to the external component of the company's activities and includes customer relationships, other strategic partnerships, customer loyalty and key suppliers

(Seetharman et al. 2004, 524; Bontis 1996, 44). At the same time, Budiarti underlines that relational capital brings even more value to an enterprise by bridging human capital and structural capital with any other external agents (2017, 151). Furthermore, as Hundal mentions combination of the customer capital and the human capital could also be called as reputational capital (Hundal 2017, 153).

Additionally, advertising initiatives, customer databases, customer-loyalty programs, the knowledge related to marketing and distribution channels could be considered a part of the customer capital. Finally, customer capital helps the company to understand the impacts of the government public policy on the company's operations.

2.1.3 Intellectual capital measurement methods

The IC measurement systems are still underdeveloped in comparison to traditional financial statements, which is based on the physical assets and measured with the help of the double entry accounting system (Salman et al 2012, 21). Despite the fact that human capital is taking a leading role in the knowledge-based economy, most companies do not have appropriate tools and their managers and executives have no clear understanding of IC impact on companies' performance.

In a knowledge-based economy knowledge itself composes a large part of the product's value and the enterprise's wealth. Furthermore, the IC measurement can assist managers to be aware of the status quo of intellectual capital management, getting to know the strength and weakness of existing IC through benchmarking.

Finally, researchers agree that the major focus of those systems is on building an effective measurement model. Such measurement model should combine both financial and non-financial indices, reflect the company's operations under the influence of the knowledge economy and provide company executives with accurate information for knowledge management. (Chen et al. 2004, 195-196).

Over the last two decades, more than 30 IC measurement systems were created. Those systems were targeted to assist managers with business activities and with a specific focus on non-financial measures. Table 2 shows major IC measurement methods, provided by three authors, namely Bontis, Sveiby, and Meihami. Every scholar makes them based on a personal understanding of the concept of IC.

Table 2. Intellectual capital measurement methods, compiled by the author based on the sources Chen et al. (2004, 199), Sveiby (2010, 3), and Meihami et al. (2014, 46)

Classification of intellectual capital measurement methods			
	Bontis (Chen et al. 2004, 199)	Sveiby (2010, 3)	Meihami et al. (2014, 46)
Human Resource Accounting (HRA)	X		
Economic Value Added (EVA)	X		
Scorecard method	X	X	x
Intellectual Capital – Skandia Navigator	X		
Return on Assets Methods (ROA)		X	x
Market Capitalization Methods (MCM)		X	
Direct Intellectual Capital Methods (DIC)		X	x
The Investment Market Value			x

In the present thesis, the author concentrated on Sveiby's classification, which includes four categories of the IC measurement. A complete structure of measurement methods and sub-methods could be seen from Figure 5.

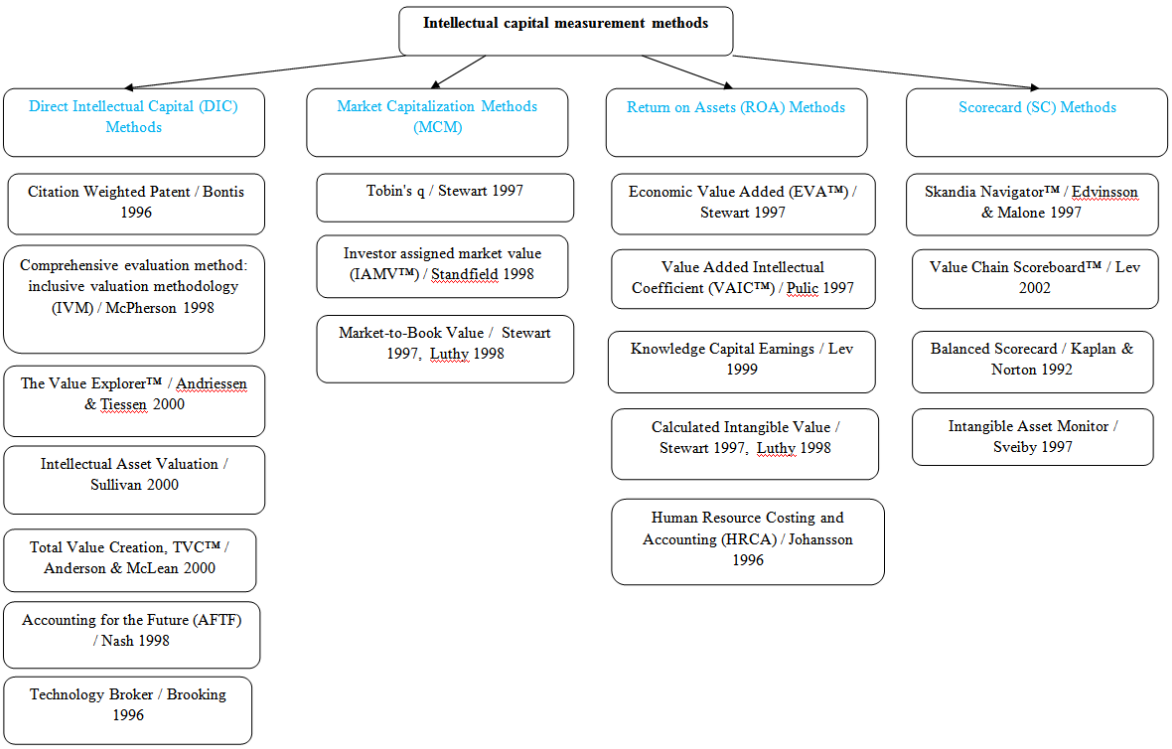

Figure 5. Intellectual capital measurement methods by Sveiby (2010, 5-8)

As Figure 5 reflects, there are different sub-methods under each category. Due to the limitations of the present study, it seems possible to focus only on some of the sub-methods. Thus, the author decided to give a detailed explanation of the following sub-methods: Total Value Creation (Direct Intellectual Capital Method), Tobin's q and Market-to-Book value (Market Capitalization Methods), the EVA and the VAIC (Return on Assets Methods), Scandia Navigator and Intangible Assets Monitor (Scorecard Methods).

Direct Intellectual Capital (DIC) Methods

According to Roos (2006), with the help of this method specialists identify intangible assets components and measure their $-value (247). Once components are known, researchers evaluate them either individually or as a combined coefficient. (ibid.)

- Total Value Creation (TVC). According to Anderson and McLean, TVC uses the discounted projected cash flows to determine how events would affect planned activities (Nazari 2014, 124). In other words, it estimates the value, which could be generated in the future.

Market Capitalization Methods (MCM)

This method focuses on calculating differences between "a company's market capitalization and its stakeholder's equity as the value of its intellectual capital or intangible assets" (Sällebrant et al. 2007, 1474). One of the most famous sub-methods, which is covered in this chapter, is Tobin's q and market-to-book-value.

- Tobin's q. Tobin's q is a ratio between the total market value of the enterprise and total assets value. According to Sveiby, "changes in 'q' provide a proxy for measuring effective performance or not of a firm's intellectual capital" (2010, 8).
  Based on the above-mentioned description, the formula of the ratio could be written as follows:

$$\text{Tobin's Q ratio} = \frac{Total\ Market\ Value\ of\ the\ Company}{Total\ Asset\ Value}$$

- Market-to-book-value. The contention of this indicator is that the value of a company's IC is seen as the difference between its market value and the book value (Dzinkowski 1999, 13).

$$\text{Market-to-book-value} = \frac{Market\ Capitalization}{Net\ Book\ Value}$$

Return on Assets Methods

Based on Meihami's description, return on assets is the ratio between the profit before the company tax for a particular period of time and the average of the value of physical assets for the same period of time (2014, 46). When the company's ROA is calculated, specialists compare it with the industry's average ROA percentage. Afterward, specialists calculate average annual earnings from intangibles by multiplying the difference between the company's ROA and industry's average ROA by the company's average tangible assets. As a result, approximate value of intangible assets can be calculated by dividing average earnings by the enterprise's cost of capital (Sällebrant et al. 2007, 1474).

- Economic Value Added. The EVA is defined as a performance evaluation method, which "measures the net operating results after the taxes less a charge

for the capital employed to generate those profits" (Jacque 2014, 670). Boer sees the EVA as an estimate of true economic profit (2002, 5).
According to Hundal, the EVA is "obtained by subtracting a charge for using total capital, i.e. equity, debt, and any other hybrid form from net operating profit after taxes (NOPAT) of a firm" (Hundal 2015, 6). Thus, a formula in order to calculate EVA could be shown as follows:

EVA = NOPAT – invested capital * WACC, where

- NOPAT is Net Operating Profit After Taxes;
- Invested capital is an amount of money, which the company uses to fund a certain project
- Weighted Average Cost of Capital (WACC) is an average rate of return that the company is planning to pay its investors.

- Valued Added Intellectual Coefficient. The VAIC is seen as an analytical procedure, which helps management team of the company, shareholders and other stakeholders to monitor and evaluate the efficiency of VA by a firm's total resources and each major resources component (Firer & Williams 2003, 352). This coefficient contains three major resources, which help to create added value creation:
  - capital employed (CE): a combination of physical and financial capital, e.g. book value;
  - human capital (HC), which could be interpreted as employee expenses;
  - structural capital (SC), which could be interpreted as the difference between produced added value (VA) and human capital (HC), e.g. VA-HC (Ståhle et el. 2011, 533).

  A formula, which researchers use for calculation the VAIC, looks as follows:

VAIC = ICE + CEE

Logic on how the formula was derived is clearly seen from Figure 5:

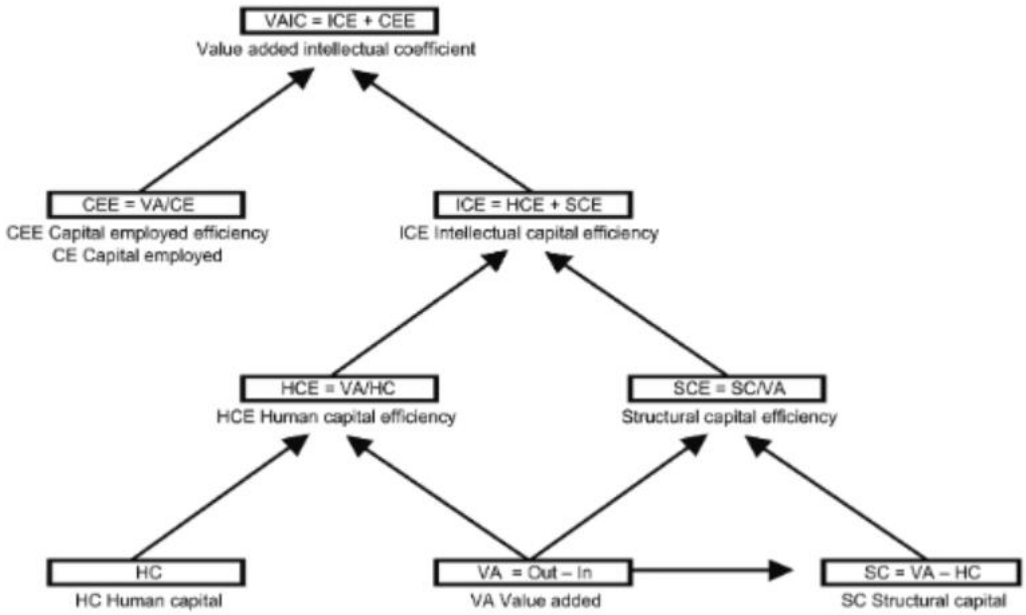

Figure 6. Value Added Intellectual Coefficient (Ståhle et al. 2011, 534)

As it is seen from the above picture, VAIC is calculated as the sum of major efficiency figures, which are calculated as ratios:

- capital employed efficiency, which is calculated as VA/CE;
- human capital efficiency, which is calculated as VA/HC; and
- structural capital efficiency, which is calculated as SC/VA.

As an intermediate result, Intellectual Capital Efficiency (hereafter ICE) is calculated as a sum of human capital and structural capital efficiencies:

ICE= HCE + SCE

Scorecard (SC) Methods

With the help of a scorecard, methodology managers got a chance to measure financial and non-financial factors, including the customer perspective groups, the internal business process, the learning and growth perspective (Chen et al. 2004, 199).

- Skandia Navigator. This method is considered one the most famous IC measurement model. It contains five major focuses of the company's performance: human, customer, financial, process, and renewal and

development. Every focus has a number of factors, which are quantified in order to measure the change. Figure 7 illustrates the structure of the model, including all five focuses and their indicators.

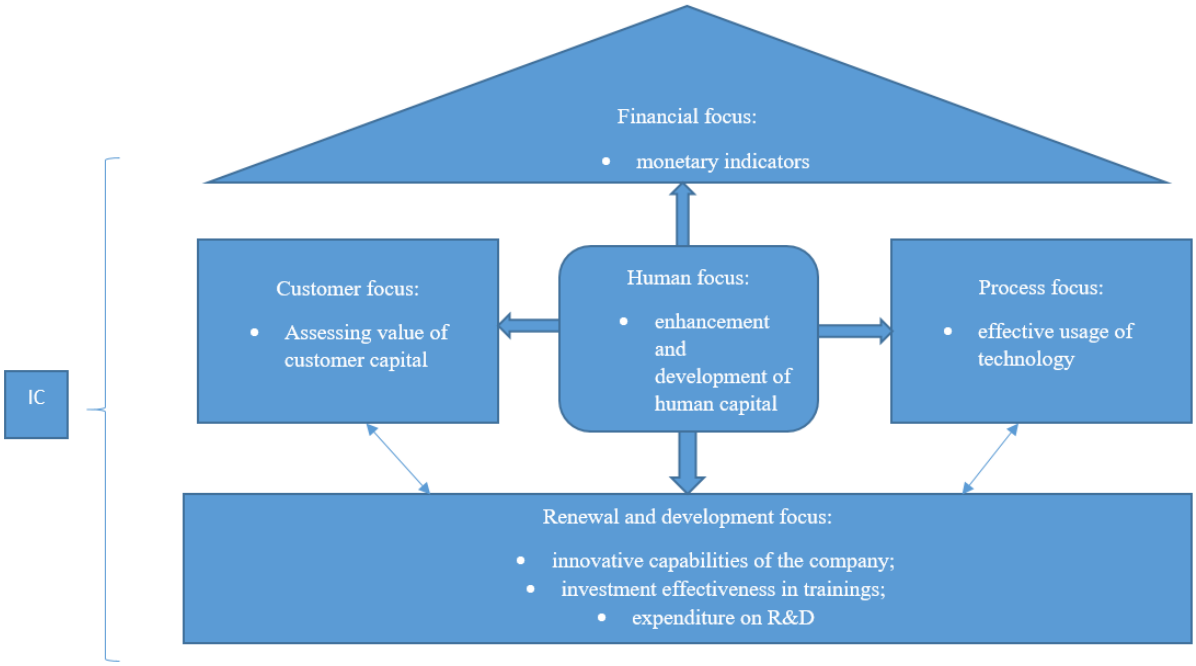

Figure 7. Skandia Navigator model, modified by the author from the source Starovic & Marr (2003, 11-12)

- Intangible Asset Monitor (IAM). IAM was created by Sveiby in 1997 as a method for measuring IC or intangible assets. Based on the model, a company's management takes three strategic objectives of the company and three indicators. Strategic objectives are people's competence, internal structure and external structure of the company. As for indicators or value creation modes, they are growth and renewal, efficiency, and stability. Figure 8 clearly illustrates the structure of the IAM model:

The Intangible Assets Monitor		
External Structure	**Internal Structure**	**Competence**
Indicators of Growth/Renewal	Indicators of Growth/Renewal	Indicators of Growth/Renewal
Indicators of Efficiency	Indicators of Efficiency	Indicators of Efficiency
Indicators of Stability	Indicators of Stability	Indicators of Stability

Figure 8. The Intangible Asset Monitor (Sveiby 1997, 78)

To conclude, in the literature review chapter the author provided a variety of IC definitions, its major components, and the measurement methods. Additionally, the importance of the IC was discussed.

2.2 Theoretical framework for the thesis

Based on the literature review performed in this chapter, the following theoretical framework has been developed:

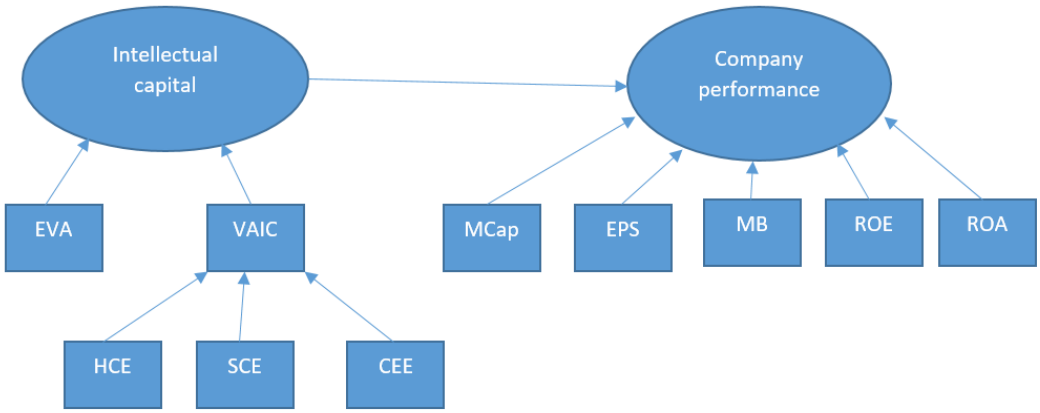

Figure 9. Theoretical framework, created by the author

Key intellectual measurement methods, which are extensively used by the companies are the EVA and the VAIC. From the perspective of these two methods, the author will conduct the research on their influence on company performance. The company performance is presented with five indicators: MB, ROE, ROA, EPS, and MCap. Thus, IC and company performance could be treated as latent variables.

Based on the description above, following hypotheses have been formulated:

Hypothesis 1: there is no significant relationship between the VAIC and performance of the Finnish publicly listed companies

- Hypothesis 1.1: There is no significant relationship between human capital efficiency (hereafter HCE) and a performance of the Finnish publicly listed companies
- Hypothesis 1.2: There is no significant relationship between capital employed efficiency (hereafter CEE) and a performance of the Finnish publicly listed companies
- Hypothesis 1.3: There is no significant relationship between structural capital efficiency (hereafter SCE) and a performance of the Finnish publicly listed companies

Hypothesis 2: there is no significant relationship between the EVA and performance of the Finnish publicly listed companies.

3 Methodology

3.1 Research approach

Research methods are divided into three major categories: qualitative, quantitative and mixed methods. Qualitative research is understood as an approach aiming at learning the phenomenon through the eyes of the individuals or larger entities (Creswell 2014, 32). Quantitative methods test objective theories by examining relationships within variables and use statistical methods for the data analysis (ibid., 32). Finally, there is mixed-method research, which incorporates both qualitative and quantitative data collection techniques and analysis procedures either at the same time or one after the other (Saunders et al. 2009, 595). Based on the above-mentioned characteristics, the

current study employed the quantitative research method, since the variables of the research are expressed as numbers and statistical methods were used in the data analysis.

Generally speaking of the research process and design, its structure is well-illustrated by Saunders and his colleagues. They show research processes as the layers of an "onion". According to Figure 10, there are six layers identified by Saunders: philosophies, approaches, strategies, choices, time horizons, and techniques and procedures.

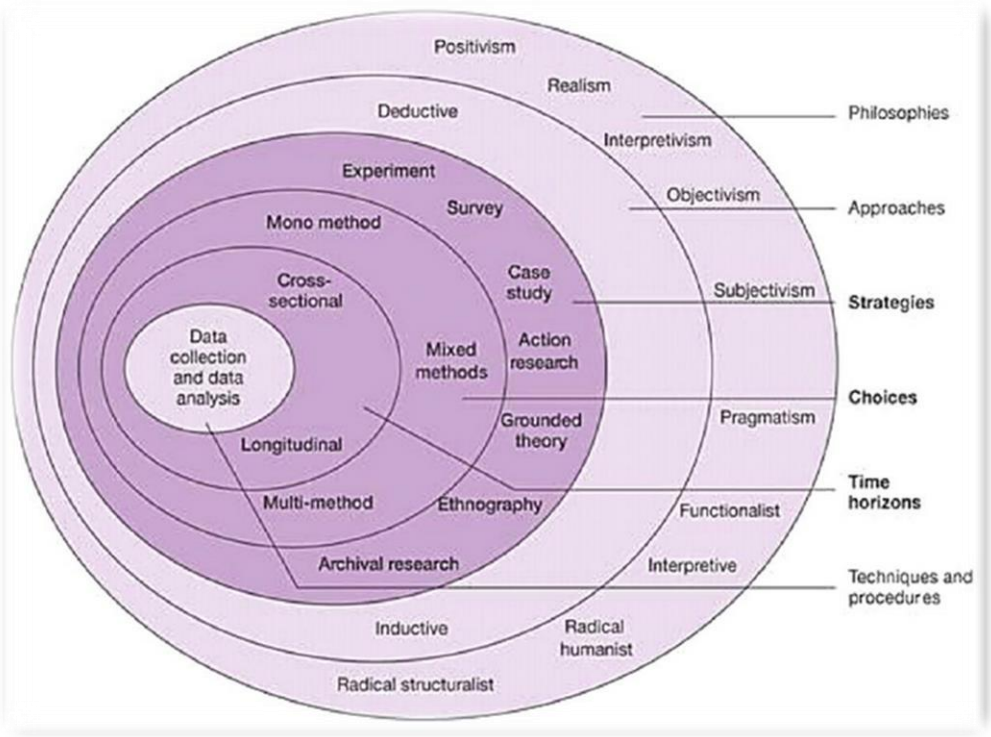

Figure 10. The research onion (Saunders et al. 2009, 108)

Identifying the research philosophy is the first step that the researcher should take. Research philosophy includes key perspectives on the way how the world is seen and understood by the people, and which you are able to reflect and defend throughout the research paper (ibid., 108). Research philosophies fall into four major types: positivism, realism, interpretivism, and pragmatism.

Interpretivism is focused on understanding the roles that human beings play as social actors. Depending on their roles, humans have motives, actions, and intentions. Moreover, results cannot be generalized, since the context in question may not be duplicated in the future (Jones et al. 2008, 234).

The second research philosophy is realism. Its essence is that reality exists separately from the human mind. Besides, realism is based on the assumption of a scientific approach to knowledge development.

The third philosophy is called pragmatism. Its main focus is on actual "actions, situations, and consequences" (Creswell 2014, 294). In their works, researchers emphasize research problems more than on methods. They use the available methods in order to understand the problem or phenomenon.

The fourth philosophy is positivism. According to Saunders, those who apply the positivist theory work with the observable social reality and produce law-like generalisations as an end product (2009, 113). The author of the thesis considered this philosophy the most appropriate, since the purpose of the research was to measure the observed phenomenon and generalize the results afterwards.

Having selected the philosophy framework, the researcher should move to the next layer of the research process by making the design of the research project (ibid., 124). This stage is called the research approach. Creswell defines research approach as a combination of plans and procedures that the researcher uses in the work. According to him, the research approach steps include assumption building, data collection methods, analysis stage and interpretation of the data received (Creswell 2013, 31).

Saunders and colleagues identify two types of research approach: deductive or inductive. In the case of the inductive approach, the researcher collects data and develops theory, which is based on the analysis of the collected data. Under the deductive approach, the researcher develops a theory and hypotheses, and then defines the research strategy, which tests the developed strategy (Saunders et al. 2009, 124). In addition, the deductive approach has two major characteristics. First of all, it is "a search to explain causal relationships between variables" (ibid., 125). Secondly, it is a collection of quantitative data. Thus, based on the above-mentioned characteristics, the deductive approach was applied in the current research.

In addition to the philosophy and the approach of the research, it is necessary to identify the purpose of the same research. Scientists identify three major purposes: exploratory, explanatory, and descriptive. By using the exploratory purpose the researcher is seeking new insights, asking questions and assessing phenomenon in a new light (Robson 2002, 59). As for the descriptive purpose, it includes detailed information on the people, events, actions, etc. (Saunders et al. 2009, 140). Moreover, if the researcher would like to use the deductive purpose, he should have a clear understanding of the phenomenon prior to the data collection. Finally, the explanatory purpose emphasizes "studying a situation or a problem in order to explain the relationships between variables" (ibid., 140). Thus, the current research used the explanatory research purpose.

3.2 Context

It was decided to implement a study on the Finnish public companies, which were listed at the Helsinki Stock Exchange (Nasdaq OMX Helsinki) and belonged to the telecommunication and information technology sector (altogether 42 companies). The author focused on the public companies because of data availability. Calculations of the ratios and variables, which were needed for the research, required financial data. In the case of private companies, such type of data could be obtained by contacting the company directly and then signing certain legal agreements (non-disclosure agreements etc.). Moreover, there was always the chance that the company could refuse to provide financial documentation at all.

Since the author's intention was to collect data from 30 to 50 companies, it would have been time-consuming to collect the required data prior to the actual research in these circumstances. Consequently, it was decided to collect data from publicly listed companies because such companies are required to publish financial information annually.

Companies of such business entity are required to publish financial information annually. In the world of information technology, the majority of the companies publish annual reports on their websites, so that information can be easily accessed with the help an internet connection. Besides, annual reports made by a public company are constantly audited by the regulatory bodies, which means that they have been checked against any misstatements or any other false information. Finally, every

publicly listed company should also follow the reporting guidelines of the stock exchange that they are listed in. For example, companies listed in any of the Nasdaq OMX Group stock exchange markets should follow three major documents:

- Issuer Rules;
- The Member Rules;
- The Warrant Rules Book.

Furthermore, there were a few reasons why the Helsinki OMX Nasdaq was selected for the research, even though there are larger stock exchange markets available in other European countries. As a matter of fact, the author is residing in Finland and speaks the local language, thus it was decided to research companies in the local stock exchange. Even though the majority of companies publish annual reports in both English and Finnish, some of the enterprises have them only in the local language. For that reason, knowledge of the local language helped in conducting the research. In this case, there was no reason for asking for external assistance in translation work.

Officially, the Helsinki Stock Exchange was founded in 1912 (History of the Finnish stock market, 2010). Since the year 2003, the Helsinki Stock Exchange has functioned under the name of Nasdaq OMX Helsinki as a part of the Nasdaq OMX Group.

Nowadays, the Nasdaq OMX Helsinki is an officially regulated market, which has been licensed in Finland. The headquarters of the stock exchange is located in Helsinki. The Helsinki Stock Exchange is the 77^{th} largest of the exchanges that are tracked by Nasdaq.

Finally, the author selected the information technology and telecommunications sector for the research purpose. Information technology is considered an industry mainly driven by IC (Kavida & Sivakoumar 2010, 25). This industry belongs to the “new economy”, which is driven by information and knowledge and with high interest in the IC theory (Cunho et al. 2015, 53). Besides, the IT sector in Finland has been an icon of economic development.

3.3 Data collection

In order to answer the research questions, the current research used secondary data. According to Saunders et al., secondary data is the one that has been already collected

for some other purpose (2009, 256). Various data sources were employed in this paper in order to complete theoretical and empirical parts. For example, for completing the literature review chapter, the author used books, articles and other material published by professional organizations. Literature was both of paper and electronic format.

Empirical research was completed by using annual reports of companies as well as stock price information on the Nasdaq OMX Helsinki web page. Both sources are considered reliable since they are seen as the official numerical corporate data. For example, the annual report makes it official for the reason that the company should follow International Financial Reporting Standards.

Besides the sources of data, it is necessary to mention about time horizons of the research. According to Saunders and his colleagues, collected data could be either cross-sectional or longitudinal. Cross-sectional research is conducted at a particular time, whereas in longitudinal research phenomenon is analyzed during a fixed period of time (Saunders et al. 2009, 594). In the case of current research, financial data was studied within five financial years (2013-2017), thus it is considered longitudinal.

Having described the time horizons of the research, it is necessary to mention that the unbalanced panel data model has been selected. A major reason is that not all companies have financial data available during the selected timeline. Explanations for that could be stated as follows:

- Company merger or acquisition. For example, in 2017 Affecto Oyj was bought by the CGI Oyj and the Comptel Oyj was bought by Nokia Oyj. Thus, both of the companies (Affecto Oyj and Comptel Oyj) do not have separate financial data available for the year 2017;

- Trading at the Nasdaq OMX Helsinki started in between the research years. For example, DNA started its trading at the Nasdaq OMX Helsinki in 2016. Thus, disregard the fact that annual reports of the DNA Oyj are available from the year 2009, financial data from the year 2016 onwards has been in use.

Variables were collected from annual reports and are divided into two groups:

1. Independent variables

a. Value Added Intellectual Coefficient. The current variable is used to calculate the efficiency of the company in using the IC resources. Algebraically VAIC formula could be written as follows:
VAIC = CEE + HCE + SCE

In order to calculate HCE, SCE and CEE following formulas are used:

- HCE =$\frac{VA}{HC}$, where VA is value added and HC – human capital of the firm, which consists of total salary cost.
Value added is calculated as the sum of operating profit, employee cost, amortization, and depreciation:

VA = OP + EC + A + D

- CEE =$\frac{VA}{CE}$, where CE is a book value of net assets of a firm.
Algebraically it is written as:
CE = Total assets – intangible assets

- SCE = $\frac{SC}{VA}$, where SC is the structural capital of a firm.
Mathematically it can be written as the difference between Value Added and human capital:
SC = VA-HC

b. Economic Value Added**.** The EVA is can be defined as net operating profit after tax (NOPAT) subtracted with the capital charge.
Algebraically it could be written as follows:
EVA = $NOPAT_t$ – [(TA_{t-1}– CL_{t-1})] *$WACC_t$

In order to calculate WACC, it was required to check from annual reports following variables: total equity, total debt, cost of equity, cost of debt, and a corporate tax rate.

2. Dependent variables
    a. Financial performance:
        - Return on assets. It reflects the profitability of the company in relations to total assets. The ratio was calculated based on the formula:

$$\text{ROA} = \frac{Net\ operating\ profit}{Total\ assets}$$

Data for the ratio calculation was retrieved from the companies' annual report.

- Return on equity. It reflects the profitability of the business by showing how much profit an enterprise generates in relation to invested money by shareholders:

$$\text{ROE} = \frac{Net\ operating\ profit}{Total\ equity}$$

Companies' financial statements were used as the primary source of numerical data in order to calculate the ratio.

- Earnings per share**.** The EPS is the ratio, which is used to calculate the common shareholder's portion of the company's profit. Information about the EPS can be either found directly from the company's annual report or then calculated as follows:

$$\text{EPS} = \frac{Net\ income - Dividents\ on\ Preferred\ Stock}{Average\ Outstanding\ Shares}$$

b. Market performance:

- Market-to-book ratio**.** The MB helps to evaluate the company's market value in relation to its book value. The market value of the company is the current stock price of all outstanding shares, whereas book value is what the company is left with after liquidating all its assets and repaying all its liabilities. In addition, it should be added that book value is equal to the net assets of the firm, which can be taken from the balance sheet. Ratio's formula looks like the following:

$$\text{Market to book value} = \frac{Market\ Capitalization}{Net\ Book\ Value}$$

Net Book Value = Total Assets – Total Liabilities

- Market Capitalization. The MCap refers to the total value of the company's outstanding shares. It is calculated by multiplying the total amount of the outstanding shares by the price of one share at

the current point of time. However, information about the market capitalization of the company could be found directly from the annual report.

3.4 Data analysis

In order to analyze data collected for the current research, a few data analysis methods were used. First of all, the data was visualized with the help of graphs and diagrams. Visualization of data helps to see overall tendencies within the variables of the research.

Secondly, descriptive analysis methods were used. According to Creswell, descriptive analysis is used for all dependent and independent variables when the means, standard deviation, and range of scores are indicated (2014, 209). With the help of the IBM SPSS Statistics, the author made a separate table, which contained information on the minimum and maxim values of each variable, their means, variance, and standard deviations. The minimum value is the smallest observation of a sample, whereas the maximum value is the largest observation of the same sample. The mean is used as another term for average, which is a partition between the total sum of the value and the count. Standard deviation "indicates the difference between a group of values and their mean, taking all of the data into account" (Stewart 2016, 27).

Thirdly, correlation analysis was performed that checked the relationship between two variables (Saunders 2009, 589). Correlation is measured with the correlation coefficient, meaning a number ranged between -1 and +1, which then represent the strength of the relationship between two variables. (ibid.) If the coefficient value is +1, it means that the relationship is perfectly positive, whereas -1 means that the relationship is perfectly negative. If the value is 0, it means that variables are independent, whereas values between -1 and +1 are evaluated according to Cohen's correlation coefficient's interpretation guidelines:

- Correlation coefficients in the order of -0.10 or 0.10 are "small;
- Correlation coefficients of -0.3 or 0.30 are "medium";
- Correlation coefficients of the value -0.50 or 0.50 are "large" (Cohen 1988, 77-81)

Moreover, the significance level should be less than 0.05. It means that 5% of the results could be considered random due to the hazard.

Fourthly, regression analysis was performed. One of the coefficients used in the analysis was the adjusted coefficient of determination or adjusted R squared. The coefficient underlines the proportion of variance in the dependent variable associated with the independent variable. The current coefficient ranges between 0 and 1. Thus, the larger R square value is, the more of the variation is explained by the model. However, if the value is 0, the independent variable cannot be explained based on the dependent variable.

Unfortunately, there are no common rules on how to evaluate adjusted R squared values. For example, Zikmund William (2000, 513) provides the following range:

- $R^2 < 0.3$ is considered none or very weak effect size;
- $0.3 < R^2 < 0.5$ range is considered weak or low effect size;
- $0.5 < R^2 < 0.7$ is considered moderate effect size;
- $R^2 > 0.7$ is considered strong effect size.

Henseler and his colleagues, as well as Chen, use a different scale for the analysis of the R squared. According to them, R^2 values below 0.25 are considered low whereas values between 0.25 and 0.60 are interpreted as moderate. Values above 0.60 are seen as substantial. (Henseler et. al. 2009, 303; Chin 1998, 323.)
In the current research, the author used the range provided by Henseler and Chen.

4 Results

Current chapter presents the empirical results of the study. Results are divided into two major parts, namely descriptive statistics, and regression results.

4.1 Descriptive analysis

Based on the secondary data used in this research, the VAIC (including HCE, SCE, and CEE) and the EVA were calculated. Furthermore, other dependent variables have been calculated or taken from the financial statement of the annual reports. Variables have been calculated for all the years of the studied period and gathered into the common table, which is used for analysis in this chapter under Table 3. In addition,

variables have been calculated for every year separately and the results are presented in Appendices 1-5.

Table 3. Descriptive statistics, 2013-2017

	N *	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	166	-7,90	54,10	3,8783	6,94828	48,279
HCE	178	,00	4,60	1,7062	,62136	,520
SCE	186	-,40	,90	,2737	,25149	,063
CEE	156	-7,20	9,00	,9295	2,17013	4,709
EVA (million €)	145	-1172,80	717,20	-35,3393	236,57584	55968,126
MB (%)	185	-,20	1,50	,5135	,28223	,080
ROE (%)	185	-28,10	33,50	8,9762	10,65469	113,522
ROA (%)	186	-11,40	15,70	3,5204	4,66802	21,790
EPS (€)	191	-1,21	2,97	,4901	,70840	,502
MCap (million €)	175	,00	15941,00	1634,8326	2738,14242	7497423,921

*N- number of observations

VAIC

In order to understand data better, descriptive statistics has been applied. Table 3, as well as Appendices 1-5, present minimum, maximum, mean and standard deviation values of dependent and independent variables. Table 3 contains an average data of all the variables throughout the period 2013-2017. As for appendices, they contain company data for every year separately.

Based on the descriptive statistics presented in Table 3, the reader can observe that the mean value of the VAIC between the year 2013 and 2017 is 3.88 with a standard deviation value of 6.95. The minimum value of the variable was -7.90 and the maximum value was 54.10. A negative value of the VAIC means that the company makes losses of 7.90 euro for every 1 euro invested.

Moreover, it should be underlined that the value of VAIC was not stable throughout the years. For example, in 2013 the mean value of VAIC was 3.06 (Appendix 1), in 2016 the same value was already at the level of 5.45 (Appendix 4), and in 2017 value dropped to 4.61 (Appendix 5).

At the same time, minimum and maximum values varied quite much. For example, within minimum values, the highest was in 2013 with the value of -2.70. The lowest minimum value for the five years of research was observed in 2016 at the level of -7.90.

As for maximum value, in the year 2014 it was 6.00 but by 2017 it increased by almost ten times to the level of 54.10.

Having mentioned the difference between the minimum and maximum values, it should be outlined that it led to an increase in standard deviation. The dramatic increase in standard deviation value happened between 2015 and 2016. In 2015 standard deviation of VAIC was still 2.56, though in 2016 standard deviation increased by five times to the level of 10.12. In 2017, the level of standard deviation kept on the same level, which meant that the gap between companies in gaining values from their IC has increased.

When analyzing the VAIC, it should be considered that analysis of the components of the VAIC separately would be necessary as well. Based on Table 3, an average value of the HCE is 1.71. Its minimum and maximum values vary between 0.00 and 4.60 with a standard deviation of 0.62. It should be noted that if we look at mean value by year, it had a tendency to steadily increase. For example, in 2013 an average value of HCE was 1.54, though in 2017 the same value was already 1.90 (Appendix 5). It means that the company started using more effectively its human capital and generating more value out of it.

The second component of the VAIC is Capital Employed. Mean value of the CEE is 0.93 with a standard deviation of 2.17. However, the average value could be higher, if not a dramatic drop between 2015 and 2016. According to Figure 8, mean value in 2015 was 1.33 but in 2016 it dropped to 0.37. One of the reasons for that could be that companies started gaining less value from physical capital than from other components.

The third VAIC component is Structural Capital. Its mean value is 0.27 with a standard deviation of 0.25. Though SCE has the lowest value within all three VAIC components, it is the most stable. Within five years it stayed on the level of 0.24-0.28.

According to the results presented above, one can say that Human Capital is the most effective component in case of value creation than Structural Capital and Capital employed for the period under research.

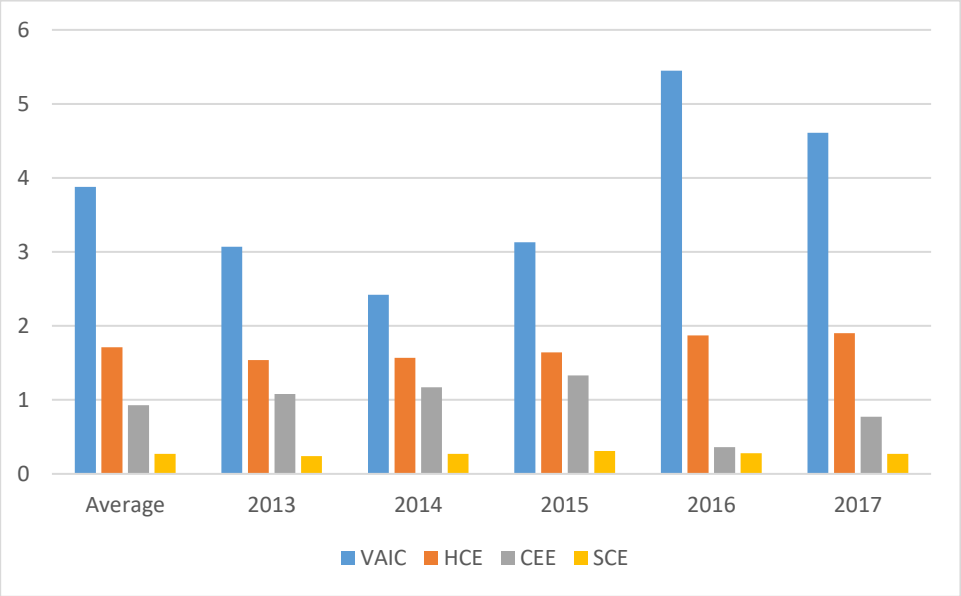

Figure 11. VAIC descriptive statistics 2013-2017.

EVA

According to Table 3, the average of the EVA of the Finnish companies during the period of 2013-2017 was negative, approximately -35.34. It reflects the fact that companies are not able to create positive economic value added during the study period and lost more than 35 million euro. The EVA was ranged from -1172.80 to 717.20 with a standard deviation of 236.58, reflecting a clear disparity and difference among the companies in achieving economic value added during the study period.

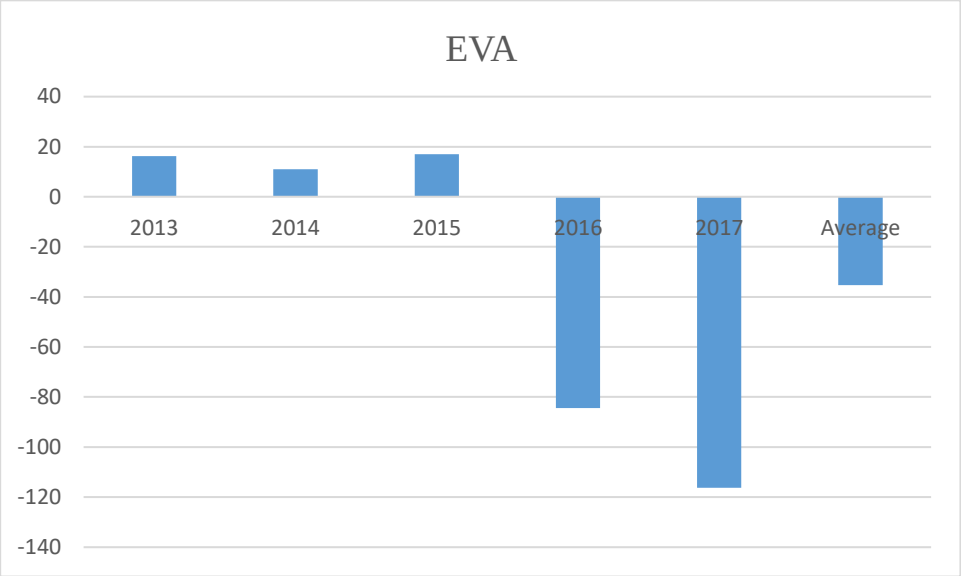

Figure 12. EVA descriptive statistics 2013-2017.

ROA

The average rate of ROA in the study sample during the period of 2013-2017 was about 3.52 and ranged from -11.40 to 15.70. The standard deviation level was at 4.67. It shows that companies under research have different abilities to gain profit out of their investments. Some companies manage to gain 15 euro out of 100 euro invested, though some companies make 11 euro of losses on every 100 euro invested.

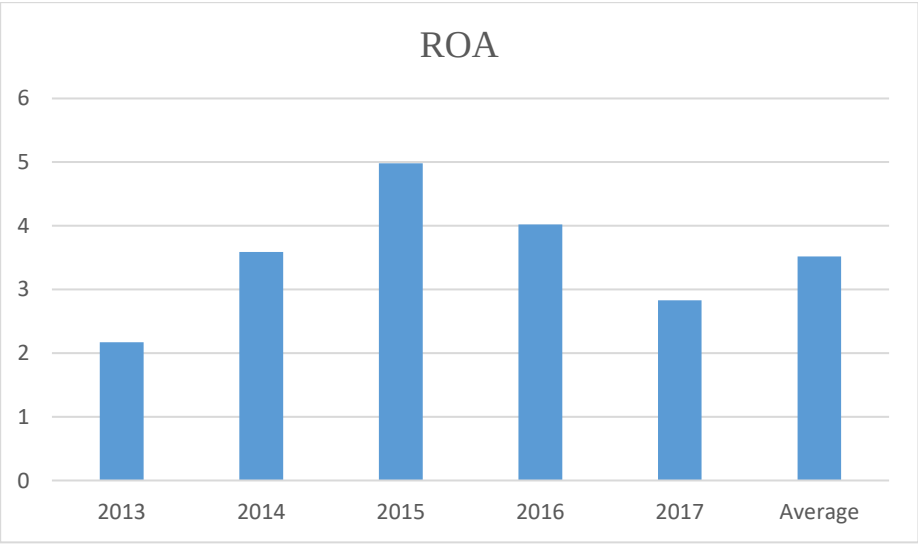

Figure 13. ROA descriptive statistics 2013-2017.

ROE

The average rate of return on equity of the Finnish companies was 8.98%, which ranged from -28.10% to 33.50% and a standard deviation of 10.66%. This reflects the ability of the companies to achieve a positive rate of return on shareholders' funds during the study period, indicating a relative convergence between the enterprises in terms of rate of ROE.

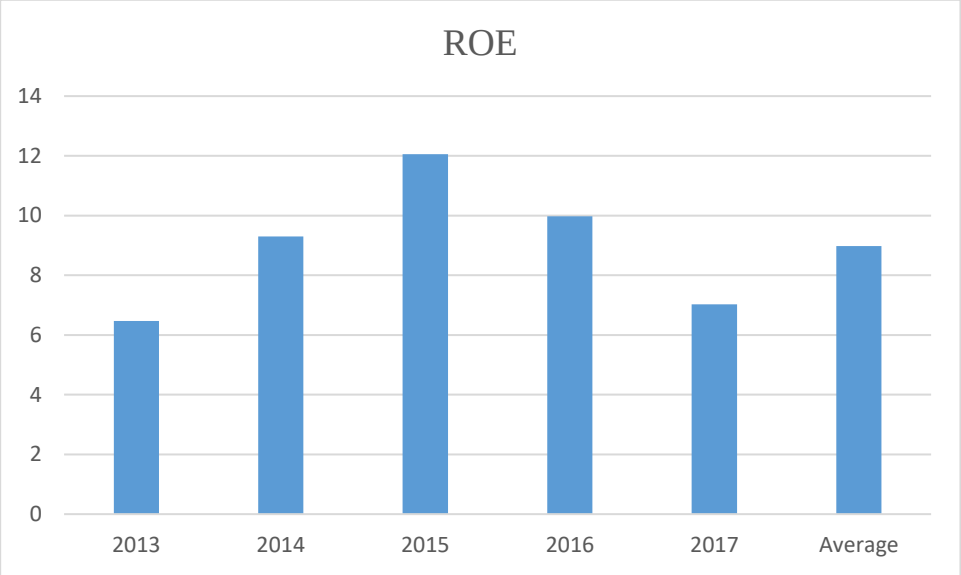

Figure 14. ROE descriptive statistics 2013-2017.

Market capitalization

According to Table 3, mean value for the Market Capitalization of the Finnish companies is 1634 million euro with the standard deviation 2738. As we can observe from Figure 12 there has been an increase of 20-25% for the last few years. One of the reasons for that could be an increase in capitalization of the large companies, like Fortum Oyj, Metso Oyj, and Ahlström-Munksjö Oyj.

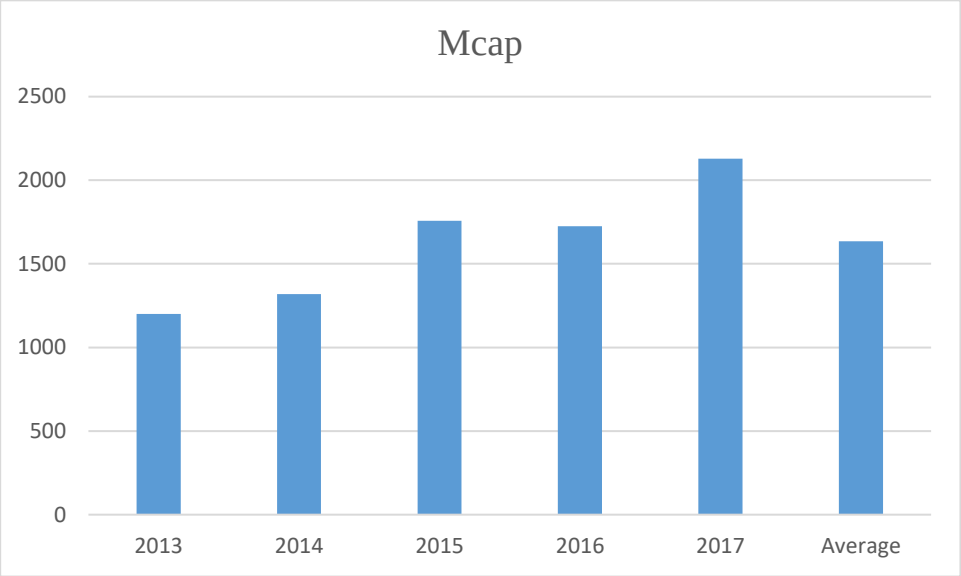

Figure 15. Market capitalization descriptive statistics, 2013-2017.

EPS

The mean value of the Earnings Per Share ratio was 0.49 Euro per share. The ratio ranged from -1.21 to 2.97, with the value of a standard deviation of 0.71. The highest value for the EPS was in 2015 at the level of 0.65 (Appendix 3).

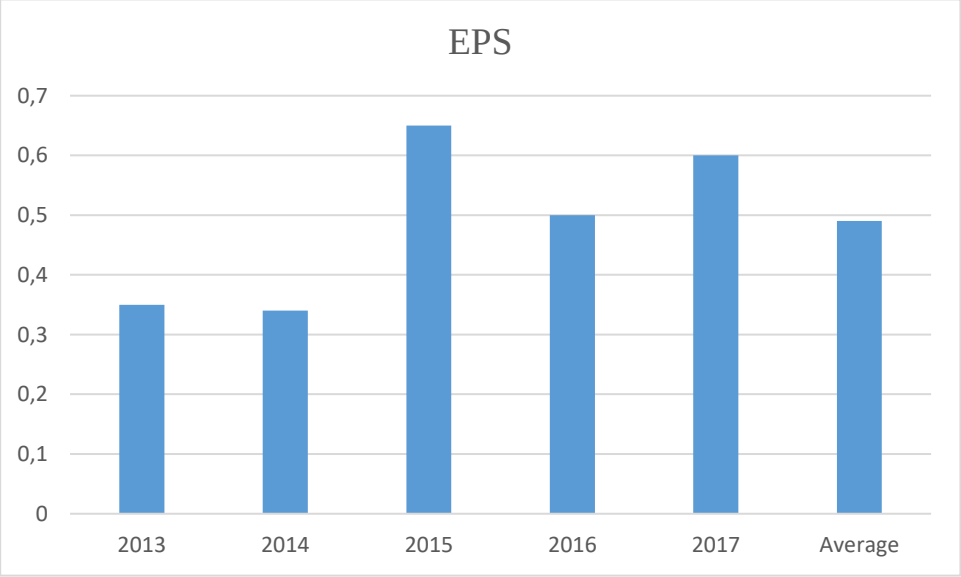

Figure 16. EPS descriptive statistics, 2013-2017.

4.2 Correlation analysis

VAIC

Correlation analysis of the VAIC and the dependent variables between 2013 and 2017 are presented in Table 4. As for data for every year separately, it is listed in Appendices from 6 to 10.

According to Table 4, the VAIC has a positive effect on all the dependent variables: ROA 0.147, ROE 0.094, Market Capitalization 0.026, MB 0.011 and the EPS 0.315. However, the significance level for most of the variables is exceeding the allowed 0.01-0.05 threshold. Thus, it is data is not statistically significant for the studies. The EPS (0.000) is the only dependent variable with an acceptable significance level.

As it was mentioned above, the correlation coefficient of the EPS at the level of 0.315 indicates a moderate positive linear relationship between it and the VAIC. It means that an increase of the VAIC value will automatically lead to an increase in the Earnings Per Share by more than 30%.

Thus, the author could draw the first conclusion that in overall VAIC does not have a significant impact on company performance. The only variable, which was affected by the VAIC, is the EPS.

Table 4. Correlation matrix (Pearson), VAIC (2013-2017)

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	166								
HCE	Pearson Correlation	,128	1							
	Sig. (2-tailed)	,118								
	N	152	178							
SCE	Pearson Correlation	,177*	,658**	1						
	Sig. (2-tailed)	,029	,000							
	N	151	165	186						
CEE	Pearson Correlation	,471**	,205*	,171*	1					
	Sig. (2-tailed)	,000	,017	,043						
	N	146	135	140	156					
MB	Pearson Correlation	,011	,124	,136	-,150	1				
	Sig. (2-tailed)	,895	,116	,077	,077					
	N	153	163	169	140	185				
ROA	Pearson Correlation	,147	,268**	,253**	-,023	-,204**	1			
	Sig. (2-tailed)	,070	,000	,001	,782	,007				
	N	153	166	175	143	171	186			
ROE	Pearson Correlation	,094	,305**	,319**	-,036	-,163*	,944**	1		
	Sig. (2-tailed)	,253	,000	,000	,675	,033	,000			
	N	151	163	174	141	171	183	185		
MCap	Pearson Correlation	,026	,565**	,256**	,089	,119	,174*	,252**	1	
	Sig. (2-tailed)	,760	,000	,001	,318	,132	,028	,001		
	N	144	161	163	129	161	161	160	175	
EPS	Pearson Correlation	,315**	,398**	,331**	,190*	-,027	,540**	,565**	,489**	1
	Sig. (2-tailed)	,000	,000	,000	,022	,717	,000	,000	,000	
	N	158	170	178	145	177	177	177	170	191

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

N – number of observations

If checking VAIC correlation data on yearly basis, one can conclude that the tendency of weak correlation with a high significance value was relevant for Finnish companies. Exceptionally, in 2017 VAIC had a significant correlation with EPS, when Pearson Correlation value was at the level of 0.659 (Appendix 10) and the significance level showed 0.000.

Having analyzed VAIC in general, the author takes its component separately and study their effects on company performance.

a. HCE

According to Table 4, the Human Capital has a weak positive correlation with the following dependent variables: MB (0.124), ROE (0.305) and ROA (0.268). In the case of the EPS (0.398) and the Market Capitalization (0.565), correlations are considered moderate and large respectively. As for the significance level, collected data is not statistically meaningful for the MB ratio only, since its value is 0.116 (above 0.05). For the rest of the variables the significance level is 0.00. It means that knowledge, skill, experience, leadership and entrepreneurial ability of the human resources have a strong impact on the EPS and the Market Capitalization.

Checking HCE values throughout the years of the research, it could be noticed that the value for the Market Capitalization stayed stable (0.488-0.659) with a little fluctuation. It means that the influence of the HC efficiency on the variable was constant.

As for the EPS value, there was a tendency towards the decrease of its influence from the human capital, since value in 2013 was at the level of 0.533 (Appendix 6), in 2014 it showed a decline by 10 % to the level of 0.488 (Appendix 7), in 2017 the Pearson correlation value was already 0.387 (Appendix 10).

Finally, in 2017 the HCE had the highest rates of correlations with the significant correlation being below the accepted level of 0.005:

- EPS -> 0.387;
- Market Capitalization -> 0.572;
- ROA -> 0.463;
- ROE -> 0.483

Thus, one can conclude that the Human Capital has influenced the companies' performance the most during the last financial year.

b. CEE

Based on the correlation analysis presented in Table 4, CEE has a weak negative correlation with the following variable: MB (-0.150), ROE (-0.36) and ROA (-0.023),

As for the Market Capitalization (0.089) and the EPS (0.190), the correlation could be observed as positively weak. After looking at the significance level, we could conclude that data is statistically significant for the EPS variable only with the significance value of 0.022. Thus, it could be concluded that as CE efficiency increases the EPS value increases as well by 19%.

If one would look at the data for every year (Appendices 6-10), the result would be identical to the one in Table 4. The significance level for all the collected data was above the allowed range 0.001-0.005, thus it could be concluded that CE efficiency does not have a significant impact on the company performance.

c. SCE

Structural capital has a positive statistically significant linear correlation with all the dependent variables, except the MB, whose significance coefficient is 0.077. For the rest of the variables, the statistical significance level is either 0.000 or 0.001.

According to Table 4, SCE correlation with the ROA and the Market Capitalization can be identified as weak, since their values of the correlation coefficient are 0.253 and 0.256 respectively. As for the ROE (0.319) and the EPS (0.331) correlation is considered moderate positive. Thus, we can conclude that physical capital influenced the companies performance in regards to their ROA and ROE rates and the EPS and Market capitalization values.

When looking at Appendices 6-10, it should be outlined that likewise for the HCE, in 2017 SCE showed the highest correlation coefficient values for all the variables but MB. Values for the ROE (0.496) and the ROA (0.479) almost reached the “large” border of the Cohen’s classification. As for the Market Capitalization (0.428) and the EPS (0.415), their correlation was considered moderate positive.

Having analyzed correlation coefficients of the VAIC components, one can conclude that the human capital had the most of the influence on the company performance. Least influence on the performance, if any, had the Capital Employed Efficiency. In addition, in 2017 two out of three components (HCE and SCE) had the highest correlation values.

EVA

Correlation analysis between the EVA and dependent variables are displayed in Table 5. According to Table 5, EVA has a negative correlation with all the variables but MB (0.083). However, it should be noted that the significance level is above 0.05 for all the variables but the Market Capitalization (0.043). It means that the data for the ROE, the ROA, the EPS, and the MB ratio is not statistically significant.

Since the correlation coefficient for the Market Capitalization is -0.170, the relationship between it and the EVA is considered weak negative. Thus, the influence of the EVA on company performance is not relevant.

If checking EVA values year-by-year, it could be underlined that one of the strongest correlation between the IC coefficient and company performance variables was in 2015. That year Pearson Correlation value for Market Capitalization was -0.742 and the significance level of 0.000. Moreover, it is necessary to underline that in 2017 correlation data was statistically significant for all the variables but EVA MB (0.671). That year Market Capitalization's correlation coefficient was -0.758, the ROE value was -0.449, the EPS value was at the level of -0.410 and the ROA correlation value was -0.391. Since correlation is negative, it means that an increase in the value of the EVA could lead to a decrease in the respective dependent variables.

Table 5. Correlation model (EVA)

Correlations

		EVA	MB	ROA	ROE	MCap	EPS
EVA	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	145					
MB	Pearson Correlation	,083	1				
	Sig. (2-tailed)	,328					
	N	141	185				
ROA	Pearson Correlation	-,055	-,204**	1			
	Sig. (2-tailed)	,531	,007				
	N	132	171	186			
ROE	Pearson Correlation	-,078	-,163*	,944**	1		
	Sig. (2-tailed)	,377	,033	,000			
	N	132	171	183	185		
MCap	Pearson Correlation	-,170*	,119	,174*	,252**	1	
	Sig. (2-tailed)	,043	,132	,028	,001		
	N	143	161	161	170	175	
EPS	Pearson Correlation	-,110	-,027	,540**	,565**	,489**	1
	Sig. (2-tailed)	,192	,717	,000	,000	,000	
	N	143	177	177	177	170	191

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

N – number of observations

4.3 Regression analysis

VAIC

Based on the results presented in Table 6, the highest value of the unstandardized B coefficient had the market capitalization (9.666). It means that the VAIC increase by one unit might lead to the company's capitalization increase by 9.67. The rest of the dependent variables' B coefficient was 0.000 (MB) or very low, like EPS (0.032), ROA (0.101), ROE (0.144). However, the significance level of all the variables was higher the allowed threshold (0.05), exceptionally of the EPS, which was at the level

of 0.000. Thus, data for four other dependent variables did not have a significant statistical meaning for the research.

Considering the fact that the B coefficient was on the level of 0.032, the influence of the VAIC on the earning per share could be considered negligible. Furthermore, adjusted R^2 in the regression analysis for the EPS was at the level of 0.093. It indicates that the ability of variables to explain the relationship between the independent and dependent variable is only 9.3%.

Table 6. Linear regression, VAIC.

Variables	Number of observations	Adjusted R^2	F-statistics	Unstandardized coefficients		Standardized coefficients	t	Sig.
				B	Std. Error	Beta		
ROA	153	0.015	3.337	0.101	0.055	0.147	1.827	0.070
ROE	151	0.002	1.315	0.144	0.125	0.094	1.147	0.253
MCap	144	-0.006	0.094	9.666	31.543	0.026	0.306	0.760
MB	153	-0.007	0.018	0.000	0.003	0.011	0.133	0.895
EPS	158	0.093	17.171	0.032	0.008	0.315	4.144	0.000

Having mentioned regression analysis for the VAIC in general, the author would analyses components of the coefficient and their influence on the company performance.

a) HCE

According to Table 7, the influence of the human capital on the company performance is larger than the VAIC overall. Once again, market capitalization had the highest value for the unstandardized B coefficient (2181.6). It means that the increase of human efficiency by one unit would lead to an increase in the capitalization by more than 2000 units. Values of the rest the variables were lower but still positive, like ROE (4.592), ROA (1.170), EPS (0.375) and the MB (0.047). As for the significance level, data is not statistically relevant for the MB ratio, since its significance ratio was larger than allowed 0.05 (0.116). It means that human efficiency has a positive influence on the dependent variables.

At the same time, the level of adjusted R^2 is still considered weak or negligible. The highest level had the market capitalization as well (0.315). It shows that influence of the HCE on market capitalization could be explained by 31.5% only. For other variables level of R^2 is measured as very weak or none, since their values are below 0.300: 0.066 (ROA), 0.087 (ROE) and 0.154 (EPS).

Table 7. Linear regression, HCE.

Variables	Adjusted R^2	F-statistics	Unstandardized coefficients		Standardized coefficients	t	Sig.
			B	Std. Error	Beta		
ROA	0.066	12.656	1.170	0.497	0.268	3.558	0.000
ROE	0.087	16.458	4.592	1.132	0.305	4.057	0.000
MCap	0.315	74.625	2181.632	252.545	0.565	8.639	0.000
MB	0.009	2.497	0.047	0.030	0.124	1.580	0.116
EPS	0.154	31.625	0.375	0.067	0.398	5.629	0.000

b) CEE

Unstandardized beta coefficient is considered positive for the Market Capitalization (113.671) and the EPS (0.062), and the negative for the rest of the variables: ROE (-0.184), ROA (-0.054) and MB (-0.020). However, values of the determination coefficient (R^2) is the lowest of all the VAIC components and thus could be considered negligible, since its range is between -0.006 and 0.029. As for the significance level, data is not relevant for all the variables, except the EPS (0.022). Thus, one can conclude that the CEE did not have any impact on company performance.

Table 8. Linear regression, CEE.

Variables	Number of observations	Adjusted R^2	F-statistics	Unstandardized coefficients		Standardized coefficients	t	Sig.
				B	Std. Error	Beta		
ROA	143	-0.007	0.077	-0.054	0.193	-0.023	-0.277	0.782
ROE	141	-0.006	0.675	-0.184	0.438	-0.036	-0.420	0.675
MCap	129	0.000	1.003	113.671	113.478	0.089	1.002	0.318
MB	140	0.015	3.168	-0.020	0.011	-0.150	-1.780	0.077
EPS	145	0.029	5.370	0.062	0.027	0.190	2.317	0.022

c) SCE

Unstandardized Beta coefficient has a positive value for all the variables. The influence of the SCE on market capitalization is considered strongest within the VAIC components with the B value of 3081.310. ROE and ROA have high values as well, 14.578 and 5.061 respectively. As for the MB (0.156) and the EPS (0.961), their values are below 1 and considered negligible. Furthermore, the significance level for all the variables, except of the MB, is within acceptable range:

- ROA – 0.001;
- ROE – 0.000
- MCap – 0.001;
- EPS – 0.000.

Based on these figures, data is statistically significant for all four variables. However, the influence of the structural capital could be considered none or very weak for all the components since their R^2 values are in the range between 0.000 and 0.300. The highest value of the adjusted coefficient of determination was for the EPS – 0.105 and for the ROE – 0.097. As for the MCap, its adjusted R^2 is only 0.060. It means that the SCE influence on the capitalization could be explained by 6% only. Thus, in overall the SCE did not have strong influence on company performance.

Table 9. Linear regression, SCE.

Variables	Number of observations	Adjusted R^2	F-statistics	Unstandardized coefficients		Standardized coefficients	t	Sig.
				B	Std. Error	Beta		
ROA	175	0.059	11.846	5.061	1.470	0.253	3.442	0.001
ROE	174	0.097	19.548	14.578	3.297	0.319	4.421	0.000
MCap	163	0.060	11.257	3081.310	918.392	0.256	3.355	0.001
MB	169	0.013	3.165	0.156	0.087	0.136	1.779	0.077
EPS	178	0.105	21.166	0.961	0.207	0.331	4.655	0.000

EVA

According to Table 10, unstandardized Beta coefficient is negative for the ROA (-0.001), the ROE (-0.004) and the MCap (-1.585). It means that an increase in EVA by one unit would lead to a decrease in market capitalization by 1.585 unit. As for the MB and the EPS, their values stay unchanged.

The significance level of the variables is above 0.05 for all variables, except of the MCap (0.043). That could explain why data is statistically significant for market capitalization only. In addition, the linear regression of the EVA on the market performance is considered very weak, since the value of the coefficient of determination is 0.022. It means that the EVA impact on the MCap could be explained by 2.2% only.Thus, we could conclude that the influence of the EVA on the company performance is negligible.

Table 10. Linear regression, EVA.

Variables	Number of observations	Adjusted R^2	F-statistics	Unstandardized coefficients		Standardized coefficients	t	Sig.
				B	Std. Error	Beta		
ROA	132	-0.005	0.395	-0.001	0.002	-0.055	-0.629	0.531
ROE	132	-0.002	0.787	-0.004	0.004	-0.078	-0.887	0.377
MCap	143	0.022	4.175	-1.585	0.776	-0.170	-2.043	0.043
MB	141	0.000	0.964	0.000	0.000	0.083	0.982	0.328
EPS	143	0.002	1.720	0.000	0.000	-0.110	-1.311	0.192

4.4 Verification of the results

According to Shenton, the verification of the results requires four tests: credibility (or internal validity), transferability (or external validity), dependability (or reliability), and confirmability (or objectivity) (2004, 64).

Credibility (internal validity)

Internal validity in quantitative research is supported when the dependent variable is affected by the independent variable only, not by other confounding variables. As far as this study is concerned, dependent variables do not have significant relations with the independent variables, thus internal validity cannot be proved. One of the reasons for possible threats to internal validity could be the selection process, which could refer to the dependent variables as well as the IC measurement methods. However, it also could be the case that all chosen variables are independent and should not affect each other at any circumstances.

Transferability (external validity)

Transferability of the findings refers to the possibility of generalization of the results to some other contexts. In the light of current research, it means that one could generalize the results on the Finnish IT and Telecommunications industry as a whole. Unfortunately, such generalization is not possible, since research covered publicly listed companies, which are traded at the Nasdaq OMX Helsinki only. However, in Finland there are IT companies that are traded elsewhere, for example at the Nasdaq Stockholm or the Nasdaq Copenhagen. Moreover, the majority of IT companies are privately limited, thus out of the research scope at all. Reasons for that are described in more detail in chapter 5.3 “Limitations of the research”. That is why the results of the research are general for the IT and Telecommunication companies that are traded at the Nasdaq OMX Helsinki.

Dependability (reliability)

According to Yin (1994, 36), reliability refers to the fact the research can be conducted by another person and the same findings would be obtained. In the case of current research, financial data was used from the companies’ financial statements, which are available to everyone in the same format and the same content. For

example, the total assets of the company X for the financial year 2013 would be the same for every researcher as long as the annual report stays untouched. Moreover, formulas for the VAIC and the EVA stay the same in every literature. Thus, results stay the same as long as no external manipulation to the data and formula is performed.

Confirmability (objectivity)

Objectivity of the research refers to the appropriate distance that research participants keep in order to decrease bias. In the case of the current study, the author did not have direct contact with the companies' representatives on the subject of the research. Thus, the author could not influence the companies in terms of published financial data. The same way, the company could not affect the author on the topic of the research.

5 Discussion

5.1 Answering the research questions

IC is one of the main sources of value creation. It is especially true in case of the knowledge-based economy, such as Information Technology and Telecommunication, where the added value of the companies and individuals has a direct connection with knowledge and IC (Bontis 2001, 42). The main goal of the current study was to research the influence of IC on the performance of the Finnish publicly listed companies of the IT and Telecommunication industry. The research was conducted by analyzing the financial data of 42 companies listed in the Nasdaq OMX Helsinki. The VAIC and the EVA were used as measurement methods of IC. The company performance was measured with market variables (MB and Market Capitalization) and the financial variables (ROA, ROE, and EPS).

The first research question was stated as follows:

> Research question 1: Did the Value Added Intellectual Coefficient have an impact on the performance of the Finnish publicly listed companies?

According to the regression and correlation analysis, the VAIC did not have an impact on the performance of the Finnish companies. The only variable that IC had an effect on was the EPS. In the case of correlation analysis, the analysis showed the result of 0.315, and the regression analysis result was at the level 0.093. Thus, one can

conclude that IC does not affect the market performance of the companies. However, it does have an effect to some extent on the financial performance through the EPS variable.

In addition, the following hypothesis was formulated:

> Hypothesis 1: there is no significant relationship between the VAIC and performance of the Finnish publicly listed companies

Based on the above given description, it could be concluded that the hypothesis is accepted.

The current research question contained three sub-questions, which were related to VAIC's components and their influence on the company performance.

The first sub-question was stated as follows:

> Sub-question 1: Did the Human Capital Efficiency have an impact on the performance of the Finnish publicly listed companies?

According to regression and correlation analysis, human capital had an impact on market capitalization only. The correlation coefficient showed a strong relationship between two variables on the level of 0.565. As for the regression analysis, the value was somewhat lower but still considered medium (0.315).

In the case of other variables, the relationship was negligible, or then the data was statistically not significant. Thus, one can conclude that HCE did have an impact on the market performance of the companies but not on their financial performance. In addition, a hypothesis related to the HCE and its impact on company performance was formulated:

> Hypothesis 1.1: There is no significant relationship between human capital efficiency and the financial performance in the Finnish publicly listed companies.

Based on the explanations above, it could be concluded that the hypothesis could be accepted in regards to the financial performance of the companies.

The second sub-question was about the capital employed efficiency:

> Sub-question 2: Did the Capital Employed Efficiency have an impact on the performance of the Finnish publicly listed companies?

Correlation and regression showed a lack of significant relationship between the capital employed efficiency and company performance. The only statistically significant result was for the EPS, though the value was negligibly low (0.190 and 0.029).

Hypothesis in regards to the CEE impact on the company performance was formulated as follows:

> Hypothesis 1.2: There is no significant relationship between the capital employed efficiency and the financial performance in the Finnish publicly listed companies

Based on explanations above, this hypothesis can be accepted.

The third sub-question was stated as follows:

> Sub-question 3: Did the Structural Capital Efficiency have an impact on the performance of the Finnish publicly listed companies?

According to correlation and regression analysis, structural capital did not have a significant impact on companies' performance. Regression analysis underlined that relationship is weak or none, though correlation results showed a moderate relationship with the ROE and the EPS, and a very weak relationship with the ROA and Market Capitalization. Thus, one can conclude that the structural capital has a moderate influence on both marketing and financial figures of the companies, though this relationship cannot be considered significant.

Hypothesis on the SCE impact was formulated as follows:

> Hypothesis 1.3: There is no significant relationship between the structural capital efficiency and the financial performance in the Finnish publicly listed companies

Based on the above-mentioned explanations, the hypothesis can be rejected.

In overall, findings for the research question 1 show that HCE is the most effective factor in the issue of the value creation than the SCE and CEE for the period of study between 2013 and 2017.

Research question 2 concerned the influence of other IC measurement method, named the EVA:

> Research question 2: Did the Economic Value Added have an impact on the performance of the Finnish publicly listed companies?

According to correlation and regression analysis, the EVA does not have a significant relationship with either market or financial companies' performance. Results showed a very weak influence on Market Capitalization. However, it should be outlined that correlation analysis showed a weak negative relationship (-0.170) but the regression analysis showed a weak positive relationship (0.022). However, since the values were very low, thus not significant.

Hypothesis formulated in regards to the EVA is stated as follows:

> Hypothesis 2: there is no significant relationship between the EVA and financial performance in the Finnish publicly listed companies.

Based on above explanations, current hypothesis can be accepted.

5.2 Practical implications

Based on the above-mentioned results, some practical implications could be pointed out. First of all, findings provide new insights into the importance of human capital. Human capital is the only variable, which has a strong positive impact on the market performance of the company. Therefore, companies' management could be interested in human capital's influence on the company financial and marketing performance. Thus, company management could be interested in conducting a more detailed research on specific company case.

Secondly, even though the EVA, SCE, and CEE do not have a significant positive effect on the companies' market and financial figures, they can still have a positive direct effect on their performance in future. It is especially true in light of the variables' significant relationship for the last financial year of the study (2017). All three independent variables had statistically significant strong values against all dependent variables. Thus, it could be of great interest for the researchers to expand

the timeline and make a similar type of research for the same companies between 2015 and 2020.

5.3 Limitations of the research

Due to the author's lack of the experience in the research field and the resources limitations, no research has been conducted on the reasons why data has not been statistically significant for some of the variables. One of the reasons could be the fact that variables are independent and do not influence each other. However, there is a possibility that mistakes occurred in the calculation of the variables or selection of the variables as such.

The second limitation is related to the usage of the VAIC. Some of the researchers are of the opinion that the current method cannot provide a full picture of IC. They assume that the VAIC concentrates more on the human and structural capital while lacking thorough attention towards relational capital (Salehi et al. 2014, 278).

The third limitation is related to the fact that the study is performed on publicly listed companies. The major reason was that their annual reports are open to everyone in electronic format. However, their performance could be different from the performance of private limited companies, the financial data of which is not publicly available. In addition, getting financial data from private limited companies could be time-consuming. Thus, research was limited to the public listed companies only.

5.4 Recommendations for future research

A similar type of research could be done with the broader timeline, covering the economic crisis of 2008 as well. By doing so, it would be possible to compare the influence of IC on the company performance prior to the economic crisis, during the economic crises and after the economic crisis.

Furthermore, it is also possible to make a clear distinction between the industries and make a comparison on how IC influences companies' performance between the industries. For example, whether companies of the real estate sector have a stronger relationship with IC than the one from the IT sector.

Thirdly, future research could be made for all the Nordic countries (Norway, Denmark Sweden, Finland, and Iceland), and results then being compared between countries.

Finally, a similar type of research could be conducted as a case study for a specific IT or Telecommunication publicly listed company. In this type of research, the mixed methods could be used by combining quantitative data from the annual reports and interviews with the management team and the ordinary workers.

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Appendices

Appendix 1. Descriptive statistics, 2013

	Number of observations	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	38	-2,70	8,30	3,0567	2,38482	5,687
HCE	38	,70	3,20	1,5412	,48249	,233
SCE	38	-,30	,80	,2371	,24744	,061
CEE	38	-2,20	3,00	1,0833	1,12222	1,259
EVA (million €)	38	-1007,40	531,60	16,1933	257,99237	66560,063
MB	37	,10	1,40	,5758	,29689	,088
ROE	39	-28,10	24,90	6,4667	11,28339	127,315
ROA	39	-11,40	12,10	2,1730	4,98301	24,830
EPS	39	-,65	1,98	,3450	,57181	,327
MCap (million €)	38	,00	7055,00	1200,2364	1981,74082	3927296,671

Appendix 2. Descriptive statistics, 2014

	Number of observations	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	39	-5,40	6,00	2,4226	2,93175	8,595
HCE	39	,00	3,40	1,5722	,61114	,373
SCE	39	-,40	,90	,2737	,25541	,065
CEE	39	-1,00	2,80	1,1724	,98303	,966
EVA (million €)	39	-90,70	171,90	11,0080	46,52746	2164,805
MB	38	-,20	1,50	,5703	,33239	,110
ROE	40	-16,50	30,00	9,3029	10,36696	107,474
ROA	40	-6,80	14,80	3,5944	4,63249	21,460
EPS	40	-1,21	1,76	,3443	,55786	,311
MCap (million €)	39	,00	7315,00	1319,7147	2025,32086	4101924,580

Appendix 3. Descriptive statistics, 2015

	Number of observations	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	39	-5,20	7,20	3,1250	2,55540	6,530
HCE	39	,40	3,20	1,6382	,61448	,378
SCE	39	,00	,90	,3139	,23195	,054
CEE	39	-2,60	8,50	1,3333	1,96913	3,877
EVA (million €)	39	-152,30	259,40	16,9423	77,60160	6022,008
MB	39	,10	1,40	,5135	,28979	,084
ROE	40	-16,80	33,40	12,0514	9,79069	95,858
ROA	40	-6,10	15,70	4,9838	4,43186	19,641
EPS	40	-,15	2,96	,6542	,83058	,690
MCap (million €)	40	,00	12366,00	1757,6194	2991,69790	8950256,345

Appendix 4. Descriptive statistics, 2016

	Number of observations	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	42	-7,90	42,50	5,4561	10,11687	102,351
HCE	42	,40	4,40	1,8568	,86684	,751
SCE	42	-,40	,80	,2763	,28134	,079
CEE	42	-7,10	7,60	,3656	2,72558	7,429
EVA (million €)	42	-1172,80	717,20	-84,4114	350,38625	122770,524
MB	42	-,10	1,10	,4683	,25243	,064
ROE	42	-21,10	28,30	9,9744	9,59426	92,050
ROA	42	-6,30	10,40	4,0237	3,77935	14,283
EPS	42	-1,00	2,60	,4949	,70287	,494
MCap (million €)	42	12,20	12452,00	1724,5811	2801,12808	7846318,538

Appendix 5. Descriptive statistics, 2017

	Number of observations	Minimum	Maximum	Mean	Std. Deviation	Variance
VAIC	40	-6,10	54,10	4,6056	9,33485	87,139
HCE	40	,60	4,60	1,9000	,88003	,774
SCE	40	-,10	,80	,2667	,24531	,060
CEE	40	-7,20	9,00	,7657	2,99617	8,977
EVA (million €)	40	-741,00	101,50	-116,2517	213,29782	45495,961
MB	39	,10	,90	,4514	,22438	,050
ROE	40	-21,20	33,50	7,0342	11,70205	136,938
ROA	40	-9,70	11,70	2,8342	5,13737	26,393
EPS	40	-,80	2,97	,5972	,80128	,642
MCap (million €)	40	,00	15941,60	2129,5371	3551,19234	12610967,016

Appendix 6. Correlation analysis (VAIC), 2013

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	30								
HCE	Pearson Correlation	-,029	1							
	Sig. (2-tailed)	,883								
	N	28	34							
SCE	Pearson Correlation	,327	,726**	1						
	Sig. (2-tailed)	,096	,000							
	N	27	31	35						
CEE	Pearson Correlation	,599**	,258	,073	1					
	Sig. (2-tailed)	,001	,213	,724						
	N	27	25	26	30					
MB	Pearson Correlation	-,015	,048	-,068	-,320	1				
	Sig. (2-tailed)	,943	,804	,725	,127					
	N	25	29	29	24	33				
ROA	Pearson Correlation	,319	,317	,384*	,190	-,345	1			
	Sig. (2-tailed)	,098	,077	,025	,334	,057				
	N	28	32	34	28	31	37			
ROE	Pearson Correlation	,243	,314	,333	,104	-,345	,971**	1		
	Sig. (2-tailed)	,222	,086	,059	,606	,057	,000			
	N	27	31	33	27	31	36	36		
MCap	Pearson Correlation	,159	,659**	,296	,092	,106	,142	,215	1	
	Sig. (2-tailed)	,448	,000	,112	,668	,591	,447	,253		
	N	27	31	33	27	32	34	34	33	
EPS	Pearson Correlation	,338	,533**	,448**	,321	-,074	,518**	,585**	,634**	1
	Sig. (2-tailed)	,085	,002	,009	,103	,685	,002	,000	,000	
	N	27	31	33	27	32	34	34	31	36

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

N – number of observations

Appendix 7. Correlation analysis (VAIC), 2014

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	31								
HCE	Pearson Correlation	,019	1							
	Sig. (2-tailed)	,922								
	N	29	36							
SCE	Pearson Correlation	,369*	,365*	1						
	Sig. (2-tailed)	,049	,034							
	N	29	34	38						
CEE	Pearson Correlation	,615**	,130	,100	1					
	Sig. (2-tailed)	,001	,535	,621						
	N	27	25	27	29					
MB	Pearson Correlation	-,004	,077	-,001	-,198	1				
	Sig. (2-tailed)	,982	,670	,993	,321					
	N	29	33	35	27	37				
ROA	Pearson Correlation	-,310	,280	,243	-,115	-,326	1			
	Sig. (2-tailed)	,109	,121	,166	,575	,064				
	N	28	32	34	26	33	36			
ROE	Pearson Correlation	-,365	,310	,238	-,200	-,215	,954**	1		
	Sig. (2-tailed)	,062	,090	,183	,338	,237	,000			
	N	27	31	33	25	32	35	35		
MCap	Pearson Correlation	,179	,547**	,167	-,046	,063	,035	,102	1	
	Sig. (2-tailed)	,372	,001	,352	,835	,731	,853	,592		
	N	27	33	33	23	32	31	30	34	
EPS	Pearson Correlation	-,015	,481**	,238	-,037	-,061	,527**	,561**	,597**	1
	Sig. (2-tailed)	,937	,004	,161	,856	,731	,002	,001	,000	
	N	29	34	36	26	34	33	33	33	37

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

N – number of observations

Appendix 8. Correlation analysis (VAIC), 2015

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	28								
HCE	Pearson Correlation	,449*	1							
	Sig. (2-tailed)	,022								
	N	26	34							
SCE	Pearson Correlation	,515*	,655**	1						
	Sig. (2-tailed)	,010	,000							
	N	24	30	36						
CEE	Pearson Correlation	,732**	,155	,140	1					
	Sig. (2-tailed)	,000	,458	,494						
	N	27	25	26	30					
MB	Pearson Correlation	,201	,520**	,334	-,265	1				
	Sig. (2-tailed)	,324	,002	,057	,182					
	N	26	32	33	27	37				
ROA	Pearson Correlation	-,279	,021	-,208	-,234	-,215	1			
	Sig. (2-tailed)	,168	,909	,230	,239	,222				
	N	26	32	35	27	34	37			
ROE	Pearson Correlation	-,156	,110	,150	-,127	-,184	,938**	1		
	Sig. (2-tailed)	,455	,557	,391	,529	,297	,000			
	N	25	31	35	37	34	36	37		
MCap	Pearson Correlation	,253	,566**	,332	-,123	,286	,283	,495**	1	
	Sig. (2-tailed)	,222	,001	,059	,550	,106	,111	,003		
	N	25	32	33	26	33	33	33	36	
EPS	Pearson Correlation	,272	,364*	,149	-,004	,023	,379*	,515**	,679**	1
	Sig. (2-tailed)	,170	,034	,401	,985	,895	,023	,002	,000	
	N	27	34	34	28	35	36	35	34	38

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

N – number of observations

Appendix 9. Correlation analysis (VAIC), 2016

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	41								
HCE	Pearson Correlation	,034	1							
	Sig. (2-tailed)	,841								
	N	37	37							
SCE	Pearson Correlation	,031	,747**	1						
	Sig. (2-tailed)	,855	,000							
	N	37	34	38						
CEE	Pearson Correlation	,860**	,369	,378*	1					
	Sig. (2-tailed)	,000	,054	,047						
	N	31	28	28	32					
MB	Pearson Correlation	,117	,069	,240	-,219	1				
	Sig. (2-tailed)	,471	,688	,153	,236					
	N	40	36	37	31	41				
ROA	Pearson Correlation	,127	,172	,197	-,259	-,130	1			
	Sig. (2-tailed)	,455	,322	,250	,175	,444				
	N	37	35	36	29	37	38			
ROE	Pearson Correlation	,021	,203	,276	-,351	-,049	,892**	1		
	Sig. (2-tailed)	,899	,242	,098	,062	,772	,000			
	N	38	35	37	29	38	38	39		
MCap	Pearson Correlation	-,061	,488**	,041	,160	,175	,061	,061	1	
	Sig. (2-tailed)	,722	,004	,820	,426	,306	,737	,730		
	N	36	33	34	27	36	33	34	37	
EPS	Pearson Correlation	,242	,370*	,381*	,222	,090	,540**	,491**	,495**	1
	Sig. (2-tailed)	,133	,026	,018	,230	,580	,001	,002	,002	
	N	40	36	38	31	40	37	38	37	41

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

N - number of observations

Appendix 10. Correlation analysis (VAIC), 2017

Correlations

		VAIC	HCE	SCE	CEE	MB	ROA	ROE	MCap	EPS
VAIC	Pearson Correlation	1								
	Sig. (2-tailed)									
	N	36								
HCE	Pearson Correlation	,354*	1							
	Sig. (2-tailed)	,047								
	N	32	37							
SCE	Pearson Correlation	,302	,726**	1						
	Sig. (2-tailed)	,082	,000							
	N	34	36	39						
CEE	Pearson Correlation	,380*	,185	,093	1					
	Sig. (2-tailed)	,027	,310	,608						
	N	34	32	33	35					
MB	Pearson Correlation	-,073	,162	,229	-,090	1				
	Sig. (2-tailed)	,688	,367	,187	,631					
	N	33	33	35	31	37				
ROA	Pearson Correlation	,401*	,463**	,479**	,152	-,077	1			
	Sig. (2-tailed)	,019	,005	,003	,398	,654				
	N	34	35	36	33	36	38			
ROE	Pearson Correlation	,306	,483**	,496**	,162	-,109	,948**	1		
	Sig. (2-tailed)	,078	,003	,002	,369	,527	,000			
	N	34	35	36	33	36	38	38		
MCap	Pearson Correlation	,013	,572**	,428*	,188	,112	,279	,311	1	
	Sig. (2-tailed)	,944	,001	,013	,328	,541	,117	,078		
	N	31	32	33	29	32	33	33	35	
EPS	Pearson Correlation	,600**	,387*	,415*	,344*	-,035	,717**	,693**	,267	1
	Sig. (2-tailed)	,000	,022	,011	,050	,838	,000	,000	,122	
	N	35	35	37	33	36	37	37	35	39

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

N – number of observations