Intellectual Capital Management and Information Risk

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Abstract The value relevance of intellectual capital (IC) disclosure has been vastly investigated in different countries and settings. Prior studies investigate the effect that IC has on different organisational performance dimensions. In particular some scholars found that IC information is able to provide valuable information for issuing positive recommendations on listed companies. However, to date the literature lacks in providing evidence of the effect of IC management on a company's information risk, defined as the analyst's recommendations to buy, hold or sell stocks. The aim of this research is thus to analyse the effect that IC performance may have on the information risk, measured as the way in which the market is informed about the firm performance. To test our main research question, we ran panel data regressions applied to a sample of 3027 US listed companies, which disclosed IC information on a stand-alone social or IC statement over the period 2008–2012. Empirical results may be of interest for both academics and practitioners, since it allows to reduce a gap in the literature about the contribution of the IC performance on firms' reputation and to give support to managers to properly understand the potential of both beneficial and unintended effects of such voluntary disclosure.

Keywords Intellectual capital • Voluntary disclosure • Information risk • American firms • Panel data

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K. Corsi et al. (eds.), *Reshaping Accounting and Management Control Systems*,
Lecture Notes in Information Systems and Organisation 20,
DOI 10.1007/978-3-319-49538-5_20

1 Introduction

The value relevance of intellectual capital (IC) disclosure has been vastly investigated in different countries and settings [1–4]. In this framework, prior studies investigate the effect that IC has on different organisational performance dimensions. In particular some scholars found that IC information is able to provide valuable information for issuing positive recommendations on listed companies [5]. However, to date, the literature lacks in providing evidence of the effect of IC management on a company's information risk, defined as the analyst's recommendations to buy, hold or sell stocks.

Based on the previous considerations, we attempt to answer the main research question, "Does IC management impact on a company's information risk?", by testing whether the IC management reflects into a company's information risk. To answer the main research question, we used a "cross-sectional dominant" pooled OLS regression model on a sample of 3027 US listed firms that issued stand-alone social and IC statements over the period 2008–2012.

Empirical results may be of interest for both academics and practitioners, since they allow to reduce the gap in the literature about the contribution of the IC performance on firms' reputation and to give support to managers to properly understand the potential both beneficial and unintended effects of such voluntary disclosure.

The remainder of the paper is organised as follows. The second and the third sections will provide a review of the literature and the theoretical development of the conceptual framework. The fourth section will discuss sample selection and data collection. The fifth section will present the statistical model. The sixth section will analyse results from the sample. A discussion of empirical findings and concluding remarks are outlined in the final section.

2 Literature Analysis

2.1 Information Risk and Asset Pricing

Asset pricing literature stresses the role of information risk in setting an asset price [6]. In an equilibrium-state market, indeed, individuals have common beliefs and an asset price should be insensitive of information other than these beliefs. Nonetheless, differential information issued through public or private channels may affect stock market prices.

Information risk, indeed, refers to private or public information, which can affect asset prices. It is usually defined as the analyst's recommendations to buy, hold or sell stocks [5]. Other scholars investigated the information risk, by taking into account the financial analysts' report, such as [7, 8] In particular, they examined, through a content-analysis approach, sell-side analyst company report, by finding interesting considerations about the role of the narrative section of the annual report

on the investment recommendation by analysts. Furthermore, other scholars carried out a survey to financial analysts in order to analyse priority measures in their reports [9, 10].

2.2 Intellectual Capital

Amongst the very different definitions of IC reported into the literature [11–13], this study adapts the broad definition by Hsu and Fang [14] and defines IC as the dynamic set of knowledge, capabilities, networks, operation processes and individual and organisational relations that contribute to creating a company's long-lasting value. Such a definition encompasses most of the characteristics that prior definitions put forward in that it is grounded on the most widespread classification of IC components, which categorises three types of IC: human competencies, "the knowledge embedded in people"; structural or organisational capital, "the knowledge embedded in the organisation and its systems"; and relational capital, "the knowledge embedded in customers and other relationships external to the organisation" [4, 15, p. 70]. Furthermore, it accounts also for capabilities [11, 16, 17] and organisational relations as part of the firm's IC.

The IC literature increased significantly over the last three decades and addressed some new knowledge into the managerial [18, 19], accounting [15, 20–22], leadership [23] and organisational literature [24]. The increasing interest in this topic is related to the positive effect that IC has on different organisational performance dimensions, amongst which organisational learning and new product development [14], incremental and innovative capabilities [19] and the orchestration and configuration effects of top executives' capabilities [25] are some of the most cited ones. Although prior studies could not achieve a consensus on a shared IC theoretical framework yet [4], the concept of IC states that knowledge management is at the core of competitive advantage.

2.3 Information Risk and IC Management

Since mandatory financial information is getting less relevant in the decision issued by financial analysts regarding a company's recommendation consensus, more and more voluntary and non-financial information provides support to this decision [26–28]. In particular, some scholars, by using a survey of Belgian financial analysts, found that firms which disclose more forward-looking information and more internal-structure information have more accurate forecasts by financial analysts [29]. Amongst non-financial voluntary information, IC information has been found to provide valuable information for issuing positive recommendations on listed companies [5, 30] As a matter of fact, [30] found that financial analysts are more willing to consider good news, such as an increase in the costumer satisfactions for their firm's forecast than bad news. García-Meca and Martínez [5], through a

sample of listed Spanish companies, demonstrated that financial analysts usually convey some kinds of IC information in their recommendations, such as information regarding a firm's strategy, customers and processes. However, the extant literature on the relationship between intellectual capital and information risk focuses primarily on the quantity and quality of the voluntary information disclosed by firms [1, 2, 5] without investigating whether IC management would affect financial analysts' recommendation. Thus, in this paper we attempt to empirically test whether the IC management reflects into a company's information risk, which can be stated into the following main research question: Does IC management impact on a company's information risk?

3 Hypothesis Development

In order to reply to our main research question, Does IC management impact on a company's information risk?, we grounded our theoretical development on both the general asset pricing theory [31, 32] and the resource-based view of the firm [33, 34]. Indeed, since firms seek to survive over time, they have to build a sustainable competitive advantage based upon a financially viable positioning in the capital market. IC literature found that the management of intangible assets, other than those considered by the international accounting standards, contributes to the development of a sound strategy [5] and a long-run competitive advantage [18, 22, 35].

However, the value of non-conventional intangible assets is neither easily accessible to financial investors nor always professionally audited. Thus, financial investors have both to look for such kind of information through more expensive systems, than the publicly audited financial information, and to check the extent to which this information is reliable in making their investment decisions. Therefore, there is a lack of correlation between the firm's capability to generate future earnings and its financial risk, as represented by capital markets. The value relevance of intellectual capital disclosure has been vastly investigated in different countries and settings [1–4]. However, to date the literature lacks in providing evidence of the effect of IC management and a company's information risk. Empirical evidence of that could support more efficient capital market decisions. On the other hand, IC management could become less trivial and more focused on those components and items, which are supposed to provide better recommendations [5]. Some studies investigate the quality and amount of IC information reported on analysts' recommendation report and found that analysts are more willing to use IC information in their "buy" rather than "sell" recommendations.

When checking for the effect of each IC component on the overall report issued by analysts, human capital information fell short in providing valuable insights to financial analysts. This result could be due to the fact that employees' capabilities are not firm owned [36]. However, other streams of literature suggest that more experienced and well-trained personnel drive higher organisational performance, thus reducing the firm's information risk [37, 38]. Moreover, lower levels of turnover of employees allow the personnel competences to increase over time

and generate productivity improvements, which result in higher organisational performance. Human capital management has also been found to support the implementation of a company's strategy, when it is performed at the average. Indeed, an early investment in human capital is not able to offset the costs for it [39]. Financial analysts might take this information into account when issuing their recommendation report. Therefore, we would like to test the following hypothesis.

HP1. Higher human capital performance positively affects a company's information risk.

Structural capital performance has to do with the company hard and soft infrastructure supporting the firm's core business. Effectiveness and degree of access to the networks, information technology systems, production system, safety procedures and so forth are all examples of organisational capital items. Prior literature found that when such systems are in place, organisational performance improves too [40]. Quality systems, such as Six Sigma, and safety systems, such as those aimed at reducing the lost time for injury rate, have also been found to improve organisational performance [41, 42]. Moreover, costs linked to innovation activities, which are aimed at enhancing the structural capital contributes to the quality and productivity levels displayed by the company [43]. Structural capital has also been found to contribute to a determinant of a firm's information risk, i.e. management accounting practices [44]. For instance, prior literature found that traditional capital budgeting practices are strongly related to structural capital management. Indeed, companies showing a strong budget emphasis should put in place suitable structural assets to support managerial activity. This, in turn, leads to the development of reliable private and public information, thus reducing information risk. Therefore, financial analysts that are aware of the company's performance related to such kind of capital might well reduce the information asymmetry between the company and the capital market by issuing a more favourable recommendation on the company under investigation. We are therefore testing the following hypothesis.

HP2. Higher structural capital performance positively affects a company's information risk.

Relational capital component oversees the relationship between the company and its customers as well as other external stakeholders. It also includes corporate reputation [45]. Prior literature found that profitable and loyal customers are supposed to generate sustainable revenues in the long term [46, 47]. However, these relationships are not easily captured and valued by traditional financial reporting frameworks [48]. Thus, investors might take misleading investment decisions, whether they are not able to gauge the relevance of such intellectual assets. Analysts might reduce the asymmetry between the company and the financial market by issuing a recommendation, which reports such information also.

HP3. Higher relational capital performance positively affects a company's information risk.

4 Sample Selection and Data Collection

We selected all the US industrial listed firms from ESG Asset4 database (Thomson Reuters Datastream). We excluded financial institutions, as they have particular features and they need a separate treatment. We identified 3027 US listed firms that issued stand-alone social and intellectual capital statements.

According to the literature, the information risk is measured by a proxy, which is the analyst stock recommendations. A higher value issued by analysts indicates a higher information risk [5].

To measure the quality of IC management, we first reviewed the literature on IC [3] and identified eight items, which refer to performance of three components—relational capital, human capital and structural capital—of IC. Data on the eight items was gathered from Thomson Reuters Datastream, which provides the item value on a scale from 0 to 100.

For the IC management, we identified, according to some scholars, the following items: average training, client loyalty, turnover of employees, training hours total, Six Sigma and quality management systems, lost time for injury rate, score performance and internal promotion [3].

For each component of IC, the following items were included:

- Relational capital (RC): Client loyalty
- Human capital (HC): Average training, turnover of employees and training hours total
- Structural capital (SC): Internal promotion, lost time for injury rate, Six Sigma and quality management systems and score performance/cost innovations

As control variables and to test the firm's complexity, we used total inventories, total receivables and total assets.

Our sample time period goes from 2008 to 2012, ending up with 15,135 observations for each variable ($N = 181{,}620$).

5 Statistical Model

Table 1 shows some descriptive statistics of our research variables; correlation matrix and Pearson index in order to check for the presence of multicollinearity are presented in Table 2. Correlation matrix entries allow us to reject the hypothesis of the presence of multicollinearity.

In order to test our research hypotheses, we used a "cross-sectional dominant" pooled OLS regression model [49]. The linear model, based on panel data analysis, is drawn as follows:

$$Y_{it} = \beta_0 + \beta_1(X1_{it}) + \beta_2(X2_{it}) + \ldots + \beta_n(Xn_{it}) + \varepsilon_{it}$$

Table 1 Descriptive statistics of the research variables ($N = 181{,}620$)

Variable	Min	Max	Mean	Standard deviation
Information risk	1	5	2.45	0.56
Average training	0.06	297	34.99	13.01
Client loyalty	38.61	100	44.37	14.71
Turnover of employees	0.00	84.52	11.49	3.99
Training hours total	138.50	3.6240e + 07	1.2767e + 06	1.1138e + 06
Six Sigma and quality management systems	−1	1	−0.65	0.66
Lost time for injury rate	0.00	67	4.14	2.64
Score performance/cost innovations	0.06	63.21	56.91	15.65
Internal promotion	−1	1	−0.17	0.85
Total assets	645	6.3165e + 11	2.4026e + 09	1.9426e + 10
Inventory	−9.54	2.8106e + 10	9.7180e + 07	6.9707e + 08
Receivables	0.00	4.6291e + 10	1.5777e + 08	1.0463e + 09

where $i = 1,\ldots, 3027$ for each firm in the panel data and $t = 2008, \ldots, 2012$ refers to the sample time period.

The dependent variable (y) is the information risk, whereas the independent variables are average training, client loyalty, turnover of employees, training hours total, Six Sigma and quality management systems, lost time for injury rate, score performance and internal promotion, which together measure the performance of IC.

In order to reduce data heterogeneity, which could affect analysis results, before running the pooled data analysis, each variable has been normalised.

6 Empirical Findings

The results of the pooled regression analysis for the whole set of firms are reported in Table 3.

Empirical findings show that if the average training, the training hours total and the Six Sigma and quality management systems increase, the information risk that analysts perceive decreases and vice versa.

Furthermore, results highlight that, if the client loyalty, the score performance and the internal promotion increase, the information risk measured through the recommendation consensus increases and vice versa.

Nothing can be said about the relationship between information risk and (1) turnover of employees and (2) lost time for injury rate.

Table 2 Correlation matrix and Pearson index

	IR	CL	IP	SS	AT	TE	TH	CI	LTI
Information risk (IR)	1								
Client loyalty (CL)	0.019* 0.018	1							
Internal promotion (IP)	0.041** 0.000	0.159** 0.000	1						
Six Sigma (SS)	−0.013 0.122	0.047** 0.000	0.146** 1.721E-72	1					
Average training (AT)	−0.048** 0.000	0.095** 0.000	0.000 0.624	0.070** 0.000	1				
Turnover of employees (TE)	−0.002 0.838	0.004 0.633	0.058** 8.7823E-13	−0.017* 0.039	−0.090** 0.000	1			
Training hours (TH)	−0.043** 0.000	0.017* 0.031	0.037** 4.3071E-06	0.051** 0.000	0.342** 0.000	0.028** 0.001	1		
Cost innovations (CI)	0.044** 0.000	0.060** 0.000	0.156** 7.7785E-83	0.079** 0.000	−0.018* 0.027	0.003 0.756	−0.005 0.508	1	
Lost time injury (LTI)	0.003 0.717	0.004 0.582	0.037** 4.3254E-06	−0.017* 0.033	−0.075** 0.000	0.002 0.814	0.004 0.619	0.013 0.120	1

The first entry of each cell shows the Pearson index, and the last entry shows the sign (two tailed)
*Correlation is significant at 0.05 (two tails)
**Correlation is significant at 0.01 (two tails)

Table 3 Results of the pooled OLS regression analysis (information risk is the dependent variable)

	β	P value	Standard error
Average training	−0.074	0.001***	0.022
Client loyalty	0.014	0.027**	0.006
Turnover of employees	−0.216	0.263	0.019
Training hours total	−0.106	0.001***	0.031
Six Sigma and quality management systems	−0.005	0.069*	0.003
Lost time for injury rate	−0.008	0.731	0.023
Score performance/cost innovations	0.017	0.000***	0.004
Internal promotion	0.009	0.000***	0.002
Total assets	−0.151	0.000***	0.031
Inventory	−0.035	0.485	0.050
Receivables	−0.200	0.000***	0.056

$R^2 = 1.18\,\%$

*, ** and *** indicate a significance degree between 0.10 and 0.05, between 0.05 and 0.01 and between 0.01 and 0, respectively

Therefore, the HP1 (higher human capital performance positively affects a company's information risk) is partially supported since both the average training and the training hours total affect the management of the IC.

The HP2 (higher structural capital performance positively affects a company's information risk) is partially confirmed since the Six Sigma and quality management systems increase and the information risk decreases. However, internal promotions and cost innovations move both in the opposite direction that we predicted. Even if they deserve further investigation, the sign of cost of innovations could be interpreted as a proxy of projects' riskiness; therefore, they could be recognised as intangible assets and increase, for this reason, the corporate risk.

Finally, the HP3 (higher relational capital performance positively affects a company's information risk) is not supported, even if the relationship is statistically significant (the sign is positive, therefore opposite to our expectations).

Amongst control variables, total assets and receivables are statistically significant (β are both negative); therefore, if total assets and receivables increase, the information risk decreases and vice versa.

7 Conclusions

Empirical results carried out in the US sample allow us to reply to our main research question: "How does IC management impact on a company's information risk?" As a matter of fact, the extant literature on the relationship between IC and information risk focuses primarily on the quantity and quality of the voluntary information disclosed by firms [1, 2, 5] without investigating whether IC management would

affect financial analysts' recommendation. Therefore, performing a pooled OLS, we try to fill the literature gap, by testing whether the IC management reflects into a company's information risk.

In particular, we found that higher human capital performance positively affects information risk of a company, since the IC performance related to average training and the training hours total positively affect the information risk. These results confirmed previous literature about this topic [36]. This is because lower levels of turnover of employees and higher training hours allow the personnel competences to increase over time and generate productivity improvements, which result in higher organisational performance.

Surprisingly, the relationship between relational capital performance and information risk shows an opposite sign with respect to the predicted one.

Furthermore, we found that higher levels of one component of the structural capital performance positively affect company's information risk; as a matter of fact, the Six Sigma and quality management systems increases; and the information risk decreases. However, internal promotions and cost innovations move both in the opposite direction that we predicted. Even if they deserve further investigation, the sign of cost of innovations could be interpreted as a proxy of projects' riskiness; therefore, they could be recognised as intangible assets, thereby increasing the corporate risk. These particular results open interesting avenues of research.

Empirical results may be of interest to both academics and practitioners, since they allow to reduce the gap in the literature about the contribution of the IC performance on firms' reputation and to give support to managers to properly understand the potential both beneficial and unintended effects of such voluntary disclosure.

This study is not without its limitations. First, the study sample is cross-sectional so our analysis lacks any industry-specific focus or comparison between different industries. As for control variables, we have controlled complexity with the amount of accruals only, without taking into account merger and acquisitions, the number of foreign subsidiaries and markets served, etc. Furthermore, the sample is large but the research is focused only on the US market; thereby, it could be interesting to extend the analysis to other countries and propose comparisons amongst them.

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