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**INTELEKTUĀLĀ KAPITĀLA IETEKMES UZ UZŅĒMUMA SNIEGUMU
NOVĒRTĒŠANA**

**IMPACT ASSESMENT OF INTELLECTUAL CAPITAL ON BUSINESS
PERFORMANCE**

IMPULSUM INTELLECTUALIS CAPITIS PERFICIENTUR ET MERCABIMUE

S U M M A R Y

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The doctoral thesis consists of an introduction, three parts, conclusions, recommendations, cited or used sources and appendices.

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ABSTRACT

The history of Intellectual capital (IC) as a young management discipline is outstanding. IC research initiated by practitioners and going through sporadic and fragmented non-science periods created the vision of concept and identified basic IC principles in the 90s. At the beginning of the 2000s, Intellectual Capital was recognized as a scientific discipline within the management domain.

In the first part of the thesis, the author has analysed the theoretical findings reflected in scientific publications on the concept and framework of Intellectual Capital as well as historic four development stages, identifies thematic blocks in the Intellectual Capital domain, has made the research on the insights into Intellectual capital structure developments and compares the research framework and gaps for the Intellectual Capital impact analysis on business performance. A systematic, structured and expanded international research outline summarized number of opinions and approaches that can and should be used in the planning of industry, group of companies and business.

In the second part of the thesis, taking into account the growing number of business performance indicators reaching three hundred according to the scientific sources and dilemma of choice for the stakeholders of the company, the author has analysed the systematization and targeting of the business performance indicators and compares selected criteria, including composite ratio, based on *Nasdaq Baltic* firms' data in the period 2012-2019.

In the third part, the author has proved the hypothesis on the impact of intellectual components on the business performance of the *Nasdaq Baltic* issuers in the period 2012-2019 extending the composite model with Intellectual Capital variables identified in the first part, business performance indicators approbated in the second part, adding normalisation proxies, longitudinal analysis and number of moderate and control variables. The author's analysis would demonstrate also the use of theoretical methods at the Baltic level, new aspects and unique results at the international level.

Keywords: Intellectual capital, business performance, longitudinal intellectual capital impact evaluation

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INTRODUCTION

Competitiveness of the companies is a crucial fact besides the country's economic growth. Among the factors of competitiveness are the resources of the company, enterprise strategies, managerial / owners' experience and education, i.e. the ability to assess and eliminate potential bottlenecks in business operations, including through performance indicators.

Intellectual capital (hereinafter referred to as "IC") in management theory and business practice is one of the dominant business development factors and its significance has been increasing over the last decade. "In 2015, intangibles, also referred to as 'intellectual capital', represented 87% of the market capitalization of listed companies forming part of the S&P 500 stock-market index; trademarks represent a large percentage of these assets, with expenditure on R&D often exceeding the net profits of these companies" (Cannibano, 2018). Lately "technological progress, outsourcing, complex supply chains, and changing cultural values have propelled intangible asset value to more than 90% of the valuation of many companies" (Samonov, 2021). Investment in the creation of IC for businesses provides opportunities and these statistics prove the statement. Intangibles provide an opportunity but require a willingness to adapt.

IC is a relatively young management discipline created and established by the practitioners, managers and executives of the companies who identified basic IC principles, elaborated one on the concept and initiated the introduction of the toolset for the measurement of IC a decade ago. The merit of the practical implementation and as a result setting the framework for further scientific research goes to the experts in management all around the world. Implementing the series of initiatives, projects, collaborations and making the information public they have forced the whole world to start investigating and discussing the notion and as a result to recognize the IC as a scientific discipline. Since Karl-Eric Sveiby has published the revolutionary book "The new organizational wealth: managing and measuring knowledge-based assets" (Sveiby, 1997) and a number of articles on the new organizational wealth and managing and measuring knowledge-based assets in 1997 the research has gone through the three stages and keep transforming through the fourth.

The evolution of the research from the measurement to the impact analysis, quantitative research, revealed that there are several contradictions and unanswered global issues in this area. Continuing the research the use intellectual capital related resources of the companies or costs of the resources, treated as investments, and its impact on the performance of the company and in

broader sense sector, industry or group of the companies that current paper is the next stage. As resources are limited there is a need to use resources more efficiently and longer. Role of IC becomes crucial when a company or sector wants to increase competitiveness; acquire external financing, evaluate the impact or make a comparative analysis between the companies. The positive impact of IC has been investigated and proven to be overall positive in the static models.

The missing component of the research is analysis of the long-term dynamic longitudinal effect and segregated IC's components impact. The number of IC and performance indicators is growing, the research finding are contradictory, there is a lack of longitudinal analysis and research on the control and moderate variables and normalization proxies thus providing wide maneuver for the research on IC components impact changes in time, including significance, direction and sign of the impact.

Research object: *Nasdaq Baltic* issuers.

Research subject: Intellectual capital impact on business performance evaluation.

Research goal: Develop and appropiate systematic approach to assessing the impact of Intellectual Capital and its components on the performance results of companies in Latvia, Lithuania and Estonia.

Aware that the company's operations under modern management theory may be influenced by a wide variety of factors, such as the company's business sector, size, country development level, economic cycle, enterprise life cycle, etc., by selecting control factors and a common analysis approach authors avoids the risks of interpreting influencing factors by analyzing all companies according to the *ceteris paribus* principle.

Tasks:

1. To study the development and use of the concept of IC and to define it within the framework of the doctoral thesis as well as to develop the set of the components of IC for use in the econometric impact model.
2. To extract the target group for the research from expanding body of targeted research on profit and non-profit type organisations and apply relevant selected methods.
3. To filter performance indicators for strategic business analysis, investigate the performance of *Nasdaq Baltic* issuers and appropiate the composite performance indicator rate of business success (RBS).
4. To proceed with business performance and added value change and correclation analysis.

5. To develop conclusions and proposals for evaluating, systematising and improving the management capability of an enterprise's impact on company performance indicators, as well as developing a management planning and control system evaluating IC impact.

Research methods: Bibliographic analysis of scientific publications and previous research, comparative quantitative and qualitative analysis where descriptive statistics characteristics were used for quantitative data analysis, Ordinary Least Square multiple panel regressions and dynamic / longitudinal regression analysis, approbating normalization proxies, control and moderate variables, constructed research samples and visualization, systematization of company performance indicators according to target groups, analysis of ratings and integrated ratios.

The current research faces several research questions:

1. What ratios to choose for the analysis of the performance of the companies of around 300 ratios on evaluation of the company available?
2. How to group performance indicators for the different purposes and target groups?
3. How to use integrated assessment and composite ratios?
4. What are the Intellectual capital measures to use?
5. How to evaluate the impact of IC on the performance of the company?
6. How long does it take to see the Intellectual Capital impact (longitudinal analysis)?
7. How to choose between normalisation proxies for the Intellectual Capital variables, i.e. choosing between adjustment for Assets, Value Added or Sales Revenue?
8. Whether business performance indicators correlate with changes in value added?

Research Hypothesis: Intellectual Capital has systemic and significant impact on business performance.

Statements to be defended:

1. Each component of intellectual capital has systemic and significant impact on the performance of the strategic and investment business performance and its composite.
2. Company's value creation and distortion is correlated with changes in business performance.
3. The components of intellectual capital are affected by changes over time, including the significance and direction of the impact.

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.
- The problem of missing data – unbalanced panel data, pdf only, different currencies, different approaches in Notes.

Novelty (scientific contribution)

The scientific contribution of the paper is:

Theoretical:

1. Systematization of methods, models and main indicators according to the stages of evolution of intellectual capital theory and target groups.
2. Improved definitions of intellectual capital, meta-analysis of structural updates and the selection and calculation of intellectual capital components in intellectual capital impact models.
3. A systematized, structured and expanded approach to the evaluation of the effectiveness of intellectual capital on the company's performance development.

Methodological:

1. Selected normalisation proxies for the Intellectual Capital impact models.
2. Selected and extended range of moderate values and control values in the Intellectual Capital impact models.
3. Meta-analysis of Intellectual Capital structure expansion, choice and approbation of Intellectual Capital components', adding composite ratios on business performance side, improved by selection of normalisation proxies, moderate and control variables for the impact models, improves the conceptual models approbated in international research.

4. Calculation, analysis and creation of visualisation patterns for the business performance of strategic and investment ratios and composite ratio.
5. Longitudinal Intellectual Capital impact analysis extended and summary of the results adding composite ratios on financial performance side and number of control and moderate variables contributes to the theory of the resources and changing the perception of the IC from the static to the dynamic view.

Novelty at Baltic countries level:

1. An assessment of the impact of intellectual capital has been carried out using *Nasdaq Baltic* data, which demonstrates new aspects of the research and unique results at the international level
2. Analysis of value creation and in particular value distortion combined with correlation analysis with financial performance tendencies in *Nasdaq Baltic* companies
3. The research is based on the unique data base and data on Intellectual Capital of the companies are first time used for the comparative analysis in the Baltic region for the first time

Limitations of the research

Name of the thesis is IC impact evaluation on business performance, that defines the first limitation of the research, i.e. target group definition – business entities. Government institutions, public organisations and NGO are excluded from the research scope.

For the analysis of the impact of IC, selected performance indicators used in internationally conducted research and business analysis were utilised. The set of performance indicators chosen by the author should not be considered complete. The selection is limited to the monetary analysis. Business performance ratios and IC components, moderate and control variables and normalisations proxies are only ones that can be measured in monetary terms.

Public data used are available on the *Nasdaq* companies in Latvia, Lithuania and Estonia within the period 2012-2019., t.i. pre-pandemia years and year 2020 when the econometric analysis of the data manually selected was initiated.

One of the major limitations is missing data or fragmented data provided by the companies. Amount of information disclosed as many companies fill the obligatory part as income statement and balance sheet, but not much in the descriptive part not elaborating on costs, making it difficult to analyse information.

Accounting and legislative rules and procedures are not the subjects of discussion in the research.

Aware that the company's operations under modern management theory may be influenced by a wide variety of factors, such as the company's business sector, size, country development level, economic cycle, enterprise life cycle, etc., by selecting control factors and a common analysis approach authors avoids the risks of interpreting influencing factors by analyzing all companies according to the *ceteris paribus* principle.

Structure

In order to achieve the purpose of the thesis, the author, in line with the tasks of the work, the first part of the promotion work covers analysis of IC concept evolution.

Within the framework of part two, the author assesses performance and composite solutions to evaluate strategic and investment ratios of the *Nasdaq Baltic* listed issuers during the period 2012-2019.

In the third part of the promotion work, the author links IC and its components to the strategic and investment performance indicators of the company in the static and dynamic settings, taking into account latest developments in IC research. In third part of the thesis IC impact model for evaluation of IC and its components in the company or group of companies is developed and approbated in Latvia, Lithuania and Estonia.

Approbation

The author has discussed the issues related to competitiveness and intellectual capital in international scientific conferences and peer-reviewed scientific publications, five publications are indexed in Web of Science, Hirsh index is 3 and one publication is indexed in Scopus.

International scientific conferences

1. Titova Nellija. "Impact of Intellectual Capital Efficiency on Growth rate and Profitability of a company: *Nesdaq Baltic* case", 17TH EIASM interdisciplinary conference on "Intangibles and intellectual capital – sustainability and integrated reporting, governance, and value creation", September 22-23, 2022, Taormina, Italy;
2. Titova Nellija, Erika Pancenko, "Intellectual capital and competitiveness of industrial enterprises of the Baltic countries", 7th Virtual International Scientific Symposium «Economics, Business & Finance», July 28th -29th, 2021, Jurmala, Latvia;

3. Titova Nellija, "Intellectual capital impact analysis: approbation of normalisation proxies in extended model", 14th annual scientific Baltic business management conference (online) ASBBMC 2021, June 1st -2nd, 2021, Riga, Latvia;
4. Titova Nellija, "Intellectual capital: from definition to impact assesment integrating social and innovation capital", the 17th annual international scientific conference "Social innovations for sustainable regional development", April 28th-29th, 2021, Klaipeda, Lithuania ;
5. Titova Nellija, "Evaluation of the business performance: case of Nasdaq Baltic", 37th IBIMA Conference 2021, May 30th -31st, 2021, Cordoba, Spain ;
6. Titova Nellija, "Business success rate as example of the composite ratio of business performance evaluation: baltic states", IV. Economics, Business & Organization Research Conference (EBOR), May 21st-23rd, 2021, Poland;
7. Titova Nellija, "The progress and advancement of the business performance measurement research", Nellija Titova, Maris Freifalts, Conference "Economy and Business", August 20th -24th, 2019, Burgas, Bulgaria;
8. Titova Nellija, "Different faces of value-added and its implications in intellectual capital research: literature review", "ICIC 2019: International Conference on Intellectual Capital, May 23rd-24th, 2019, Barcelona, Spain;
9. Titova Nellija, "Research methods: business v.s. linguistics", Young researchers conference "Via scientiarum", April 12th-14th, 2019, Ventspils, Latvija;
10. Titova Nellija, "Impact of gambling industry on the economy", RISEBA international scientific Baltic business management conference ASBBMC 2019 "Foreseeing Challenges and Opportunities for Organizations at the Macro and Micro Level", February 21st-23rd, 2019, Riga, Latvia;
11. Titova Nellija, "Normatīvo aktu regulējums cilvēkresursu atlasē procesā", E. Feldmane, N. Titova, A. Muižnieks, Christmans Conference, December 20th, 2018, Ventspils University of applied sciences, Latvija;
12. Titova Nellija, "Intellectual capital: 4th stage of research", 32nd conference organized by International Business Information Management Association, November 15th-16th, 2018, Sevilla, Spain;

13. Titova Nellija, "Intellectual Capital: from definition to impact assessment", international scientific conference Youth civic participation: practical and theoretical solutions (Interreg, ERDF), November 7th-8th, 2018, Klaipeda University, Klaipeda, Lithuania;
14. Titova Nellija, "Intellectual Capital: from definition to impact assessment", International Congress on Banking, Economics, Finance, and Business, August 17th-19th, 2018, Sapporo, Japan;
15. Titova Nellija, „Value Added Intellectual Coefficient: 1998-2018”, 4th International Scientific Symposium "Economics, Business & Finance", July 10th-14th, 2018, Jurmala, Latvia;
16. Titova Nellija, „Value Added Intellectual Coefficient (VAIC): state of progress”, Eurasian Academic Conference, January 13th-14th, 2013, Antalya, Turkey;
17. Titova Nellija, „Intellectual capital as driver of regional development”, 'Smart, Creative, Sustainable, Inclusive: Territorial Development Strategies in the Age of Austerity' conference, November 22nd-24th, 2012, London, Great Britain;
18. Titova Nellija, „Соотношение эффективности интеллектуального и задействованного капитала: текущее и последующее влияние на производственные показатели", October 12th-14th, 2012, Saint Petersburg, Russia;
19. Titova Nellija, „Three wales of Project management: time, resources and quality”, „Project management development – practice and perspectives” conference, February 8th-9th, 2013, Riga, Latvia;
20. Titova Nellija, „Intellectual capital efficiency vs. capital employed efficiency: longitudinal analysis of the impact on the financial performance of Latvian banks”, „Management Horizons in Changing Economic Environment: Visions and Challenges” conference, September 22nd-24th, 2011, Kaunas, Lithuania;
21. Titova Nellija, „Voluntary disclosure on Intellectual capital in Latvian banks”, EBES 2011, June 1st-3rd, Istanbul, Turkey;
22. Titova Nellija, „An empirical study on the impact of the Intellectual capital value added on business performance on Latvian banks”, EBES 2011, June 1st-3rd, Istanbul, Turkey;
23. Titova Nellija, „Intelektuālā kapitāla vērtēšana un finanšu vadības sistēma: hipotēžu testēšanas vēsture”, „Management of Business and Culture for sustainable development”, May 18th-20th, 2011, Riga, Latvia;

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1. EVOLUTION AND CURRENT STAGE OF THE RESEARCH ON INTELLECTUAL CAPITAL AND IMPACT ON BUSINESS PERFORMANCE

The intellectual capital research has a short history while the necessity of the research on the intellectual capital is growing exponentially. “In 2015, intangibles, also referred to as ‘intellectual capital’, represented 87% of the market capitalization of listed companies forming part of the S&P 500 stock-market index; trademarks represent a large percentage of these assets, with expenditure on R&D often exceeding the net profits of these companies” (Cannibano, 2018). In 2020 “technological progress, outsourcing, complex supply chains, and changing cultural values have propelled intangible asset value to more than 90% of the valuation of many companies” (Samonov, 2021). Investment in the creation of IC for businesses provides opportunities and these statistics proves the statement. Intangibles provide an opportunity but require a willingness to adapt. The dynamics of the research on IC is illustrated in Figure 1.1. “Dynamics of the research on Intellectual Capital”, 1980 — 2020”.

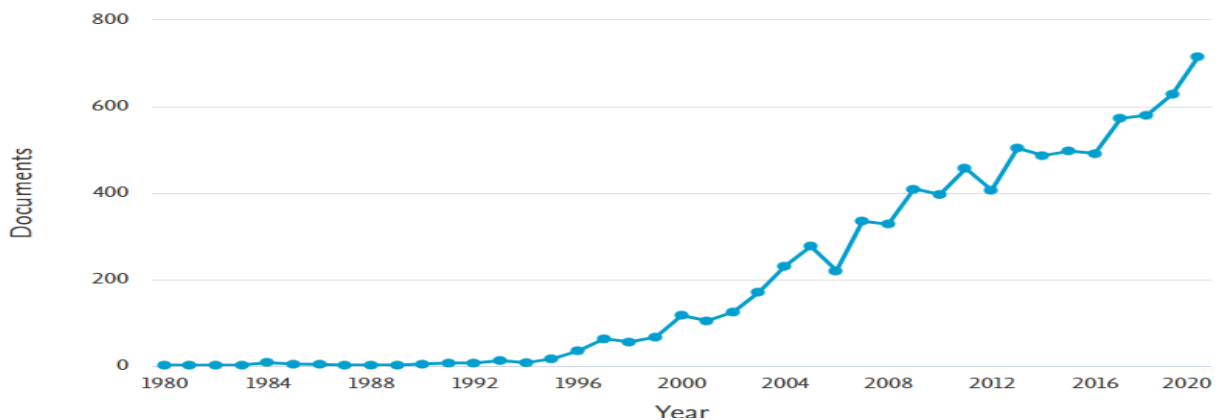


Figure 1.1. Dynamics of the research on Intellectual Capital, 1980 -2020

Source: author's construction from Scopus

The research on IC is divided into four blocks reflecting the evolution and four stages of the research described in part 1.3.1. of the thesis (see Figure 1.2. “Intellectual Capital co-citation analysis, 2016-2020”).

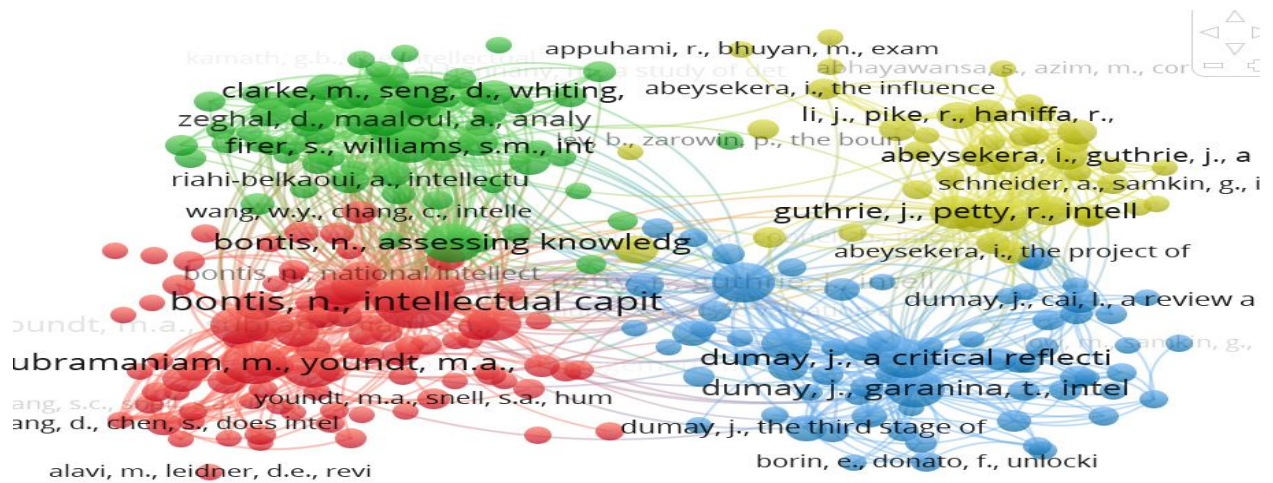


Figure 1.2. Intellectual Capital co-citation analysis, 2016 – 2020

Source: author's Scopus data construction

Leading authors are Bontis, N., Dumay, J., Guthrie, J., Roos, G., Maar, B., Mouritsen, J and Edvinsson, L. Nick Bontis is the author of 70 articles on Intellectual Capital.

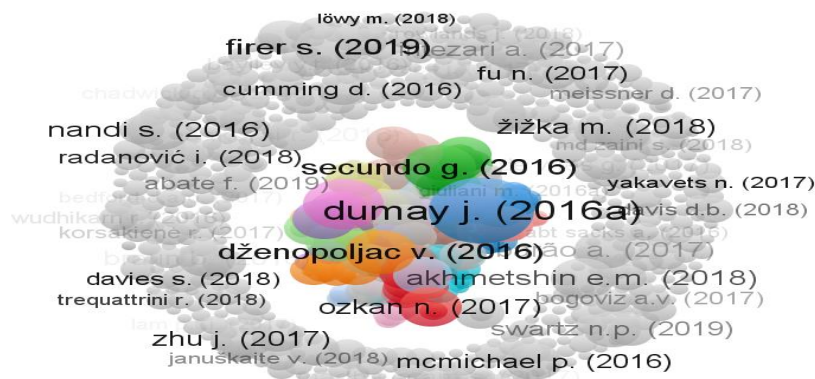


Figure 1.3. Citation analysis of Intellectual Capital Research, 2016-2020

Source: author's Scopus data construction

BiblioFigureic analysis of the last five years (2016 – 2020) (see Figure 1.3. “Citation analysis of Intellectual Capital Research, 2016-2020”) shows that most cited articles on Intellectual Capital are ones by Dumay J., Secundo G., Dženopoljac V., and Ozkan N.

1.1. Analysis of the definitions and structure of the Intellectual Capital

From an accounting point of view, the term most usually associated with intellectual capital is the intangible asset. IFAC defines intellectual capital as the total stock of capital and capital based on the knowledge available to the company. With the rise of discourses on intangibles which have been defined as “an identifiable non-monetary asset without physical substance” (IAS38), it

can be noted that at a closer look an intersection between accounting and law can also exist. Intellectual property as a legal term reflects the subject's right to own and freely dispose of an intangible asset. To define the object or notion the characteristics have to be analyzed. If the value of the object is higher than zero, it can be considered as capital. Conversely, if it brings income, it is an asset. If any of the objects is legally protected, it will also be considered intellectual property. Bernard Marr has noted that "the terms" knowledge assets", "intangible assets "and "intellectual capital " are widely used - intangible assets are used in accounting literature, knowledge assets are used by economists and intellectual capital - in management theories and legal literature"(Pastor, 2017). For the purpose of this study in the field of management theories, the term “Intellectual Capital” will be used.

The scientific publications indicate there is a wide range of definitions and terms which can be attributed either to intellectual capital or intangible assets. Originally the number of researchers defined intellectual capital as the difference between a company's market value and accounting value, the earliest IC definitions focus on the gap between a company's market value and other references such as the replacement cost of its assets (Bontis, 1996) or its book value (Edvinsoon, 1997, Lev, 1998, Sveiby, 1997). During the period 1996 – 2004 many authors have defined intellectual capital in reference to its capacity of generating future benefit and profit (Harrison and Sullivan, 2000), value (Rastogi, 2003) and wealth. According to Sang (2014) and Lerro (2014) the term intellectual capital (IC) will connote a firm's whole intangible capability that can create future benefits. It includes a firm's unrevealed intellectual and other intangible stock of capital, including intangible assets recognized on the balance sheet, while in an academic context Martic Alcazar et. al (2019) referred to IC as all the non-tangible assets of the institution, including processes, innovation capacity, patents, tacit knowledge of its members and their abilities In 2016 Letušenkova and Lapina (2016) have offered the overview of the definitions in the scientific research and definition of IC as the organization's asset that includes the organization's human capital, business processes (procedures and their descriptions), information and communication technologies, and intangible assets that can be transformed into tangible and intangible value. Stratifying the concept according to Meija Intellectual capital, in contemporary management literature, refers to two elements: (a) the group of intangible assets (resources and abilities) that businesses have, and (b) the contribution that this kind of capital produces in the value creation processes, in competitive improvements and the generation of competitive advantages (cost,

quality, time/speed and innovation) (Gallego, 2020). IC paradigm shifting to beyond commercial structures Intellectual capital is also defined by Natamizadeh (2020) as “The capital that emerges from the interaction of human resources’ ‘ability to think’ and to ‘create ideas’ with ‘a favorable internal and external organizational environment’ (including the managerial, social, structural, and physical environment, as well as communication between the inside and outside of the organization).

IC can be formally analyzed considering three main components such as human capital, structural capital, and relational capital (Romano, 2014). This classification schema is based on the three broad classification categories advanced by the “first generation” of scholars: human, structural, and relational capital. Taking into account the growing body of knowledge on the capital sub-components and the number of research is expanding author can refer to Marr and Ferenhof (Ferenhof, 2015) as researchers consequently and profoundly working on tracking the evolution of the research in the field of IC classification (Annex 1 – “Intellectual Capital Dimensions”). Expanding the network (Soewarno, 2020) the most crucial components entering excelled and elaborated meta-analysis in the period 2014-2020 are social and relational capital. Relational capital refers to the organization’s relationships or network of associates and their satisfaction with and loyalty to the company. It includes knowledge of market channels, customer and supplier relationships, industry associations, and a sound understanding of the impacts of government public policy (Hosseini, 2016). The external structure consists of relationships with customers and suppliers, brand names, trademarks, and reputation. Social Capital is a newcomer in the meta-analysis of Intellectual Capital (Ievdokimova, 2020). Zhyhlei and Zakharov (2019), ŁopaciukGoncaryk (2019), Garrigos-Simon et al. (2018), Paoloni (2020).

In 2023 in the global research there are approximately twenty-five types of IC components (see Annex -2 – Components of IC and distribution by the dimension of analysis). Author’s finding from these particular research groups’ works and other related peer-reviewed articles is that the composition and classification of IC are getting extensive and richer over the recent years. First, The dominating structure of human capital and structural capital has dissolved confidently by the relational capital and moreover in the light of recent transfer to the fourth stage of the research also by the social capital, still sometimes used as synonyms as they are not. Second, each of the components is stratified into numerous layers. This is a choice of each particular author to define the components within each particular research. Third, due to the proven fact of the components’

interrelations, in most of the cases the sub capitals are not strictly affiliated to one of another capital groups and due to the ongoing discussions on the definitions of the also partly overlap. The definitions are blurred and allow for interpretation and overlap. Important to understand the components are complementary and make the IC more specific and global at the same time.

1.2. Four stages of research on IC and research target group's expansion

The intellectual capital theory has evolved from the several theories that were dominating in the 20th century in the Strategic Management field - the resource-based view, competence-based view and knowledge-based view. The evolution of the research can be blocked in four stages, although the borders between them are vague and the flow is growing in all directions at tremendous speed (see Figure 1.4. “Evolution – four stages of the research”).

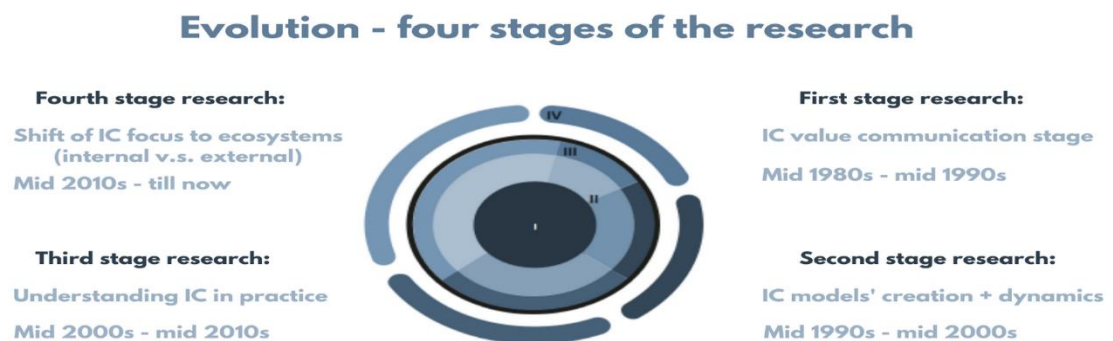


Figure 1.4. Evolution – four stages of the research

Source: author's construction

The research before 1997 was sporadic, fragmented, and mostly based on case studies that allow calling this period a non-science period. Initially, at the first stage of the research, researchers were concerned with theory building and raising awareness, i.e., the value communication stage, and IC researchers, like Neely, Petty, Guthrie, successfully accomplished this mission (Serenko (2013)). The first stage of ICR is firmly grounded in the work of practitioners in the 1980s and 1990s. For example, Karl-Erik Sveiby “discovered the knowledge organization” while working at Swedish publisher Affarsvarlden Group; Leif Edvinsson is famous for his work at the Swedish insurer Skandia. The second stage was characterized by gathering evidence to justify the use of IC as a management technology, i.e., IC measurement models’ creation and dynamics aspect. As a result, by the mid-2000s more than 50 methods had been created (Secundo, 2017). 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. Fourth stage is a big step forward ecosystems and extended analysis of the company in the environment. The impact of IC on society and the environment can be seen in the emerging factor of IC disclosure, integrating this information into corporate sustainability reports (see Table 1.1. – Intellectual Capital research focus by stages).

Table 1.1.

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 <i>et al.</i> (2000), Baum <i>et al.</i> (2000), Andriessen and Tiessen (2000), Sullivan (2000), Andersen and McLean (2000), Lev (2001), Chatzkel (2004), Bontis (2004), Andriessen (2004), Bounfour and Edvinsson (2005), Pasher and Shachar (2005)
3rd stage Development of implications arising from the use of IC in an organization's management	2006 to 2010	Focus: OIC Line of research: practical analyses with deeper implications of IC management, considering different types of organization	Mouritsen and Roslender (2009), Reed <i>et al.</i> (2006), Dean (2007), Schiuma and Lerro (2008) and Martín-de Castro (2014), Edvinsson (2009).
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)

It is clear that the understanding of its importance is unifying science and entrepreneurship and has opened diverse still logical frontiers for the current and future research to extend within and beyond the research *blocks* (see Figure 1.5. *Directions of the Intellectual capital research evolution*). One of the necessities identified by the researchers is the need to use longitudinal studies much more than it was done before.

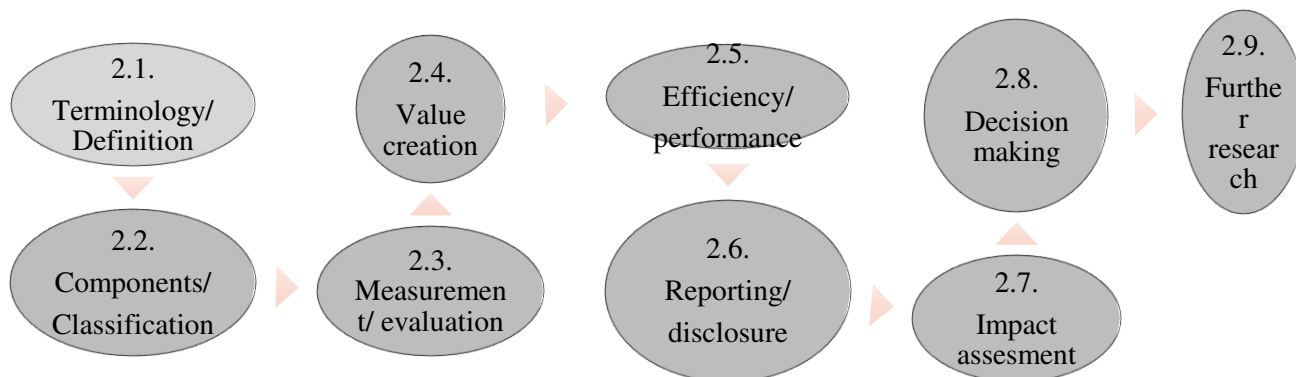


Figure 1.5. Directions of the Intellectual capital research evolution

Source: Author's construction based on literature overview

Similarly, the number of definitions, and expanding the number of classifications, measurement models, also the number of target groups using IC measurement systems is growing (see Table 1.2. – Target groups and related models, concepts and tendencies in the research).

Table 1.2.

Target groups and related models, concepts and tendencies in the research

Target group	Models (year)	Concept	Tendency in research
National (country level)	Bounfour and Edvinsson, 2004; Stähle and Pöyhönen, 2005). Lin and Edvinsson (2011), ELSS Stahle et al., 2015, Fun (2019)	National Intellectual Capital is comprised of the knowledge, wisdom, capability, and expertise that provide a country with a competitive advantage over others.	Increasing numbers of criteria on quantitative and scale data to reflect current concerns, for example, environment and gender issues.
IC and public sector	Public sector IC; EFQM (European Foundation for Quality Management, 2003); intangible assets statement (Mouritsen et al., 2004; Kong and Prior, 2008; Kong 2010), Guthrie et al. (2012), Guthrie et al., 2014b, Secundo et al., 2015, Dumay et al., 2015, Massingham and Tam, 2015, Borin and Donato, 2015; Veltri and Silvestri, 2015), Hosseini (2019), Dameri et al. (2020) 2020	Originally the companies were calculating balance sheet and market values and the public sector was not concerned. Lately, as education, medical, local governments, non-profit organisations are intangible in nature, the models were developed for the public sector as well.	The public sector is one of the least addressed areas of IC research. Major tendencies are to identify, measure, manage and disclose IC in public and non-profit organizations.
IC and Universities	Ramirez and Gordillo, 2014; Wu et al., 2012; Veltri et al., 2012; Nava and Mercado, 2011; Secundo et al., 2010; Ramírez, 2010; Paloma Sánchez et al., 2009; Ramirez et al., 2007; (Silvestri and Veltri, 2011;	Universities are considered critical players in the knowledge-based society and are at the core of the policy	Splitting universities in teaching and research-intense groups to define researches and academia as human capital, publication and networks/spin-offs as structural capital creation

	Siboni et al., 2013), (Elena-Perez et al., 2014), Pedro (2019) Martin Alcazar et al. (2019), Aversano (2020)	agenda at the national and EU level	of spin-off as structural capital and partnership agreements as relational capital.
IC and science parks	Annerstedt (2006) and Haselmayer (2004), Kohl and Al Hashemi, 2011), Romano, M., Catalfo, P., Nicotra, M. (2014)., Díez-Vial, I., Montoro-Sánchez, M. (2017)..	There is a strong need to combine knowledge theory and business practice, a strong need to strengthen the cooperation between two different environments: research and business. Moreover, 92.4 percent have formal relationships with universities.	The main challenge is the identification and standardization of indicators in order to compare and benchmark different organizations. The top six technology sectors are IT, biotechnology, software, informatics, energy, internet technology, and service.
Research on commercial companies	Bontis (1998), Meritum Project (2012), Osinski (2017), Tyskbo (2019), Camodeca (2019), Temouri (2019), Shashkina (2020), Lentjušenkova and Lapina (2020)	Intangibles can be represented by either quantitative or qualitative indicators.	Dynamic reporting on IC, integrated reporting, the proposition of new frameworks and models, investigating research contradictions and gaps

Source: a content analysis by author

As it can be observed from the analysis the concentration on the needs of each target group defines the research directions, including definitions, interpretation of components, dynamics, concepts, research gaps and challenges and opportunities to serve within the framework of the IC evaluation, reporting, models, impact analysis and other research blocks presented in the thesis.

1.3. Intellectual Capital impact assessment research

Intellectual Capital impact assessment explored within the number of the research papers represented by Javornik (2012), Jordao (2018), Lin (2018), Nadeem (2017), Pedro (2018), Scafarto (2016), Sardo (2017) showed the research gaps and opportunities for the research. Differing from previous studies, Sardo (2016) proves a significant, negative relationship between IC and firms' financial performance (Sardo 2018). Scafatto (2016) provided evidence that "the empirical results support the hypotheses that RC and PrC have a positive impact on corporate performance. Counter to the expectations, Innovation capital by itself is negatively associated with performance. Results failed to confirm the hypothesis that human capital directly and positively affects performance. Nadeem (2017) has argued that irrespective of the geolocation, IC brings considerable relevance to the financial performance of the companies. Kamath (2017) revealed that IC influences performance in a positively significant way for Indian companies. Similar results were recorded by Radić (2018) for Serbian banks. Jian Xu and Jingsuo Li (2020) explored and compared the extent of intellectual capital (IC) and its four components in high-tech and non-high-tech small and

medium-sized enterprises (SMEs) operating in China's manufacturing sector, and to examine the relationship between IC and the performance of high-tech and non-high-tech SMEs and the findings of this paper reveal that there is a significant difference in MVAIC between high-tech and non-high-tech SMEs. One of the issues raised in the paper by Vadi M. et al. (2019) is productivity and IC in knowledge-intensive industries in aging societies and measures to take to sustain productivity targets. Paper by Xu, J. and Liu, F., in 2020 shows that physical capital was the most influential factor to firm performance; human capital was viewed as a performance-enhancing measure; structural capital had no significant impact on firm performance, and innovation capital and relational capital hurt a firm's profitability. As for the market-to-book ratio, the result is a negative for structural capital. Since earlier methodology addresses IC through two components only, human capital and structural capital, namely, there are also some studies modifying and extending methodology to address some other IC components, which were neglected by the original approach, such as process Capital (Scafarto (2016), customer capital and innovation capital (Ulum (2014); Vishnu and Gupta (2014); Bayraktaroglu, Calisir and Baskak (2019), Gupta and his colleagues (2020). The insignificant association between structural capital and performance has been the most debatable issue justified by the difficulties associated with the management of SC and standardizing it. The majority of the research are focusing on the profitability ratios, adjusting for value-added, and analyzing the current period. A growing number of IC components and performance ratios, lack of longitudinal analysis, and contradictions in the findings are engines for further research. Addressing the research gaps and opportunities for the research, the majority of the research are focusing on the profitability ratios, adjusting for value-added, and analyzing the current period. A growing number of IC components and performance ratios, lack of longitudinal analysis, and contradictions in the findings are engines for further research. The modification would be to use inverse relation, add other types of IC capital to the model, choice of normalization proxies, moderate and control variables and longitudinal analysis in addition to static one.

Statements to be defended: (1) Each component of intellectual capital has systemic and significant impact on the performance of the strategic and investment business performance and its composite; (2) The components of intellectual capital are affected by changes over time, including the significance and direction of the impact.

1.4. Creation and destruction concept of Value Added

The whole strand of the research in Intellectual capital as an intangible resource stresses the fact that effective use of Intellectual capital (IC) adds value to the company and business value, in turn, brings company success. The majority of the sources are concentrating on Value Added concept as Shiu, H.-J. (2006), Kujansivu, P., Lönnqvist, A. (2007), Diez, J.M., Ochoa, M.L., Prieto, M.B., Santidrian, A. (2010), Chang, W., Hsieh, J. (2011), Iazzolino, G., Laise, D. (2016). The market value appears in Chen, M., Shu-Ju, C., Yuhchang, H. (2005), Shirin, M., Mausavi, K. Ahmadi, A. (2012), Nimtrakoon, N. (2015), Sardo, F., Serrasqueiro, Z. (2017) and others in IC impact analysis as the dependent variable. Moreover, the necessity to switch to the disclosure of IC concentrating on value-added has been discussed widely in works by Schaper, S., Nielsen, C., Roslender, R. (2017). Scholars have highlighted that IC also has a negative or destructive side that tends to be overlooked, not only in theory but also in practice.

Hypothesis 2: Value creation and distortion are directly related to dynamics of financial growth or decline.

2. EVALUATION OF THE STRATEGIC BUSINESS PERFORMANCE

Performance ratios or coefficients help a company's owner or its current and potential investors better understand the overall health of the company as well as its condition in various specific financial performance categories. In addition, tracking financial ratios over a while, against other companies and the company's industry as a whole offers a powerful way to identify trends in their early stages. Lenders and business analysts often use ratios to determine a company's financial stability and standing. In the general case, the number of performance ratios can already reach several hundred and the extensive analysis of the ratios can be found in numerous books, for example, Ciaran Welsh, Roberts Higgins, and Stephen Bragg and articles (Al-Dmour (2019); Ahmed (2019); Akgün and Memiş Karataş (2020); Weqar, Sofi and Haque (2020); Tjahjadi, B.(2020); Campos and his colleagues (2020); Wahyuni, N.M. and Sara, I.M. (2020)). However, in practice, it is sufficient to use a limited number of indicators.

The second part of the research is covering the ratio's selection procedure, stakeholders interests, type of business decisions, business performance indicators and composite ratio as a notion, and compares business performance in *Nasdaq Baltic* group of companies to provide a broad view of the scope of the analysis.

The data was collected primarily from the balance sheet, profit and loss statement, and what is crucial notes where major cost positions are explained and Fact sheets prepared by *Nasdaq* and *MorningStar* for the *Nasdaq Baltics* stock issuers for the period 2012-2019. *Nasdaq Baltic* and Nordic in cooperation with Morningstar, a leading provider of independent investment research, has introduced a company fact sheet to increase investor awareness for publicly traded small and medium-sized enterprises. The two-page fact sheets cover more than 100 fundamental equity data points including key company financials, profitability, and performance analysis meeting increasing demand on investors' side to quickly and easily retrieve the knowledge about the listed companies. A number of data points are calculated using raw data provided to Morningstar and by applying Morningstar's methodology to make these data points comparable across different companies. These fact sheets do not constitute investment advice. (see Annex 3 - “*Nasdaq* Fact sheet and methodology”). The list of data collected is eighty-four data items for each of eighty two companies from Latvia, Lithuania and Estonia listed at *Nasdaq Baltic* that was later used in calculations. The whole sample was used, no sampling was attributed. Companies have obligatory

requirements to publish the yearly reports on the *Nasdaq* webpage. All the data are in PDF text files and as the majority of the data were obtained from the annex to the annual reports “Notes to financial statement” that is choice of the company to include and explain and there is no standard format, the data was collected manually and adjusted accordingly.

Unified Baltic stock exchange - *NASDAQ OMX Baltic* – was introduced on January 1, 2007. It was implemented to promote the integration of the Baltic securities market. “*Nasdaq Baltic* market represents a joint offering of Nasdaq’s exchanges in Tallinn, Riga, and Vilnius as well as *Nasdaq CSD*. *Nasdaq Baltic* market includes a common Baltic equities market with harmonized trading rules and market practices, same trading system, joint trading lists, harmonized indexes, a single membership, trading and settlement currency allowing investors easy access to all Baltic listed financial instruments through any of the pan-Baltic members” according to the webpage. At present, joint-stock companies of *NASDAQ OMX Baltic* are divided into two lists – main and secondary. The official list includes companies with a history of at least 3 years, with a market capitalization of at least EUR 4 million, with a free turnover of at least 25% of shares or at least EUR 10 million, and corporate accounts must be prepared in accordance with International Financial Reporting Standards (IFRS). The second list is for medium-sized companies, and there are no quantitative requirements for capitalization or the number of shares in free circulation for stock issuers (Nasdaq, 2017). Overall turnover in three years’ time – EUR 987 mln.

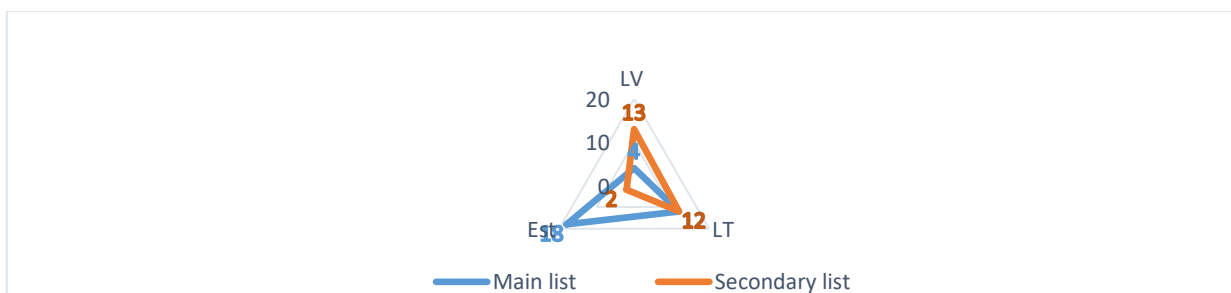


Figure 2.1. Number of Nasdaq Issuers in Baltic Countries, 2020

Source: author’s construction based on Nasdaq Baltic data 2020

All three countries show different patterns. Latvian companies are mostly represented in the secondary list, while only four, namely HansaMatrix, Olainfarm, Grindex, and SAF Tehnika included in the main list. Estonia in the contract has a dominating the main list of companies and only two in the secondary list. Lithuania shows equal shares for each. Therefore, most of the companies fulfilling the financial and operational standards of the first list are registered in Estonia.

2.1. Classification of the financial performance ratios for strategic and investment decision process

Historically the financial ratios can be divided into five categories (Welsh, 2003):

1. The liquidity or solvency ratios.
2. The financial leverage or debt ratios.
3. The asset efficiency or turnover ratios.
4. The profitability ratios.
5. Market value ratios.

Researchers and practitioners have approbated Dupont analysis (Heikal and Khaddafi (2014), Rupeika-Apoga and Saksonova (2018), Kourtis (2019); Suharno and Dini (2018), hierarchical method of analysis and others and continue to experiment with the solutions to offer a panoramic view of the current financial situation of the companies as Nuan N.V. (2020). According to Solovjova and her colleagues' findings in 2018 each enterprise's way of capturing and monitoring its financial situation in its way and this depends on many criteria such as: indicators of financial structure analysis, ability to solvency, profitability, etc., among these indicators profitability indicators are always of special interest. The initiative undertaken by several 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 (2016) 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. First of all, the stakeholders have to be defined. Freeman in 1984 has defined stakeholders as “any group or individual who is affected by or can affect the achievement of an organization’s objectives. Within the current research, the author has defined seven groups of stakeholders and related ratios/spheres of interests: 1) Managers, interested in resource deployment, turnover, etc.; 2) Owners interested in return on the investments, growth rates, profit ratios, etc.; 3) Borrowers interested in liquidity and cash flow, etc.; 4) Employees interested to have a job and receive a salary and social guarantees; 5) A government interested in taxes and business environment, etc.; 6) Society interested in CSR, social and environmental programs, etc.; 7) Suppliers are interested to have a stable income, strategic reputable partnerships, stable growth rate, etc. Second, we have to define decision-making levels. According to Welsh (2003), there are four levels of decision making, i.e., operational, financial,

market investment and strategic. Third, Sorokin defines the framework for the analysis. The matrix offers solid ground for the discussions and development of the approach still keeping the main advantages it. Critical thinking suggests that strict classification might be a threat as the interests of the stakeholders might overlap. Therefore, there is a space for maneuver, flexibility, and tailored made systems in each particular research or business case. Comparing ratios in the matrix and facts sheets and financial report we can obtain the following ratios (see Table 2.1 Modified matrix of Selected *Nasdaq Baltic* performance ratios based on the approach by M. Sorokin).

Table 2.1.

Modified matrix of selected *Nasdaq Baltic* ratios based on the 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 author based on Sorokin matrix and Nasdaq Baltic data

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 Business performance Composite ratio and sales Revenue growth rate. For further research, the target groups can be added. Others (State/Employers/Investors/Society/Suppliers). The ratios of Strategic and Investment decisions groups selected for the analysis are:

Table 2.2.

Business performance ratios selected for the impact analysis

Name	Description	Formula
ROA	Return on assets	Gross earnings/Average total assets
ROE	Return on Equity	Net Earnings / Average Total Equity
ROI	Return on Investments	Net Profit / Cost of Investments
P/E	Price/Earnings	Share Price/ Earnings per share
GR	Sales 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: Author's construction

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;
- the area of responsibility is clearly defined.

2.2. Assessment of the selected performance measurements

Sales growth rate

Sales growth is the percent growth in the net sales of a business from one fiscal period to another. Net sales are total sales revenue fewer returns, allowances, and discounts. Among eighty-two companies with 680 observations in the period 2012-2019, the most frequent sales growth Rate is between 0.00~3.75 percent and a few above 3.75; the most frequent value is 1.25. The histogram is skewed right. The highest ratio was achieved in 2018 – 13.65 and the lowest value was achieved in 2015 and 2018 – 0.05. The data similarly proves growth rate in Baltics is mostly observed in intervals 0 – 3,75 and indicates a positive tendency over 2018 and 2019 increasing both dispersion and intensity. It allows us to critically observe the cyclical behavior of the market with 2013 and 2017 being narrowly dispersed years followed by greater activity in the market and higher rates for the significant bulk of companies. Figure 2.2. illustrates how the company's Sales Growth Rate changes depending on the age of the company in the Baltics.

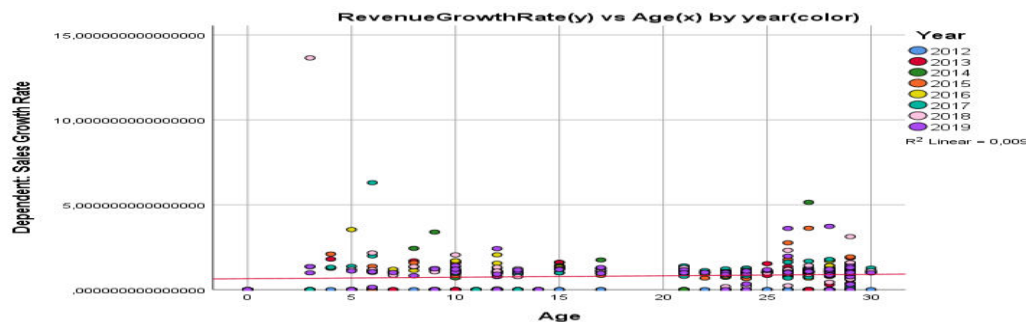


Figure 2.2. Sales Growth Rate's distribution by age of the company, Nasdaq Baltic Issuers, 2012-2019

Source: Author's construction, Nasdaq Baltic Data

It records the change in Sales Growth Rate for a group of companies, all of the data recorded from the year 2012 and filtered by years. The plot has a weak positive correlation: it is a weak correlation because the data points are not closely grouped to each other (by x-axis). It is positive because the trend line of Sales Growth Rate is increasing. It is noticeable that companies are primarily mature companies showing intense distribution in the group of companies older than 20

years old. All ages are represented. Group of younger companies in age interval three to fifteen year old shows uneven results and the whole scale of growth rate values, including the highest outlier. This visualisation indicates the more stable growth for mature companies in Latvia, Lithuania and Estonia.

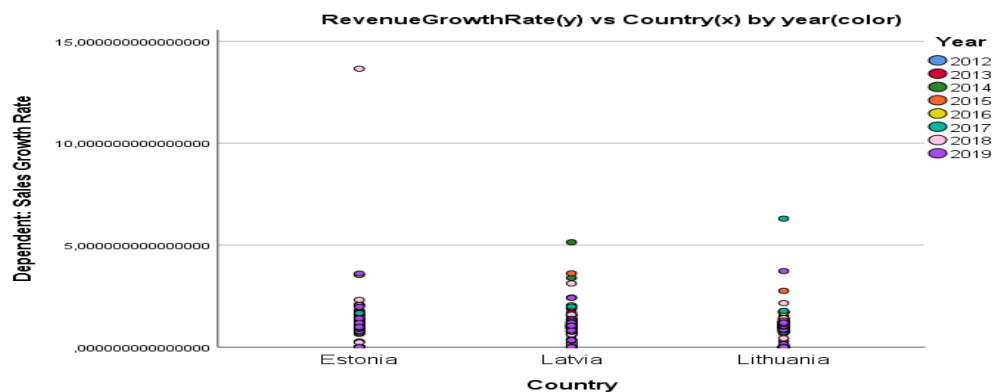


Figure 2.3. Sales Growth Rate distribution by country, Nasdaq Baltic Issuers, 2012-2019

Source: Author's construction, Nasdaq Baltic Data

The highest Sales Growth Rate was achieved by companies from Estonia, which showed the maximum Sales Growth Rate in 2018 – 13.65 (*Figure 2.3. Sales Growth Rate distribution by country, Nasdaq Baltic Issuers, 2012-2019*). The second-largest result was achieved by Lithuania when in 2017 a company reached an indicator of 6.30. Companies from Latvia achieved the lowest maximum Sales Growth Rate in 2014 – 5.14. From north to south countries shows a wider dispersion of data and Sales Growth Rate maximum and minimum values. As for distribution, Latvia is providing a more intense distribution of the growth rate.

Figure 2.4. “Sales Growth Rate’s distribution by sector, Nasdaq Baltic Issuers, 2012-2019” – by sectors. The highest Sales Growth Rate was achieved by the Real Estate Management industry and by the Real Estate sector, which showed the maximum Sales Growth Rate in 2018 – 13.65. At the same time, the Packaged Food industry and the Cheese Making sector showed the minimum Sales Growth Rate in 2018 – 0.05.

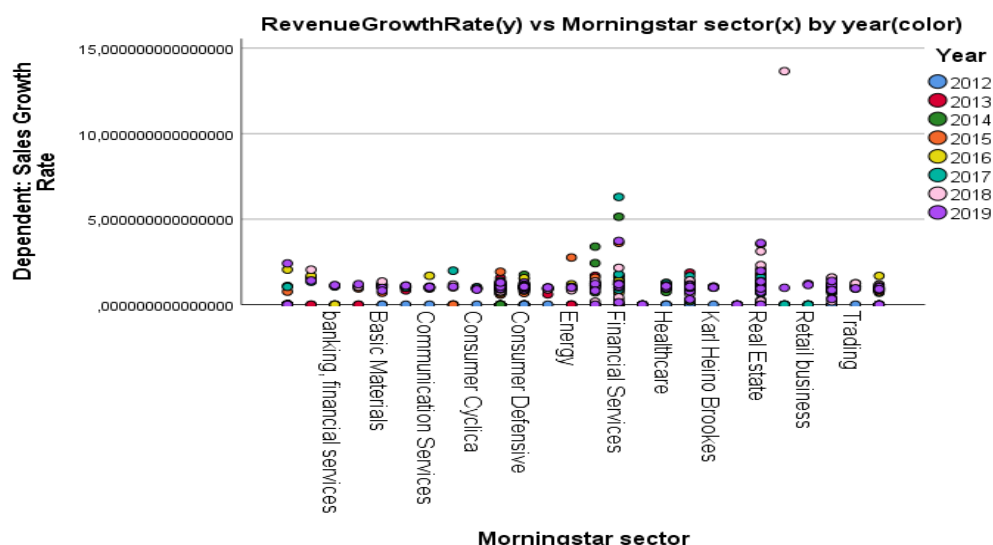


Figure 2.4. Sales Growth Rate's distribution by sector, Nasdaq Baltic Issuers, 2012-2019

Source: Author's construction, Nasdaq Baltic Data

The second-largest result was achieved by the Asset Management industry and Financial Services sector when in 2017 a company working in this industry and sector - 6.30.

2.5.2. Return on Assets

Return on assets (ROA) - an indicator of how profitable a company is relative to its total assets. ROA gives a manager, investor, or analyst an idea as to how efficient a company's management is at using its assets to generate earnings. Among ninety two companies with 680 observations in the period 2012-2019, the most frequent Return on Assets is within -0.1~0.1 percent interval. There are a lot of outliers on a boxplot, which are associated with abnormal data. The highest value was achieved in 2017 – 110% and the lowest value was achieved in 2018 – -75%. It is noticeable that companies that are in a group of 21-29 years old are managing their assets more efficiently compared with the younger group of companies that can be explained by the level of maturity, internal processes, and experience. Among three Baltic countries, the highest Return on Assets ratio was achieved by companies from Latvia in 2017 - 110%, followed by a company in Estonia- 45% and the third best is in Lithuania – 40%. The tendencies for the countries are observed as disperse and dominant in Estonia, very concentrated with several outliers in Latvia and closer to the upper range of the highest ROA and showing a high level of concentration in Lithuania. Among the 39 industries and 19 sectors presented, the highest Return on Assets ratio was achieved by the Consumer Electronics industry and Technology sector, which showed the maximum Return on Assets ratio in 2017 (about 110%), the second-largest result was achieved by Electrical Equipment

& Parts industry and Industrials sector when in 2017 a company working in this industry and sector reached an indicator of 45%. The company from the Apparel Retail industry and Consumer Cyclical sector achieved the lowest maximum Return on Assets ratio in 2018 – 40% sharing the lowest value of indicator with the Textile Manufacturing industry and Consumer Cyclical sector.

Return on Equity

Return on equity (ROE) is a measure of financial performance calculated by dividing net income by shareholders' equity. The data similarly to Return on Assets shows the volatility around 0-1% with outliers for a particular company. Very significant seems to be the age group 29-30 years when the intensity and scale are reaching their peak. There are 2 outlier points that are related to 24 years old companies: One of them shows the highest Return on Equity ratio – 429% – in 2016. The second-largest result was achieved also by Latvia when in 2019 a company from this country reached an indicator of 126%. Companies from Estonia achieved the lowest. From south to north countries shows wider dispersion of data while overall positive ratios prove to be in Latvian case. Among the 19 sectors presented, the highest Return on Equity ratio was achieved by the Consumer Electronics industry and Technology sector. The second level is for the result achieved by the Textile Manufacturing industry and Consumer Cyclical sector when in 2019 a company working in this industry and sector reached an indicator of 126%. Companies from Apparel Retail industry and Consumer Cyclical sector shows the lowest results.

Return on Investment

Return on Investment (ROI) is a performance measure used to evaluate the efficiency of an investment or compare the efficiency of several different investments. It is noticeable that companies that are in a group of 20-29 years old are making better investment decisions than the younger group of companies, as reasons to mention experience and strong management teams. It is also noticeable that companies that are in the age group of 30 years, recouped all investments. Overall the data shows the dominance of the mature companies in the data pool as the Nasdaq Baltic has special requirements for the companies in the first list that the companies have to meet to become the *Nasdaq Baltic* Issuers. The highest Return on Investment ratio was achieved by companies from Estonia, which showed the maximum Return on Investment ratio in 2016 (about 34%). The second-largest result was achieved by Latvia when in 2016 a company from this country reached an indicator of 28%. From south to north-south countries shows wider dispersion of data and Return on Investment ratio maximum and minimum values. Among the 39 industries and 19

sectors presented, the highest Return on Investment ratio was achieved by Apparel Retail industry and Consumer Cyclical sector, which showed the maximum Return on Investment ratio in 2018 (about 34%). The second-largest result was achieved by Furnishings, Fixtures & Appliances industry and Consumer Cyclical sector when in 2012 a company working in this industry and sector reached an indicator of 28%. The company from Drug Manufacturers - Specialty & Generic industry and Healthcare sector achieved the lowest maximum Return on Investment ratio in 2018 – 26%.

Price-to-Earnings Ratio (P/E)

The price-to-earnings ratio (P/E ratio) is the ratio for valuing a company that measures its current share price relative to its per-share earnings (EPS). The visualisation shows the dispersion of the data in the earliest periods and more stable and consequent ranges over the last three years. It is noticeable that companies' share price which is in a group of 20-29 years old is going up and down more frequently than younger group of companies. The data show unambiguous dominance of the mature companies and a high rate of dispersion in this group. Among three Baltic countries, the visualisation proves the level of dispersion and scale is low in Lithuania and more dispersed in Latvia and Estonia while Latvia shows an overall more positive sample. Maximum values are observed in Estonia and lowest in Latvia. Among the 39 industries and 19 sectors presented, the highest Price to Earnings ratio was achieved by the Asset Management industry and Financial Services sector and the Wood Production industry and Basic Materials sector showed the minimum Price to Earnings ratio. The second-largest result was achieved by the Engineering & Construction industry and Industrials sector.

2.3. Integrated assessment of financial performance: Barhatov algorithm

Development of methods for the integrated assessment of success or composite ratio, developed by D.A. Pletnev and E.V. Nikolaev (2015), involves the justification of the criterion and a system of indicators to assess the success of small and medium businesses in Russia (that in Baltic countries means big companies). For this, a number of tasks were consistently solved (Barhatov, 2014, Barhatov and Belova, 2016, Barhatov and Bents, 2018). First, the concept of “success” is defined and its criterion is formulated. “Existential ability” is proposed as a success criterion. Existence ability manifests itself in three aspects of the company's activities: profitability, growth, and achievement of goals, which are evaluated both in absolute terms and relative to competitors (the second method of evaluation is preferable). Secondly, directions on which, in line with the

accepted criterion, success was determined. Third, specific indicators were selected, with the help of which the success of the company was evaluated. Fourth, the developed methodology was tested on the data of 11000 real companies in Russia. Further, the initial success rates were developed:

$$1) \text{ Ability to grow = sales growth rate: } BS_1 = \frac{TR - TR_{-1}}{TR_{-1}} (2.1.)$$

where BS_1 – 1st business success ratio; TR_{-1} – sales revenue previous year; TR – sales revenue current year;

$$2) \text{ The ability to generate profit - return on assets and return on sales: } BS_2 = \frac{E}{S} (2.2.) \text{ and}$$

$$BS_3 = \frac{E}{A} (2.3.)$$

where BS_3 – 3rd business success rate; A – a value of the assets of the company in the current period (balance sheet), where BS_2 – 2nd business success rate; E – net profit for the period; S – sales revenue for the current period.

3) To take into account the factor of the time of existence of Russian firms, it is proposed to use an indicator with a minimum value of 0 and a maximum of 1:

$$R4_t = \frac{N}{N_{max}} = \frac{t - T_{est}}{t - 1991} (2.4.)$$

where t – current year; N – age of the company; N_{max} – max possible age of the company in Baltics (companies were allowed to register since 1991); T_{est} – a year of establishment. Thus, if a firm was established in 1991, then for it the value of this success component ($R4$) will be 1, and if in 2005, the value of $R4$ will depend on the current year - in 2013, the corresponding value will be $R4 = (2014 - 2005) / (2014 - 1991) = 9/23 = 0.391$.

To include the cumulative factor in the method of estimation, you can use the calculation of the weighted average score value of each success rate indicator:

$$t = \frac{\frac{8}{7}}{\frac{1}{2} * R1t + \frac{1}{4} * R1t - 1 + \frac{1}{8} * R1t - 2} (2.5.)$$

where $R1t$ – scoring of success on the first indicator in the year t , taking into account the result of the firm's work in the two preceding years on the first initial indicator (sales growth rate); $R1t, R1t-1, R1t-2$ – scoring on the first indicator in years $t, t-1, t-2$ for the first ratio.

There is such a notion of a weighted retarded moving average - to get the current some value of its value in the preceding moments of time are summed up with some weight coefficients. To obtain the current value of R , the last year is summed with a weight of 1/2, the preceding one with

a weight of 1/4, another previous one with a weight of 1/8. If all values of $R(t)$ in the right part are equal to 1, then the sum will be equal to 7/8. For normalization, that is, in order for the calculated value to be equal to 1, the sum must be multiplied by 8/7. These 8/7 appear in front of the bracket. The overall score of success in points will be determined by the sum of all components of success:

$$RBS_t = \hat{R}1t + \hat{R}2t + \hat{R}3t + R4t \quad (2.6.)$$

This indicator (let's call it the rating of business success) varies on a scale from 0 to 10, while the higher RBS value is characterized by a more successful enterprise.

2.7. Results of Barhatov Calculations

According to the statistical analysis of RBS of the Nasdaq companies in Lithuania, Latvia and Estonia in the period 2012-2019 the observations for RBS had an average of 2.55. Author calculated that values vary on average from 2 to 8 which are some exceptions for 2017 and 2019 when the rate exceeded 8 points out of 10.

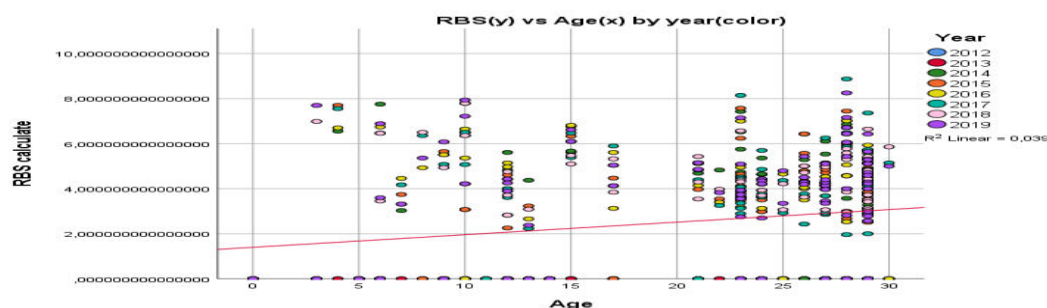


Figure 2.5. RBS's distribution by age, Nasdaq Baltic Issuers, 2012-2019

Source: Author's construction, Nasdaq Baltic Data

It is noticeable that young companies might be as successful as elder companies. Still, the highest-ranking and higher probability to be successful among others are achieved by the older companies with the highest density in group 20 plus years old. Of the three Baltic countries compared, companies from Lithuania achieved the top 3 highest results of RBS ratio – 8.87, 8.25, 8.14 otherwise countries showing the similar patterns. Among the 39 industries and 19 sectors presented, the highest RBS ratio was achieved by the Asset Management industry and Financial Services sector, which showed the maximum RBS ratio in 2017 – 8.87. The second-largest result was achieved by the Financial Services industry and Banking sector when in 2019 a company working in this industry and sector reached an indicator of 8.25.

Summarizing the findings of the author's approach to the visualization and grouping of the results, the distribution of the integral indicator of success has a similar pattern. Visualisation allows to track the increase in the number of companies in interval 5-7,5 meaning medium success

companies. Thus, the measured indicator has certain permanent statistical properties, which makes it a convenient tool for studying the success of small and medium-sized businesses in Russia and all types of companies in the Baltics. It can be noted that there was an increase in the share of successful enterprises and leaders of success. Such changes indicate an increase in the sustainability of the entire “population” of the enterprises, a shift in distribution towards a greater mass of successful enterprises, considered successful against the rest.

The second part has answered the 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 to group performance indicators for the different purposes and target groups?; How to use integrated assessment and composite ratios?

3. INTELLECTUAL CAPITAL IMPACT ON BUSINESS PERFORMANCE

The third part of the research is answering the main research question, impact analysis and research gaps, namely what are the Intellectual capital measures to use, how to evaluate the impact of IC on the performance of the company, how long does it take to see the impact (longitudinal analysis) and analyze the choice between normalization proxies, t.i. adjusting for Assets, Value Added, or Sales Revenue. In addition, one of the crucial issues appearing in the research literature is the discussion on value creation and value distortion. This part treats costs as investments (see part 1) and, using IC components (see part 1) and business performance indicators at Nasdaq companies (see part 2), evaluates the impact of IC on business performance in dynamics (see part 3).

3.1. Intellectual capital impact panel data models

Models provide insights into the static and the dynamic impact of Intellectual Capital on business performance, segregating the components and testing for the three different proxies for the IC components' ratios, namely assets, value-added and sales revenue. Within the Ph.D. research, the main principle of the model will be used for the calculation of the costs as investments of the IC elements. In this approach, for example, employee expenses are not calculated as input, in other words, they are not treated as a cost, but as an investment and therefore come into the analysis as Human Capital. Employees invest their knowledge and skills into the company, which is to be evaluated on the market. It is focused on value creation not cost control and takes IC, particularly Human Capital into account.

Considering that the main objective of the current study is to analyze the influence of IC on the firm's successful development treating costs as investments the following regression models were developed (see Figure 3.1. "IC impact on business performance: panel data analysis"):

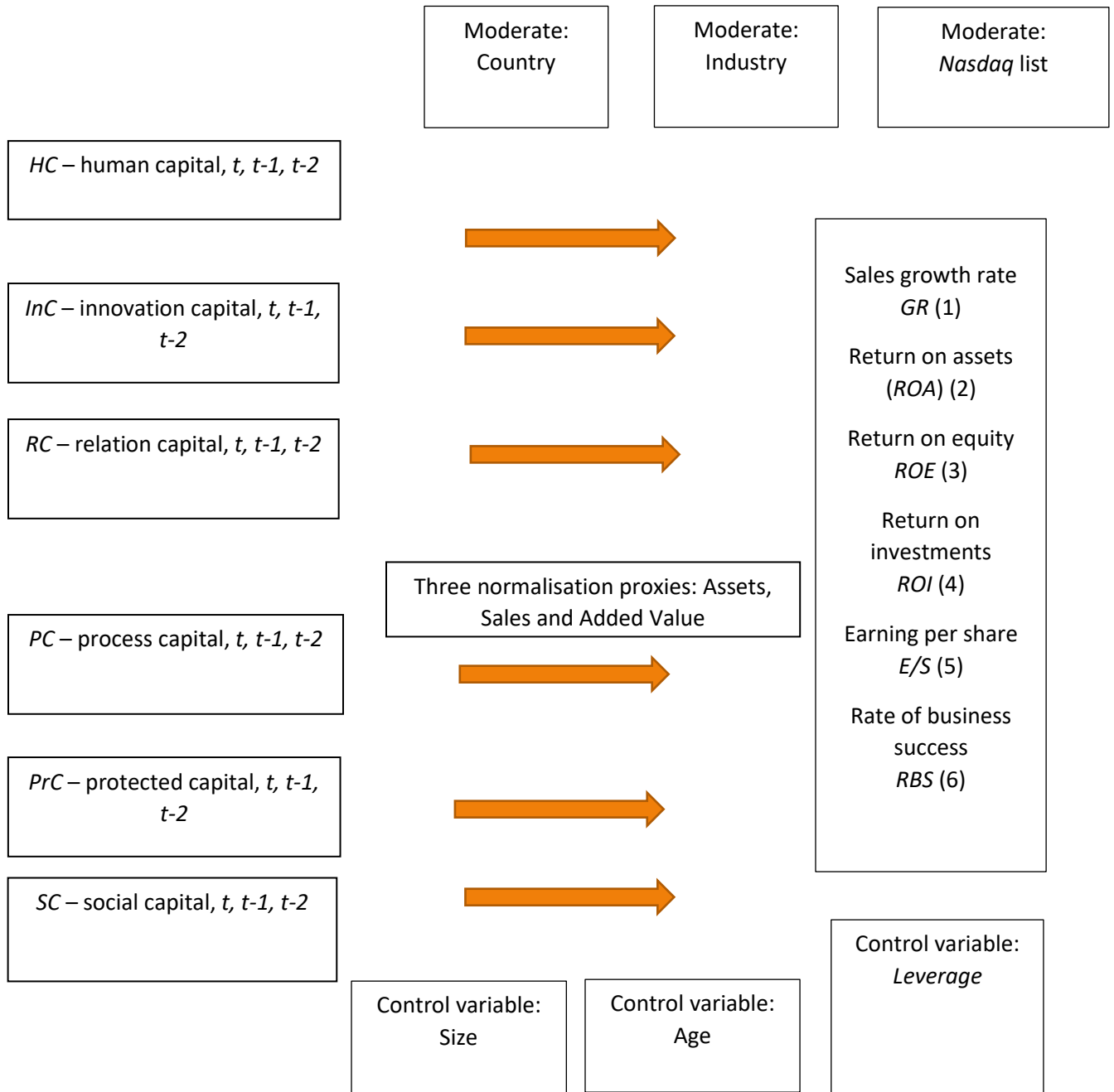


Figure 3.1. IC impact on business performance: panel data analysis

Source: author's analysis

Considering that the main objective of the current study is to analyze the influence of IC components on the firm's successful development the regression models were developed:

$$PERF_{ti} = \beta_0 + \beta_1 HC_{ti} + \beta_2 RC_{ti} + \beta_3 PrC_{ti} + \beta_4 PC_{ti} + \beta_5 SC + \beta_6 InC \quad (3.1.)$$

Control variables: $\ln AGE_{ti}$, $\ln SIZE_{ti}$, LEV_{ti}

Moderate variables: Country, Industry, Main or Secondary list

where:

PERF – performance ratio (ln Sales (growth rate), ROA, ROE, ROI, RBS, and E/S)

HCE – human capital;

RCE – relational capital;

PrCE – protected capital;

PCE – process capital;

SCE – social capital;

InCE – innovation capital;

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 – Issuers in *Nasdaq* Main list

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

T – current period;

I – *Nasdaq* emitent;

$\epsilon_{i,t}$ is the residual error.

The calculation of variables: Human Capital (Sobakinova (2019), Biedenbach (2019), Dash and Roy (2020), Hutahayan (2020), AlQershhi (2020), Hussen (2020), Huang (2020), Mubarik (2020) was 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 researchers. The majority of authors have adjusted Personnel Costs to added value. Within the current research, sales revenue is used as an adjustment as it helps to avoid interpretation issues when the value-added number is negative.

$$Human\ Capital = \frac{Personnel\ Cost}{Sales\ Revenue} \text{ or } \frac{Personnel\ costs}{Value\ Added} \text{ or } \frac{Personnel\ costs}{Assets} \quad (3.2.)$$

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

$$\begin{aligned} \text{Relational capital} &= \frac{RC}{\text{Sales Revenue}} \\ &= \frac{\text{Marketing costs}}{\text{Sales Revenue}} \text{ or } \frac{\text{Marketing costs}}{\text{Value added}} \text{ or } \frac{\text{Marketing costs}}{\text{Assets}} \end{aligned} \quad (3.3.)$$

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

$$\text{InC} = \frac{\text{InC}}{\text{Sales Revenue}} = \frac{\text{R\&D}}{\text{Sales Revenue}} \text{ or } \frac{\text{R\&D}}{\text{Value Added}} \text{ or } \frac{\text{R\&D}}{\text{Assets}} \quad (3.4.)$$

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 (Mutalib, 2018).

$$\begin{aligned} \text{PrC} &= \frac{PR}{\text{Sales Revenue}} \\ &= \frac{\text{Trademark value} + \text{patent costs} + \text{copyright} + \text{industrial design} + \text{intangible assets}}{\text{Sales Revenue or Value Added or Assets}} \end{aligned} \quad (3.5.)$$

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

$$\text{PC (Process Capital)} = \frac{PC}{\text{Sales Revenue}} = \frac{IT + \text{Board salary}}{\text{Sales Revenue or Value Added or Assets}} \quad (3.6.)$$

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.

$$\text{SC} = \frac{SC}{\text{Sales Revenue}} = \frac{\text{Donations and Financial Support}}{\text{Sales Revenue or Value Added or Assets}} \quad (3.7.)$$

A control variable is a variable that is not the focus or planned as part of a research study but its existence has a certain impact over Dependent Variable (DV) that cannot be ignored in which it is included in the research model testing together with other Independent Variables (IVs). The measurement of control variables chosen for the current research is:

- 1) $\text{Lev}_{i,t}$ is the natural logarithm of the leverage of the current period, given by the ratio of the book value of total debt of the current period to total assets of the current period;
- 2) $\text{SIZE}_{i,t}$ is the size of the current period, given by the natural logarithm of total assets of the current period;
- 3) $\text{AGE}_{i,t}$ is the 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, 2017)

Moderating variable is a variable that is required as part of a research study to evaluate how it moderates the relationship between the IV & DV. The moderating variable is usually explicitly stated as part of the hypothesis. Moderating variables chosen for the current research are:

- 1) *Nasdaq* list – first list;
- 2) Country – Latvia, Lithuania, Estonia;
- 3) NACE – Services;

As performance variables are ratios, we have to normalize also IC components. The research questions are what to choose for the normalization – according to the research, there are several options, including assets, value-added, or sales revenue. Testing normalization proxies for the IC variables provides the room for maneuver for analysing the impact on ratios additional research question 4: How to choose between normalization proxies, t.i. adjusting for Assets, Value Added or Sales Revenue? Testing the first statement lagged values have to be added for the period t-1 and t-2. The hypothesis is answering research questions on the evaluation of impact and time effect.

3.2. Results of the longitudinal regressions and comparative analysis of intellectual capital on business performance

The data was collected primarily from the balance sheet, profit, and loss statement and what is crucial Notes to the financial statement where the major cost positions were explained and Fact sheets prepared by *Nasdaq* and *MorningStar* for the stock issuers. No sampling was attributed. Due to missing values and outliers, the data cleaning process demanded consideration to avoid a 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 pairwise deletion). For each of the variables, QST and 2nd quartiles were calculated, obtaining in quartile range, upper and lower bounds, and outliers identified. Outliers were further excluded from the analysis.

3.2.1 Impact on Intellectual Capital on *ln Sales* (Sales growth rate)

The first approach: segregation of periods

First, we pre-select significant variables adjusted for the sales revenue for the period t.

$$\ln Salesw_{ti} = \beta_0 + \beta_1 HC_{ti} + \beta_2 RC_{ti} + \beta_3 PrC_{ti} + \beta_4 PC_{ti} \quad (3.8.)$$

Control variables: $\ln AGE_{ti}$, $\ln SIZE_{ti}$, LEV_{ti}

Moderate variables: Country, Main or Secondary list, Industry

where: $\ln \text{Sales}$ – sales revenue growth rate in period t ;

Following several iterations and preselecting the variables, we exclude non-significant variables from the results in table 3.1. “IC impact on $\ln \text{Sales}$ in period t , revenue proxies, shortlisted, *Baltic Nasdaq*, Latvia, Lithuania, Estonia, 2012 – 2019”.

Table 3.1.

IC impact on $\ln \text{Sales}$ in period t , revenue proxies, shortlisted, *Baltic Nasdaq* Issuers, Latvia, Lithuania, Estonia, 2012 – 2019

Parameter	B	Std. Error	t	Sig.	Noncent. Parameter	Observed Power ^a
Intercept	1.577	.459	3.433	.001	3.433	.962
List	.387	.143	2.709	.007	2.709	.855
Size_ \ln	.795	.041	19.255	.000	19.255	1.000
RC	2.086	.597	3.492	.001	3.492	.967
PC	-8.942	1.117	-8.004	.000	-8.004	1.000
[Country=1]	.726	.123	5.890	.000	5.890	1.000
[Country=3]	0b

Source: author's calculations

IC impact assessment indicates that $\ln \text{Sales}$ or revenue sales growth is positively dependent on the control variable SIZE of the company, relational capital (costs of marketing and sales in the current period), and moderate variable List, that is first Nasdaq Baltic list. Narrowing down the number of independent variables the model for the period $t-1$ variables impact on t period sales growth identifies marketing and sales costs having a positive impact. And [Country=1], which is Estonia, has a statistical significance (p-value of 0.000). As in period t first Nasdaq Baltic list companies and big companies are most likely to have an increase in sales growth rate. In period $t-2$ payments have a weaker impact compared with period t and $t-1$ investments are still very similar to $t-1$ period analysis marketing and sales costs having a positive impact.

Summarizing the tests, normalization proxy adjusting IC capital to sales revenue shows a relatively high and significant model (R Squared =,758 (Adjusted R Squared =,751)) clearly indicating Size of the company, affiliation to the first *Nasdaq Baltic* list and registration in Estonia as favorable control and moderate factors behind revenue sales growth rate in addition to the Intellectual Capital variables Relational capital expressed as marketing and sales costs in all period having a positive impact on $\ln \text{Sales}$ and Process capital including costs of IT and Board Motivation scheme as negatively correlated to the revenue sales growth rate in period t .

Adjusting for the value-added might add complexity to the analysis as in the case of the sales revenue one might expect correlation with sales revenue growth. The extended model compared with the adjustment for the sales revenue has indicated a full spectrum of IC variables as significant and higher adjusted R^2 . $R^2 = 0,766$ (Adjusted $R^2 = 0,759$). Normalizing proxies for the value-added in period t similarly as n sales revenue proxy model indicated the positive impact of costs on marketing and sales in period t on sales revenue growth. In contrast to the sales revenue proxies' model (3.12). In period $t-1$ according to the analysis all three IC variables – Human Capital, Process Capital, and Relational Capital - are significant and $R^2 = 0,754$ (Adjusted $R^2 = 0,744$). Moderate and control variables in addition to the list, size, and country dummy for the first time have indicated also leverage of the company in the period $t-1$ as significant for the increase in sales revenue rate in period t . It might be explained by the fact that the high leverage of the company allows for the extended spendings and positive impact in the next period business ratios. In period $t-2$ costs are still significant as the Revenue of Sales growth rate in period t . Costs of the marketing and sales system, employees, board, and IT in two periods in advance still have a significant impact on business performance measure in this particular case as In Sales and pending on personnel again has a negative impact. With no exception also in this model registration in Estonia, affiliation to the first *Nasdaq Baltic* list and size of the company are prerequisites for the positive business performance in the region.

The third option is to adjust IC variables for the assets. Sales revenue growth all three IC variables – Relational Capital, Human Capital, and Process Capital have a significant and positive impact $R^2 = 0,765$ (Adjusted $R^2 = 0,757$). Protected capital is excluded from the analysis as being not significant. Combined with Leverage and Size control variables and Estonia dummy variables it provides a significant and positive model for the evaluation of IC impact on business performance in period t with adjusted R^2 reaching 75%. Period $t-1$ spending is significant for Relational and Human capital only, control and moderate variables still being significant in the case of Size and Estonia as a country with $R^2 = 0,766$ (Adjusted $R^2 = 0,761$). The same tendency with $R^2 = 0,744$ (Adjusted $R^2 = 0,737$) is observed also for the $t-2$ period.

Summarizing the results for the first approach testing each period variables and its impact separately the conclusion is that normalization proxies for the assets allow proving the hypothesis all significant variables have a significant and positive impact on Sales Revenue Growth as a business performance indicator. Value Added proxy model allows to prove the positive impact of

Relational and Process Capital and adds leverage as a significant variable explaining the impact. Sales Revenue proxy proves only Relational Capital positive impact. Also, two control variables – affiliation with the first list of *Nasdaq Baltic* and size of the company as well as registration of the company in Estonia proved significant in all the models.

The second approach: IC elements' segregation

The approach foresees the impact via each of the components of the Intellectual Capital calculated, including Human Capital, Relational Capital, Process Capital, and Protected Capital. All periods' costs are included in the analysis for each of the variables and similarly, as the first approach, the impact on Sales Revenue growth or Ln Sales is tested. The first step is to analyze the impact of Relational Capital with three proxies on Sales Growth Rate:

$$\ln Salesw_{ti} = \beta_0 + \beta_1 RC_{ti} + \beta_2 RC_{t-1i} + \beta_3 RCECVA_{ti} + \beta_4 RC_CVA_{t-1i} + \beta_5 RC_CA_{t-1i} + \beta_6 RC_CA_{ti} \quad (3.9.)$$

Control variables: $\ln AGE_{ti}$, $\ln SIZE_{ti}$, LEV_{ti}

Moderate variables: Country, Main or Secondary list, Industry

where: $\ln Sales$ – sales revenue growth rate in period t ;

The only IC variable left is relational capital expressed as Marketing and Sales costs, both normalized for Sales revenue and Assets. Variables of $t-1$ and $t-2$ are excluded from the regression as only current period marketing and sales expenditures prove to have an impact on the sales growth in the current period. Both proxies adjusted for Assets and Sales Revenue are identified as significant, excluding one for value-added. According to the results significant are big size company from the first *Nasdaq* list from country 1 (Estonia).

The second step is to analyze human capital expenditures (Salaries and all personnel expenses on Sales Revenue growth). Results allow for drop out of Age control variable as well as value-added normalized proxies preselecting variables to increase the significance of the model. In the case of human capital, the impact is observed for expenditures of period t and period $t-1$ for both assets and sales revenue proxies on sales growth rate. First list issuers, big size companies with leverage, NACE. Control variables all have a significant and positive impact.

The third capital to analyse the impact is process capital. All t periods proxy and control variables are included in the reduced regression for the Process capital impact on the Sales growth rate. Results of the model approbation appear to be significant, indicating the positive impact of expenditures on the IT system and Board salaries, combined with control variables with the size of

the company, its age, and first list affiliation. Both period t and t-1 expenditures have a positive impact adjusting for sales revenue and assets.

Protected capital as expenses on intangible assets is the next step of the analysis. Protected capital expenditures (IT system and Board Member salaries) have a direct impact on Sales Revenue growth in the current year controlling for the size, age, Nasdaq list, and industry factors. Proxies for protected capital for assets and sales revenue are both significant and have a positive impact.

Summarizing individual impact assessment of Intellectual Capital components on the sales growth the panel data regression is following:

$$\ln Salesw_{ti} = \beta_0 + \beta_3 HCE_{ti} + \beta_5 HCE_CA_{ti} + \beta_7 PCE_{t1i} + \beta_8 PCE_CA_{ti} + \beta_{10} PrCE_{ti} + \beta_{11} PrCE_CA_{ti} \quad (3.10.)$$

Control variables: $\ln SIZE_{ti}$

Moderate variables: Country

where: $\ln Sales$ – sales revenue growth rate in period t;

Within the second approach, testing for the cascade of variables and its proxies, the model evaluating the impact of IC on business performance appears to be significant with adjusted $R^2 = 0,831$. According to the analysis 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. 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 what is key success factor behind volumes, pricing policy, and sales increase.

As a result of the analysis the statement 1.1. is proved:

Statement 1.1. Intellectual Capital has a positive significant impact on $\ln Sales$ with a time lag

The analysis answered also the research question: How to choose between normalization proxies, t.i. adjusting for Assets, Value Added or Sales Revenue? The two approaches are tested and both methods prove it is better to adjust for assets. The second approach brings more significant variables both IC and control and moderate ones and better model fit.

A similar procedure was applied to the panel data analysis for other business performance indicators, return on assets, return on investments, price-earning ratio, market to book value, rate of business success.

Return on Assets

Statement 3.2. Intellectual Capital has a positive significant impact on ROA with a time lag.

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

$$\begin{aligned} ROA = & Intercept + NACE + List + Age_{ln} + Size_{ln} + Lev_{ln} + RC + RC_CA \\ & + RC_CA_1 + HC_HCA + HC_HCA_1 + PC_CVA_1 + PrC \\ & + PrC_PrCA_1 + Country \quad (3.11.) \end{aligned}$$

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 with an adjusted R^2 of 33%.

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* 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. Statement 3.2. proved: Intellectual Capital has a positive significant impact on ROA with a time lag.

Regression ROE

Return on equity is one of the main strategic performance indicators of the company. It measures the absolute return delivered to the shareholders. Diminishing the number of variables analyzing IC impact on ROE full regression included 10 variables and short one limited the number of variables to seven:

$$\begin{aligned} ROE = & Intercept + List + RC_CA + RC_CA_1 + PC_CVA_1 + PrC + PrC_1 + \\ & Country \quad (3.12.) \end{aligned}$$

Final model is significant at 0,011 with explanatory factor $R^2 = 40\%$ and adjusted $R = 34\%$. The model illustrates the factors behind the increase in Return on equity in the current period. The main conclusion of impact analysis is 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. 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.

Statement 3.3. proved: IC has a positive significant impact on ROE with a time lag

Regression ROI

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

$$ROIC = Intercept + List + Size_{ln} + HC_{HCA_1} + PC_{CVA_1} + PrC + PrCE_1 + Country \quad (3.13.)$$

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. 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. Statement 3.4. proved: Intellectual Capital has a positive significant impact on ROI with a time lag.

P/E ratio

Statement 3.5. Intellectual Capital has a positive significant impact on P/E with a time lag. Cannot prove the hypothesis: rejection.

3.2.6. Return on Business Success

Statement 3.6. Intellectual Capital has a positive significant impact on RBS with a time lag.

$$\text{Short: } Intercept + Size_{ln} + RC_{CA} + RC_{CA_1} + PrC + Country \quad (3.14.)$$

Analysis indicates low explanatory power (26%) and the significance of this regression.

3.2.7. Added value

Positive and growing financial ratios does not mean positive and growing value-added or Value distortion can be observed despite the positive financial performance. In this particular case, we can use ROA as a performance indicator and add a time scale. The next step is to group companies by value-added and ROA and define four groups: the first group – positive value-added and positive ROA – group “++”; the second group – positive value-added and negative

performance – group “+–“. This type of company creating added value; the third group – negative value-added and positive performance – group “-+”. This is a company where value distortion is observed despite the positive performance; forth group – negative value-added and negative performance – group “—“. This group has to be carefully analyzed as these companies might be on the way to their bankruptcy. The analysis of the *Nasdaq* companies shows that majority of the companies in the first and second list are creating value. Analyzing the correlation coefficient between value-added and intangible assets the positive correlation is proved by the Pearson correlations index of 0,59. Third and fourth groups show value deformation in spite of positive business financial performance ratios. Statement 2 proved: Value creation and distortion are directly related to dynamics of financial growth or decline.

The results of the study helped to answer the questions of what measurements of IK contribution can be used in the models of the impact on the company's performance, how to evaluate the impact and how long the impact can be observed, and also help to answer the question of the choice of noarmalisation proxies, moderator value and control values, as well as to understand the correlation and the company classification by performance and added value dynamics. The study helped to confirm the theses put forward for the defense. Each component of intellectual capital has a systemic and significant impact on strategic and investment business performance. Overall conclusion the models are valid, there is a significant impact, except for P/E ratio, The model fit and significance is higher for Sales growth rate, weaker for ROA, ROE, ROI, RBS and not significant for Price/Earning ratio. This method allows calculating quantitative measures based on accounting audited data at the company, sector and industry level and compare them and is complimentary to the existing reports. Value creation and distortion are directly related to dynamics of financial growth or decline.

CONCLUSIONS

1. Intellectual Capital as a new term appeared in the 1990s, which in essence coincided with the concept of intangible assets. In particular, 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 using intangible assets as a management object to increase the value of the company by involving previously unused reserves such as knowledge, information technology, customer satisfaction, etc. There is no unified definition therefore there is flexibility in using the term.
2. The evolution of the IC research is divided into four stages, although the borders between them are fluid and the exchange of ideas is growing in all directions at tremendous speed since the end of the 90s. The intellectual capital theory has evolved from the resource-based view, competence-based view, and knowledge-based view. The research before 1997 was sporadic and mostly based on case studies that allow calling this period a non-science period. Initially, researchers were concerned with theory building and raising awareness, i.e. value communication stage. The second stage was characterized by gathering evidence to justify the use of IC as a management technology, i.e. IC measurement models' creation, and dynamics aspect. The third stage allowed understanding IC in practice and is known for wide approbation ground of the models within the organisations and even nation-states. Fourth stage is a step toward ecosystems and extended analysis of the company in the environment and opens the number of new research gaps and challenges.
3. Originally the initiative to elaborate on IC research was presented by enterprises and commercial entities. Later the models were also developed for the non-profit organisations, educational institutions, and government bodies as government authorities and in particular public organisations have no value in the market, do not operate in a competitive environment and their products and services carry no price but because of a high degree of "intangibility" of these organisations. Profit and non-profit aspect bring diversity in the evaluation of impact analysis of Intellectual Capital on the performance on the company.
4. Based on analysis of intellectual capital research, research questions can be defined in a form of a block-chain of the research areas, including [a] terminology and definition, [b] components and classification, [c] measurement and evaluation systems, [d] value creation and more recently

also distortions, [e] efficiency and effectiveness, [f] reporting and disclosure, [g] impact assessment, [h] decision-making, and [i] indication of contradictions and gaps for further research.

5. The research literature reflects and demands the distinction of intellectual capital between human capital, structural capital, and relational capital, allowing for a broad variety of components and subcomponents. Analysis of research groups' works and other related peer-reviewed articles that the composition and classification of IC are getting extensive and richer over the recent years: [a] human capital and structural capital is joined by relational capital and in the fourth stage of the research also by the social capital; [b] each of the components is stratified into layers by specific research publications; [c] all components are interrelated and definitions partly overlap. It is important to understand that the components are mutually complementary and make the Intellectual Capital more specific and more global at the same time, allowing each author a choice to define the components within each particular research.

6. IC measurements break into two main streams of studies: the first focuses on IC disclosure while the other adopts a management accounting / control approach. Measurements can also be monetary or non-monetary, micro- and macro-level measurements are presented in publications.

7. Numerous researches were devoted to the content analysis of the reporting, and discussions on the reporting, disclosure, integrated reporting with the clear message it is needed but it is time to go beyond reporting to disclosure and learn the first lessons from this mature stage of the research in this field.

8. Most companies involved in IC management do not identify, assess and measure properly the results and the impacts achieved through the IC management projects and initiatives. There is a growing need for longitudinal analysis. The majority of the research is based on a one-year period that does not allow researchers to fully follow the IC's impact on an organisation. The decision-making process in the uncertain and saturated environment has to integrate a management toolbox to analyse the information available either via reporting, disclosure, or stakeholders analysis. There is a critical mass of research articles arguing that the majority of organisations are "locked-in" to the accounting domain, in which actors' attention is predominantly orientated towards measurement rather than management.

9. Performance ratios or coefficients help a company's owner or its current and potential investors better understand the overall health of the company as well as its condition in various specific financial performance categories. In the general case, the number of performance ratios

can already reach several hundred and the extensive analysis of the ratios can be found in numerous books. However, in practice, it is sufficient and pragmatic to use a limited number of indicators.

10. The growing number of the new performance ratios has created the critical mass of the data to analyse 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. The framework is enriched by the Business performance composite ratio and sales revenue growth rate.

11. According to the statistical analysis of Return on Assets, Return on Equity and Return on Invested Capital of the *Nasdaq* companies in Lithuania, Latvia and Estonia in the period 2012-2019 the observations are fluctuating around 0 reaching 1%.

12. The variables are considered to be symmetrical. The research results show mature companies have higher ROA and ROE and the highest value in the Financial Services industry and Technology sector.

13. According to the statistical analysis of Price to Earnings of the *Nasdaq* companies in Lithuania, Latvia and Estonia in the period 2012-2019 the observations for Price / Earnings had an average of 4.30 and the variable is considered to be symmetrical about its mean. Among the three Baltic countries compared, the highest Price to Earnings ratio was achieved by companies from Lithuania.

14. Methods for the integrated assessment of success (RBS) requires the result of the composite ratio's calculations expressed in numbers, which allows to make a qualitative conclusion about the success of the enterprise (successfully, not quite successfully, unsuccessfully, etc.), reflect the maximum possible number of characteristics of an enterprise's success: the ability to grow, the ability to generate profit, the actual "existential ability", as well as the ability to be a better business environment. RBS integral indicator, the values of which are formed taking into account different aspects of the enterprise's activities, expressed by different initial indicators calculated directly based on data from financial statements. Among the three Baltic countries compared, companies from Lithuania achieved the top 3 highest results of Return of Business ratio (max 10) – 8.87, 8.25, 8.14. Leaders are observed in the Asset Management industry and Financial Services and Banking sectors.

15. Experimenting with groupings of RBS results the distribution of the integral indicator of success in 2014 – 19 has a similar pattern, in each case the central tendency, the "tails" of the

distribution, are clearly distinguished. Thus, the measured indicator has certain permanent statistical properties, which makes it a convenient tool for studying the success of all types of companies in the Baltics. In the period analyzed there was an increase in the share of successful enterprises and leaders of success. Such changes indicate an increase in the sustainability of the entire “population” of the enterprises, a shift in distribution towards a greater mass of successful enterprises, considered successful against the rest.

16. The model proposed in the third part integrates IC costs as investments indicators and business performance indicators at *Baltic Nasdaq* companies and evaluates the impact of IC on business performance in dynamics. Dependent variables are ln Sales (growth rate), ROA, ROE, ROI, RBS, and E/S tested separately. IC variables are Human Capital, Relational Capital, Protected Capital, Process Capital, Social Capital, and Innovation Capital. Model is extended with control variables ($\ln AGE_{ti}$, $\ln SIZE_{ti}$, LEV_{ti}) and moderate variables (Country, Industry, List).

17. Intellectual Capital has a positive significant impact on Sales Growth Rate. The model is significant with an adjusted $R^2 = 0,831$. According to the analysis, 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. 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 the key success factor behind volumes, pricing policy, and sales growth.

18. IC have a positive significant impact on Return on Assets and with a time lag;

19. IC has a positive significant impact on Return on Equity and with time lag;

20. IC has a positive significant impact on Return on Investments and with time lag;

21. IC does not have a positive significant impact on Earnings per Share with time lag;

22. IC has a positive significant impact on the Rate of Business Success;

23. The model fit and significance is higher for Sales Growth Rate, weaker for ROA, ROE, ROI, RBS and not significant for Price-Earnings Ratio. This method allows calculating quantitative measures based on accounting audited data of a company, and comparing across companies. This approach to analysis of an enterprise can be used as complementary to the existing reports.

24. Impact assessment of the IC using *Nasdaq Baltic*, which demonstrates new aspects of research and unique results at an international level, revealing the interaction between individual

performance indicators of IC and its elements and company performance. The method can also be applied at the level of an economic sector or an industry.

Suggestions

Suggestions to Government Institutions

1. Government institutions in cooperation with industry associations/chambers of commerce and *Nasdaq Baltic* in all three Baltic States can reassess reporting recommendations on the Intellectual Capital, including intangible assets, and its components, broadening the scale beyond intangible assets to include social capital, human capital, etc, clearly defining the structure of the components and taking into account experience of other countries working on mandatory and voluntary reporting on IC. Moreover, the impact analysis on the national level and micro-level of the companies, as well as industry-level research, can contribute to defining the development and sustainability strategy of the economy.
2. Companies are required to publish their annual reports on the *Nasdaq* webpage. As companies use different individual approaches to Notes to the Financial Statements in their reporting to *Nasdaq Baltic*. *Nasdaq Baltic* can more clearly define its requirements for the Notes to the Financial Statements that companies submit, harmonize the structure of the descriptions, and specify the data required and data formats.
3. *Nasdaq Baltic* and Nordic in cooperation with Morningstar, a leading provider of independent investment research, has introduced a company fact sheet to increase investor awareness for publicly traded small and medium-sized enterprises. The initiative could be extended making this data available in Excel or any other workable format, and sector / country / industry level summaries or averages could be produced to allow for further comparative and impact analysis.
4. Elaborated approach to systematisation of the impact of IC on the performance of the company can be used both in Latvia and in other countries of the world; it could 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.
5. Using *Nasdaq Baltic* the research can be extended to the whole economy of Latvia using Lursoft data for the purpose of the analysis for the Ministry of Economy, Latvian Investment and Development Agency or particular needs and perspectives of business associations. Government can then make decisions on the support of particular industries based on the impact analysis provided by the research. The priority of economic policy and management – business and political – should be to raise efficiency in the low-efficiency regions.

Suggestions to Enterprises and Industry Associations

6. The elaborated approach to measuring IC can be employed to build the mid-term development strategy of enterprises and industries provided sufficient data is available from all units of the enterprise or all enterprises in the industry. Such a new perspective of analysis can provide a competitive edge to an enterprise, a cluster, or an industry seeking to improve its output, sales or profitability.
7. Change of perspective by evaluating the IC as clearly defined investments objects and redirecting financial flow to the components of IC predicted to have the most significant impact on business performance is an approach proven in international literature and it can now be applied in the Baltic Region based on the findings of the thesis.

Suggestions to Education Establishments & Researchers

8. The rapid development of the Intellectual Capital theory and practice strengthened by the growing dominance of intangible resources, start-up culture, incubator's culture, intellectual property protection cases, Intellectual Capital becomes one of the essentials in the entrepreneurship-related disciplines, both economics and management. Education and research institutions in the Baltic Countries can fill the gap in IC research as the issue is not yet sufficiently developed in the Baltics.
9. To continue research in the forthcoming years that were not analysed in the current research due to the various research limitations: [a] normalized proxies, [b] model with all variables.

Recommendations for further research: expanding the range of component measurements and using them in models, testing aggregate indicators in impact models, expanding geography, increasing the number of companies, developing a reporting standard, promoting the provision of new information at the *Nasdaq* level for research.

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