From Knowledge to Firm Performance: An Empirical analysis of Intellectual Capital Impact in Polish and Dutch Listed Firms

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Abstract

Purpose: Empirical results about the direct relation of knowledge leading to financial performance at a firm is dispersed. This study aims to examine the impact intellectual capital (IC) has on firm performance in Polish and Dutch listed firms.

Methodology: Quantitative data is collected based on audited annual reports from the top 20 companies listed at the Warsaw Stock Exchange and Amsterdam Stock Exchange between 2007 and 2011. IC is measured using the VAIC methodology with its individual elements of HCE, SCE, and CEE. Direct relations between ICE, HCE, and SCE and five measures of firm performance are statistically analysed.

Results: The results suggest that there is a direct positive relationship between ICE and firm performance of Polish and Dutch listed firms, particularly with ROA, ROE, EP, and to a lesser extent with ATO. Firms listed in Poland provide a stronger positive ICE relation to ROA and ROE where firms listed in the Netherlands provide a stronger positive ICE relation to EP. Regarding individual elements, HCE relates highly positive to ROA, ROE, and EP where SCE finds only partial negative relation with ATO.

Implications: Nurturing IC and in particular HC confirms the importance of firm knowledge and employees with right training and other support. Additionally, further clarification regarding SC is required.

Originality: This paper presents the first study of the IC relationship with firm performance in Poland as well in the Netherlands. Additionally, the comparison between firms of both countries establishes a novelty in IC research.

Keywords: intellectual capital, firm performance, human capital, structural capital, VAIC methodology

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Introduction

"Often regarded as the fourth factor of production, beside land, labor and financial capital, intellectual capital (IC) embodies intangible value drivers and for that reason it has an increasingly important role in achieving high business performance" (Komnenic and Pokrajcic, 2012, p. 106). Firms consider IC as a main asset promoting competitive advantage and treat it as the base of value generation (Bontis, 2001; Edvinsson and Malone, 1997). Primary determinant of IC is knowledge, which can be found within the firm when reviewing (1) employees, (2) strategies, patents, and brand names as well as outside the firm regarding (3) relations with its stakeholders. Hence, IC is divided into three elements namely, Human Capital (HC), Structural Capital (SC), and Relational Capital (RC).

Although IC clarification and importance was recognized in past literature (Stewart, 1997; Sveiby, 1997), conclusive empirical evidence remains scarce. Inconsistencies on valuation and measurement provide controversy and division between scholars as well as practitioners. Difficulty of examining immaterial aspects, hence their influence on firms, prove complex conditions for research. With the help of internationally accepted finance and accountancy regulations, a start of measuring and valuing intangible assets is currently made. In annual reports of firms specific posts regarding IC and explanatory notes referring to elements of IC provide a foundation for empirical research.

With the increased importance and a starting disclosure of IC, a growing number of measures to determine intangible assets and their impact emerge. No individual measure has yet reached universal agreement and results concerning IC are mixed (Zambon, 2004). One of the measures available, the Value Added Intellectual Coefficient (VAIC) methodology offers the opportunity to investigate IC, its elements, and the impact on financial performance in firms. In order to investigate IC, using the VAIC methodology, a sample of the top 20 listed firms at the Polish and Dutch stock exchange was formed. A five year timeframe and audited annual reports provide a comprehensive dataset linking IC to financial performance indicators. Derived from a validated empirical analysis executing correlation and multiple regression analysis, significant results are found. With evidence on the IC and firm performance relation, this study contributes to the knowledge database of theoretical and practical implications for firms handling knowledge and financial results.

With studies concluded around the world, practicality and validity of IC and its effects are increasing. Empirical proof on firm knowledge leading to financial performance in Poland and the Netherlands has not yet been established, hence initiating a pioneering role for this study. Listed firms in Poland and the Netherlands that are researched are of a diverse array of industries constructing a broad and valid sample. In addition, the methodology used in this study presents a novelty in IC research by comparing two subsamples to one other indicating a national IC influence. Specific characteristics of the more developing nature of Poland and the developed

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state of the Netherlands provide explanations for differences found. Last, the distinction between elements of IC provides further evidence for the established specialization in IC literature and its practical implications. HC, SC, and RC represent individual elements of knowledge and each relate differently to financial performance. Combination of the new sample scope, multi sample comparison, and selective element investigation collaborates to provide a distinctive value to this study.

The paper is structured as follows; successive section provides the literature review on IC. Section three is concerned with exposition of the problem statement in order to provide a general guidance regarding this study. In section four, the sample and variables of this study are introduced and explained. All decision made in this section are concluded in the fifth section. Discussion and interpretation of the results can be found in section six. Sections seven to nine refer to implications, limitations and further research, as well as conclusions to complete the paper.

| Literature Review

The origin of IC can be traced back to the establishment of the resource-based view of the firm (Wernerfelt, 1984). The approach of assessing a firm in a broader set of resources broke with the tradition of taking a product perspective. Resource-based view of the firm sparked the emergence of dividing and measuring all the resources within a firm. By dividing the different resources, firms are given the possibility to oversee the different valuable resources to their disposal and apply these resources to achieve a competitive advantage. Although the initial focus steered towards the technological resource of the firm, the last three decades has seen an emphasis on the human resource with knowledge in particular.

Intellectual Capital

Intangibles are in accordance with the resource-based view of the firm as it is the tangible and intangible resources which make a firm perform. Due to an abundance of definitions on intangibles, different constructs arose. Next to IC, intellectual property, intangible assets, intellectual capital, intellectual assets, knowledge capital, and knowledge-based assets are some of the constructs derived from the foundation established by intangibles. Next to the fact that all of the constructs focus on the resources within an organization, other similarities the constructs enclose can be summed up as valuable, rare, inimitable, and non-substitutable.

A broad range of attempts have been made to provide a coherent definition of IC. The definition of IC has followed a path that is along its popularity. This is due to the fact that IC has spawned in the 1990's to become the most important element of a firm (Nahapiet and Ghoshal, 1998). Unfamiliarity with the IC phenomenon manifested itself in diverse and broad descriptions as IC was characterized as wealth of organisations (Stewart, 1997) or "knowledge that can be converted

into profits" (Sullivan, 2000, p. 17). The different definitions do not create one universal definition but shape the construct IC in a certain way. Another definition of IC posed "the knowledge and knowing capability of a social collectivity, such as an firm, intellectual community, or professional practice" (Nahapiet and Ghoshal, 1998, p. 245). Similarities among the different definitions conclude that IC can be characterized as invisible, closely related to knowledge, and offering better opportunities for future success of a firm. Setting these characteristics, IC is seen, in essence, as the firm knowledge which is used and useable to create value. This definition collaborates with other scholars (e.g. Choong, 2008; Mouritsen, Larsen and Bukh, 2001; Stewart, 1997), by linking the knowledge aspect to value creation. The definition of IC as the difference between book value and market value of a firm was also found in the beginning of the concept's emergence. Next to adopting this difference as the calculation of IC, it was also adopted as the definition of IC. It provides the possibility of calculating the assets which are not seen on the balance sheet of a firm.

Intellectual Capital Classification

By labelling certain aspects of the firm, for instance employees, and attaching value to it, knowledge has become measurable as asset. Measurement of knowledge in the form of the construct IC has been interpreted and developed in different forms and by different research streams. As each stream started from an own perspective, IC has been reviewed in many different ways. Despite the different streams, an important distinction is mentioned by, among others, Sveiby (1997) and Bontis (1999). Both authors argue that IC can be seen as the collection of Human Capital, Structural Capital and Relational Capital. This distinction is widely seen, recognized and adopted to describe and measure IC. As firms encounter problems when assessing the value and nature of their intangibles, the division into three separate concepts provide a framework that helps in the measurement of IC.

Human Capital

Within the current knowledge society (Drucker, 1994), determination of the value accounted as Human Capital became popular and accepted. Due to its popularity, different measurements and definitions arose. This paper adopts the definition of Bontis (1999, p. 443) describing Human Capital (HC) as "the combined intelligence, skills and expertise that gives the firm its distinctive character". The fact that all aspects of HC are intangible and subjective has led to diverse measurement of the HC concept. A recent approach to tackle the HC valuation problem is by implementing the Value Added Intellectual Coefficient method (VAIC). This method has been accepted by a substantial number of scholars as it provides the possibility to calculate the total IC value and individual elements such as HC (Andriessen, 2004). Calculation of the VAIC method is based upon the values of complete posts in annual reports. In the case of HC, the post of total salaries and wages paid by the company in a fiscal year is used to calculate the efficiency of HC. As merely a monetary approach due to incorporating only the salaries and wages, the Human Capital Efficiency has

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proven different results when linking HC with firm performance (Mehralian, Rajabzadeh, Sadeh, and Rasekh, 2012). Hence, the overall conclusion that HC valuation lacks a definitive coherent approach seems justified. The call for broader and more precise interpretation of HC has been an unanswered one. A very limited number of HC valuation methods are truly capable of measuring HC beyond the monetary statistics and further investigation is necessary.

Structural Capital

The division of IC into Human Capital, Structural Capital and Relational Capital shaped also the valuation methods to specifically address these three issues. The VAIC methodology is aimed to calculate all aspects of IC for valuation, with Structural Capital (SC) being one of the pillars (Andriessen, 2004). While HC was focused more on the employee, SC "consists of internally developed IC, capturing the effectiveness of the firm's policies and processes, the positive nature of the working environment, and the innovation produced by the firm research and development teams" (Clarke, Seng, and Whiting, 2011, p. 506). Derived from this definition, the policies and processes implemented in the firm culture of individuals working alone or together in teams are considered in this element of IC. Examples such as a strategy, patents, and brand names are recognized as representation of value to a firm. Again, the argument of valuation is valid as the exact financial amount attached to a strategy, patent or brand name is highly debatable. Where patents can still be counted and attached to a specific product with its cash flows, the strategy used within a firm leads, even indirectly, to vague financial benefits. Brand names can be seen here as a middle point within the two extremes of patents and strategy. The brand value can be calculated using customer questionnaires but that approach is far from free of context or content bias.

The three elements, strategy, patents, and brand names, indicated by Clarke et al. (2011), are measured via the VAIC method when subtracting the HC element from the total value added, leaving the valuation for SC. Normally, the total value added is seen as the total amount between the sales revenue and the cost of goods sold. The remaining value after subtracting HC from the total value added and labelling as SC indicates no clear understanding of the knowledge apart from the employee wages and salaries pooled as HC. This is even more remarkable as the three elements of SC are specifically named. Valuation of strategy, patents, and brand names is affected by subjectivity but still indicate boundaries which will adhere to create a valuation of SC based on its elements and leave room for Relational Capital. However, in the VAIC method, RC is not accounted for and not being calculated.

Relational Capital

The final element next to HC and SC which constitutes to the construct of IC is Relational Capital (RC). Existing research regarding RC started to form when Sveiby (1997) proposed the external structure of a firm as one of elements related to intangibles. The external structure of brands,

customer and supplier relations was pooled together to form RC (Bontis, 2001). When leaving out brands, the relationships with third parties as suppliers, customers, and others precludes RC. A definition presented by Komnenic and Pokrajcic (2012, p. 108), describes RC as "the ability to build quality relationships with external stakeholders: customers, suppliers, investors, state and society in general". Emphasis on the ability instead of the relationships itself underline the intangible nature of RC. Deeper interpretation of this definition reveals the knowledge behind third party relations. Establishment and maintenance of relation with external parties requires skill, network, and knowledge. The combination of that all is viewed as RC and a possible subject for measurement. A major difference between RC in comparison to HC and SC is that, the valuation of RC is redundant. This finds its origin in the ground rule of accountancy and financial reporting. Where HC and SC are internal sources generating added value of the firm, RC generates added value via external sources. As the external sources are the ones to which the valuation of the added value is disclosed, external sources are left out of the calculation. It is the disclosure of own results by the firm, the internal sources of added value, which are of interest and analysed. Although analysed with the purpose to establish a knowledge base within the firm or by external parties, RC remains an external source of revenue and is therefore excluded in financial calculation methods.

Value Added Intellectual Coefficient methodology

The Value Added Intellectual Coefficient (VAIC) method was created by Austrian Intellectual Capital Research Centre (AICRS) under professor Pulic (2000). The method was further developed by Kujansivu and Lonnqvist (2007) and Nazari and Herremans (2007). The method has relations to each element of IC explained before, despite RC. Hence, the method calculates the efficiency of three types of inputs endured by a firm, namely Human Capital, Structural Capital and Capital Employed Efficiency. Accumulation of the three types constitutes the level of VAIC and is presented in a value. Higher values indicate an on average higher efficiency of the three input types suggesting a better managed utilization of the intangible assets by its firm.

Two out of the three input types used in the VAIC method are related to the elements of IC, namely Human Capital Efficiency and Structural Capital Efficiency. The third type is Capital Employed Efficiency. This type of input relates to the tangible assets of the firm. In total, the VAIC method highlights the efficiency of intangible assets but cannot neglect the tangible assets. Dependent on firm size, industry, and individual firm, tangible assets have an influence to the size and impact of intangible assets.

Use of the VAIC methods presents some advantages. First, the distinction between three types of variables investigates the most important aspects of IC. Interpretation of the values given by the three types is perceived as simple and straightforward. Next to the traditional accounting report, all stakeholders will be provided with easy to understand information regarding sophisticated and not everyday topics. Second, the information provided by the VAIC will fill up the absence

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of IC disclosure by presenting quantitative indicators. Third, the quantitative indicators provide the possibility to establish a comparison between firms on the aspect of IC. Provided information and comparison can even constitute to calculate the different IC levels between countries. Last, the financial data used is derived from audited reports and by executing the calculation, further validity to the data is given (Chan, 2009a).

However, the VAIC also provides some disadvantages which should be taken into account. First, the VAIC method cannot be performed on firms which display a negative book value or negative profit. With a negative book value or profit, the input is higher than its output, resulting in low and incorrect productivity. Second, a hidden inverse relation between HC and SC can cause difficulty to establish the exact weight of each element when calculating the overall IC valuation (Chu, Chan and Wu, 2011).

Prior research on Intellectual Capital and firm performance

Dominant vocation regarding IC valuation and implication stems from an accounting and financial approach (Bontis, 2001). According to some researchers, it is the value of IC, which accounts for the financial discrepancy between the market value and book value of a firm. This discrepancy is also interpreted as the net worth of the intangibles assets within a firm. When specifically using the VAIC method, studies have proven a relation between financial ratios and the level of IC with the elements HC, SC, and RC. Adoption of this method with a long time period and a Taiwanese sample led Chen, Cheng and Hwang (2005) to conclude a wide range of positive relations between VAIC and its individual elements with the financial ratios such as Return On Assets (ROA), Market to Book value (MB), Revenue Growth (RG), and Employee Productivity (EP). Shui (2006) has performed a study in Taiwan resulting in a positive relation between VAIC and ROA and MB while finding a negative relation between HC and ATO and MB. Moreover, Ting and Lean (2009) provide further proof on the relation between VAIC and ROA, next to the relation between HC and ROA, with their nine years study conducted in Malaysia. Studies performed with a longer period of time indicated more solid results, proven in different countries and industries. Additionally, selecting a sample from multiple industries indicates that despite the difference in IC level per industry, the general relation between IC and firm performance is valid. Remarkably, the final relation between elements of IC in the form of HC and SC, still provide different results. Where the relation between HC and firm performance is numerous but showing opposing implications, SC still lacks significant coherent results.

More recent studies have shown more coherent results as the refinement on definition and valuation of IC increased. With a sample based on firms in Hong Kong and a time period of five years, Chan (2009b) was able to determine relations between VIAC and ROA and ROE, HC and ATO and MB as well as SC in relation to ROA and ROE. Maditinos, Chatzoudes, Tsairidis and Theriou (2011) add to the research database by concluding a positive relation between HC and ROA within three year study in Greece. With a one year study in Australia, Clarke et al. (2011) found

a conclusive relation between the main measurement VAIC and ROE, ROA and EP. Additionally, the individual element of HC provides significant relations with ROE, ROA, EP and RG. Similar results were also found by Komnenic and Pakrajcic (2012) as a positive relation between HC and ROA, ROE, and ATO as well as SC related to ROE indicated the linkage between IC and firm performance. The sample of 31 Serbian multinational corporations provided the basis for the significant relations found in the study. Although some recent studies still lack the relation between SC and firm performance, the remaining relations provide frequently significant results.

Next to all the established relations, the VAIC methodology has also proved insignificant results as, despite their large Finnish sample size, Kujansivu and Lönnqvist (2005) did not prove any relation between IC and ROA.A similar situation was projected by the study of Kamath (2008) as with a sample of 25 Indian pharmaceutical firms in a ten year time frame, the significant results have not been established. Preparations of selecting the right sample size in combination with the right time frame are emphasized by these studies as prerequisite criteria. These criteria form the basis for the next step of selecting and determining the right valuation method for IC as well as firm performance.

| Hypothesis development

Prior studies on IC and firm performance have focused on firms listed at major stock exchanges in Asia (Al-Twaijry, 2009; Chan, 2009a; Chu et al., 2011), South-Africa (Firer and Williams, 2003), Australia (Clarke et al., 2011), and Serbia (Komnenic and Pokrajcic, 2012). These studies focused on firms within a single country, other scholars have taken a unilateral approach on specific industries. Mehralian et al. (2012) focused on the Iranian pharmaceutical industry but emphasized the limitations of a narrow focus and a developing country. Limitations due to the narrow focus on a single industry seem to be justified as significant results have failed to emerge (Kamath, 2008). Other studies with a more diverse set of firms do hail significant results (Maditinos et al., 2011). The approach on a diverse set of firms from different industries is therefore adopted in this study.

As indicated, all studies used the VAIC method and found significant results when relating IC to firm performance. As a measurement of the level of IC, the VAIC methodology has over time proven its validity and has the ability to accurately determine the IC level. The overall hypothesis is therefore the following.

H1: Firm Intellectual Capital has a positive relation in respect to firm performance

The Intellectual Capital index proposed by Bontis (2004) set forth an analysis of IC per country. Based on market capital, renewal capital, process capital, and human capital, national IC found to have a significant influence on the country's wealth. Dominant factor of national IC has been the human capital and comparisons between country's IC levels were made. The selection of

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multiple countries when investigating IC initiated an invention of comparing IC levels between countries. Conclusions of the comparison indicate that the development of a country is related to the IC level. Higher IC levels are expected and found in more developed countries and high IC levels indicate a high long-term prosperity. The IC index presents a resemblance with the learning curve where the initial steep phases are followed by gradually less positive steps. In the beginning of underdeveloped countries, the IC can be easily caught up and integrated. More developed countries face the difficulty of less clear cut knowledge and less dependency on existing knowledge. Comparing IC levels of firms from different countries has not yet been introduced by studies. This study establishes a novelty by taking a diverse set of firms from different industries and also from two different countries. Due to the ascertainment of higher IC levels found in more developed countries, the related firms within that country will expect to exhibit higher firm performance. The country, in this relation, will play a moderation effect. The existing relation between the IC level and firm performance will be more enhanced in a more developed country and less enhanced in a less developed country. Based on this rationale the hypothesis is as follows.

H2: Firm Intellectual Capital and firm performance is stronger related in a more developed country

Next to the overall link between the level of IC and firm performance, the VAIC method also offers the opportunity to investigate elements of IC. Despite the inability to select and determine RC, the other elements of IC, namely HC and SC are incorporated in the VAIC method. The relation between HC and firm performance has yielded many significant results (e.g. Firer and Williams, 2003; Maditinos et al., 2011). More recent studies indicate a positive relation between HC and firm performance (Komnenic and Pokrajcic, 2012), but the negative relation found by the solid study of Shiu (2006) sets some doubts to the argument. It is however expected that all elements of IC have their positive contribution to firm performance. Each individual element is part of the total knowledge process which increases firm performance.

Only a limited number of studies have proven the relation between SC and firm performance. The structural element of IC with strategy, patents, and brand names is less obvious to generate knowledge and to influence the firm performance in a significant way. Tan et al. (2007) provide evidence for a positive relation between SC and firm performance. That evidence is in line with the rationale that a higher value of strategy, patents, and brand names leads to a higher firm performance.

Next to the overall IC and the HC and SC elements, the VAIC method provides the possibility to research the Capital Employed (CE) within a firm. Scholars who used the VAIC method have found significant relations between CE and the firm performance (Chen et al., 2005; Kamath, 2008). As CE refers to tangible assets, a better use of these assets by the firm will lead to a rise in performance. This study is purely focused on the influence of knowledge on firm performance.

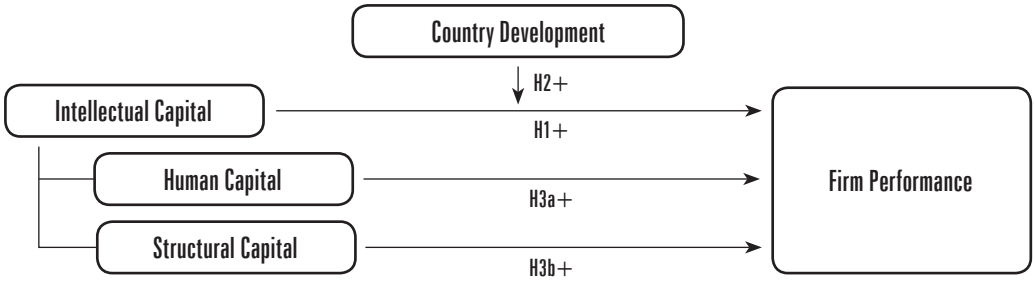
Tangible assets in the form of capital do however spur the use of the intangible ones. More financial resources provide the possibility to increase the knowledge within the firm. Hence, CE is treated in this study as a control variable in order to fully isolate and determine the relation between knowledge and firm performance. Overall, two out of the three elements of IC can be tested namely HC and SC. RC falls outside the scope of the VAIC method as only financial data from the annual reports is available. As the VAIC method also provides the opportunity to investigate CE as control variable, the hypotheses are stated accordingly.

H3a: Firm Human Capital has a positive relation in respect to firm performance

H3b: Firm Structural Capital has a positive relation in respect to firm performance

The total research model with the overview of all hypotheses is depicted in Figure 1.

Figure 1 | Research Model



| Methodology

Sample

Final sample of the study comprises the top 20 largest firms from the Warsaw Stock Exchange as well as the top 20 firms from the Amsterdam Exchange (AEX) index. The list of 20 largest listed firms in market capitalization of Poland is classified as the WIG20. Division within industry displays Mining (1), Finance and Insurance (6), Oil and Natural Gas (2), Energy (4), Telecommunications (1), Software (1), Real Estate (1), Media (2), and Construction (2). The AEX index consists of the 25 largest listed firms in the Netherlands but only 20 have been selected in this study to create a fair comparison between both groups. Selection of the 20 is been made on the basis of index weighting and the five firms with the lowest index weighting have been left out of the sample. The remaining firms can be divided into different industries, namely Oil and Natural Gas (1), Fast Moving Consumer Goods (3), Finance and Insurance (2), Iron and Steel (1), Consumer Electronics (1), Telecommunications (1), Real Estate (2), Chemicals (2), Semiconductors (1), Publishing (2), Employment Agency (1), Oil Equipment and services (2), and Postal services (1).

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The sample of 40 firms will deliver all data published in the annual reports. Providing the data in written and/or digital form, an annual report composes a balance sheet, income statement and cash flow statement. These three elements provide an annual overview of the financial situation at the end of the year plus the financial changes during that year. Combining the different forms of the annual report will indicate an accurate picture of the financial state and performance of the firm. Outcomes can be seen and calculated by comparing the different annual reports per firm over a time period. The years 2007 to 2011 constitute the most recent financial overview of the sample which will increase the accuracy of the study. Due to stricter financial regulations, recent annual reports comprise more comprehensive valuation methods and improved disclosure. Furthermore, the use of universal regulations regarding financial reporting provides an opportunity to calculate the average financial state of a firm and compare it to others. When combining both ways of calculation, the sample provides an extensive financial overview of all firms and a comparison between firms per country.

Variables

Investigating the relation between IC and firm performance requires a number of variables. IC is composed of the variables HC and SC of the overall VAIC and present the cause of the relation. A change in these variables would result into an effect in firm performance. Different firms in two different countries provide the data to investigate different IC levels or HC, SC, CE, and VAIC values. Measuring IC is in this study treated as the starting point of the relation by which knowledge will eventually lead to firm performance. Different independent variables used to measure IC compose the starting point in the hypotheses.

Independent variables

The VAIC methodology delivers three components related to IC, namely, human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE). Combined, the three coefficients comprise the value added intellectual coefficient known as VAIC. An important factor in calculating the individual and overall coefficients is the determination of the value added for the firm. This added value can be traced back when investigating and accumulating the expenses for the year on interest (*I*), depreciation (DP), dividends (*D*), corporate taxes (*T*), and retained earnings (*RE*). The equation for the added value per firm *i* is as follows.

$$\mathrm{VA}_i = I_i + \mathrm{DP}_i + D_i + T_i + RE_i$$

Next, the element of IC concerned with the employees can be determined. HC represents the human element which can lead to knowledge and eventually value creation for the firm. Within the VAIC methodology, VAHU proliferate the efficiency in expenditure on human capital in the form of salaries and wages (HCE). Annual reports bring forward a yearly value on expenditures which is used to determine the HCE of firm *i* in the following equation.

$$HCE_i = VA_i / HC_i$$

Second element to measure IC is related to the structural capital (SC) within a firm. SCVA is derived from the VAIC methodology to establish the efficient use of SC within a firm. Given the assumption that the overall added value of a firm can only be generated using human and structural capital, the remaining part of value added is dedicated to SC. Within firm *i*, the equation to calculate the efficiency of SC (SCE) is given as follows.

$$SC_i = VA_i - HC_i$$

$$SCE_i = VA_i / SC_i$$

In order to provide the mere focus on the knowledge aspect, only HC and SC are constituted to be the intellectual capital efficiency (ICE). A proposed inverse relation, emphasized by Chu et al. (2011), between HC and SC might outbalance both effects but is neglected by many scholars when calculating the VAIC. Per firm *i* the calculation of VAIC is composed using the following equation with an emphasis of HC and SC resulting in ICE.

$$VAIC_i = VAHU_i + SCVA_i + VACA_i$$

$$VAIC_i = HCE_i + SCE_i + CEE_i$$

$$ICE_i = HCE_i + SCE_i$$

In this study, firm performance is investigated as to be influenced by IC. Firm performance is described using different financial ratios mainly focusing on the returns and productivity within a firm. The following dependent variables establish an overview of the performance by a firm and give the opportunity to be investigated.

Dependent variables

Firm performance is purely derived from posts in the annual reports published by firms. With values indicating the financial state of individual posts, the possibility to calculate the ratios relating to firm performance is given. First, Return on Assets (ROA) can be described as the performance seen in the net income (NI), divided by the reported book value of the average total assets of the firm (ATA). With a firm *i*, the equation following from the rationale is presented as follows.

$$ROA_i = NI_i / ATA_i$$

Second, Return on Equity (ROE) indicates the financial performance of equity used to generate added value. Calculation of the ratio is done by dividing net income through the book value of the total equity of the firm (SE). Following equation represents the financial ratio ROE with firm *i*.

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$$ROE_i = NI_i / SE_i$$

As a third financial ratio comprising the firm performance, Average Turnover (ATO) provides insight into the financial performance in revenue terms as it divides total revenue (R) by the total book value of the firm (BV). Firm *i* and the financial ratio ATO is calculated using the following equation.

$$ATO_i = R_i / BV_i$$

As fourth, the revenue aspect is further emphasized by the revenue growth (RG). Indicating the revenue progress a firm makes by a year is calculated when dividing the difference between current year and past year total revenue (ΔR) with the past year revenues (R). As with firm *i*, the equation is as follows.

$$\Delta R_i = R_{it} - R_{it-1}$$

$$RG_i = \Delta R_i / R_{it-1}$$

Fifth and last, the specific focus on employee contribution to the financial performance is set by Employee Productivity (EP). To calculate EP, the profit before tax (PBT) is divided among the number of employees (EE). Following equation is a depiction of the EP calculation for firm *i*.

$$EP_i = PBT_i / EE_i$$

4.2.3 Control variable

Third and last element of IC, CE, is set as control variable to provide an even clearer relation between knowledge and firm performance. Annual reports provide the net book value of the firm (CA) and are being opposed to the value added in that same time period. Following equation depicts the performed calculation of the efficiency of CE (CEE) per firm *i*.

$$CEE_i = VA_i / CA_i$$

| Results

Descriptive statistics

Data combined in the sample presented in some cases extreme results due to incompatibility of the formulas. Total value added which is significantly smaller than salaries and wages present extreme cases which dilute the effect and use of the VAIC methodology (Meyers, Gamst and

Guarino, 2006). In line with previous research (i.e. Clarke et al., 2011), extreme cases with an ICE level above ten or below minus ten have been removed from the data. Table 1 presents an overview of all variables.

An average mean of 3.63 for ICE provides the presumption that value added is 3.63 times larger than the ICE within firms. Taking the mean plus or minus one standard deviation, 68.2 percent of all firms attain an ICE value in the range of 0.46 to 6.80. Financial ratios of ROA, ROE, and EP have all been multiplied with 100 to provide more clear indication. RG is been treated similar as it is a percentage growth in comparison to previous year. With an average revenue growth of 36 percent and high ROA and ROE, firms in the sample display a prosperous financial state.

Value differences between firms from Poland and the Netherlands are clearly visible in the independent variables but less obvious with dependent variables. Firms listed in Poland express almost double levels of ICE, HCE, and SCE in comparison to Dutch firms. Extreme values regarding the dependent variables of ROA and ROE assume more volatile financial performance in Poland. Opposing this observation are the values related to ATO and RG. Table 1 presents a significantly higher average turnover in the Netherlands in contrast to a higher level of revenue growth in Poland.

The negative mean of CEE is largely due to relatively higher valuation of intangible assets as well as a higher value of liabilities resulting into a negative net book income. Regarding the normal distribution of variables, the skewness and kurtosis of all independent variables show a good fit. Dependent variables on the contrary have some extreme values as for instance CEE. An explanation for these extreme values is the continuous growth in revenue, the mere positive outcome of CEE due to positive value added and net book value, and the evermore positive values of EP.

Correlations

Table 2 depicts the correlations between all variables investigated in this study. Explanatory value of this study is significant with correlations between independent and almost all dependent variables. A difference can be seen regarding HCE and SCE as the latter receives only partial correlation with three dependent variables. Combined with HCE, ICE correlates in a medium sense with ROA (.387), ROE (.295), ATO (-.195), and EP (.363) presenting a first indication for the hypotheses. Conclusion can be drawn that a higher ICE leads to higher ROA, ROE, and EP next to a lower ATO.

Apart from revenue growth, all dependent variables indicate substantial correlation coefficients with the independent variables. Especially ROA and ROE are highly correlated with ICE as well as with the individual elements HCE (.408 and .267) and SCE (.172 and .179). Hence, increased ICE based predominantly upon HCE has a positive influence on the net income. Contrary to a previous study (Mehralian, et al., 2012), ATO offers a negative correlation with partial significance indicating that higher values of ICE result into lower ATO. Explanation for this inverse

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Table 1 | Descriptive Statistics

	n	Mean	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis
HCE	163	2.45	2.18	-5.92	8.62	0.06	2.20
Poland	82	3.35	2.14	-5.79	8.62	-0.46	3.58
the Netherlands	81	1.53	1.82	-5.92	7.39	0.40	5.20
SCE	163	1.19	1.95	-8.50	8.83	-0.20	6.13
Poland	82	1.42	0.96	-1.41	5.68	0.31	6.10
the Netherlands	81	0.95	2.59	-8.50	8.83	0.05	2.94
ICE	163	3.63	3.17	-7.60	9.96	-0.75	0.51
Poland	82	4.77	2.35	-4.93	9.75	-1.30	3.94
the Netherlands	81	2.48	3.48	-7.60	9.96	-0.21	-0.21
ROA	163	5.36	7.36	-14.63	38.75	1.58	4.95
Poland	82	5.51	8.58	-14.63	38.75	1.91	4.99
the Netherlands	81	5.20	5.94	-8.33	21.11	0.27	0.37
ROE	163	16.52	22.79	-46.69	184.29	2.86	18.55
Poland	82	15.21	25.38	-46.69	184.29	3.93	25.31
the Netherlands	81	17.85	19.90	-32.66	75.62	0.68	0.87
ATO	163	0.70	0.58	-0.05	2.77	0.88	0.38
Poland	82	0.54	0.53	0.02	1.82	0.88	-0.42
the Netherlands	81	0.86	0.58	-0.05	2.77	0.95	0.75
RG	163	6.91	35.97	-155.92	227.24	1.67	13.56
Poland	82	9.29	37.25	-64.62	227.24	2.59	14.05
the Netherlands	81	4.51	34.69	-155.92	182.43	0.53	13.32
EP	163	3.25	15.85	-97.91	61.84	-2.23	18.38
Poland	82	3.87	9.46	-38.50	48.64	0.95	13.85
the Netherlands	81	2.62	20.43	-97.91	61.84	-2.15	12.14
CEE	163	-0.25	4.04	-40.95	3.17	-7.91	71.38
Poland	82	0.42	0.58	-0.14	3.17	3.28	11.63
the Netherlands	81	-0.93	5.64	-40.95	2.16	-5.60	35.22

relation is the fact that higher ICE values leading to higher profits increases the book value while not affecting the revenues, hence causing a lower ATO. Another important note to be made is in regard to the correlation between EP and ICE. Although the overall construct ICE correlates to EP, the individual element of SCE finds no significance while HCE presents a strong case.

Table 2 | Correlations

		HCE	SCE	ICE	ROA	ROE	ATO	RG	EP	CEE
HCE	Pearson Correlation	1	.172*	.795**	.408**	.267**	-.115	.033	.463**	-.030
	Sig. (2-tailed)		.028	.000	.000	.001	.146	.679	.000	.701
SCE	Pearson Correlation		1	.735**	.172*	.179*	-.189*	.037	.071	-.039
	Sig. (2-tailed)			.000	.028	.022	.015	.637	.368	.622
ICE	Pearson Correlation			1	.387**	.295**	-.196*	.045	.363**	-.045
	Sig. (2-tailed)				.000	.000	.012	.565	.000	.569
ROA	Pearson Correlation				1	.744**	.288**	.045	.391**	-.008
	Sig. (2-tailed)					.000	.000	.567	.000	.918
ROE	Pearson Correlation					1	.204**	-.026	.305**	-.169*
	Sig. (2-tailed)						.009	.738	.000	.031
ATO	Pearson Correlation						1	.041	.158*	.069
	Sig. (2-tailed)							.600	.044	.384
RG	Pearson Correlation							1	.064	.029
	Sig. (2-tailed)								.418	.715
EP	Pearson Correlation								1	-.008
	Sig. (2-tailed)									.915
CEE	Pearson Correlation									1
	Sig. (2-tailed)									

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

Overall, the obvious correlation between ICE and its elements HCE and SCE confirms the validity of the construct. With VIF values between 0.8 and 1.2, multicollinearity between variables is no issue. Where the independent variables ICE, HCE, and SCE present a strong connection towards each other, dependent variables indicate similar patterns. Based on net income, both ROA as well as ROE find a strong correlation with each other. Same accounts for ROA, ROE, and EP as it use the profit before tax, separating only the tax figures as the numerator between the variables. Last important observation is the fact that RG correlates with none of the other variables indicating a relatively low fit to the other measures.

Regression

According to hypothesized relations, Table 3 consists of three models. Model 1 refers to hypothesis 1 as a regression analysis of ICE with the different ratios regarding firm performance. As drawn from Table 3, ICE can account for 14.4, 8.1, 3.2, and 12.6 percent of the

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variation in firm performance, respectively ROA, ROE, ATO, and EP. With the exception of revenue growth, evidence supports that there is a significant relation between IC and firm performance.

In Model 2, regression analysis is subjected to partial data observations categorized in the two different countries, Poland and the Netherlands. With a mediation effect of the country, the results indicate some similarities and one clear distinction. Firms from both countries provide roughly equal results regarding ROA and ROE (adjusted R^2 of 0.177 and 0.080 in Poland versus 0.184 and 0.153 in the Netherlands). Difference is seen between ICE with firms in Poland and the Netherlands accounting for respectively 3.6% and 17.4% in employee productivity. Despite insignificant results found at ATO and RG a clear indication between Poland and the Netherlands regarding IC and firm performance is established.

Regarding Model 3, the individual elements comprising ICE are tested in a multiple regression analysis with CEE as control variable. HCE and SCE as subject to predict firm performance and provide evidence for what the individual elements of ICE result into. All relevant financial ratios linked to both elements are listed. A clear divide between HCE and SCE is visible as HCE has found significant results to ROA, ROE, and EP with adjusted R^2 values of 0.144, 0.051, and 0.207. SCE provides only significant results in accordance with ATO although adjusted R^2 is very weak (0.023).

Generally, adjusted R square values are found to be weak but significant given the F values in ROA, ROE, and EP. Individual explanations by the Polish or Dutch sample mainly exceed in the significant relations the overall findings. A more coherent sample related to the listed country presents more explanatory power. Combining both samples with their national characteristics in most relations results into a lower explanatory value. That can not be said in such an extreme way from the individual elements of ICE. Accummulation of HCE and SCE presents in the relation of ROA a marginal higher explanation while having reduced explanation in the case of ROE. EP relation with ICE is explained for 12.6 percent while the combination of HCE and SCE comes to 21.2 percent. This difference is due to the evident relation of human capital with employee productivity.

With initial evidence determined, Table 4 with the regression analysis coefficients elaborates on the proposed relations. Derived from Model 1, ICE indicates positive relations to ROA, ROE and EP while having a negative relation to the partial supported ATO and not signficant RG. With clear significance in the model summary as well as positive coefficients, it can be concluded that hypothesis 1 is supported. Therefore, there is a positive relation between a firms' IC and its firm performance. These results are in line with previous findings of Chan (2009b) as the overall effect of IC is recorded in ROA and ROE. Findings also collaborate with Chen, et al. (2005) by providing evidence of the relations between IC and ROA and EP. Furthermore, the insignificant results of IC with RG and ATO found in this study are in accordance with previous studies.

Table 3 | Regression Analysis Model Summaries

Model 1	ICE					
	Adjusted R square	Std. Error of the estimate	F change			
ROA	0.144	6.8106	28.359**			
ROE	0.081	21.845	15.298**			
ATO	0.032	0.568	6.405*			
RG	-0.004	36.042	0.332			
EP	0.126	14.818	24.384**			
Model 2	ICE Poland			ICE the Netherlands		
	Adjusted R square	Std. Error of the estimate	F change	Adjusted R square	Std. Error of the estimate	F change
ROA	0.177	7.780	18.438**	0.184	5.364	19.036**
ROE	0.080	24.347	8.007**	0.153	18.316	15.435**
ATO	0.024	0.523	2.952	-0.010	0.584	0.232
RG	-0.011	37.444	0.149	-0.007	34.818	0.417
EP	0.036	9.293	4.009*	0.174	18.562	17.904**
Model 3	HCE			SCE		
	Adjusted R square	Std. Error of the estimate	F change	Adjusted R square	Std. Error of the estimate	F change
ROA	0.144	6.742	28.518**	0.006	6.742	2.075
ROE	0.051	21.649	10.029**	0.012	21.649	3.019
ATO	0.001	0.569	1.111	0.023	0.569	4.829*
RG	0.006	36.250	0.119	0.005	36.250	0.175
EP	0.207	14.178	42.476**	0.005	14.178	0.016

* Significant at the 0.05 level
** Significant at the 0.01 level

Clarke et al. (2011) finds also few support for ICE with RG as does Mehralian, et al. (2012) by concluding non significant results between ICE and ATO. In general, Model 1 results collaborate with previous studies by emplifying the relation between ICE and ROA, ROE and EP while remaining partly inconclusive regarding ATO and RG.

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Table 4 | Regression Analysis Coefficients

	ROA		ROE		ATO		RG		EP	
	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
Model 1										
Constant	2.089	2.569*	8.824	3.383**	0.825	12.183**	82.539	12.183**	-3.343	-1.890
ICE	0.899	5.325**	2.119	3.911**	-0.036	-2.531*	-3.562	-2.531*	1.814	4.938**
Model 2										
Poland Constant	-2.029	-1.038	-0.345	-0.056	0.738	5.618**	12.545	1.333	-0.330	-0.141
Poland ICE	1.581	4.294**	3.260	2.830**	-0.042	-1.718	-0.683	-0.386	0.880	2.002*
Netherlands Constant	3.331	4.539**	12.108	4.832**	0.881	11.035**	2.720	0.571	-3.649	-1.437
Netherlands ICE	0.753	4.363**	2.315	3.929**	-0.009	-0.482	0.723	0.646	2.527	4.231**
Model 3										
Constant	1.667	2.020*	8.341	3.146**	0.812	11.666	5.127	1.155	-4.927	-2.838*
HCE	1.317	5.340**	2.508	3.167**	-0.022	-1.054	0.458	0.346	3.380	6.517**
SCE	0.397	1.441	1.537	1.737	-0.051	-2.197*	0.620	0.418	-0.073	-0.127
CEE	0.014	0.108	-0.882	-2.095*	0.008	0.766	0.275	0.391	0.021	0.076

* Significant at the 0.05 level
** Significant at the 0.01 level

Model 2 presents a novelty by splitting the dataset into two individual samples, based upon the national stock exchange at which the firm is listed. With a sample of 82 observationsin Poland and 81 from the Netherlands, differences in the ICE levels are acknowledged (4.77 in Poland versus 2.48 in the Netherlands). Taking into account this difference, similar measures of firm performance display significance. Worthwile inconsistency among the two different samples is noted as the coefficients of ICE to explain ROA, ROE, and EP present a mixed picture. Higher ICE will result in a higher ROA and ROE among firms in Poland compared to the Netherlands. Despite lower return on assets and equity, firms in the Netherlands are able to generate a significantly higher EP. In line with the overall findings in Model 1, ICE levels in firms from Poland and the Netherlands have a positive relation to ROA, ROE, and EP. In contrast with the conclusion based on the national IC index by Bontis (2004), higher IC values as well as higher impact of IC was on average found in firms listed in Poland compared to the Netherlands. Hence, hypothesis 2 is rejected as IC is stronger related to firm performance in the more developing country.

Individual elements of ICE are tested and produce different implications. Where HCE show significant results in line with the overall model, SCE offers only one significant result in contrary

to the general findings. HCE finds significant relations and positive coefficients with ROA, ROE, and EP, thus supporting hypothesis 3a. Similar results were found by Komnenic and Pakrajcic (2012) while using a different approach to IC. Overall, a diversity of approach generates similar results regarding HCE and firm performance (e.g. Clarke, et al., 2011; Ting and Lean, 2009). SCE and the relation with firm performance is a different story. In coherence with previous studies, no significant results apart from a negative relation with ATO are found. Although other studies have found negative relation of SCE with firm performance, results remain not significant (Chen et al., 2005; Shiu, 2006). Therefore, this study concludes not to support hypothesis 3b. With respect to the control variable CEE, a significant result is found regarding ROE. This result is substantially different than previous findings where CEE is predictor with high explanatory value (Clarke et al., 2011).

Overall, the findings are different than earlier results of Firer and Williams (2003) who established no relations between ICE and firm performance. This study is more in line with recent studies (Clarke et al., 2011; Komnenic and Pokrajcic, 2012; Mehralian et al., 2012) to prove a positive relation of ICE with firm performance. The diversity of firm performance ratios has been numerous and significant in various studies where this study adds to establish the relation with ICE and ROA, ROE, and EP. Complete new approach of investigating two different samples established via country has shown consistent results related to the overall findings. Last, the individual elements of ICE has produced a mixed outcome with positive significant relations of HCE with ROA, ROE, and EP but only a weak negative significant relation of SCE with ATO. Where other studies have found that the individual elements exhibit greater explanatory power than the general ICE construct (Chen et al., 2005; Clarke et al., 2011), this study shows that IC and HCE present similar results in both cases mainly due to a lack of influence from SCE. All results are schematically depicted in Figure 2.

| Discussion

With further emphasis on the importance of intangible assets in accounting practices, firms provide more statistical data to investigate the impact of Intellectual Capital. Different elements of IC have been defined, resulting into the possibility to empirically investigate Human Capital as well as Structural Capital. Relational Capital remains difficult to value and is not disclosed by firms, and is not included in the VAIC methodology either. Derived from annual reports with a timespan of five years and a sample of listed firms in Poland and the Netherlands, results indicate a consistent relation between ICE and firm performance. Significant evidence is found in the general model, the individual samples of Poland and the Netherlands, and individual elements of ICE. In line with previous studies (e.g. Chan, 2009b; Clarke et al., 2011), this study emphasizes that investing into IC and specifically HC will result into a better firm performance. This result has been established by investigating three hypotheses with the help of the VAIC methodology.

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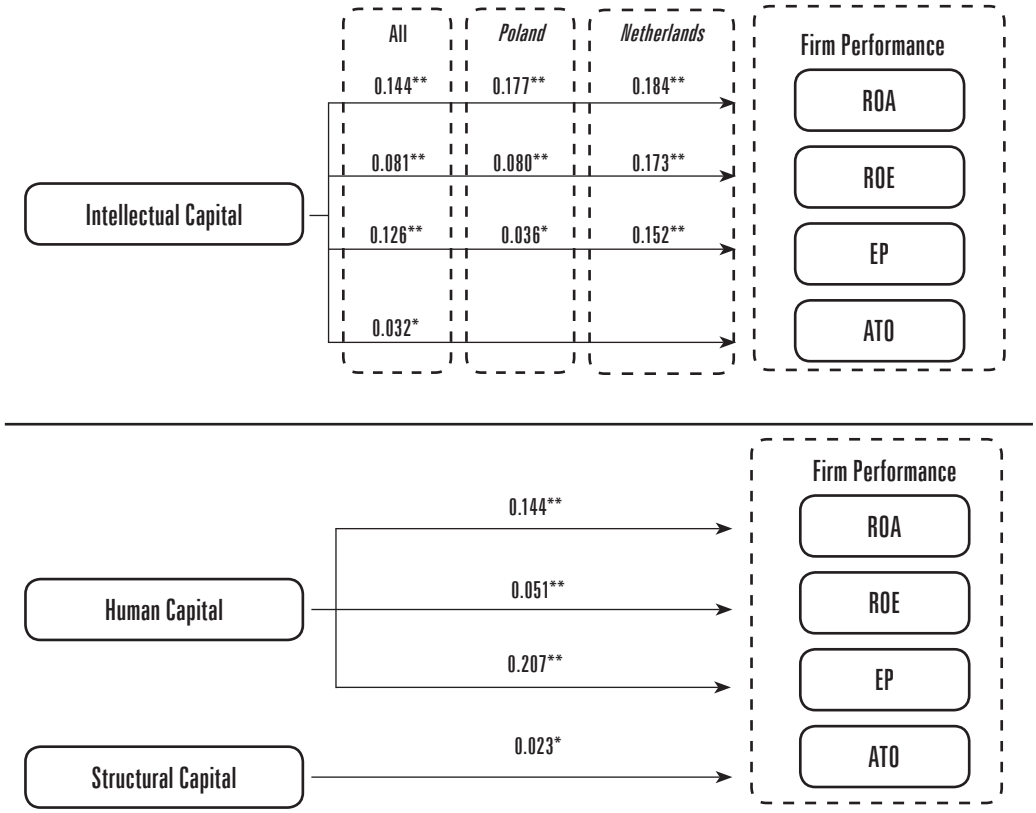
Figure 2 | Research Model Results



First hypothesis provides conclusive evidence of the direct relation between IC and firm performance. A positive correlation and coefficient is found, indicating a rise in ROA, ROE, EP, and to a lesser extent ATO when increasing IC. Firms in Poland and the Netherlands with higher level of IC, higher value added generated by human and structural capital disclose higher profits after taxes in comparison to total average assets or equity. It is a direct relation that efficiency on salaries and wages as well as other intangible assets generates higher value added, hence better financial performances.

Opposite results regarding hypothesis 2 have been found, concluding higher IC levels in Polish firms leading to improved financial ratios of ROA and ROE. An explanation for the higher IC levels can be found in high economic growth due to the developing nature of the country (Kornecki, 2010). Currently, Poland enjoys a high economic growth started a decade ago in combination with low labour costs. Where low wages in Poland have led to stable productivity, Dutch firms encompass a large variation resulting in a strong positive relation with IC. A more advanced economy with high revenues while retaining fewer employees, i.e. a large output from limited inputs is present in Dutch firms.

After review of the individual elements, Human Capital indicates strong and sound relation with virtually similar financial ratios found in the overall model, namely ROE, ROA, and EP. Evidence found that investing in employees by training and promoting improvement of abilities, skills, and motivation leading to financial results is an important tool and it is in line with previous conclusions (Bollen, Vergauwen and Schnieders, 2005; Stewart, 1997). Structural Capital is so far the only other measure next to HC to evaluate the impact of intangible assets. Strategy, patents, and brand names are treated in the VAIC methodology as the leftover explanatory part of value added after subtracting HC. Unfortunately, these intangible aspects of the firm establish not yet significant results, not in this study nor in previous works (Komnenic and Pokrajcic, 2012; Maditinos et al., 2011). Although HC is seen as the primary initiator of SC (Bollen et al., 2005), equal level of explanatory power and predictions remain imperceptible. A weak inverse relation with average turnover might be explained by the fact that strategy, brand names, and predominantly patents are valued highly as assets. Intellectual property such as copyrights, trademarks, and patents reduce ATO due to increased book value while generating a high SC efficiency. An inverse relation mainly pivoting around the increase in assets by patents is the result.

Implications

HC and SC provide the elements for IC as a predictor for increased financial performance. Providing time and possibilities for employees to improve their skills and motivation by providing training or even providing more communication between employees, feeds the ground as of which improvements grow higher efficiency. However, contemplating the time and possibilities to encourage HC and SC present a precarious issue as excess IC might destruct efficiency and performance. A beneficial mixture between IC and added value is sought after, to balance the input with the eventual output.

Novelty in this study to compare two samples based upon national stock exchange listing, leads to similar and differing implications for Polish and Dutch firms. An increase of IC efficiency in Polish firms proliferate ROA and ROE but tend to slightly overlook EP. It is proposed to broaden the knowledge of each individual employee with training to fully utilize the potential before adding extra workers. In the Netherlands, the situation is slightly different. Emphasis on converting the available IC into profits is here the advice.

Third and final practical implication from this study concerns the importance of HC while at the same time the absence of SC evidence. Although the overall relation between IC and firm performance is established, individual elements such as HC and SC are highly interesting constructs. Research concerning specifically the elements of IC will lead to a further investigating into causes and explanations. Difference between HC and SC regarding significant results is

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evident and explicates that according to this study the important element for practice within a firm is to focus on the improvement of HC.

Theoretical implications based on this study are represented in the results produced by executing the VAIC methodology. Overall, the validity and usability of IC in relation to firm performance has been found significant based on a dataset of 163 observations derived from annual reports. As a theoretical construct, IC has been proven correct and useful to explain firm performance and the VAIC methodology in general a significant tool to use.

Selected individual elements of IC namely HC and SC next to CEE as control variable have found mixed implications. Results of HC has been recognized and significantly approved, while SC on the other hand remains insignificant and problematic. Practical implications are non-existent leading to the conclusion that a more thorough and insightful analysis of the construct is necessary. Without significant relations, CEE provides a questionable role within the knowledge process. With studies treating CEE as independent variable, control variable or as non-existent, individual assessment and investigation is advised.

Limitations and further research

While the VAIC methodology is the dominant tool used in empirical studies concerning IC, the method skews the data collection and calculations by focusing on certain variables. Calculating the value added with just five financial posts provides practical usage while at the same time prove to be rather subjective. A similar limitation can be placed at the calculation of SC as the remainder of value added when subtracting HC. Furthermore, partly influenced by the VAIC methodology and partly by the data gathering, excess results were ruled out manually, which is prone to limitations. Lastly, the organization of the dataset was chosen to be five years on the top 20 listed firms in Poland and the Netherlands. Although this sample adds new data to the existing body, bias and subjectivity due to these decisions limits this study.

Derived from the results and the structure of the research, this study offers starting points to extent further. IC exploration has found itself on a junction where different methodologies collide as the general concept is considered clear and ready for investigation. Further research in the specific elements of IC, however, might be beneficial for IC, its elements, and the different methodologies. Additionally, initial scanning and pioneer research related to empirical evidence for RC can be started. Third, the novelty of comparing two samples within this study links to evidence for country IC, discussed by Bontis (2004), which can grow out of its pioneering phase. Last, the VAIC methodology has been designed a mere decade ago but receives lately more and more revisions. Complex and critical investigation into its reasoning and applicability might suffice to further strengthening its validity by clearing inconsistencies and multiple interpretations.

Conclusion

Intangible assets of a firm present the value of knowledge and are referred to as Intellectual Capital. With various methodologies available, the VAIC methodology brings forward data found in annual reports to be converted into empirically functional evidence. Results consequent of this methodology concludes a positive relation between IC and firm performance, specifically ROA, ROE, and EP. Similar relations are found when splitting the sample into Polish and Dutch listed firms. Difference in coefficients and explanatory values provide evidence that IC is influencing profits to be higher in Poland while employee productivity due to IC is found to be greater in the Netherlands. Furthermore, the relations between ROA, ROE, EP, and IC are mainly produced by its element HC, providing emphasis on the human side of IC. Overall, knowledge is concluded to be a predictor of firm performance. Knowledge produced and handled by employees is a driving force to the financial state of a firm.

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