

# How does Intellectual Capital Disclosure Affect the cost of Capital? Conclusions from two Decades of Research

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10.34190/EJKM.18.01.003

**Abstract:** According to Dumay (2012), there are two grand foundations of intellectual capital (IC) disclosure theory: the MV/BV ratio and greater profitability because of the lower cost of capital. Consequently, the purpose of this paper is to perform a literature review of the empirical studies conducted in the last 22 years on the link between intellectual capital disclosure and the cost of capital (cost of equity and cost of debt). The findings of empirical research analysed in this paper indicate that the hybridization of financial and non-financial data reporting contributes to the lower cost of capital. Moreover, in general, researched studies confirm a negative relation between the non-financial information disclosure and the cost of equity. IC data disclosure also improves credit rating and thus lowers the cost of debt. In terms of IC sub-categories, disclosure of human capital items performs the strongest impact on decreasing the cost of equity. The Corporate Social Responsibility (CSR)/ (Environmental, Social and Corporate Governance (ESG) reports (43%) and annual reports (39%) were the most often utilized IC data sources, followed by corporate websites disclosures (15%). A minority of the studies (4%) used integrated reports, IPO prospectuses, and reports dedicated solely to the IC. This paper has a twofold contribution: first, it provides a valuable insight for regulators, practitioners and stock market analysts into the role of IC disclosure in the reduction of the cost of capital. Second, it attempts to revive the discussion on the relevance of IC reporting by the entities in terms of minimalizing their cost of capital.

**Keywords:** intellectual capital disclosure, intellectual capital reporting, cost of capital, cost of debt, cost of equity, literature review

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## 1. Introduction

The link between information disclosure and the cost of equity capital is of fundamental interest to academics and regulators alike (Dutta and Nezlobin, 2017). Contemporary growth-oriented firms look for external finance on the capital markets in order to increase capital, either by issuing new shares or by taking new loans. Among factors influencing both the cost of debt and/or cost of equity, a significant proportion of the literature concentrates on the impact of mandatory and non-mandatory information disclosure. Policymakers, financial regulators and academics frequently refer to the decreased cost of capital as a justification for improving the quality of disclosure (see, for example, Sengupta, 1998; Easley, Hvidkjaer and O’Hara, 2002; Ecker et al., 2006). Bloomfield and Wilks (2000) showed the positive impact of disclosure quality on investors’ demand, which in turn reduced the cost of capital by improving liquidity. Although the literature is vast and seems to suggest a clear, direct impact of the information quality on the cost of capital, most papers relate to general disclosure, without concentrating on certain reported items, e. g. intellectual capital (IC) which in the knowledge-based economy is crucial for a better understanding of contemporary business performance. Following Tian and Chen (2009) we assume that the disclosure of the IC increases the quality of information presented to stakeholders and therefore, it should lead to the decrease of the cost of capital. Edvinsson and Malone (2001) perceive IC as knowledge, experience, organizational structure, relationships with clients and professional skills that provide sustainable competitive advantage. The notion of competitive advantage based on IC is also stressed by Dumay (2016) who defines IC as “the sum of everything everybody in a company knows that gives it a competitive edge. Intellectual capital is intellectual material, knowledge, experience, intellectual property, information that can be put to use to create value”. With reference to the intellectual capital disclosure theory Dumay (2012) states that there are two grand foundations – the difference between market-to-book values (Mouritsen et al., 2001) and greater profitability through a lower cost of capital (Bismuth and Tojo, 2008). In our research we focus on the latter one. The choice of this research topic is also dictated by the fact that there is a major literature gap observed in terms of analyzing the impact of IC disclosure in the form of its various dimensions and multiple corporate documents on firms’ cost of capital. The paper addresses this issue, by providing a literature review of empirical studies. To the authors’ best knowledge, this literature review is

the first comprehensive analysis of up-to-date research with a time span amounting to 22 years and adopting a multi-source IC data framework.

The aim of the paper is twofold: first, to determine what is the current state of knowledge concerning the impact of intellectual capital disclosure on firms' cost of capital and second, to indicate possible gaps and hence identify future directions of studies. Consequently, we developed three research questions:

*RQ1: What does the discipline know about the link between intellectual capital disclosure and the cost of capital based on empirical studies?*

*RQ2: What is the impact of each of the intellectual capital components on the cost of capital?*

*RQ3: How intellectual capital and cost of capital were operationalized in the empirical studies?*

This study has two main contributions: first, it enables managers and regulators to focus on those IC disclosure items that are effective in the reduction of the cost of capital. Second, it attempts to revive and foster the discussion of the relevance of IC data reporting by the entities especially in the context of external capital raising. In addition, although the proposed review is not limited to any particular sample of studied firms, it addresses the implications for listed firms in terms of their value creation. Consequently, the paper refers to the importance of value relevance theory by identifying those reporting schemes that contribute to lower cost of capital and hence increase the market capitalization of listed firms.

The structure of the paper is as follows. Section 1 is an introduction, in Section 2 we present the literature review background concerning the theoretical link between IC disclosure and the cost of capital. Section 3 describes the research method applied in the analysis. In Section 4 the main findings of existing empirical research concerning IC disclosure and the cost of capital are presented and discussed. Section 5 contains the conclusions and suggestions for future lines of research together with limitations concerning this study.

## **2. Literature background**

Theory suggests that better reporting should facilitate access to new capital and enhance shareholder value, as it increases management credibility and improves analysts' forecast. Consequently, the cost of capital is decreased because of stakeholders' better estimation of firm risk and the greater amount of potential investors (Vergauwen and van Alem, 2005). Better reporting contributes also to the increase of liquidity of the market, which reduces capital costs, as liquidity is perceived as a function of information asymmetry (Glosten and Milgrom, 1985). Lambert, et al. (2011) proposed a theoretical model that explains information asymmetry impact on the cost of capital. They show that low liquidity influences the amount of information that is reflected in prices, which in turn lowers investors' average precision and consequently increases the cost of capital. Diamond and Verrecchia (1991) developed a model in which voluntary disclosure reduces the information asymmetry among investors. Investors trading in shares of companies that perform high-quality disclosure can be relatively confident that transactions occur at a "fair price", which leads to the increased liquidity of firms' shares. Consequently, firms that provide extensive voluntary disclosures improve the liquidity of stocks, reduce the cost of capital and experience an increase in the number of financial analysts following (Healy and Palepu, 2001). However, the question is how much and what type of information should firms voluntarily disclose? In the last decades, it has been largely underlined that, despite accounting, information is still the crucial source of knowledge on a company, but it is insufficient for investors and analysts, especially when they are seeking to value new firms (Lev and Zambon, 2003; Mavrinac and Siesfeld, 1998; Nielsen, et al., 2015). Therefore, companies are increasingly understanding the importance of disclosing corporate information related to strategy, value creation and intellectual capital (IC) (Cardi, et al., 2019). However, as Meek, et al. (1995) underline, managers have to find a balance between the benefits of lower capital cost due to extra information disclosed and the possible threats associated with such reporting. Boot and Thakor (2001) showed that disclosed information is either complementary or substitute. Complementary information is orthogonal, thus statistically independent, to information that is already available while substitute information reveals what was previously known from other sources. This authors argue that complementary information reporting strengthens investors' private incentives to acquire information, which translates into greater liquidity in financial markets. In contrast, substitute information disclosure weakens the incentives for gathering additional information, thus reducing market liquidity. Similarly, the significance of backward and forward-looking information should be analyzed in terms of the cost of capital influence.

Theoretically, forward-looking information should have a higher potential to be of value for investors and to be more relevant in capital markets, as it is a subject of predictions by the company itself. Finally, theoretical deliberations distinguish also the impact of disclosure on the cost of capital in terms of the type of firms. Boone and Raman (2001) conclude that R&D-intensive enterprises have less liquid markets for their shares, which suggests the higher cost of capital.

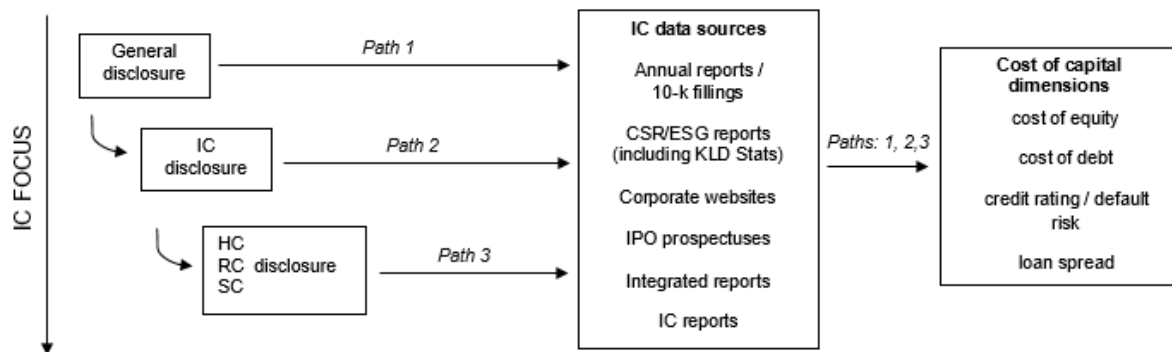
The theory on the relation between the corporate disclosure and the cost of capital is in place and generally indicates that the disclosure of information lowers the cost of capital. To validate the theory and make it useful it is necessary to confirm it by the empirical analysis that is presented in the following chapters.

### 3. Research method

In this study we adopt the literature review method. In light of the increasing quantity of publication outlets, research output, and potentially conflicting findings, literature reviews serve an important function of knowledge systematisation (Oll and Rommerskirchen, 2018, s. 20). Among various review approaches, a distinction between traditional (narrative) and systematic reviews is made (Rousseau, et al., 2008; Tranfield, et al., 2003). For the present review we follow the traditional (narrative) review.

The purpose of the proposed review is to present a possibly comprehensive overview of the existing research on the interrelation between IC disclosure and the cost of capital. A query in all management, strategy and accounting journals was run using the EBSCOhost, ScienceDirect, Emerald, JSTOR and ProQuest, as well as Wiley Online databases. A systematic search process combined identification of papers in the mentioned electronic databases by keywords with a manual search for printed materials, books, as well as sources tagged by authors dealing with this area of study. The initial set of keywords (“intellectual capital disclosure”, “intellectual capital// reporting”, “cost of capital”, “cost of debt”, “cost of equity”, “credit rating”) was formed by general readings on intellectual capital and cost of capital. However, in order not to miss the relevant contributions, the set of keywords was systematically extended, especially in terms of IC disclosure practices with the help of sustainability reports, as suggested by e.g. Oliveira, Rodrigues and Craig (2010) and Lungu, Caraiani and Dascălu (2012). As a result, the following conceptual framework was created (figure 1).

Figure 1: Literature review conceptual framework



Source: own work

Figure 1 depicts the conceptual framework developed for the purpose of our analysis which consists of two main sections that are: input (IC data) and output (cost of capital). An overview of the IC sources identified in the studies plays an auxiliary role in the existing framework. In the input section, we adopted a deductive approach by: first, identifying papers that refer to the link between voluntary non-financial information disclosure and cost of capital, second, by analyzing those papers that study the relation between IC data and the cost of capital, and third by studying the papers on the impact of certain IC items on the cost of capital. We adopt a division of IC into the following categories: human capital (HC), relational capital (RC) and structural capital (SC), introduced by Sveiby (1997) and renamed by Guthrie and Petty (2000). Within the process of identifying certain IC sub-categories, we utilized Guthrie and Petty (2000) framework. From the output section, we identified four possible costs of capital dimensions, which are: cost of equity, cost of debt, credit rating and loan spread. This design of the framework enabled us to create three paths revealing the possible impact of certain IC reporting ways on the given dimension of the cost of capital. This approach was adopted to better formulate practical implications for managers willing to lower their firms’ cost of capital. We aimed to identify

the most cohesive findings by layering IC embeddedness and thus its impact on the cost of capital. Moreover, since our paper consists also of the methodological analysis, we have introduced a brief overlook of employed sources of data on IC that, as mentioned before, play an auxiliary role for the proposed frameworks. Our review refers to the papers published in the last 22 years. We argue that the period of the analysis is justified, since, according to Dumay (2014) studies on IC disclosure prior to 1994 should not be perceived reliable ones, as the term “intellectual capital” was not a matter of interest before the Stewart and Losee (1994) article.

#### 4. Results and discussion

##### 4.1.1 Descriptive statistics

The total number of the analyzed papers amounted to 28. The initial quantity was greater, however, due to the need for high-quality research, we have eliminated those without a decent quantitative approach. As a result, 79% of the papers included in the final sample employed regression models. Most of them also adopted the robustness test.

**Table 1:** Summary of the literature review

<b>No. of papers</b>	28
<b>National context</b>	75% developed, 4% developing nations (explicitly), 11% mixed, 7% unknown
<b>Methods of data analysis adopted in the studied papers</b>	Regression models: 79%
<b>Sample - industry</b>	Manufacturing as dominant industry
<b>Studied papers publishing years</b>	1997-2018 (22 years)
<b>Time span of the empirical studies</b>	1986-2014 (29 years)
<b>Length of study</b>	Share of longitudinal studies: 68%, excluding 2-years ones: 52%

Source: own work

In the analyzed papers, the studies were performed mostly on the sample of firms from developed nations. Surprisingly, there was only one research found explicitly on enterprises from developing countries (Indonesia), however some papers employed studies on firms from a mixed economic background, and some did not specify the sample. In this sense, we argue that the research on IC disclosure and the cost of capital is geographically underscored. Moreover, most of the studies may be classified as longitudinal ones. Even though our analysis covers the studies concerning analysed topics that were published in the last 22 years, it is worth noticing that some of them go back with their time span of research to 1986. Therefore, the empirical research performed in the studied papers covers almost 30 years. A detailed review of the studied empirical papers is presented in table 2.

**Table 2:** Intellectual capital disclosure and cost of capital – summary of the systematic literature review (from oldest to newest)

Study	Research design	Size / national context	Industry	Sample	IC data source	Method of data analysis	Cost of capital estimation	Findings
Botosan (1997)	Link between voluntary disclosure and cost of equity capital	122 US listed firms	Metal manufacturing (Primary metals, fabricated metal products, industrial and commercial machinery)	1990	Annual reports	Content analysis, DSCORE framework	Cost of equity calculated on the base of EBO valuation formula*	Only disclosure of key non-financial statistics in the group of firms with low analyst coverage is significant in reducing the cost of equity.
Richardson and Welker (2001)	Relation between financial and social disclosure and the cost of equity capital	700 Canadian firms	9 industries	1990-1992	Annual reports	Regression model	Cost of equity calculated on the base of EBO valuation formula	The positive relationship between the disclosure of social information and the cost of equity.
Botosan and Plumlee (2002)	Association between the level of voluntary disclosure and cost of equity	668 US listed firms	Various (43 in total, including banking)	1986-1996	AIMR reports	No Information	Cost of equity calculated on the base of the dividend discount model	Non-financial information disclosure increases the cost of equity.
Kristandl and Bontis (2007)	Association between the level of voluntary disclosure and cost of equity	95 listed firms from Austria, Germany, Sweden and Denmark	Materials, industrials, consumer discretionary, consumer staples, health care, IT	2004	Annual reports	Content analysis, (modified I and III pillars of VRSCORE index framework), regression model	Cost of equity calculated on the base of the modified residual income valuation model	The negative relationship found between the level of forward-oriented IC information and cost of equity. Positive relationship stated between the level of historical IC information and cost of equity.

Empirical approach	Cost of capital estimation	Underpricing and cost of capital (in general)	No information	Capitalization of software development costs reduces information uncertainty of investors in IPOs and firms cost of capital more than their expensing.	Disclosure of nonfinancial information, such as: number of employees, average compensation per employee and market share leads to lower cost of equity.	Additional data presented in the intellectual capital report contributes to more homogeneous ratings, however intellectual capital report does not necessarily lead to more favorable rating.		
	Method of data analysis						OLS regression	Multivariate regression model
IC data source	IPO prospectuses	Annual report. Software development cost reported on the balance sheets	Annual reports, 10-k filings, Self-constructed index based on Botosan (1997)	Annual report, IC report				
							Years of analysis	1997-2004
Industry	Not specified	SIC codes 7371-7374: software (excluding Internet firms)	No information	No information		No information		
							Size / national context	334 Singapore IPOs
Research design	Association between underpricing and IC disclosures in IPOs prospectuses		Role of capitalization and expensing of software development cost in the cost of issuing new equity		Link between voluntary disclosure and cost of equity		Impact of intellectual capital reports on the credit rating	
Study	Singh and Van der Zahn (2007)		Givoly and Shi (2007)		Francis, Nanda and Olsson (2008)		Alwert, Bornemann and Will (2009)	

Findings	Empirical approach	
	Cost of capital estimation	Method of data analysis
Greater IC disclosure is associated with lower implied cost of equity in the case of Continental Europe firms only.	No information	No information
Negative association between the level of Web-based non-financial disclosure and the implied cost of equity.	No information	Regression model
The only IC components that affect equity pricing are employee relations and product characteristics: all other attributes exhibit little or no significant impact on firms' cost of equity.	Cost of equity calculated as the mean of four models**	Regression model
Initiation of CSR disclosure benefit firms with a lower cost of equity capital. Superior social responsibility performance enjoys a subsequent reduction in the cost of equity capital.	Cost of equity as the mean of three models***	OLS regression
	IC data source	IC extracted from data on CSR from KLD STATS
	IC data source	Standalone CSR reports, 7-pillar CSR analysis and KLD STATS database
	Sample	
	Years of analysis	2002
	Industry	Consumer goods and services, Energy, Chemicals and drugs, Industrials, Information technology, Materials (resources), Telecom and media, and Utilities.
	Industry	Various
	Industry	48 industry groups - Fama and French (1997) industry classification
	Industry	Various (23, including banking)
	Size / national context	267 largest listed firms from Continental Europe (43 Belgian, 43 Dutch, 97 French and 84 German)
	Size / national context	894 firms from Continental Europe and North America
	Size / national context	2 809 US listed firms
	Size / national context	294 US listed entities
	Research design	Impact of Web-based intellectual capital (IC) reporting on firm's value and its cost of finance
	Research design	Association of Web-based non-financial disclosure and firm's cost of equity
	Research design	Link between firms' CSR activities and their cost of equity
	Research design	Link between firms' CSR activity and cost of equity
Study		Orens, Aerts and Lybaert (2009)
		Orens, Aerts and Cormie (2010)
		EI Ghoul, Guedhami, Kwok and Mishra (2011)
		Dhaliwal, Li, Tsang and Yang (2011)



Empirical approach	Cost of capital estimation	Findings
	Method of data analysis	
	Loan spread over LIBOR on private bank debt	Firms with the worst social responsibility scores pay up to 20 basis points more than the most responsible firms. However, for the majority of firms, the impact of CSR is not economically important.
	Multivariate regression model	Disclosure of: employee relations, diversity issues, product issues, community relations, and environmental issues positively affect firms' credit ratings, while human rights dimension does not have a significant effect on firms' credit ratings.
	IC data source	Cost of debt as Standard & Poor's credit rating
	IC extracted from data on CSR from KLD STATS	Multivariate regression model
	IC extracted from data on CSR from KLD STATS	IC extracted from data on CSR from KLD STATS
Sample	Years of analysis	1991-2006
	Industry	1991-2010
		Various (excluding banking)
	Size / national context	Various (48 in total, including banking) based on Fama and French's (1997) industry classification
		1 534
		1 585 US listed firms
Research design		Impact of social responsibility on the cost of private debt financing
		Link between firms' CSR activity and credit rating
Study		Goss and Roberts (2011)
		Attig, El Ghoul, Guedhami and Suh (2013)
		Boujelbene and Affes (2013)
		102 companies listed in the French SBF 120 stock market index
		Several sectors, sample divided into two groups : the traditional industries and the high-tech industries
		Impact of IC components disclosure on the cost of equity
		Linear multiple regression
		CAPM model
		Annual reports, websites disclosure, www.finance.yahoo.com and the Thomson Reuter databases







Empirical approach	Cost of capital estimation	Default risk	No information	Cost of capital price-earnings growth (PEG)	Cost of equity calculated based on modified PEG measure
	Method of data analysis	Content analysis (Authors' own framework), multi-discriminant analysis	Generalized method of moments (GMM) estimator	Multivariate regression model	Artificial intelligence based content analysis, Regression model
IC data source	Financial and non-financial corporate reports	The Ethical Investment Research Service (EIRIS) and CSR reports;	Standalone CSR reports, 5-level Garcia-Sanchez et al. (2014) framework based on GRI	English language CSR reports and analyst forecast data from Thomson Reuters	
Sample	Years of analysis	No information	2003-2009	2007-2014	2013-2014
Industry	NACE Rev. 2 sector (from 10 to 33) (Manufacturing sector) and NACE Rev. 2 sector (58, 60, 61, 62, 63, Quaternary sector)	Various	Various (including banking)	Various (including banking)	Various
Size / national context	44 "very large" Italian firms	575 non-financial companies from 17 countries	Forbes Global 2000 firms (only developed countries)	264 German companies	
Research design	Significance of IC disclosure in credit risk assessment	Effect of voluntary information disclosure of CSR on information asymmetry.	Link between firms' CSR activity and cost of equity	Relationship between CSR disclosure and information asymmetry and cost of equity	
Study	lazzolino, Migliano and Gregorace (2015)	Martínez-Ferrero, Ruiz-Cano, and García-Sánchez (2015)	Cuadrado-Ballesteros, García-Sánchez and Martínez Ferrero (2016)	Michaels and Grüning (2017)	

Findings	Empirical approach	
	Cost of capital estimation	Method of data analysis
The non-financial disclosure makes external financing more flexible and lowers the cost of debt.	WACC defined based on the Modigliani and Miller (1958). The payable interest rates after tax is a proxy of the cost of debt.	Regression model
A negative relationship between the cost of equity and the disclosure of an integrated report.	PEG ratio based on the Easton model (2004)	Generalized Method of Moments (GMM) regression models
	IC data source	The annual CSR questionnaire survey
	Years of analysis	2007-2013
	Industry	Various
	Size / national context	525 Japanese firms
		2009-2013
		Various
		995 companies in 27 countries
Research design	Link between corporate social performance and the cost of capital	Effect of Integrated Information disclosure on the cost of equity
Study	Suto and Takehara (2017)	García-Sánchez and Noguera-Gámez (2017)

Empirical approach	Cost of capital estimation	Firms that declare a high disclosure level do not obtain a significant cost of equity capital benefit compared to firms that declare a lower disclosure level. However, among GRI reporting firms with poor CSR performance, firms declaring a high disclosure level have significantly higher cost of equity than those declaring a lower disclosure level. This result is consistent with investors imposing a penalty on firms suspected of greenwash.	Only disclosure of key non-financial statistics in the group of firms with low analyst coverage is significant in reducing the cost of equity.	The positive relationship between the disclosure of social information and the cost of equity.
	Method of data analysis	Logistic regression	Content analysis, DSCORE framework	Regression model
IC data source	CSR report data from the GRI's Sustainability Disclosure Database	Annual reports	Annual reports	Annual reports
Sample	Years of analysis	2005-2013	1990	1990-1992
	Industry	Various	Metal manufacturing (Primary metals, fabricated metal products, industrial and commercial machinery)	9 industries
	Size / national context	260 companies The analysis embraced 878 reports.	122 US listed firms	700 Canadian firms
Research design	Analysis whether CSR report characteristics, including disclosure level, external assurance and reporting performance explain variation in cost of equity			
Study	Weber (2018)		Botosan (1997)	Richardson and Welker (2001)







Empirical approach	Cost of capital estimation	Cost of equity calculated as the mean of four models***	Initiation of CSR disclosure benefit firms with a lower cost of equity capital. Superior social responsibility performance enjoys a subsequent reduction in the cost of equity capital.	Firms with the worst social responsibility scores pay up to 20 basis points more than the most responsible firms. However, for the majority of firms, the impact of CSR is not economically important.	Disclosure of: employee relations, diversity issues, product issues, community relations, and environmental issues positively affect firms' credit ratings, while human rights dimension does not have a significant effect on firms' credit ratings.
	Method of data analysis	Regression model	OLS regression	Multivariate regression model	Multivariate regression model
Sample	IC data source	IC extracted from data on CSR from KLD STATS	Standalone CSR reports, 7-pillar CSR analysis and KLD STATS database	IC extracted from data on CSR from KLD STATS	IC extracted from data on CSR from KLD STATS
	Years of analysis	1992-2007	1993-2007	1991-2006	1991-2010
Research design	Industry	48 industry groups - Fama and French (1997) industry classification	Various (23, including banking)	Various (excluding banking)	Various (48 in total, including banking) based on Fama and French's (1997) industry classification
	Size / national context	2 809 US listed firms	294 US listed entities	1 534	1 585 US listed firms
Study	Link between firms' CSR activities and their cost of equity	Link between firms' CSR activities and their cost of equity	Link between firms' CSR activity and cost of equity	Impact of social responsibility on the cost of private debt financing	Link between firms' CSR activity and credit rating
	Author(s)	El Ghoul, Guedhami, Kwok and Mishra (2011)	Dhaliwal, Li, Tsang and Yang (2011)	Goss and Roberts (2011)	Atig, El Ghoul, Guedhami and Suh (2013)
Findings		The only IC components that affect equity pricing are employee relations and product characteristics; all other attributes exhibit little or no significant impact on firms' cost of equity.			

Empirical approach	Cost of capital estimation	Method of data analysis	IC data source	Sample	Industry	Size / national context	Findings
	Cost of equity based on PEG model						
	CAPM model	Linear multiple regression	Annual reports, websites disclosure, www.finance.yahoo.com and the Thomson Reuter databases	2009	Several sectors, sample divided into two groups : the traditional industries and the high-tech industries	102 companies listed in the French SBF 120 stock market index	The existence of a significant and negative association between IC disclosure with its two components (human and structural capital) and the cost of equity.
	Cost of equity based on PEG model	Content analysis, Authors' own framework (61 variables), Spearman correlation, t-test analysis	Annual report	2004-2005	Various (15 in total, including banking)	125 UK firms listed on the London Stock Exchange	IC disclosure is negatively related to the cost of equity, moreover, the relationship between financial disclosure and the cost of equity is magnified when combined with IC disclosure. The effect of financial disclosure on the cost of equity capital is augmented for firms characterized by a medium level of IC disclosure.
	Cost of equity based on PEG model	Content analysis, the regression model	Annual reports	2005-2009	Biopharmaceutical and chemical	77 listed companies' from eight Western European countries	Results do not confirm an inverse relation between the amount of R&D information and cost of equity.
	Impact of IC components disclosure on the cost of equity	Link between IC disclosure and cost of equity					
<b>Study</b>							
	Boujelbene and Affes (2013)	Mangena, Li and Tauringana (2014)	La Rosa and Liberatore (2014)				

Empirical approach	Cost of capital estimation	Capital constraints calculated as KZ index, SA index, WW index, No Repurchase Indicator	ECON and ESG disclosures are negatively associated with cost of equity, but only growth and research (environmental and governance) sustainability performance dimensions contribute to this relationship. Operation efficiency is positively, while social sustainability performance is only marginally, related to cost of equity.	IC disclosure has significant negative effect on the cost of equity and lack of impact on cost of debt. Structural capital has a negative and significant effect on the cost of equity. Relational capital has insignificant effect on cost of equity and human capital has a positive effect on the cost of equity.
	Method of data analysis	OLS regression	Regression model	Content analysis based on Li et al. (2008) framework. Regression model
Sample	IC data source	Environmental, social and governance (ESG) performance scores obtained from Thomson Reuters ASSET4	KLD database and CRSP databases	Annual reports
	Years of analysis	2002-2009	1990–2013	2010
Research design	Industry	Various (9, including banking)	Various	Banking, insurance, telecommunication, media and advertising, computer, electronic and cable, automotive, pharmacy and chemicals
	Size / national context	10 078 listed firms from 49 countries	3 000 firms	
Study	Link between firms' CSR activities and capital constraints	Cheng, Ioannou and Serafeim (2014)	Ng and Rezaee (2015)	Barus and Siregar (2015)
	Analysis of how various components of ECON and ESG disclosure affect cost of equity.			Relationship between IC disclosure (as well as its components: human, structural and relational capital) and cost of equity and cost of debt

Empirical approach	Cost of capital estimation	Default risk	No information	Cost of capital price-earnings growth (PEG)	Cost of equity calculated based on modified PEG measure
	Method of data analysis	Content analysis (Authors' own framework), multi-discriminant analysis	Generalized method of moments (GMM) estimator	Multivariate regression model	Artificial intelligence based content analysis, Regression model
IC data source	Financial and non-financial corporate reports	The Ethical Investment Research Service (EIRIS) and CSR reports;	Standalone CSR reports, 5-level Garcia-Sanchez et al. (2014) framework based on GRI	English language CSR reports and analyst forecast data from Thomson Reuters	
Sample	Years of analysis	No information	2003-2009	2007-2014	2013-2014
Industry	NACE Rev. 2 sector (from 10 to 33) (Manufacturing sector) and NACE Rev. 2 sector (58, 60, 61, 62, 63, Quaternary sector)	Various	Various (including banking)	Various	Various
Size / national context	44 "very large" Italian firms	575 non-financial companies from 17 countries	Forbes Global 2000 firms (only developed countries)	264 German companies	
Research design	Significance of IC disclosure in credit risk assessment	Effect of voluntary information disclosure of CSR on information asymmetry.	Link between firms' CSR activity and cost of equity	Relationship between CSR disclosure and information asymmetry and cost of equity	
Study	Iazzolino, Migliano and Gregorace (2015)	Martinez-Ferrero, Ruiz-Cano, and Garcia-Sanchez (2015)	Cuadrado-Ballesteros, Garcia-Sanchez and Martinez Ferrero (2016)	Michaels and Grüning (2017)	
Findings	Integration of IC and financial data improves the evaluation of credit risk.	The decrease in the cost of capital is a consequence of the strategy of transparency regarding sustainability, especially for those companies located in countries that are more preoccupied with the rights of stakeholders.	CSR disclosures tend to reduce the cost of equity by reducing information asymmetries.	CSR disclosure is significantly negatively associated with information asymmetry as well as the cost of equity.	

Findings	Empirical approach	
	Cost of capital estimation	Method of data analysis
The non-financial disclosure makes external financing more flexible and lowers the cost of debt.	WACC defined based on the Modigliani and Miller (1958). The payable interest rates after tax is a proxy of the cost of debt.	Regression model
A negative relationship between the cost of equity and the disclosure of an integrated report.	PEG ratio based on the Easton model (2004)	Generalized Method of Moments (GMM) regression models
	IC data source	The annual CSR questionnaire survey
	IC data source	The Ethical Investment Research Service (EIRIS) and Spencer & Stuart Board Index (SSBI) for data on corporate governance, corporate websites.
	Sample	Years of analysis
		2007-2013
		2009-2013
	Industry	Various
	Industry	Various
	Size / national context	525 Japanese firms
	Size / national context	995 companies in 27 countries
	Research design	Link between corporate social performance and the cost of capital
	Research design	Effect of integrated information disclosure on the cost of equity
Study		Suto and Takehara (2017)
		García-Sánchez and Noguera-Gámez (2017)

Study	Research design	Sample		IC data source	Method of data analysis	Cost of capital estimation	Findings
		Industry	Years of analysis				
Weber (2018)	Analysis whether CSR report characteristics, including disclosure level, external assurance and reporting performance explain variation in cost of equity	Various	2005-2013	CSR report data from the GRI's Sustainability Disclosure Database	Logistic regression	Cost of capital calculated as the mean of the Gebhardt et al. (2001), Claus and Thomas (2001) and Easton (2004) modified PEG*** cost of equity models.	Firms that declare a high disclosure level do not obtain a significant cost of equity capital benefit compared to firms that declare a lower disclosure level. However, among GRI reporting firms with poor CSR performance, firms declaring a high disclosure level have significantly higher cost of equity than those declaring a lower disclosure level. This result is consistent with investors imposing a penalty on firms suspected of greenwash.

\* Formula developed by Edwards and Bell (1961), Ohlson (1995) and Feltham and Ohlson (1995)

\*\* Claus and Thomas model (2001), Gebhardt et al. model (2001), Ohlson and Juettner-Nauroth model (2005) and the Easton model (2004)

\*\*\* Gebhardt et al. (2001), Claus and Thomas (2001) and Easton (2004)

\*\*\*\* Two proxies for the cost of equity estimation were employed. First – a variation of the price multiple – the industry-adjusted earnings–price ratio (IndEP). Second - the implied cost of equity is the internal rate of return that equates the current stock price to the present value of expected future cash flows.

Source: own work

The starting points for our analysis are, according to the proposed conceptual framework, the output section items which are the various costs of capital dimensions. Then, within each dimension we analyse the impact of the various IC embeddedness layers. Due to the mutual interrelations, studies on the cost of debt, credit rating and loan spread were summarized together.

#### 4.1.2 The IC disclosure impact on the cost of equity

Concerning the impact of IC disclosure on the cost of equity, we observed that the majority of the studies confirm theoretical deliberations suggesting a negative relationship. Within the first path (voluntary non-financial disclosure) Botosan (1997) on the sample of US-listed firms observed that reducing the cost of equity by key non-financial data (including the ones associated with IC) is significant only in the group of firms with low analyst coverage. Orens, Aerts and Cormie (2010) found a similar link, however it applied only to the web-based non-financial data and to the Continental Europe firms. Interestingly, there was no such association observed in terms of US companies. A recent study by García-Sánchez and Noguera-Gámez (2017) on the geographically diversified sample indicated the same effect of disclosure on the cost of equity, however in this case the source of non-financial information was the integrated report. The only paper indicating an adverse

(positive) link between non-financial disclosure and the cost of equity was the study by Botosan and Plumlee (2002) on the sample of US-listed firms. Authors argue that this phenomenon may be explained in a sense that a higher level of disclosure attracts occasional investors, hence leading to greater volatility and consequently a higher cost of equity.

Regarding the second path (IC disclosure and the cost of equity), we found a plethora of studies confirming a negative association. Mangena, Li and Tauringana (2014) proved that IC reporting has a greater impact on lowering the cost of equity than financial disclosure. Their results demonstrated also the importance of disaggregating disclosure into IC and financial information in understanding the disclosure–cost of capital relationship. The study by Orens, Aerts and Cormie (2009) on the sample of Western European firms indicated that greater IC reporting leads to a lower cost of equity, similar to the findings by Barus and Siregar (2015). However, according to Kristandl and Bontis (2007), there is a negative link, but only in the case of forward-oriented IC information. Interestingly, historical IC data appeared to increase the cost of equity. Gietzman and Ireland (2005) observed also a negative relationship but only when accounting policies are more aggressive.

As indicated in the conceptual framework of this study, the IC data may be captured with the help of a variety of sources, one of them are CSR/ESG reports. With the help of these reports, Dhaliwal, Li, Tsang and Yang (2011) observed that disclosing IC in the form of CSR reports benefits US-listed firms with a lower cost of equity. Similarly, Ng and Rezaee (2015) confirm the negative association of ESG reporting performance with the cost of equity. In addition, two recent studies (a sample of German and Forbes 2000 firms) by Cuadrado-Ballesteros, Garcia-Sanchez and Martinez-Ferrero (2016) and Michaels and Grüning (2017) not only linked better IC disclosure with the lower cost of equity but also with the lower information asymmetry, which is a vital factor for cost of capital, as the theory suggests. There was only one paper identified (Boujelbene and Affes, 2013) on French listed firms that found the IC disclosure irrelevant in terms of cost of equity impact.

In addition, Weber (2018) highlights the necessity of the disclosed information credibility in terms of cost of equity impact. She states that firms that declare a high disclosure level do not obtain a significant cost of equity benefit compared to firms that declare a lower disclosure level. However, what is highly important nowadays, when the regulators, preparers and investors discuss the materiality and verifiability of the information presented by the companies, is, she underlines, that among GRI reporting firms with poor CSR performance, those entities that declare a high disclosure level have a significantly higher cost of equity capital than those declaring a lower disclosure level. This result is consistent with investors imposing a penalty on firms suspected of greenwash, and provides new insight into the consequences of disclosure levels when disclosures lack ex-post verifiability (Weber, 2018). Weber finds also that suspected greenwash firms have a higher cost of equity capital than firms that are not suspected of greenwash. Moreover, greenwash firms obtain the largest cost of equity capital benefit associated with external assurance.

The third path, which analyses the influence of certain IC categories and sub-categories indicates that not all IC dimensions perform an impact on the cost of equity. Boujelbene and Affes (2013) argue that only human and structural capital reporting leads to a lower cost of equity. The study by Francis, Nanda and Olsson (2008) indicates only three IC data as significant in terms of lowering the cost of equity. These are number of employees, average compensation per employee and market share. Among CSR reporting Ng and Rezaee (2015) refer to environmental and governance sustainability pillars as those important in lowering the cost of equity. Similarly, El Ghouli, Guedhami, Kwok and Mishra (2011) indicate that the only IC sub-categories that affect the cost of equity are employee relations and product characteristics. All other attributes exhibit little or no significant impact on firms' cost of equity. The study by La Rosa and Liberatore (2014) on Western European firms did not find any influence of disclosure of specific IC sub-category (R&D expenses) on the cost of equity. Surprisingly, a study by Richardson and Welker (2001) on Canadian firms found a positive link between social reporting and the cost of equity. However, this relation proved to be mitigated among firms with better financial performance.

#### *4.1.3 The IC disclosure impact on the cost of debt*

A recent study by Suto and Takehara (2017) on Japanese firms showed that non-financial disclosure leads to more flexible external financing and hence lowers the cost of debt (path 1). Concerning the impact of IC data reporting on the cost of debt (path 2), we may conclude from these two studies that IC disclosure plays an auxiliary role in evaluating the firms' cost of debt. Alwert, Bornemann and Will (2009) proved that investors who are given additional data in the form of the intellectual capital reports provide more homogeneous



ratings. In turn, Iazzolino, Migliano and Gregorace (2015) on the sample of Italian firms indicated a supportive role of IC data, in a sense that the integration of IC and financial data improves evaluation of credit risk. Relatively more studies were carried out on the topic of IC categories and sub-categories impact on the cost of debt (for the third path). In these cases data on IC, mainly referring to the firms' CSR activities, were collected either from KLD Stats database or Asset4 ESG dataset. Attig, El Ghouli, Guedhami and Suh (2013) found a wide array of disclosure of IC related data that improves firms' credit rating, hence decreasing cost of debt. These IC sub-categories were: employee relations, diversity issues, product issues, community relations and environmental issues. The only IC items that in the studied sample of US firms did not perform a significant positive influence on firm credit rating were human rights disclosure. Comparatively similar results on the relatively similar sample were gathered by Ge and Liu (2015) who stated that the S&P bond rating is greatly improved by information on: community, product, employee relations and corporate governance. A broad study on firms from 49 countries was performed by Cheng, Ioannou and Serafeim (2014) who indicated that, in contrary to previous studies, only social disclosure is negatively and significantly related to capital constraints. This phenomenon was confirmed by Goss and Roberts (2011) who observed that social reporting leads to lower loan spread over LIBOR on private bank debt. Firms with the worst social responsibility disclosure scores pay up to 20 basis points more than the most responsible ones. An interesting study was performed by Givoly and Shi (2007) who analyzed that capitalization of expensing of software development costs (structural capital) decreases the cost of issuing new equity. On the sample of US software IPOs, the authors found that capitalization of software development costs leads to lower information uncertainty among investors and thus decreases firms' cost of capital. The only study that did not prove any impact of IC disclosure on cost of debt was the one performed by Barus and Siregar (2015) on the sample of Indonesian technology-intensive listed firms.

#### 4.1.4 *Methodology applied in the analyzed studies*

Detailed analysis of the information in the table shows that data for the measurement of the IC disclosure level is derived usually from the CSR/ESG reports (e.g. Cuadrado-Ballesteros, Garcia-Sanchez and Martinez-Ferrero, 2016; Suto and Takehara, 2017; Michaels and Grüning, 2017; Weber, 2018) and annual reports (e.g. Mangena, Li and Tauringana, 2014; Kristandl and Bontis, 2007), followed by corporate websites disclosure (e.g. Boujelbene and Affes, 2013, Orens, et al., 2010). There are also some researchers that used different sources of IC disclosure, e.g. IPO prospectuses (Singh and Van der Zahn, 2007), AIMR reports (Botosan and Plumlee, 2002), 10-K Filings (Francis, et al., 2008) and Integrated reports (García-Sánchez and Noguera-Gámez, 2017). Some studies analyze only selected elements of IC and their impact on the cost of capital, e.g. R&D that is researched by Givoly and Shi (2007) as well as by La Rosa and Liberatore (2014). Boujelbene and Affes (2013) measure the level of disclosure for each firm calculating an index that is created by dividing the sum of disclosures by the total number of items scored. Orens, et al. (2010) base the measurement of the non-financial disclosure items on the balanced scorecard approach. They examine voluntary web placement of non-financial disclosures using an information index covering a firm's value creation process. The disclosure index was also applied in the study of Mangena, et al. (2014). With regard to the cost of equity and cost of debt operationalization their measurement approaches are varied, however they usually followed one of the generally accepted ways described in the subject literature. Some of the studies apply the mix of methods (Orens, et al., 2010). Mangena, Pike and Li (2010), La Rosa and Liberatore (2011), Michaels and Grüning (2017) as well as García-Sánchez (2017) use the PEG model for cost of equity measurement, whereas Boujelbene and Affes (2013) use CAPM model. Richardson and Welker (2001) apply the cost of equity capital calculated following accounting-based valuation model developed in Edwards and Bell (1961), Feltham and Ohlson (1995) and Ohlson (1995). Cost of debt was measured mostly with the help of credit rating scores.#

To sum up, with reference to the conceptual framework of this analysis that appeals to the patterns of IC data reporting, we identified that the CSR/ESG reports (43%) and annual reports (39%) were the most often utilized reporting approaches, followed by corporate websites disclosures (15%). The relatively low proportion of annual reports is contradictory to the findings by Dumay and Cai (2015) who indicated that 79% of the studies on IC employed annual reports as one or solely one source of data. A minority of the studies (4%) used integrated reports, IPO prospectuses, and reports dedicated solely to the IC. The lack of standalone IC reports stays in line with Dumay (2016). None of the papers adopted social media as tools of potential IC data.

## 5. Conclusions

In this paper, we performed the literature review of empirical studies referring to the link between disclosure of IC and the firms' cost of capital. The majority of papers (63%) focused on the impact of non-financial

information disclosure and the cost of equity. Within the research conducted it may be observed that the hybridization of reporting relating to financial and non-financial data contributes to the lower cost of capital. With regard to the first research question, it may be concluded that the results of the empirical analysis presented in the literature generally confirm a negative relation between the non-financial information disclosure and the cost of equity. IC data disclosure also improves credit rating and thus lowers the cost of debt. Referring to the second research question it may be observed that in terms of IC sub-categories, disclosure of human capital items performs the strongest impact on decreasing the cost of equity. Concerning the third research question we observed standard operationalization schemes of IC (various content analysis frameworks), cost of equity (PEG, CAPM model) and cost of debt (credit rating, loan spread). Our study shows that non-financial information concerning intellectual capital, impacts and lowers the cost of capital of companies. The results of this research may therefore be useful for the scientific debate concerning the impact of the disclosure of intangibles on the cost of capital that is of great interest to both academia and practitioners. The results can also stimulate the scientific discussion concerning the usefulness of IC disclosure. The EU's Non-Financial Reporting Directive (Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014) and the FRC's proposed amendments to the Guidance on the Strategic Report (FRC, 2018) highlights encouraging business to consider the impact of their activities on stakeholders and the factors that contribute to the success of the company over the longer term (Pilot, 2017) and to broaden the scope of information published. The results of this paper may have a practical implementation and work as an argument and support for these initiatives, as they are proof of the usefulness of the non-financial disclosure.

The conclusions here presented are drawn exclusively on the bases of the empirical studies researched in the articles, which may be understood as a limitation. Similarly, another identified limitation could be the lack of empirical studies considering the time lag between the reported IC and cost of capital – this type of research was absent in the researched sample of articles analyzed in this study. It is also important to consider that the findings presented in the analysed papers must be interpreted in the context of another limitation; both cost of capital and levels of IC disclosure are difficult to measure. Finally, apart from the study by Givoly and Shi (2007) and La Rosa and Liberatore (2014) no other studies focused on the impact of particular elements of IC disclosure (e. g. remuneration of the board, patents portfolio or R&D reports) on the cost of capital, that may be treated as a new challenging direction for a potential area of future research. Additionally, in today's world, companies are looking for the appropriate methods of information disclosure and the suitable reporting ways and methods. The use of online communication channels such as websites, newsletters, discussion forums, and social media for communicating with stakeholders has exploded over the last decades. However, the studies analysed in this paper concentrated mostly on the use of traditional reporting tools, such as: annual reports and CSR/ESG reports that may also be treated as a limitation of this paper. The extension of research to new forms of non-financial disclosure by companies may be a direction for future research.

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