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Impact of Intellectual Capital Efficiency on Growth Rate and Profitability of a Company: Nasdaq Baltic Case

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Impact of Intellectual Capital Efficiency on Growth Rate and Profitability of a Company: Nasdaq Baltic Case

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Abstract

Research on intellectual capital (IC), while realizing the fact the investments or spending on IC that can either create or destroy value, during the last decade has changed the focus from analysis of companies IC meta system to analysis of ecosystem and company as part of framework. Intellectual capital (IC) analysis that as an academic discipline has evolved and exceled since early 90's has reached the fourth stage of the research. Purpose of the study: Investigate the level of relationship between intellectual capital and its components and sales / growth rate and profitability of the companies; identifies dominating significant constituents in NASDAQ Baltic companies. Tasks: a) to identify intellectual capital and business performance ratios for the analysis, b) choose normalisations proxies, set number of control and moderate variables and period of impact to evaluate. Primary research methods: panel time-series sample of 92 companies and a 6-year observation of companies listed on the Baltic Stock Exchange between 2013 and 2019. This article contributes to the development of Intellectual Capital Theory, Value-Based Management Theory and Resource-View Theory. Elaborating on the analysis of the financial statements, as audited and public data, thorough analysis of the companies' intellectual capital and its components has been undertaken improving the methodology of the evaluation of the impact, identifying research gaps and expanding the theoretical impact models. This study reveals a significant and positive relationship between Intellectual Capital and its components and sales / growth rate and profitability of the companies; identifies dominating significant constituents in NASDAQ Baltic companies. Expanding number of IC components, number of control and moderate variables and, crucially, testing for approbation of normalization proxies and adjusting IC components for value added or assets, provides thorough and accurate analysis of the impact.

KEYWORDS: Intellectual capital, extended impact models.

Introduction

As IC has gained impetus in the leap jump period of the knowledge-based companies, growth rates and scale of such companies have been one of the entrepreneurial wonders. Capitalization of S&P 500 over recent years has been mostly driven by Intellectual Capital or intangible values. Researchers agree that the terms "intangible assets", "trademark", "good repute", "intellectual property" in accounting and valuation activities do not cover everything that should be included in the new concept. It is about managers using intangible assets as a management object, and the main purpose of this activity is to increase the value of the company by involving previously unused reserves such as knowledge, competence, corporate structures, information technology, customer satisfaction, etc. Purpose of the study: Investigate the level of relationship between

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intellectual capital and its components and sales / growth rate and profitability of the companies; identifies dominating significant constituents in NASDAQ Baltic companies. Tasks: a) to identify intellectual capital and business performance ratios for the analysis, b) choose normalisations proxies, set number of control and moderate variables and period of impact to evaluate. Primary research methods: panel time-series sample of 92 companies and a 6-year observation of companies listed on the Baltic Stock Exchange between 2013 and 2019.

Theoretical background

Intellectual capital as serious research item was recognised only in the beginning of eighties last century as in the most recognised database SCOPUS there started to be indexed scientific papers on intellectual capital: in 1981 – 1 paper; in 1984 – 3 papers. Since that time it was expanding exponentially reaching 507 scientific papers indexed in SCOPUS in 2021. In first four months in 2022 it was already indexed 177 scientific issues (SCOPUS, 2022). The dynamics of the research on intellectual capital (IC) is included in Figure 1.

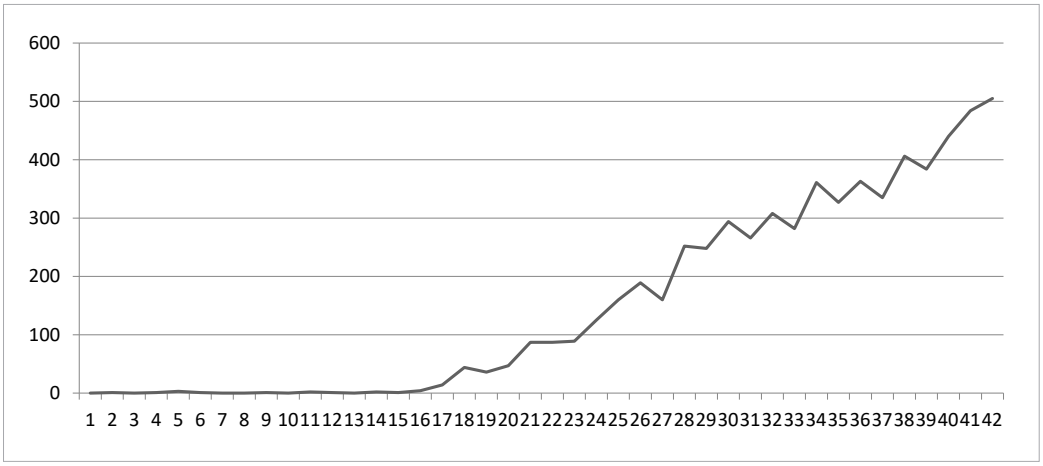


Figure 1
Dynamics of the research on Intellectual Capital indexed in SCOPUS, 1980 -2021 (SCOPUS, 2022)

The dynamics shows positive and exponential growth. The research on IC is divided into four blocks reflecting the evolution and four stages of the research.

At the first stage of the research, researchers were initially concerned with theory building and raising awareness, i.e., the value communication stage. The second stage was characterized by gathering evidence to justify IC as a management technology, i.e., IC measurement models' creation and dynamics aspect. The third stage allowed us to understand IC in practice and is known for wide approbation ground of the models within the organizations and even nation-states. And finally, the fourth stage is a big step forward ecosystems and extended analysis of the company in the environment. The research before 1997 was sporadic, fragmented, and primarily based on case studies that call this period a non-science period.

Analysis of the research on IC and other related peer-reviewed articles proves that composition and classification of IC is getting more extensive and richer (Ferenhof, et al, 2015) over the recent years. (see Figure 2.).

First, the dominating structure of human capital and structural capital has dissolved confidently by introduction of the relational capital and in the light of recent transfer to the fourth stage of the research by introduction of the social capital. The two latter are still sometimes used as synonyms that they are not. Second, each of the four components stratified into numerous layers. Third, due to the proven fact of the components' interrelations, in most of the cases the sub-capitals are not strictly affiliated to one or another capital group and due to the on-going

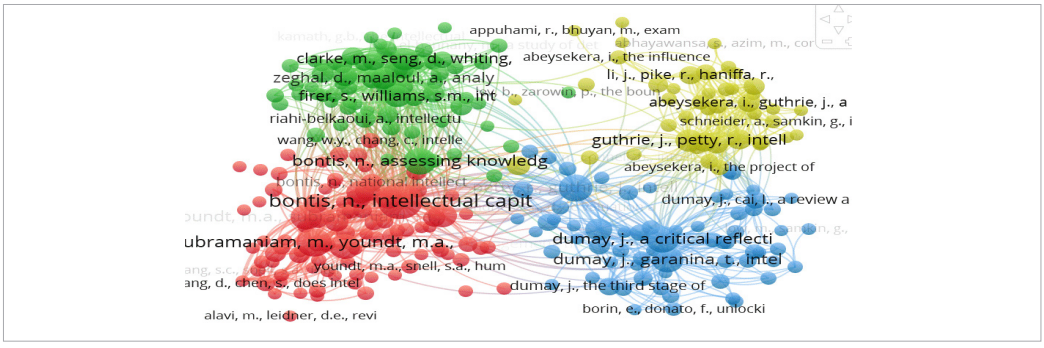
discussions on the definitions of the groups can also partly overlap. The numbers of definitions, classifications, measurement models, and target groups (Dumay, et al., 2015) using IC measurement systems are growing constantly. The initiative of IC research was presented by enterprises and commercial entities. Later models were also developed for the non-profit organisations, educational institutions and government bodies.

Table 1
Intellectual Capital research focus by stages

Stage: designation	Period	Focus and line of research	Studies of reference
1st stage: Development of a theoretical framework	End of the 1980s and the 1990s	Focus: Organizational IC Line of research: IC focused on awareness of its importance in creating and managing a sustainable competitive advantage	Kaplan and Norton (1992, 1996), Stewart and Losee (1994), Edvinsson and Malone (1997), Stewart (1997a, b), Sveiby (1997)
2nd stage: Development supported by empirical proof	2000 to the end of 2005	Focus: OIC Line of research: it is defined as a phase where approaches to measurement, management, and communication of IC are in evidence; more supported by empirical proof; conceptualization of specific aspects of IC, such as accounting, reports, and the measuring of IC; Different classifications are created which help to define and group the different methods of assessing IC	Mouritsen et al. (2000), Baum et al. (2000), Sullivan (2000), Andersen and McLean (2000), Lev (2001), Chatzkel (2004), Bontis (2004), Andriessen (2004), Bounfour and Edvinsson (2005)
3rd stage Development of implications arising from use of IC in an organization's management	2006 to 2010	Focus: OIC Line of research: practical analyses with more profound implications of IC management, considering different types of organization	Mouritsen and Roslender (2009), Reed et al. (2006), Dean (2007), Schiuma and Lerro (2008) and Martín-de Castro (2014),
4th stage Development of RIC and NIC	2011 to the present day	Focus: NIC and RIC Line of research: IC in the context of ecosystems, at the national and regional levels.	Roos and O'Connor (2015), Beretta (2019), Vrontis (2020), Diez-Vial (2019), Aversano (2020)

Source: Author's update based on Pedro et al. (2018) elaboration based on Guthrie et al. (2012), Dumay and Garanina (2012, 2013), Labra and Sánchez (2013), Roos and O'Connor (2015)

Figure 2
Intellectual Capital co-citation analysis, 2016 -2020



Source: author's construction from Scopus

Intellectual Capital impact assessment explored within the number of the research papers represented by Javornik, *et. al.* (2012), Jordao, *et. al.* (2018), Lin (2018), Nadeem, *et. al.* (2017), Pedro, *et. al.* (2018), Scafarto, *et. al.* (2016), Sardo, *et. al.* (2017), Khalique, *et. al.* (2020), Chen, *et. al.* (2020), Uslu (2020), Almutirat (2020) have shown the research gaps and opportunities for future research. Majority of the research are focusing on the profitability ratios, adjusting for value added and analysing current periods. Number of authors have indicated the gaps for the further research and methodological developments such as taking into account that number of the IC components is constantly growing, not yet clearly defined and overlapping Pedro, *et. al.* (2018) and Paoloni (2020), performance ratios have reached the number of 300 and there is a need for the composite ratios and selection of the limited amount of indicators according to the need of the particular target group (Barhatov, 2014), lack of longitudinal analysis as most of the research used static data and does not analyse the time span (when the impact can be seen in the future not in the same period Ulum, *et. al.* (2014); Vishnu & Gupta (2014); Bayraktaroglu, Calisir & Baskak (2019) and contradictions in the findings Morariu (2014), Sardo (2018), Scafatto (2016), Xu (2020) are all engines for the further research. The positive effects of IC have been studied and demonstrated in static models as generally positive. The research gaps are long-term dynamic analysis or longitudinal effect and a detailed analysis of the impact of IC components and in particular composite ratios. The number of ICs and indicators is increasing, the results are contradictory, and there is a lack of studies on control and moderator variables and normalization proxies within the impact models, which is providing space for manoeuvre the current study is addressing on IC component changes over time, meaning, direction and sign.

Research questions:

- What ratios to choose for the analysis of the performance of the companies of around 300 ratios on evaluation of the company available?
- How do group performance indicators for the different purposes and target groups?
- What are the Intellectual capital efficiency measures to use?
- How to evaluate the impact of the efficiency of IC on the performance of the company?
- How long does it take to see the intellectual capital impact (longitudinal analysis)?
- How to choose between normalization proxies for the intellectual capital variables, i.e., choosing between adjustment for assets, value added, or sales revenue?

Research methods used in the research are bibliographic analysis, comparative quantitative and qualitative analysis, constructed research samples and visualization, systematization of indicators and integrated coefficients, OLS panel regressions and longitudinal regressions. According to management theory, a company's operations can be affected by a wide variety of factors, such as the industry, size, level of development, economic cycle, life cycle, etc., the author avoids the risks of interpreting influencing factors by all establishments on a ceteris paribus basis. The main objective of the current study is to analyse the influence of Intellectual Capital on the firm's growth rate treating costs as investments. Conceptual models tested in international research have been improved by expanding the number of indicators in the impact analysis by adding composite coefficients on the efficiency and financial side and the number of variables, control and moderator variables on the IC side, also testing normalization surrogates for each indicator, Comparative analysis and visualization of separate indicators, developing the possibilities of analysis and promoting the theory of resources and changing the perception of IC from a static to a dynamic view, an analysis of the impact of longitudinal intellectual capital efficiency has been performed, and a summary of the results and finally, the study is based on a unique database, and the IC data of companies in the Baltic region are used for comparative efficiency analysis for the first time.

$$PERFti = \beta 0 + \beta 1\, HCEti + \beta 2\, RCEti + \beta 3 PrCEti + \beta 4\, PCEti + \beta 5 SCE + \beta 6 InCE + \beta 7 lnAGEti + \beta 8\, lnSIZEti + \beta 9 LEVti + Dummy\ main\ list + Dummy\ LV + Dummy\ EST + Dummy\ LT + DummyI1 \ldots n + e; \quad (1)$$

where:

PERF – selected performance variables;

HCE – human capital efficiency;

RCE – relational capital efficiency;

PrCE – protected capital efficiency;

PCE – process capital efficiency;

SCE – social capital efficiency;

InCE – innovation capital efficiency;

AGE – age control variable;

SIZE – size control variable;

LEV – leverage control variable;

Dummy LV – Nasdaq Riga;

Dummy LT – Nasdaq Vilnius;

Dummy EST – Nasdaq Tallinn;

Dummy main list – Companies in Nasdaq Main list

Dummy industry 1...n – Dummies for each NACE industry

T – current period;

I – Nasdaq companies;

εi,t is the error.

Human Capital Efficiency (Sobakinova, *et. al.*; 2019 Biedenbach, *et. al.* 2019; Dash, *et. al.* 2020; Hutahayan, 2020; AlQershi, *et. al.* 2020; Hussen. 2020; Huang, *et. al.* 2020; Mubarik, *et. al.* 2020) first discussed in articles by Ante Pulic in 2001, 2004 and 2008 and recognized as one of the crucial elements of the analysis by numerous researches Dzenopoljac, *et.al.* (2017). Majority of authors have adjusted personnel costs to added value. Within the current research, sales revenue is used as adjustment as it helps to avoid interpretation issues when the value added number is negative.

$$Human\ Capital\ Efficiency = \frac{Costs\ Personnel}{Sales\ Revenue} \quad (2)$$

Marketing is concerned with the task of developing and managing customer relationships. In order to standardize the proxy for the measurement of Relational Capital:

$$RCE = \frac{RC}{Sales\ Revenue} = \frac{Marketing\ costs}{Sales\ Revenue} \quad (3)$$

Research and development (R&D) expenditure has been used extensively in the literature as a proxy for innovation capacity[1]. The efficiency of innovation is calculated the following manner:

$$InCE = \frac{InC}{Sales\ Revenue} = \frac{R\&D}{SalesRevenue} \quad (4)$$

[1] Anifowose, M., Rashid H.M.A., Annuar H.A., Ibrahim, H. (2018). Intellectual capital efficiency and corporate book value: evidence from Nigerian economy. *Journal of Intellectual Capital*, 19(3), 653;

Intellectual Property / Intangible Assets are defined in this study as protected capital which is legally protected rights concerning ownership of specific assets such as trademark, patent, industrial design and copyright (Anifowose, *et. al.*, 2018).

$$PrCE = \frac{PR}{Sales\ Revenue} = \frac{Trademark\ value + patent\ costs + copyright + industrial\ design + intangible\ assets}{Sales\ Revenue} \quad (5)$$

The two measurement indicators for the process capital can be used - investment in information technology and administrative expenses (Scafarto, Ricci & Scafarto, 2016):

$$PCE = \frac{PC}{Sales\ Revenue} = \frac{IT + Board\ salary}{Sales\ Revenue} \quad (6)$$

Social capital can be measured within the IC ecosystem in the fourth stage of the research as support to the society beyond the company. The relations can be causal.

$$SCE = \frac{SC}{SalesRevenue} = \frac{Donations\ and\ Financial\ Support}{Sales\ Revenue} \quad (7)$$

The measurement of control variables are chosen for the current research:

1. Lev, t is the natural logarithm of the leverage of the current period, given by the ratio of book value of total debt of the current period to total assets of the current period;
2. SIZEi, t is the size of the current period, given by the natural logarithm of total assets of the current period;
3. AGEi, t is firm's age of the current period, given by the natural logarithm of the number of years of existence of the firm of the current period Sardo & Serrasqueiro (2017).

Moderating variables within the current research are:

1. Nasdaq list – main or secondary;
2. Country – Latvia, Lithuania, Estonia;
3. NACE – fifteen industries.

Historically the performance financial ratios can be divided into market value ratios, financial leverage, liquidity and solvency, profitability and asset efficiency or turnover ratios. A growing number of the new diverse ratios like value-added ratios (reaching 300), for example, has created the critical mass of the data to analyze and need to establish the layers of analysis and limit it to the bearable scale. The initiative undertaken by a number of researchers is to shift the financial performance analysis paradigm from the object of the analysis to the subject or stakeholder interests. One of the solutions offered by Sorokin is to combine the matrix integrating both classification approaches by homogeneity (five groups of financial coefficients) and stakeholders (five-plus groups of the stakeholders) and types of the decisions, opening the matrix for the additional ratios if needed in each particular case. There is a space for maneuver, flexibility, and tailored made systems in each particular research or business case. Analyzing companies' fact sheets as well as company yearly reports one can see the ratios companies, Nasdaq, and Morning star has selected to analyze. Comparing ratios in the matrix and facts sheets and financial report we can obtain the following ratios (see the Table 2.).

The main aim of the current research is to limit the analysis to strategic, income, and investment decisions. Elaborating on the classification by Sorokin the framework can be enriched by the

Table 2
Modified matrix of Selected Nasdaq Baltic financial ratios based on approach by M. Sorokin

Decision / Stakeholder	Owner	Management	Borrower (creditors)
Strategic	ROE, P/E, VA, GR, RBS		
Operational		NA	
Investment	ROA, ROI		
Financial	NA		NA

Source: construction by Nellija Titova based on Sorokin matrix and Nasdaq Baltic data according methodology by Sorokin (Сорокин, 2006).

Business performance Composite ratio and sales Revenue growth rate. The ratios of Strategic and Investment decisions groups selected for the analysis are:

Elaborating on the approach the model for the analysis is developed. By doing so the analysis of the ratios is simplified and systemized, the stakeholders can see the overlapping areas in decision making and the area of responsibility is clearly defined.

Table 3
Business performance ratios selected for the impact analysis

Name	Description	Formula
ROA	Return on assets	EBIT / Net Operating Assets
ROE	Return on Equity	Net Profit / Equity
ROI	Return on Investments	Net Profit / Cost of Investments
P/E	Price/Earnings	Share Price/ Earnings per share
GR	Growth Rate	Sales t/ Sales t-1
RBS	Rate of Business Success	$R_1+R_2+R_3+R_4$
VA	Value Added	See section 1.3

Source: Nellija Titova construction

Data and research period:

- Both dependent and independent variables are based on Nasdaq Baltic Data for the period 2013-2019 for Estonia, Latvia and Lithuania from both primary and secondary lists of companies / issuers;
- All companies issuers are included in the data base with no exclusions;
- Data is reliable, valid and legitimate as it is prepared according to EU regulations – yearly financial statements and supplements;
- It is required by law to publish the data so the source is Nasdaq Baltic webpage, where the information is stored in PDF format documents and was manually processed to the data base;
- Financial data come from Morningstar.com analysis;
- Problem of missing data – unbalanced panel data, pdf only, different currencies, different approaches in Notes.

The data was collected primarily from the balance sheet, profit and loss statement and notes, where major cost positions where explained, of the Nasdaq Baltics (Latvia, Lithuania, and Estonia) stock issuers, nighty two companies, for the period 2013-2019.

Panel data, combination of time series and cross section, is structure of the research database.

As companies do not report all the data and have presented the Notes to the financial reports in different formats or scale of reporting, the data panel is unbalanced. Panel data analysis allows identifying the same cross-sectional relationship at different points of time and accounts for individual heterogeneity. In this case fixed effect panel data model will be estimated to treat the unobserved individual heterogeneity for each company to be correlated with the explanatory independent variables. Due to the lack of data on Innovation Capital efficiency and Social Capital efficiency, they are not used in the analysis. Due the small number of companies represented in each industry at this stage dummies for the industry are not used.

Results

Due to missing values and outliers, the data cleaning process demanded consideration to avoid significant effect on the final statistical results. Consistency checks served to identify the data, which are out of range, logically inconsistent or have extreme values. The missing responses were treated carefully to minimize their adverse effects by assigning a suitable value (neutral or imputed) or discarding them methodically (case wise or pair wise deletion). For each of the variables first and second quartiles were calculated, obtaining in quartile range, upper, lower bounds, and outliers identified. Outliers were further excluded from the analysis.

Hypothesis 1. Intellectual Capital has positive significant impact on ROA
Hypothesis 2. Intellectual Capital has positive significant impact on ROA with a time lag

Return on Assets

Return on assets is one of the main strategic performance indicators of the company. Return on total assets provides the foundation necessary for a company to deliver a good return on equity. A company without a good ROTA finds it almost impossible to generate a satisfactory ROE.

$$ROA = \frac{EBIT}{TA} \tag{8}$$

EBIT is the amount remaining when the total operating cost is deducted from total revenue, but before either interest or tax has been paid. The total operating cost includes direct factory cost, plus administration, selling, and distribution overheads.

$$ROA_{ti} = \beta_0 + \beta_1 HCE_{ti} + \beta_2 RCE_{ti} + \beta_3 PrCE_{ti} + \beta_4 PCE_{ti} + \beta_5 lnAGE_{ti} + \beta_6 lnSIZE_{ti} + \beta_7 LEV_{ti} + Dummy\ main\ list + Dummy\ LV + Dummy\ EST + Dummy\ LT + e \tag{9}$$

In the case of the extended model for ROA significant and positive change is identified in size and leverage level of the company as control variables as well as Relational capital of previous period meaning expenditures related to the sales and marketing. Companies in the first list complying with special requirements for the financial status demonstrate a positive correlation with ROA as could be expected. Adding the Human Capital component, we still see leverage as a defining factor and, usefully for the further analysis, Human Capital proxies adjusted for the assets in period t and t-1 meaning expenditures on personnel including bonuses, training, and insurance have a significant and positive impact on Return on Assets. Following with Process Capital element we do not see the impact. The only variable having a relatively low impact is expenditures on IT systems and Board salaries adjusted for value-added in period t-1. What matters is the age of the company, size, and leverage level. Protected Capital does not explain the return on assets. Nevertheless, adjusting expenditure on intangible assets in the current period adjusted for the sales revenue and protected capital adjusted for the assets in the previous period for the first list of the companies we can diagnose the positive impact.

Summarizing panel data analysis of IC impact on ROA the following equation might be created with variables filtered out from the individual variables' analysis:

$$ROA_{ti} = \beta_0 + \beta_1 HCE_{ti} + \beta_2 RCE_{ti} + \beta_3 PrCE_{ti} + \beta_4 PCE_{ti} + \beta_5 lnAGE_{ti} + \beta_6 lnSIZE_{ti} + \beta_7 LEV_{ti} + \beta_8 CEE_{ti} + Dummy\ main\ list + Dummy\ LV + Dummy\ EST + Dummy\ LT + e \quad (10)$$

Table 4

Intellectual capital components' impact on Return on Assets parameter estimates 2012-2019

Parameter	B	Standard Error	t	Sig.	90% Confidence Interval		Observed Power[a]
					Lower Bound	Upper Bound	
Intercept	-32.007	6.275	-5.101	0.000	-42.382	-21.631	1.000
NACE	2.793	1.497	1.866	0.064	0.318	5.269	0.585
List	5.054	1.800	2.808	0.006	2.078	8.031	0.875
Size_ln	2.304	0.544	4.233	0.000	1.404	3.204	0.995
Lev_ln	-1.593	0.437	-3.641	0.000	-2.316	-0.869	0.976
RCE_CA_1	46.930	15.092	3.110	0.002	21.977	71.883	0.927
PCE_CVA_1	2.011	1.005	2.001	0.047	-3.674	0.349	0.636
[Country=1]	2.825	1.509	1.872	0.063	0.330	5.320	0.587
[Country=2]	2.561	2.169	1.181	0.239	-1.025	6.148	0.322
[Country=3]	0	.	.	.	.	.	.

Source: Nellija Titova calculations based on Nasdaq Baltic Data

Narrowing down the number of variables we run extended regression including all variables identified at previous levels and include them in one regression. The majority of the variables are still significant allowing for the extraction of the major IC factors behind the ROA. The regression (significance 0.019) shows significant results (see the table 4.1 "Intellectual capital components' impact on Return on Assets, parameter estimates, 2012-2019, Nasdaq Baltic") with an adjusted R2 of 33%.

Main conclusions of impact analysis that control variables as the Nasdaq Baltic list, size, age, and leverage are defining the ROA. On the intellectual capital side expenditures on relational capital (expenditures on sales and marketing) and process capital (expenditures on IT systems and Board salaries) in the previous period are behind the increasing return on assets in the current period. Choosing between proxies – IC expenditures adjusted for Value Added, Sales Revenue, and Assets, the analysis helps to extract two – adjusted for Value Added and Assets. The latter can be explained by partial correlation as the sum of assets is used in both ROA and proxy formulas. The explanation power of this regression is 33% that means that there is another non-IC factor behind the success. Still, this is a clear indication of the decision to spend on marketing, sales, IT systems, and strong motivation system for the board in the previous period (t-1) combined with listing in the first Nasdaq Baltic list, being a large enterprise with control for the debt of the company brings a meaningful increase in return on assets in the current period.

Regression ROE

Hypothesis 4.3. Intellectual Capital has positive significant impact on ROE
Hypothesis 4.4. Intellectual Capital has positive significant impact on ROE with a time lag

$$ROE_{ti} = \beta_0 + \beta_1 HCE_{ti} + \beta_2 RCE_{ti} + \beta_3 PrCE_{ti} + \beta_4 PCE_{ti} + \beta_5 lnAGE_{ti} + \beta_6 lnSIZE_{ti} + \beta_7 LEV_{ti} + Dummy\ main\ list + Dummy\ LV + Dummy\ EST + Dummy\ LT + e \quad (11)$$

Return on Equity is one of the main strategic performance indicators of the company. According to Welsh (2003), this ratio is arguably the most important in business finance. It measures the absolute return delivered to the shareholders. A good figure brings success to the business – it results in a high share price and makes it easy to attract new funds.

$$ROE = Intercept + List + RCE_{CA} + RCE_{CA_1} + PCE_{CVA_1} + PrCE + PrCE_1 + Country \quad (12)$$

Continuing with Return on Equity at an individual component level among RCE proxies RCE adjusted for assets in period t and t-1 were selected, human capital did not contribute significantly to ROE, process capital adjusted for the value-added proved significance of IT systems and board salaries expenditures in previous period on the financial results of the current period, protected capital adjusted for the sales revenue is significant for both t and t-1 period. Control variables and moderate variables appeared to be only size and leverage ratio that matters in ROE case. Diminishing the number of variables analysing IC impact on ROE full regression included 10 variables and short one limited the number of variables to seven (see formula 12 including control variables (see table 5).

Final model is significant at 0,011 with explanatory factor R^2 = 0,4 and adjusted R^2 = 0,34. The model illustrates the factors behind the increase in Return on equity in the current period. Main conclusions of impact analysis that the Nasdaq list is the only control variable that has a significant impact on ROE. It can be explained by the fact that first list companies have special requirements on the financial status. On the intellectual capital side expenditures on relational capital (expenditures on sales and marketing) adjusted for assets in the previous period from the ROE. Process capital (expenditures on IT systems and Board salaries) in the previous period are behind the increasing return on equity in the current period adjusted for value-added. Finally protected capital expenditures appear to be significant at 0,05 both in the current and previous period adjusted for the sales revenue which means investments/expenditures on IT systems and Board salaries pay off in the current and next period. Therefore, Nasdaq companies generous to support marketing and sales, IT systems and strong motivation system for the board in the previous period (t-1) combined with listing in the first Nasdaq list, can promote an increase in ROE in the current period.

Table 5

Intellectual capital components' impact on ROE, parameter estimates, 2012-2019, Nasdaq Baltic

Parameter	B	Standard Error	t	Sig.	90% Confidence Interval		Observed Power
					Lower Bound	Upper Bound	
Intercept	-4.928	4.648	-1.060	0.291	-12.625	2.770	0.281
List	15.606	4.063	3.841	0.000	8.877	22.334	0.985
RCE_CA_1	155.972	54.015	2.888	0.005	66.529	245.414	0.890
PCE_CVA_1	8.609	1.941	4.435	0.000	-11.823	5.395	0.997
PrCE	48.539	24.308	1.997	0.048	8.288	88.791	0.634
PrCE_1	49.914	24.590	2.030	0.044	-90.633	9.196	0.646
[Country=1]	5.410	3.940	1.373	.172	-1.114	11.935	0.392
[Country=2]	2.282	4.729	.482	.630	-5.549	10.112	0.139
[Country=3]	0	.	.	.	.	.	.

Source: Nellija Titova calculations based on Nasdaq Baltic Data

Regression ROI

Hypothesis 4.5. Intellectual Capital has positive significant impact on ROI
Hypothesis 4.6. Intellectual Capital has positive significant impact on ROI with a time lag

$$ROI_{ti} = \beta_0 + \beta_1 HCE_{ti} + \beta_2 RCE_{ti} + \beta_3 PrCE_{ti} + \beta_4 PCE_{ti} + \beta_5 lnAGE_{ti} + \beta_6 lnSIZE_{ti} + \beta_7 LEV_{ti} + Dummy\ main\ list + Dummy\ LV + Dummy\ EST + Dummy\ LT + e \quad (13)$$

Return on Investments is one of the main strategic performance indicators of the company. A calculation used to assess a company's efficiency at allocating the capital under its control to profitable investments (Morningstar, 2019).

$$Return\ on\ Invested\ Capital\ (ROIC) = \frac{Net\ income + Interest\ Expense * (1 - Tax\ Rate\ for\ Calculations)}{Invest\ Cap} \quad (14)$$

Applying the same method to the Return on Invested Capital ratio two final regression models can be analysed, i.e., full and short version of it:

$$ROIC = Intercept + NACE + List + Age_{ln} + Size_{ln} + Lev_{ln} + RCE_1 + HCE_{HCA_1} + PCE_{CVA_1} + PrCE + PrCE_1 + Country \quad (15)$$

$$ROIC = Intercept + List + Size_{ln} + HCE_{HCA_1} + PCE_{CVA_1} + PrCE + PrCE_1 + Country \quad (16)$$

Preselected individual variables are 5 IC variables' proxies and all control and moderate variables and short version include the reduced number of variables selected by significance factor that are four on IC side and control and moderate variables (see table 4.3. Intellectual capital components' impact on ROIC, parameter estimates, 2012-2019, Nasdaq Baltic). Explanatory power is relatively low for these regressions of 20% that is within significance interval in case of panel data analysis. Summarizing the analysis of IC impact on ROIC Nasdaq list and size of the company is defining ROIC on the control and moderate variables side. It can be explained by the fact that first list companies have special requirement on the financial status and the fact that big companies also are big scale investors.

Table 6

Intellectual capital components' impact on ROIC, parameter estimates, 2012-2019, Nasdaq Baltic

Parameter	B	Standard Error	t	Sig.	90% Confidence Interval		Observed Power
					Lower Bound	Upper Bound	
Intercept	-17.731	5.947	-2.981	0.003	-27.568	-7.893	0.907
List	3.737	1.467	2.548	0.012	1.311	6.163	0.814
Size_ln	1.576	0.499	3.158	0.002	0.750	2.401	0.933
HCE_HCA_1	9.247	2.691	3.436	0.001	4.796	13.699	0.962
PCE_CVA_1	1.862	0.757	2.459	0.015	-3.115	0.609	0.789
PrCE	22.657	9.696	2.337	0.021	6.619	38.696	0.753
[Country=1]	0.688	1.491	0.462	0.645	-1.778	3.155	0.136
[Country=2]	0.322	1.801	0.179	0.858	-2.657	3.301	0.105
[Country=3]	0	.	.	.	.	.	.

Source: Nellija Titova calculations based on, Nasdaq Baltic Data

On the intellectual capital side compared to ROA and ROE where human capital did not appear as significant for the return on invested capital personnel expenditures does matter for the next period, i.e., t-1 period expenditures influence return in the next period. Similar to ROA and ROE, process capital (expenditures on IT systems and Board salaries) in the previous period are behind the increasing return on invested capital in the current period adjusted for value-added. Finally, also similarly to ROE, ROA also for ROIC protected capital expenditures appear to be significant at 0,05 both in current and previous period adjusted for the sales revenue that means investments/ expenditures on IT systems and Board salaries pay off in the current and next period. In turn expenditures on relational capital (expenditures on sales and marketing) do not appear globally significant. Therefore, Nasdaq first lists companies generous to support personnel in terms of salaries, bonuses, insurance, training, etc. And IT systems and strong motivation system for the board in the previous period (t-1) as well as current expenditures on intangible assets, ensure a high level of Return on Invested Capital in the next period.

Growth rate

Limiting the number of variables to significant dependent variables the regression for the sales revenue growth is following:

$$Ln\_Sales = Intercept + Size\_ln + HCE + HCE\_HCA + PCE\_1 + PCE\_PCA + PrCE + PrCE\_PrCA + Country \quad (17)$$

$$Ln\ Salesw_{ti} = \beta_0 + \beta_3 HCE_{ti} + \beta_5 HCE\_CA_{ti} + \beta_7 PCE_{t1i} + \beta_8 PCE\_CA_{ti} + \beta_{10} PrCE_{ti} + \beta_{11} PrCE\_CA_{ti} \quad (18)$$

Control variables: $lnSIZE_{ti}$
Moderate variables: Country

The model appears to be significant with adjusted R squared 0,831. According to the analysis (see table 4.4. "Intellectual capital components' impact on the sales growth rate, parameter estimates, 2012-2019, Nasdaq Baltic") the major factor to influence sales is to spend on the personnel and board salaries, IT systems and intangible assets like patents, brands, know-how, etc.

Table 7
Intellectual capital components' impact on Sales, parameter estimates, 2012-2019, Nasdaq Baltic

Parameter	B	Standard Error	t	Sig.	90% Confidence Interval		Observed Power[a]
					Lower Bound	Upper Bound	
Intercept	2.979	0.392	7.598	0.000	2.331	3.628	1.000
Size_ln	0.736	0.031	24.056	0.000	0.685	0.786	1.000
HCE	5.896	0.502	11.741	0.000	-6.726	-5.066	1.000
HCE_HCA	3.129	0.307	10.200	0.000	2.622	3.636	1.000
PCE_1	4.320	1.065	4.055	0.000	-6.081	2.558	0.992
PCE_PCA	12.314	1.732	7.109	0.000	9.450	15.178	1.000
PrCE	0.210	0.664	1.821	0.070	-2.309	0.111	0.567
PrCE_PrCA	3.644	0.992	3.673	0.000	2.004	5.284	0.978
[Country=1]	-0.165	0.101	-1.630	0.105	-0.332	0.002	0.492
[Country=2]	0.119	0.116	1.030	0.305	-0.072	0.311	0.272
[Country=3]	0	.	.	.	.	.	.

Source: Nellija Titova calculations based on Nasdaq Baltic Data

Proxy of intellectual capital adjusted for assets provides higher quality data compared with adjustment with sales revenue and value-added. Process capital (IT and board salaries) is the only factor of period t-1 that has an impact on sales revenue in period t. The efficient management system is key success factor behind volumes, pricing policy, and sales increase. Control variables such as leverage and size prove to have significant impact on the company growth rate.

Discussion

Government agencies in cooperation with industry associations / chambers of commerce and Nasdaq Baltic in all three Baltic States may re-evaluate reporting recommendations on intellectual capital, including intangible assets, and its components, extending beyond intangible assets to include social capital, human capital, etc., clearly defining structure of components and taking into account the experience of other countries working on mandatory and voluntary reporting of ICs. In addition, impact analysis at the national and micro levels of companies, as well as industry-level research, can contribute to defining strategies for economic development and sustainability. Companies must publish their annual accounts on the Nasdaq website. As companies use different individual approaches to the notes to the financial statements when reporting to Nasdaq Baltic, Nasdaq Baltic can more clearly define the requirements for the notes to the financial statements submitted by companies, harmonize the description structure and specify the required data and data formats.

Conclusions

- Main conclusions of IC impact analysis on Return on Assets are that control variables such as the Nasdaq list, size, age, and leverage are defining the ROA. On the intellectual capital side expenditures on relational capital (expenditures on sales and marketing) and process capital (expenditures on IT systems and Board salaries) in the previous period are behind the increasing return on assets in the current period. Choosing between proxies – IC expenditures adjusted for Value Added, Sales Revenue, and Assets, the analysis helps to extract the two: adjusted for Value Added and for Assets. The latter can be explained away as a technical fluke of partial correlation since the sum of assets is used in both ROA and proxy formulas. The explanation power of this regression is 33%, which means that there is another non-IC factor behind the success. Still, this is a clear indication in favour of spending on marketing, sales, IT systems, and strong motivation system for the board in the previous period (t-1) combined with listing in the first Nasdaq list, being a large enterprise with control for the debt of the company bringing meaningful increase in return on assets in the current period.
- Main conclusions of IC impact analysis on Return on Equity are that the Nasdaq list is the only control variable that has a significant impact on ROE. It can be explained by the fact that first list companies have special requirements on the financial status. Process Capital (expenditures on IT systems and Board salaries) in the previous period are behind the increasing return on equity in the current period adjusted for value-added. Finally Protected Capital expenditures appear to be significant at 0,05 both in the current and previous period adjusted for the sales revenue which means investments / expenditures on intangible resources pay off in the current and next period. Therefore, Nasdaq companies generously spending on marketing and sales, IT systems and strong motivation system for the board in the previous period (t-1) and protected capital combined with listing in the first Nasdaq list, can expect an increase in ROE in the current period.
- ROI compared to ROA and ROE, where human capital did not appear as significant, for the return on invested capital personnel expenditures does matter for the next period, i.e., t-1 period expenditures influence return in the period t. Similar to ROA and ROE, process capital (expenditures on IT systems and Board salaries) in the previous period are behind the

increasing return on invested capital in the current period adjusted for value-added. Nasdaq first lists companies generous to support personnel in terms of salaries, bonuses, insurance, training, etc. And IT systems and strong motivation system for the board in the previous period as well as current expenditures on intangible assets, ensure a high level of Return on Invested Capital in the next period.

» Research proves that for the companies registered in Estonia, Latvia and Lithuania, issuers of the Nasdaq Baltic Stock Exchange, growth rate is significantly influenced by the funds spent on employees as salary, insurance and other personnel costs as well as compensation to Board Members and costs of IT services. Control variables such as leverage and size prove to have significant impact on the company growth rate.

» The developed IC longitudinal impact model can be used to support and purposefully develop a policy for effective use of the IC and other resources of the company, as well as the planning, investing, comparative analysis and decision-making process.

References

Almutirat, H.A. (2020). The impact of intellectual capital in organizational innovation: case study at Kuwait Petroleum Corporation (KPC), Review of Economics and Political Science, 7(1), 34-55, https://doi.org/10.1108/REPS-08-2019-0113

AlQershi, N.A., Mokhtar, S.S.M. & Abas, Z.B. (2020). CRM dimensions and performance of SMEs in Yemen: the moderating role of human capital, Journal of Intellectual Capital, 23(3), 516-537, https://doi.org/10.1108/JIC-05-2020-0175

Anifowose, M., Rashid, H.M.A., Annuar, H.A. & Ibrahim, H. (2018). Intellectual capital efficiency and corporate book value: evidence from Nigerian economy. Journal of Intellectual Capital, 19(3), 653, https://doi.org/10.1108/JIC-09-2016-0091

Aversano, N., Nicolò, G., Sannino, G. & Tartaglia-Polcini, P. (2020). The Integrated Plan in Italian public universities: new patterns in intellectual capital disclosure. Meditari Accountancy Research, 28(4), 655-679, https://doi.org/10.1108/MEDAR-07-2019-0519

Bayraktaroglu, A.E., Calisir, F. & Baskak, M. (2019). Intellectual capital and firm performance: an extended VAIC model. Journal of Intellectual Capital, 20(3), 406-425, https://doi.org/10.1108/JIC-12-2017-0184

Beretta, V., Demartini, C. & Trucco, S. (2019). Does environmental, social and governance performance influence intellectual capital disclosure tone in integrated reporting? Journal of Intellectual Capital, 20(1), 100-124, https://doi.org/10.1108/JIC-02-2018-0049

Biedenbach, G., Hultén, P. & Tarnovskaya, V. (2019). B2B brand equity: investigating the effects of human capital and relational trust, Journal of Business & Industrial Marketing, 34(1), 1-11, https://doi.org/10.1108/JBIM-01-2018-0003

Chen, M.Y.-C., Lam, L.W. & Zhu, J.N.Y. (2020). Should companies invest in human resource development practices? The role of intellectual capital and organizational performance improvements. Personnel Review, 50(2), 460-477, https://doi.org/10.1108/PR-04-2019-0179

Dash, S.P. & Roy, S. (2020). Performance evaluation under human capital perspective: an empirical evidence, International Journal of Productivity and Performance Management, 70(6), 1336-1369, https://doi.org/10.1108/IJPPM-07-2019-0334

Dean, A. & Kretschmer, M. (2007). Can ideas be capital? Factors of production in the post-industrial economy: a review and critique. Academy of Management Review, 32(2), 573-594. https://doi.org/10.5465/amr.2007.24351866

Dumay, J., Guthrie, J. & Puntillo, P. (2015). IC and public sector: a structured literature review. Journal of Intellectual Capital, 16(2), 267-284, https://doi.org/10.1108/JIC-02-2015-0014

Dzenopoljac, V., Yaacoub, C., Elkanj, N. & Bontis, N. (2017). Impact of intellectual capital on corporate performance: evidence from the Arab region. Journal of Intellectual Capital, 18(4), 884-903, https://doi.org/10.1108/JIC-01-2017-0014

Ferenhof, H., Durst, S., Bialecki, M. & Selig, P. (2015). Intellectual capital dimensions: state of the art in 2014. Journal of Intellectual Capital, 16(1), 58-100, https://doi.org/10.1108/JIC-02-2014-0021

Huang, S.(S)., Yu, Z., Shao, Y., Yu, M. & Li, Z. (2020). Relative effects of human capital, social capital and psychological capital on hotel employees' job performance, International Journal of Contemporary Hospitality Management, 33(2), 490-512, https://doi.org/10.1108/IJCHM-07-2020-0650

Hussen, M.S. (2020). Exploring the impact of various typologies of human capital on firms' productivity, World Journal of Entrepreneurship, Management and

Sustainable Development, 16(3), 231-247, https://doi.org/10.1108/WJEMSD-12-2019-0095

Hutahayan, B. (2020). The mediating role of human capital and management accounting information system in the relationship between innovation strategy and internal process performance and the impact on corporate financial performance, Benchmarking: An International Journal, 27(4), 1289-1318, https://doi.org/10.1108/BIJ-02-2018-0034

Javornik, S., Tekavcic, M. & Marc, M. (2012). The Efficiency of Intellectual Capital Investments as a Potential Leading Indicator. International Business & Economics Research Journal, 11(5), 161-174, https://doi.org/10.19030/iber.v11i5.6972

Jordão, R. & de Almeida, R.V. (2017). Performance measurement, intellectual capital and financial sustainability. Journal of Intellectual Capital, 18(3), 643-666, https://doi.org/10.1108/JIC-11-2016-0115

Khalique, M., Hina, K., Ramayah, T. & Shaari, J.A.N. (2020). Intellectual capital in tourism SMEs in Azad Jammu and Kashmir, Pakistan. Journal of Intellectual Capital, 21(3), 333-355, https://doi.org/10.1108/JIC-11-2018-0206

Lin, C. (2018). Intellectual capital of South Africa: a comparison with Poland and Romania. Journal of Intellectual Capital, 19(3), 498-518, https://doi.org/10.1108/JIC-12-2016-0146

Martín-de Castro, G. (2014). Intellectual capital and the firm: some remaining questions and prospects. Knowledge Management, Research and Practice, 12(3), 239-245, https://doi.org/10.1057/kmrp.2014.13

Massaro, M., Dumay, J. & Bagnoli, C. (2015). Where there is a will there is a way: IC, strategic intent, diversification and firm performance. Journal of Intellectual Capital, 16(3), 490-517, https://doi.org/10.1108/JIC-07-2014-0091

Morariu, M.C. (2014). Intellectual capital performance in the case of Romanian public companies. Journal of Intellectual Capital, 15(3), 392-410, https://doi.org/10.1108/JIC-05-2014-0061

Morningstar, (2019). Company Fact Sheet, Retrieved May 2, 2019 from lt.morningstar.com/util/GetDocument.ashx?FileId=8992.

Mubarik, M.S., Devadason, E.S. & Govindaraju, C. (2020). Human capital and export performance of small and medium enterprises in Pakistan, International Journal of Social Economics, 47(5), 643-662, https://doi.org/10.1108/IJSE-03-2019-0198

Nadeem, M., Gan, C. & Nguyen, C, (2017). Does intellectual capital efficiency improve firm performance in BRICS economies? A dynamic panel estimation. Measuring Business Excellence, 21(1), 65-85, https://doi.org/10.1108/MBE-12-2015-0055

Paoloni, M., Coluccia, D., Fontana, S. & Solimene, S. (2020). Knowledge management, intellectual capital and entrepreneurship: a structured literature review. Journal of Knowledge Management, 24(8), 1797-1818, https://doi.org/10.1108/JKM-01-2020-0052

Pedro, E., Leitão, J. & Alves, H. (2018). Intellectual capital and performance: Taxonomy of components and multi-dimensional analysis axes. Journal of Intellectual Capital, 19(2), 407-452, https://doi.org/10.1108/JIC-11-2016-0118

Reed, R., Lubatkin, R.J. & Srinivasan, N. (2006). Proposing and testing an intellectual capital-based view of the firm. Journal of Management Studies, 43(4), 867-893, https://doi.org/10.1111/j.1467-6486.2006.00614.x

Sardo, F. & Serrasqueiro, Z. (2017). A European empirical study of the relationship between firms' intellectual capital, financial performance and market value. Journal of Intellectual Capital, 18(4), 777, https://doi.org/10.1108/JIC-10-2016-0105

Scafarto, V., Ricci, F. & Scafarto, F. (2016). Intellectual capital and firm performance in the global agribusiness industry: The moderating role of human capital. Journal of Intellectual Capital, 17(3), 537, https://doi.org/10.1108/JIC-11-2015-0096

SCOPUS (2022). Registered trademark of Elsevier B.V., indexing scientific publications.

Sobakinova, D., Zhou, Y. & Durrani, D.K. (2019). The role of human capital outcomes in generating business ideas, VINE Journal of Information and Knowledge Management Systems, 50(1), 163-183, https://doi.org/10.1108/VJIKMS-03-2019-0033

Ulum, I., Ghozali, I. & Purwanto, A. (2014). Intellectual capital performance of Indonesian banking sector: a modified VAIC (M-VAIC) perspective. Asian Journal of Finance & Accounting, 6(2), 103 - 123, https://doi.org/10.5296/ajfa.v6i2.5246

Uslu, H. (2020). The role of intellectual capital in financial development: evidence from the banking sector of Turkey, Competitiveness Review, 32(2), 230-249, https://doi.org/10.1108/CR-06-2020-0084

Vishnu, S. & Gupta, V.K. (2014). Intellectual capital and performance of pharmaceutical firms in India. Journal of Intellectual Capital, 15(1), 83 - 99, https://doi.org/10.1108/JIC-04-2013-0049

Vrontis, D., Christofi, M., Battisti, E. & Graziano, E.A. (2020). Intellectual capital, knowledge sharing and equity crowdfunding. Journal of Intellectual Capital, 22(1), 95-121, https://doi.org/10.1108/JIC-11-2019-0258

Сорокин, М. (2006). С разумом и эффективностью: Матрица финансовых показателей. Финансовый директор, 9, 58-64.

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