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The impact of intellectual capital on firms' financial performance and market value: Empirical evidence from Italian listed firms

William Forte, Gaetano Matonti and Giuseppe Nicolò*

Management and Innovation Systems Department, University of Salerno, 132, Giovanni Paolo II Street, 84084 Fisciano (SA), Italy.

The purpose of this paper is to extend the understanding of Intellectual Capital (IC) in the context of Italian listed firms. In this study, the Valued Added Intellectual Coefficient (VAIC) is employed as a measure of IC to investigate the relationship between IC, firms' financial performance and market value. The empirical investigation is developed by using data drawn from a sample of 135 Italian listed companies for the period from 2008 to 2017 and performing different Ordinary Least Squares (OLS) regression models. The findings suggest that, when taken in its aggregated form, IC exerts a positive impact on firms' financial performance measured as firms' profitability and growth in revenues as well as on market value. However, when considering its components, only Human Capital efficiency shows a positive effect on firms' financial performance while Structural Capital efficiency and Capital Employed efficiency exhibit a negative effect. Astonishingly, each of the individual IC components negatively influences firms' market value.

Key words: Intellectual capital, intangible assets, valued added intellectual coefficient (VAIC), Italian listed firms, market value, financial performance.

INTRODUCTION

In last decades, the development of new technologies and scientific innovations coupled with the rise of globalization and the changes in consumer purchasing processes has driven the transition from the old industrial economy to the new knowledge-based economy in which intangible assets have gradually replaced physical assets in firms' management and productive systems (Lev et al., 2005; Ahangar, 2011; Zou and Huan, 2011).

In this scenario, the importance of Intellectual Capital (IC) as a knowledge-based capital composed of a set of intangible resources mainly related to the employee

know-how and skills, competencies, information systems, databases, patents, brands and customer relationships, emerged (Ahangar, 2011; Ahmadi et al., 2012). Indeed, within this new economic context, IC resources are considered as fundamental drivers for firms' value creation process and key determinants of corporate sustainable competitive advantage, growth opportunities and market value (Ahmadi et al., 2012; Bhasin, 2012; Pentilde et al., 2012; Sardo and Serrasqueiro, 2018).

Scholars recognise that the term "intangible assets" and "intellectual capital" can be considered as

*Corresponding author. E-mail: gnicolo@unisa.it. Tel: 089-963150.

synonymous (Bhasin, 2012; Pentilde et al., 2012; Goebel, 2015). However, Pentilde et al. (2012) clarify that, while the term intangible assets are generally employed in the field of accounting, the concept of IC is more frequently used in the human resources research field.

By considering its relevance, the correct identification, management, and measurement of IC have become essential to improve the strategy planning, formulation and assessment as well as the usefulness of information provided to investors (Bhasin, 2012; Pentilde et al., 2012; Dumay, 2016; Sardo and Serrasqueiro, 2018). Nevertheless, due to the overly-conservative approach of standard setters, traditional accounting reports fail in providing adequate representation of intangible assets on the balance sheet, thereby giving rise to an absence of the necessary data (Bhasin, 2012; Lev et al., 2005; Sardo and Serrasqueiro, 2018). As a response, in recent years, practitioners and scholars have started to develop several models to visualise, measure and manage IC (Maditinos et al., 2011; Sardo and Serrasqueiro, 2018).

Correspondingly, the Valued Added Intellectual Coefficient (VAIC) is one of the most popular employed models in the IC research field due to the objectivity and reliability of the data on which it is based and its ease of use (Chen et al., 2005; Dženopoljac et al., 2016; Smriti and Das, 2018). VAIC is not intended to provide a direct measure of IC, instead it has been developed to measure the efficiency of both tangible (capital employed) and intangible (human and structural capital) assets in the creation of firms' value added (Chen et al., 2005; Maditinos et al., 2011). Moreover, it has been widely used to investigate the relationship between IC, firms' performance and market value (Ahangar, 2011; Chen et al., 2005; Rehman et al., 2011; Smriti and Das, 2018).

Accordingly, the VAIC constitutes the basis of empirical analysis of the present work. This study embraces the lens of the resource-based view (RBV) theory of the firm which considers the IC resources such as skills, capabilities, know-how and experiences as firms' strategic assets capable to ensure a sustainable competitive advantage and superior financial performance through appropriate management and development processes (Gan and Saleh, 2008; Ahangar, 2011; Smriti and Das, 2018). Based on RBV theory, previous scholars have empirically investigated the relationship between IC measured as VAIC, firms' performance and market value in different geographical and political contexts (Chen et al., 2005; Ahangar, 2011; Rehman et al., 2011; Maditinos et al., 2011; Dzenopoljac et al., 2016; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018). However, the mixed results obtained in previous studies, constitute the primary motivation of the present research which aims at contributing to the current literature by extending the understanding of IC in the context of Italian listed firms.

More specifically, the present study applies the VAIC model to conduct a longitudinal study on the relationship between IC, firms' financial performance and market value. The methodology for the measurement of IC is based on well-established previous research (Ahangar, 2011; Rehman et al., 2011; Dženopoljac et al., 2016; Cenciarelli et al., 2018; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018). The empirical investigation is performed using data drawn from a sample of 135 Italian listed companies for the period between 2008 and 2017. The statistical analysis is based on different OLS regression models with control for year and industry sectors.

This paper contributes to the literature as follows: firstly, it extends the efforts made by previous scholars to develop an adequate IC measurement model by empirically testing the VAIC in the context of Italian listed firms.

Secondly, in the light of the RBV theory, it investigates the relationship between IC, its components, firm' financial performance and market value providing empirical evidence supporting the role of IC as a generator of higher performance concerning profitability, growth in revenues and market value.

The remainder of this paper is structured as follows: the literature review which is related to IC definition and previous research on VAIC. Then, the hypothesis development is presented. Subsequently describe both the sample selection and research method. The last two sections the main discussion of analysis along with the conclusion.

LITERATURE REVIEW

IC definition and its components

Brooking (1996: 12) defined IC as "the combined intangible assets of the market, intellectual property, human-centred and infrastructure which enable the company to function". According to Edvinsson and Malone (1997: 44), IC refers to "the possession of knowledge, applied experience, organizational technology, customer relationships and professional skills that provide the firm with a competitive edge in the market". Further, Maditinos et al. (2011: 134) argue that IC can be traced back to those "hidden assets" which although not recognised in financial statements leads organisations to obtain a competitive advantage.

According to the majority of IC scholars, it can be decomposed into three main categories: human capital, structural capital, and relational capital (Sardo and Serrasqueiro, 2018; Smriti and Das, 2018).

Human capital refers to the sum of skills, competencies, capabilities, creativity, know-how and experiences developed by employees and that they take with them when they leave the company. Structural capital delineates the basic structure of a company which supports employees in achieving performance and managers in maintaining profitable relationships with key

external stakeholders. It encompasses strategic resources such as culture, routines, databases, processes, patents, copyrights and trademarks, representing the knowledge which remains within the company at the end of the working day. Relational capital includes all the assets and resources involved in developing and managing of relationships among the organization and the external entities, including formal business collaborations and all other informal relationships with stakeholders such as customers, suppliers, banks, and non-profit organizations (Ahmadi et al., 2012; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018).

Most of IC scholars converge on the concept of IC as an invisible source of competitive advantage and superior financial and market performance (Chen et al., 2005; Maditinos et al., 2011; Dženopoljac et al., 2016; Zhang, 2017).

The relevance of IC in the firms' value creation process can be discussed within the RBV theory framework (Gan and Saleh, 2008; Ahangar, 2011; Smriti and Das, 2018). According to this theory, IC resources such as skills, competencies, know-how and experiences can be considered as strategic resources which, being rare, firm-specific and hard-to-imitate, constitute the main drivers of firms' competitive advantage and superior financial performance (Ahangar, 2011; Zéghal and Maaloul, 2010). As such, the efficient development, management and measurement of IC components within firms has gained momentum (Chen et al., 2005; Ahangar, 2011; Zéghal and Maaloul, 2010; Sardo and Serrasqueiro, 2018).

However, in spite of the importance of IC, its management is made difficult by the lack of suitable tools for its identification and measurement (Sardo and Serrasqueiro, 2018). Indeed, current financial reporting systems fail in providing an adequate representation of intangible assets due to the overly-conservative standpoint of standard setters which does not allow for the recognition of most of the IC components or provide a description that only partially reflects their real economic value (Lev et al., 2005; Maditinos et al., 2011; Sardo and Serrasqueiro, 2018). As a response, in recent years, practitioners and scholars have started to develop several models to measure and adequately manage IC and its components (Maditinos et al., 2011; Pentilde et al., 2012). One of the most general methods employed to measure IC is the VAIC developed by Ante Pulic (Pulic, 1998; Chen et al., 2005; Sardo and Serrasqueiro, 2018). It provides a measure of the efficiency of three corporate inputs, that are, Capital Employed, Human Capital and Structural Capital in the value creation process (Chen et al., 2005; Maditinos et al., 2011). A high VAIC value signals good exploitation of the firm's value creation potential through the use of Intellectual, Financial and Physical Capital (Maditinos et al., 2011).

VAIC can be included within the realm of IC measurement methods, not only because of its denomination (Intellectual coefficient) and in spite of its apparent contradiction to consider Physical Capital and IC on the same footing. Indeed, since its introduction, it has been clear that the term physical was not conceived as a counterpart of intangible or immaterial but, instead, as a counterpart of the intellectual potential which was measured, in monetary terms, by employee's salaries (Pulic, 1998). In Pulic's original vision, intellectual ability indicated, in a knowledge-based economy, "how successfully value added was created (…) with a given amount of physical and IC" (Pulic, 1998: 8). In other words, value added is the result of the appropriate combination of (highly specialized) labor and capital, made possible by the right mix of monetary investments, usually reported in two separate parts of financial statements (capital, as net assets, on the balance sheet and labor, as labor expenses, on the income statement) (Pulic, 1998).

Prior research on VAIC

Several scholars have employed VAIC to analyse the impact of IC on the different facets of firms' performance such as profitability, productivity, market value and sales growth (Chen et al., 2005; Maditinos et al., 2011; Smriti and Das, 2018).

Firer and Williams (2003) investigated a sample of 75 South African public traded companies by analysing the relationship between IC, firms' profitability, productivity and market valuation. They found only limited and mixed results suggest that, in the South African context, physical capital assets constitute the predominant driver of the firm's financial performance and market value. Chen et al. (2005) examined a sample of firms listed on the Taiwan Stock Exchange by assessing the relationship between VAIC, firms' market value and current and future financial firm performance. They found that VAIC and all of its components positively influence firms' market value. Moreover, they found that VAIC and two of its components (Capital Employed and Human Capital Efficiency) positively affect all the dimensions of financial performance (Return On Equity [ROE], Return On Asset [ROA], growth in revenues and employee productivity). Gan and Saleh (2008) conducted a study on a sample of technology-intensive companies listed on the Malaysia stock exchange by exploring the relationship between VAIC, market valuation, profitability, and productivity. Their results evidenced a positive and significant relationship between VAIC, two of its components (CEE and HCE) and both firms' profitability and productivity. However, no significant relationship between VAIC, its components and firms' market value occurred. Zéghal and Maaloul (2010) analysed a sample of 300 UK listed companies to examine the effect of IC, measured as VAIC, on firms' economic, financial and stock market performance. They observed that IC positively influences both economic and financial performance in all the

selected industry sectors, while positively affect market value only in the context of High-Tech industry. Ahangar (2011) investigated a sample of Iranian companies to assess the relationship between VAIC components and firms' profitability, employee productivity and growth in revenues. He found that HCE positively affects profitability, employee productivity and growth in revenues, while CEE exerts a negative influence on employee productivity and growth in revenues. Maditinos et al. (2011) examined the influence of VAIC on firms' market value and three dimensions of financial performance (ROA, ROE and growth in revenues) on a sample of 96 Greek listed companies. Their results failed in providing any significant relationship between the aggregate measure of VAIC, firms' market value and financial performance, showing that only human capital efficiency positively influences both market value and financial performance proxied as ROE. Rehman et al. (2011) investigated a sample of companies belonging to the Modaraba sector of Pakistan by assessing the association between VAIC, its components and firms' financial performance. They found that both VAIC and all of its components positively affect firms' financial performance. Dženopoljac et al. (2016) conducted a longitudinal study on a sample of 2.137 Serbian companies belonging to the ICT industry sector. They analysed the relationship between VAIC, its components and firms' financial performance measured as ROA, ROE, Return On Invested Capital [ROIC], profitability and Asset Turnover [ATO]). They found that CEE positively affects ROA, ROE and ATO while negatively influences firms' profitability.

As regards the other components, only HCE showed a positive and significant relationship with ROIC. Cenciarelli et al. (2018) adopted VAIC to examine the role of IC in predicting firms' bankruptcy by investigating a sample of US public companies for thirty years. Their results evidenced that firms with higher IC performance show a significantly lower probability of going bankrupt. Sardo and Serrasqueiro (2018) investigated the relationship between IC measured as VAIC, growth opportunities and financial performance on a sample of 2,044 non-financial listed firms coming from 14 European countries. Their results suggested that IC improves firms' financial performance measured as ROA in high-tech, medium-tech and low-tech firms and that growth opportunities positively influence firms' financial performance through the efficient use of IC. Finally, Smriti and Das (2018) explored a sample of 710 Indian publicly listed firms for the period 2001 to 2016 to evaluate the relationship between VAIC, its components and four dimensions of firms' performance: profitability, productivity, sales growth and market value. Results showed a deep impact of VAIC on all firms' performance dimensions, except HCE which positively influence only firms' productivity.

Therefore, considering previous studies, the relationship between IC, firms' performance and market value deserve particular attention due to its relevance for managers, investors and practitioners (Ahangar, 2011).

The widespread acceptance of IC as a source of competitive advantage and driver of superior financial and market performance and the mixed results obtained in previous research, motivates this study which intends to empirically validate the VAIC as an IC measurement model in the context of Italian listed firms and, in the light of the RBV theory, provides evidence supporting the role of IC in driving firms' financial performance and market value.

Hence, the present study employs the VAIC method (Pulic, 2000; Ahangar, 2011; Rehman et al., 2011; Dzenopoljac et al., 2016; Cenciarelli et al., 2018; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018) to extend the understanding of IC potentialities in the context of Italian listed firms. In doing so, a longitudinal study for the period 2008 to 2017 based on different OLS regression models are developed to investigate, firstly the relationship between IC, its components and firms' financial performance and secondly between IC, its components and firms' market value.

HYPOTHESIS DEVELOPMENT

According to Firer and Williams (2003), "corporate performance is a function of the effective and efficient use of the respective tangible and intangible assets of the firm". However, consistent with the RBV theory, while tangible assets are easily replicable and available on the market, intangible assets such as skills, experiences, competencies and knowledge assets are rare and difficult to imitate being internally generated (Ahangar, 2011; Ahmadi et al., 2012; Zhang, 2017; Smriti and Das, 2018). As a consequence, IC resources constitute vital and strategic elements whose proper management and development led to a sustainable competitive advantage and superior financial performance (Ahangar, 2011; Zéghal and Maaloul, 2010). As argued by Rahman and Ahmed (2012), the knowledge elements represent the most valuable assets of a company also considered responsible for increasing returns. Therefore, in addition to encouraging corporate performance, IC plays a pivotal role also in driving firms' market value (Chen et al., 2005; Gan and Saleh, 2008; Maditinos et al., 2011). Aware of IC potential, in the presence of an efficient market, investors will attribute a higher value for firms which own a greater amount of IC (Chen et al., 2005; Gan and Saleh, 2008). However, traditional financial reports based on historical figures, do not adequately reflect the value of IC components, causing a gap between market value and book value (Gan and Saleh, 2008; Maditinos et al., 2011). This gap could be reduced by developing a correct and adequate IC measurement which allow companies both to improve their internal strategic management and provide reliable information on IC to investors, fostering

Table 1. Industry sectors

Sector	Description	Frequency	%
1	Mines and manufacturers and building	85	62.96
2	Public services	11	8.15
3	Consumer goods. trade and services	19	14.07
4	Communication and IT	20	14.81
	Total of the full sample firms	**135**	**100.00**

positive effects on financial and market values (Zou and Huan, 2011; Ahmadi et al., 2012). Moreover, according to Sardo and Serrasqueiro (2018), IC also exerts a positive influence on firms' growth opportunities due to the tremendous innovative potential of some components such as Research and Development (R&D) activities whose investments positively affect earnings dynamics.

Hence, according to RB theory and previous studies, this research predicts a positive relationship between IC measured as VAIC, firms' financial performance measured as ROA and growth in revenues and market value expressed by Market to Book (MtB) Ratio by posing the following hypothesis:

H1a: IC positively affects firms' financial performance as ROA;
H1b: IC positively affects firms' financial performance as Growth in revenues;
H1c: IC positively affects firms' market value as MtB.

Moreover, this study also estimates the relationship between the different VAIC components (HCE; SCE and CEE), firms' financial performance and market value by setting out the following hypothesis:

H2a: IC components (HCE, SCE and CEE) positively affect firms' financial performance as ROA;
H2b: IC components (HCE, SCE and CEE) positively affect firms' financial performance as growth in revenues;
H2c: IC components (HCE, SCE and CEE) positively affect firms' market value as MtB.

MATERIALS AND METHODS

Sample and data selection

The sample includes 135 Italian companies listed on the Milan Stock Exchange. The selected data cover the period from 2008 to 2017.

The dataset was extracted from the Datastream database by Thomson Reuters which provides current, historical economic and financial data for all listed firms in the world's major stock exchanges.

The population of Italian listed firms included in the Datastream database in December 2018 consisted of 305 companies. The research sample has a balanced panel structure. Hence, companies incorporated after the 2008 (58 firms) have been excluded as well as firms that were delisted due to mergers,

acquisition, or bankruptcy (41 firms). Also, firms with missing financial data and Italian firms listed on different stock exchanges (71 firms) were excluded.

Finally, a sample of 135 Italian listed firms with complete and valid data for reliable statistical analysis has been obtained (from Datastream Database) for a total of 1,350 firm-year observations. Table 1 shows details regarding the industry sectors to which the companies belong to.

According to the previous literature (Chen et al., 2005), firms have been classified employing the Economic Sector Name provided by the Thomson Reuters Business Classification. However, to ensure that each cluster (or industry sector) contains a significant number of firms (at least 10 for each year), some industry sectors have been merged. For example, only three firms belong to the mines sector. These firms were included in the first cluster named Mines, manufacturers and buildings because of the specificity of these firms employing a high ratio of tangible assets, as manufacturers and buildings firms. In doing so, four different industry sector clusters have been obtained: Mines, manufacturers and building (Cluster 1); Public Services (Cluster 2); Consumer goods, trade and services trade (Cluster 3); and Communication and IT firms (Cluster 4).

At the end, 85 companies (62.96%) belong to the Mines and manufacturers and building sector; 11 companies (8.15%) pertain to the public services sector; 19 companies (14.07%) belong to the consumer goods, trade and services industry sectors; and 20 companies (14.81%) are included in the communication and IT industry sector.

Variable definition and measurement

The analysis investigates the relationship between IC, firms' financial performance and market value.

Financial performance and Market Value constitute the dependent variables, IC the independent variable. Firms' performance is measured by using two variables. The first is ROA, which is measured as the ratio of net income to book value of total assets (Ahangar, 2011; Chen et al., 2005; Gan and Saleh, 2008; Maditinos et al., 2011; Zhang, 2017; Smriti and Das, 2018). The second is growth in revenues, which measures the changes in firms' revenues from the previous year (Ahangar, 2011; Chen et al., 2005; Smriti and Das, 2018). The increases in the revenues signal firms' opportunities for growth (Chen et al., 2005; Smriti and das, 2018). Firms' market value is measured by employing the Market-to-Book ratio (MtB) calculated by dividing the market value (MV) with the book value (BV) of common stocks (Chen et al., 2005; Maditinos et al., 2011). It is computed regarding the mean of the opening and closing year values of the MtB to smooth some of the volatility in this ratio in a given year (Forte et al., 2017).

The IC is proxied by the VAIC (Chen et al., 2005; Ahangar, 2011; Maditinos et al., 2011; Dženopoljac et al., 2016; Smriti and Das, 2018).

The calculation of the VAIC requires different steps (Dženopoljac

et al., 2016; Cenciarelli et al., 2018; Smriti and Das, 2018). The starting point is the computation of Value Added (VA) which is the sum of operating profit (OP), employee costs (EC), depreciation expenses (DP) and amortisation expenses (AM):

VA= OP + EC + DP + AM

The second step involves the estimation of IC efficiency (ICE) determined as the sum of Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE).

ICE = HCE + SCE

HCE is represented by the ratio between VA and HC:

HCE = VA/HC

HC refers to annual employees' wages and salaries which in this model are considered as an investment and not as expenses (Zéghal and Maaloul, 2010). HC variable expresses the ability of a company to create value by investing in its human resources (Zéghal and Maaloul, 2010; Cenciarelli et al., 2018).

SCE is determined by the ratio between Structural Capital (calculated by subtracting HC from VA) and VA:

SCE = SC/VA

SCE measures the capacity of a firm to create value by developing its structure encompassing culture, routines, databases, processes, patents, copyrights and trademarks (Cenciarelli et al., 2018). It corresponds to the portion of value added that remains in the firm (retained earnings employed for new investments), after the subtraction of the portion that is distributed to lenders and shareholders (as respectively, interests and dividends).

The final indicator is the Capital employed efficiency (CEE), computed as the ratio between VA and net assets:

CEE = VA/CE

CEE gauges the efficiency of both physical and financial capital in the value creation process (Zéghal and Maaloul, 2010; Cenciarelli et al., 2018).

Finally, the overall measure of VAIC is obtained by summing the IC efficiency (ICE) and the physical and financial capital efficiency (CEE):

VAIC = ICE + CEE

or, that is the same,

VAIC = HCE + SCE + CEE

Despite scholars evidenced some drawbacks of VAIC mainly related to the Human Capital calculation involving the treatment of employees' costs as an investment and the Structural Capital computation which can be fundamentally associated to the accounting measure of operating margin (Dženopoljac et al., 2016; Smriti and Das, 2018), several advantages arise from VAIC employment.

Firstly, VAIC model is based on a simple calculation. Secondly, VAIC measure and its components are based on data which, coming from financial statements, are reliable and audited. Thirdly, being based on ratios, VAIC provides quantitative and standardized measures and allows for easy comparisons between firms (Firer and Williams, 2003; Ahangar, 2011; Maditinos et al., 2011; Dženopoljac et al., 2016; Sardo and Serrasqueiro, 2018).

Control variables

According to previous studies, financial leverage and firm size have been added as control variables which can influence firms' performance (Zéghal and Maaloul, 2010; Dženopoljac et al., 2016; Smriti and Das, 2018). Financial leverage is measured as the ratio of financial debts on total assets (Dženopoljac et al., 2016; Cenciarelli et al., 2018), while firm size is measured as the natural logarithm of total assets (Zéghal and Maaloul, 2010; Dženopoljac et al., 2016; Sardo and Serrasqueiro, 2018).

Regression models

To test our hypotheses, the following OLS regression models are estimated (Equations 1, 2, and 3). Each OLS regression model controls for the industry sectors and the years of the analysis. Equations 1 and 2 regress the IC measured as the VAIC with two indicators of financial performance ROA (profitability) and GROWTH (growth in revenues) while Equation 3 analyses the relationship between IC (VAIC) and firms' market value computed as MtB. In each model, two variables (leverage and size) are used as control variables.

$$ROA_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t} \tag{1}$$

$$GROWTH_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t} \tag{2}$$

$$MtB_{i,t} = \alpha_{i,t} + \beta_1 VAIC_{i,t} + \beta_2 HCE_{i,t} + \beta_3 SCE_{i,t} + \beta_4 CEE_{i,t} + \beta_5 LEV_{i,t} + \beta_6 SIZE_{i,t} + \varepsilon_{i,t} \tag{3}$$

Table 2 shows the variables definition and their measurement along with the models developed and the hypotheses stated.

RESULTS AND DISCUSSION

Descriptive statistics

Table 3 shows the descriptive statistics for all the dependent and independent variables. Moreover, Tables 4 and 5 show the average values of dependent and independent variables grouped by industry sectors (as classified in Table 1).

It is interesting to note that in our sample firms, 85 companies (62.96%) belong to the Mines, manufacturers and building sector. In these firms, the proportion of tangible assets is higher than intangible assets since they are mainly involved industrial activities (e.g. automotive, textiles, equipment, etc.); 11 companies (8.15%) belong

Table 2. Definition of variables, proxies, models and hypothesis.

Dependent variables	Variable description	Model	Hypothesis	
$ROA_{i.t}$	Financial performance measured as firms' profitability proxied by Return on Assets - Operating income/total assets.	1	H1a-H2a	
$GROWTH_{i.t}$	Financial performance measured as firms' growth in revenues proxied by the change in revenue from year t-1 to year t.	2	H1b-H2b	
$MtB_{i.t}$	Firms' market value measured as the Market-to-Book ratio proxied by the market value divided by the book value of common stock (average value at the beginning and the ending of the year).	3	H1c-H2c	

Test variables	Variable description	Model	Hypothesis	Expected sign
$VAIC_{i.t}$	Value Added Intellectual Capital proxied by the Pulic' model. estimated by summing the variables (HCE, SCE and CEE)	1	H1a	+
		2	H1b	+
		3	H1c	+
$HCE_{i.t}$	Human Capital Efficiency proxied by the Value Added (VA) scaled by the Employee costs.	1	H2a	+
		2	H2b	+
		3	H2c	+
$SCE_{i.t}$	Structural Capital Efficiency proxied by the difference between VA and HC scaled by the VA	1	H2a	+
		2	H2b	+
		3	H2c	+
$CEE_{i.t}$	Capital Employed Efficiency proxied by the ratio between VA and net assets of the year i	1	H2a	+
		2	H2b	+
		3	H2c	+

Control variables	Variable description			Expected sign
$LEV_{i.t}$	Leverage ratio proxied by financial debts scaled total assets		1	+/-
			2	+/-
			3	+/-
$SIZE_{i.t}$	Firm size proxied by the natural logarithm of total assets		1	+/-
			2	+/-
			3	+/-

to the public services sector (electricity, energy, gas and petroleum). Most of these firms have institutional ownership; 19 companies (14.07%) belong to the consumer goods, trade and services industry sectors (e.g. storage, wholesale and retail trade, food services, etc.). Finally, 20 companies (14.81%) are included in the communication and IT industry sectors. Some variables (ROA, VAIC and MtB) are winsorized at 1% level to smooth the effect of some outlier values.

The ROA (winsorized at 1% level) for the full sample has a mean of 1.73%. Table 4 shows that,

Table 3. Descriptive statistics.

Variables	Mean	Median	Std. Err.	Minimum	Maximum	Std. Dev.	25%	75%
ROA	1.73	2.41	0.20	-30.30	21.15	7.33	0.00	4.98
MTB	1.64	1.12	0.05	-1.98	12.95	1.94	0.65	2.06
GROWTH	0.02	0.02	0.01	-0.61	0.96	0.21	-0.07	0.10
VAIC	2.72	2.36	0.06	-4.85	12.48	2.21	1.83	3.23
HCE	1.69	1.46	0.19	-252.00	15.06	7.10	1.17	2.07
SCE	0.39	0.33	0.08	-24.28	97.38	2.97	0.21	0.63
CEE	0.99	0.39	0.41	-41.53	545.56	15.20	0.21	0.63
LEV	29.64	28.79	0.50	0.00	190.76	18.41	16.88	40.43
SIZE	13.33	12.96	0.05	8.28	18.92	1.86	12.06	14.45

Note: This table reports the mean for the dependent and independent variables in equations 1, 2 and 3. Please see Table 2 for variable measurement details.

Table 4. Descriptive statistics for industry sectors (Independent variables).

Sector	Description	Frequency	ROA	GROWTH	MTB
1	Mines, manufacturers and building	850	2.42	0.017	1.62
2	Public services	110	2.49	0.052	1.09
3	Consumer goods, trade and services	190	0.64	0.044	2.25
4	Communication and IT	200	-0.59	0.004	1.45
	Total	**1,350**	**-**	**-**	**-**

Note: This table reports the mean for the dependent variables in equations 1, 2 and 3, by industry sector. Please see Table 2 for variable measurement details.

on average, while public services firms (ROA = 2.49%) appear to be more profitable than other firms (ROA sector 1 = 2.42%; ROA sector 3 = 0.64%), the communication and IT firms show negative profitability (ROA = -0.59%). GROWTH (winsorized at the 1% level) has a mean of 0.02 for the full sample, meaning that, on average, the sales increase of 2% from year t-1 to year t. Table 4 also shows that, on average, public services firms (GROWTH ratio = 0.052%) register a higher growth in revenues than other firms (GROWTH ratio for sector 1 = 0.017%; GROWTH ratio for sector 3 = 0.044%) while communication and IT firms evidence the lower level (GROWTH ratio = 0.004%).

The dependent variable MTB (winsorized at the 1% level), has a mean value of 1.64 for the full sample, meanings that all sampled firms show a market value (the mean between the ending and the beginning MTB for each year) higher than the book value (the ratio, on average, is above 1). Moreover, on average, consumer goods, trade and services firms highlight the highest MTB ratio.

Overall, descriptive results highlight that public sectors firms (sector 2 in our analysis) show the higher performance (in term of ROA, GROWTH ratio and MtB) than other sample firms. This could be explained by the circumstance that public services firms operate in markets with lower competition and invest less in tangible assets and more in intangible assets than firms working in the other industry sectors.

The variable VAIC for the full sample has a mean of 2.72. This finding indicates that all sampled firms produced an average value of 2.72 euros for each euro employed. Table 5 highlights that the public services sector shows the highest amount of VAIC. More specifically, these organizations are generally more effective in creating VA from their intellectual, physical and financial resources compared to the companies.

The variable HCE for the full sample has a mean of 1.69. The mean value above 1 indicates that the amount of VA is higher than the employee costs. Table 5 shows that, on average, the human resources in public services provide a substantial contribution to the VA creation process since the HCE mean value is higher than in other industry sectors. The variable SCE for the full sample has a mean of 0.39. Table 5 shows that firms belonging to the Mines, manufacturers and building and public services industry sectors have the same SCE mean value, while firms about the communication and IT sector present the highest SCE average value. The variable CEE for the full sample has a mean of 0.99. Since CEE is computed as the ratio between VA and net asset, an average value below 1, indicates a firm's value-added lower than the net

Table 5. Descriptive statistics for industry sectors (independent variables).

Variables	Mean for industry sector			
	1	**2**	**3**	**4**
VAIC	2.419	4.137	3.289	2.708
HCE	1.358	3.245	2.299	1.657
SCE	0.374	0.374	0.389	0.492
CEE	1.168	0.342	1.048	0.530
LEV	28.359	38.536	32.874	26.380
SIZE	13.289	14.910	13.166	12.816

Note: This table reports the mean for the independent variables in equations 1, 2 and 3 by industry sector. Please see Table 2 for variable measurement details

assets value. Table 5 shows that, on average, the efficiency of firms' physical and financial capital is higher for firms belonging to both the Mines, manufacturers and building and Consumer goods, trade and services industry sectors. This could be explained by the heavy weight of tangible and financial assets in these firms.

To sum up, descriptive results signal that sampled firms created more added value from HCE than from SCE and CEE.

The control variable LEV for the full sample has a mean of 29.64%, indicating, on average, that the financial debts are about 30% of the total assets. As shown in Table 5, on average, public services firms appear to be more indebted than other firms. Finally, the control variable SIZE for the full sample has a mean of 13.33. Table 5 indicates that, on average, public services organisations have the highest size value while communication and IT firms have the lowest.

Correlation analysis

Table 6 shows the results of the correlation analysis for all the variables. Both Pearson (coefficients below the diagonal) and Spearman (coefficients above the diagonal) correlation coefficients have been calculated. No correlation exceeds the threshold value of 0.8 so detecting any multicollinearity drawback (Smriti and Das, 2018).

As regards Pearson coefficients, ROA is positively correlated (at 1% level) with the dependent variables MTB and GROWTH as well as the independent variables VAIC, HCE and SIZE (at 1% level). GROWTH is positively correlated (at 1% level) with ROA and MTB as well as VAIC, HCE and SIZE (at 1% level). MTB shows only a positive correlation (at 1% level) with ROA.

Spearman coefficients evidence a positive correlation (significant at 1% level) between ROA, MTB and GROWTH. Moreover, a positive relationship (significant at 1% level) between ROA, VAIC, HCE, SCE, CEE and SIZE has been detected. In the end, a positive correlation (significant at 1% level) between GROWTH and VAIC,

HCE, SCE, CEE and SIZE has been evidenced. Unlike Pearson correlation, Spearman coefficients highlight several associations for the variable MtB (VAIC, HCE, SCE and CEE at 1% level).

Multiple regression analysis

Table 7 shows the results of the three linear regression models performed to test the relationship between IC (VAIC), firms' financial performance (ROA and GROWTH) and market value (MtB). The models control for years and industry sectors.

The F-tests (Prob>F) is significant at the 1% level for all the models. The adjusted R-square is 0.2781 for Model 1 (ROA as the dependent variable), 0.090 for Model 2 (GROWTH as the dependent variable) and 0.0742 for Model 3 (Mtb ratio as the dependent variable). These values indicate that Model 1, Model 2 and Model 3 can explain about the 27.81%, the 9% and about the 7.42%, respectively, of the variance in the dependent variable for the whole sample. Consistent with Dzenopoljac et al. (2016), the first model, using the ROA as a dependent variable, has a higher explanatory power than the other models.

Further, to test for potential multicollinearity issues, Variance Inflation Factors (VIF), though not reported here, has been computed for all the variables, indicating that all the statistics are well below the threshold of 2 for each set of model variables.

Overall, results suggest that IC (proxied by the VAIC) taken in its aggregated form, positively affects firms' financial performance and market value. Indeed, the coefficient of VAIC is positive and significant (at 1% level) in all the performed models.

According to the RB theory, these findings support the pivotal role of IC in creating a competitive advantage and ensuring superior financial performance (Chen et al., 2005; Ahangar, 2011; Cenciarelli et al., 2018). Moreover, these results also indicate that IC contribute in enhancing firms' market value because investors attribute a higher value to those companies which invest in IC (Chen et al.,

Table 6. Correlation matrix

Variables	ROA	MTB	GROWTH	VAIC	HCE	SCE	CEE	LEV	SIZE
ROA	1	0.422**	0.354**	0.491**	0.539**	0.466**	0.164**	-0.235	0.199**
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MTB	0.149**	1	0.191**	0.295**	0.193**	0.209**	0.315**	-0.045	0.043
	0.000		0.000	0.000	0.000	0.000	0.000	0.101	0.111
GROWTH	0.250**	0.048	1	0.236**	0.264**	0.200**	0.091**	-0.088	0.107**
	0.000	0.076	-	0.000	0.000	0.000	0.001	0.001	0.000
VAIC	0.333**	0.120**	0.113**	1	0.785**	0.667**	0.148**	0.062*	0.333**
	0.000	0.000	0.000	-	0.000	0.000	0.000	0.023	0.000
HCE	0.132**	-0.063	0.114**	0.259**	1	0.851**	-0.198	0.022	0.466**
	0.000	0.020	0.000	0.000	-	0.000	0.000	0.414	0.000
SCE	0.033	0.004	-0.046	0.320**	0.002	1	-0.326	0.030	0.369**
	0.231	0.879	0.091	0.000	0.929	-	0.000	0.271	0.000
CEE	0.036	-0.007	-0.015	0.178**	0.002	-0.005	1	-0.119	-0.204
	0.186	0.809	0.578	0.000	0.948	0.842		0.000	0.000
LEV	-0.305	-0.023	-0.093	0.116**	0.073**	0.090**	0.088**	1	0.160**
	0.000	0.388	0.001	0.000	0.008	0.001	0.001	-	0.000
SIZE	0.173**	-0.064	0.079**	0.303**	0.168**	0.012	-0.056	0.117**	1.000
	0.000	0.018	0.004	0.000	0.000	0.654	0.040	0.000	-

Notes: This table reports Pearson (Spearman) coefficients correlation for the model variables below (above) the diagonal. ** Correlation is significant at the 1% level (2-tailed) and * at the 5% level (2-tailed). Probabilities are shown in brackets. For detailed variable definitions please see Table 2.

2005; Gan and Saleh, 2008; Sardo and Serrasqueiro, 2018).

However, when the individual components of VAIC are examined, different findings are observed. More specifically, in Model 1, employing ROA as the dependent, consistent with expectations, the coefficient of VAIC is observed positive and significant at the 1% level. This finding provides the evidence that the IC value has a positive impact on firms' profitability thus suggesting that IC resources play a significant role in creating value for the stakeholders and shareholders (Zéghal and Maaloul, 2010). Thus, according to the RBV theory, efficiency in managing and utilizing IC resources lead to a better performance regarding profitability (Chen et al., 2005; Gan and Saleh, 2008). This result is also consistent with prior literature (Firer and Williams, 2003; Chen et al., 2005; Gan and Saleh, 2008; Zéghal and Maaloul, 2010; Rehman et al., 2011; Dženopoljac et al., 2016; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018). Accordingly, hypothesis H1a is confirmed.
Model 1 also indicates an association between firms' profitability and some IC components. Consistent with expectations and previous studies (Chen et al., 2005; Gan and Saleh, 2008; Ahangar, 2011; Rehman et al., 2011), the coefficient of HCE is positive and significant at 5% level. This result highlights the efforts made by firms in stressing their human resources to improve their profitability (Gan and Saleh, 2008). It also indicates that the skills, competencies, capability, creativity know-how and experiences developed by employees are one of the main drivers of firms' profitability (Smriti and Das, 2008). This is particularly true in the public services sector where the weight and the relevance of human resources are notably high.

On the other hand, contrary to expectations, the coefficient of SCE is negative and significant at 5% level. This finding is not consistent with prior literature (Chen et al., 2005; Ahangar, 2011; Rehman et al., 2011), while it is consistent with Smriti and Das (2018) who find a negative relationship between SCE and ROA for Service sector. This finding may be explained by the circumstance that the 63% of the sample firm belong to the mines, manufacturers and building sector. Probably, in these firms, the investment in structural capital (e.g. processes, patents, copyright), takes time to impact on firm's financial performance.

Finally, model 1 shows that CEE does not drive firms' profitability. According to the RBV theory, firms' performance is more stimulated by the efficiency of using and developing intangible assets such as skills, competencies and experiences (HCE) considered strategic and hard to imitate than by the efficiency of tangible assets (CEE) (Zéghal and Maaloul, 2010; Smriti and Das, 2018).

Table 7. Linear panel regression model

	Model 1: ROA Firms= 135 Obs: 1.350		Model 2: GROWTH Firms= 135 Obs: 1.350		Model 3: MtB Firms= 135 Obs: 1.350	
	Coeff.	*Sig.*	*Coeff.*	*Sig.*	*Coeff.*	*Sig.*
Constant	0.211		0.044		2.325	***
VAIC	1.228	***	0.001	***	0.184	***
HCE	0.059	**	0.030	***	-0.025	***
SCE	-0.124	**	-0.004	**	-0.040	**
CEE	-0.000		-0.000		-0.006	*
LEV	-0.139	***	-0.001	***	-0.001	
SIZE	0.316	***	0.004		-0.117	***
IND:						
1	---		---		---	
2	-1.276	**	0.018		-0.628	***
3	-2.267	***	0.021		0.485	***
4	-3.526	***	-0.018		-0.258	*
	Model 1 specification: R-square: 28.78% F (18, 1331) = 29.88 Prob> F= 0.000 Adj. R-squared: 27.81% VIF < 2% for all variables Year control: yes		*Model 2 specification:* R-square:10.28% F (18, 1331) = 8.47 Prob> F= 0.000 Adj. R-squared: 9.06% VIF < 2% for all variables Year control: yes		*Model 3 specification:* R-square: 8.66% F (18. 1331) = 7.01 Prob> F= 0.000 Adj. R-squared: 7.42% VIF < 2% for all variables Year control: yes	

Notes: This table reports the linear panel regression for equations 1, 2 and 3. *** = significant at the 1% level (2-tailed); ** = significant at 5% level (2-tailed). and * = significant at the 10% level (2-tailed). For detailed variable definitions please see Table 2

Hence, hypothesis H2a is supported only by HCE results. Moreover, the control variable LEV has a negative and significant, at 1% level, sign (Dženopoljac et al., 2016; Smriti and Das, 2018). This finding suggests that the increase in leverage negatively affects firms' profitability because of the interests paid to the lenders. Finally, in line with previous studies (Dženopoljac et al., 2016; Sardo and Serrasqueiro, 2018; Smriti and Das, 2018), the control variable SIZE presents a positive sign (significant at 1% level), indicating that size positively impacts on firms' profitability.

Model 2, employing GROWTH as the dependent variable, consistent with expectations, shows that the coefficient of VAIC is positive and significant at the 1% level. As well as for model 1, results of model 2 confirm that IC represents a substantial driver of firms' financial performance. According to previous scholars (Chen et al., 2005; Smriti and Das, 2018), IC value positively influences firms' growth in revenues leading to an overall improvement of firms' financial performance. Thus, by investing in IC components, firms obtain benefits in the year. These benefits consist of growth in firms' sales arising from the confidence of the markets in firms' ability to create value for stakeholders starting from the intangible (invisible or not recognized) assets other than the tangible and physical assets (Bhasin, 2012).

According to Bhasin (2012), IC investments translate knowledge in revenues. Hence, hypothesis H1b is supported.

Model 2 also indicates an association between firms' GROWTH and some IC components. In line with expectations, the coefficient of HCE is positive and significant at 1% level, testifying a positive impact of human capital resources on firms' sales growth (Chen et al., 2005; Ahangar, 2011). On the other hand, contrary to expectations, the coefficient of SCE is negative and significant at 5% level, indicating a negative impact of structural capital on firms' sales growth. Finally, the coefficient of CEE is negative and not significant. Accordingly, hypothesis H2b is supported only by HCE results.

Further, regarding model 2, the control variable LEV has a negative and significant, at 1% level, sign. Previous literature did not investigate the relationship between leverage and GROWTH. The present finding suggests that leverage negatively impacts firms' growth in revenues. Further, the control variable SIZE has a positive sign, though it is not significant.

Model 3, with MtB as the dependent variable, by expectations, evidences a positive and significant (at the 1% level) relationship between VAIC and firms' market value. This result suggests that investors place a higher value on firms with greater IC taken in its aggregated form so exerting a positive effect on firms' market performance (Chen et al., 2005; Gan and Saleh, 2008; Sardo and Serrasqueiro, 2018). Accordingly, hypothesis H1c is supported.

Nevertheless, in contrast with the hypothesis, model 3 highlights that each IC component exerts a negative influence on firms' market value. More specifically, the coefficient of HCE is negative and significant at 1% level, the coefficient of SCE is negative and significant at 5% level and, the coefficient of CEE is negative and significant at 10% level. These findings imply that while investors are attributing a pivotal relevance to the IC value taken in its aggregate form (VAIC), negatively appreciate the importance of the separate IC components. Thus, markets negatively react to investments made only in individual IC components, considering pivotal the combined effect exerted by the three IC components (HCE, SCE, CEE) in their firms' evaluation.

These results are in contrast with those obtained by Chen et al. (2005) who, in the context of Taiwanese listed companies, found that VAIC and all of its components positively influence firms' market value and partially with those observed by Dženopoljac et al. (2016) who, in the context of Serbian ICT companies, showed that human capital efficiency positively influences market value. Accordingly, hypothesis H2c is not supported.

Finally, model 3 shows that the control variable LEV has a negative sign, though it is not significant, while the control variable SIZE has a negative and significant at 1% level coefficient.

Conclusion

The paper contributes to the literature by exploring a sample of Italian listed firms for the period of 2008 to 2017 to extend knowledge about the role of IC in enhancing firms' performance and market value. In particular, adopting a well-established IC measurement tool (VAIC), the present research attempted to investigate the relationship between IC, two dimensions of firms' financial performance (profitability and growth in revenues) and market value.

The study empirically demonstrated that, in the Italian context, firms with greater IC efficiency yield higher profitability, growth in revenues and stock market performance. It also revealed that among individual IC components, only Human Capital efficiency positively affects firms' financial profitability and growth in revenues while Structural Capital efficiency and Capital Employed efficiency negatively influence firms' financial

performance. Nevertheless, each IC component negatively affects firms' market value, evidencing that while investors are attributing a pivotal relevance to the IC investments in their aggregate form (VAIC), negatively react to investments made in individual IC components.

These results are in accordance with Pulic, who stated: "we have evidence that value creation depends much more on intellectual potential than on physical capital" (Pulic, 1998: 14) and demand further investigations, giving evidence that firm's success is determined not only by its attitude to create value-added but also to distribute it among its stakeholders: as a matter of fact, leverage has, through the burden of interests, a negative, and sometimes, significant impact.

The research has implications for managers and researchers. Managers must recognize the relevance of IC in driving the firms' financial performance and market value by developing appropriate management and developing a programme of this kind of resources. In particular, human resources deserve attention due to their positive impact on firms' profitability and growth in revenues. The researcher can utilise these results and replicate the study in other countries also employing other variables to obtain useful insights.

The study also has some limitations that provide avenues for future research. Firstly, it employs only one of the possible existing methods for measuring IC: the VAIC. This method, as aforementioned, presents some drawbacks. Secondly, the sample is limited to the Italian listed companies. Thirdly, it controls for the effect of only two variables such as size and leverage.

Thus, future research could focus on a larger sample including companies from different European countries also testing the effects of other variables. Moreover, future research might consider the use of other versions of the VAIC.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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