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Abstract

Purpose – The purpose of this paper is to examine the effect of intellectual capital (IC) on financial performance (FP) for Indian companies listed on the Centre for Monitoring Indian Economy Overall Share Price Index (COSPI).

Design/methodology/approach – Hypotheses were developed according to theories and literature review. Secondary data were collected from Indian companies listed on the COSPI between 2001 and 2016, and the value-added intellectual coefficient (VAIC) of Pulic (2000) was used to measure IC and its components. A dynamic system generalized method of moments (SGMM) estimator was employed to identify the variables that significantly contribute to firm performance.

Findings – Indian listed firms appear to be performing well and efficiently utilizing their IC. Overall, human capital had a major impact on firm productivity during the study period. Furthermore, the empirical analysis showed that structural capital efficiency and capital employed efficiency were equally important contributors to firm's sales growth and market value. The growing importance of the contribution of IC to value creation was consistently reflected in the FP of these Indian companies.

Practical implications – This study has robust theoretical grounds and employs a validated methodology. The present study extends knowledge of IC among academicians and managers and highlights its contribution to value creation. The findings may help stakeholders and policymakers in developing countries properly reallocate intellectual resources.

Originality/value – This study is the first study to evaluate IC and its relationship with traditional measures of firm performance among Indian listed firms using dynamic SGMM and VAIC models.

Keywords India, Intellectual capital, System GMM, Firm performance measures

Paper type Research paper

1. Introduction

The growth of knowledge-based, fast-changing and technologically advanced companies in the world economy has increased the importance of intellectual capital (IC) (Petty and Guthrie, 2000; Cañibano *et al.*, 2000). In this cutting-edge economy, tangible and intangible resources are considered potential sources of strategic advantage (Ruta, 2009). The resource-based theory of the firm and tangible and intangible resources are drawing significant interest in the strategic management, economic and accounting literature based on the observed links between intangible resources and performance measure. Thus, a direct impact of IC on firm performance is expected (Pew Tan *et al.*, 2008).

Researchers have linked the value of IC to firm performance (Bollen *et al.*, 2005; Kamath, 2008; Dženopoljac *et al.*, 2016). The measure of firm performance classified into three categories, namely: operational performance, business performance and financial performance (FP) (Bollen *et al.*, 2005). This paper selects FP as a traditional measure of performance. Researchers have used indicators like return on assets (ROA) (Chen *et al.*, 2005, Nadeem *et al.*, 2017), asset turnover (Chen *et al.*, 2005; Kamath, 2008) and sales growth (SG) (Chen *et al.*, 2005; Li and Zhao, 2018). Some researchers have also observed the effect of IC on market value (Chen *et al.*, 2005; Kamath, 2008; Sardo and Serrasqueiro, 2017). This study uses these four indicators as indicators of firm performance. Simple measures of financial indicators are not adequate for stakeholder's analysis of the performance of the knowledge-driven firm.

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Such stakeholders comprise governments, shareholders, suppliers, customers and employees (Kamath, 2008). Traditional financial accounting measures ignore the role of human capital (HC, a component of IC), which can mislead decision makers and stakeholders (Grant, 1996; Stewart, 1997; Bontis, 2001). In response, firms have begun reporting intangibles due to their growing importance in strategic competitive advantage. IC generally comprises of those intangible resources that play an important role in the wealth – creation process of a firm, including the sum of all skills and competencies possessed by employees that create value for the firm (Mitchell Williams, 2001; Choo Huang *et al.*, 2007; Smriti and Das, 2017).

In developing or emerging economies such as India, the reporting of IC and its disclosure are in their infancy. The knowledge economy of India remains in a renovation phase, and investment in knowledge infrastructure is required. The quality of human resources is a primary concern in emerging countries because a knowledgeable, flexible and well-trained workforce enhances the competitiveness of an organization. Accordingly, the Government of India has recognized the expansion of intellectual resources, human resources and innovation as a core scheme under the Ministry of Skill Development and Entrepreneurship (2015).

This paper investigates the effect of IC on business performance in the service and manufacturing sectors in India. In 2015–2016, the Indian service market contributed approximately 66.1 percent of gross value-added (VA) growth in India (IBEF Report, 2017a, b). The Government of India aims to expand the manufacturing sector share of gross domestic product from 16 to 25 percent and to create 100m new jobs by 2022. The manufacturing component of the Index of Industrial Production (IIP) grew by 4.9 percent in FY17 (FY: Indian financial year, April to March) and 1.8 percent in the first quarter of FY18.

In 2016–2017, the service sector was responsible for 60.7 percent of the foreign direct investment equity inflows, highlighting the emergence of India as an attractive destination for investments in manufacturing-oriented and service-oriented sectors. The manufacturing and service sectors are among most capital and knowledge-intensive and fastest-growing sectors in the Indian economy, and contribute a major portion of the country's foreign exchange earnings. Both types of industries require extremely specialized knowledge and skills and are subject to organizational implicit knowledge and capabilities (Sharabati *et al.*, 2010). The endurance of these industries requires significant volumes of human resources and physical capital (PC) for its endurance.

The study addresses the gap in the literature by exploring the relationships between IC and traditional measures of corporate performance in the service and manufacturing industries in India. The findings of this study will be useful for domestic manufacturing and service-oriented industries seeking to measure IC performance and will also offer insights on critical issues that demand quick consideration to enhance IC performance. Firms can identify whether IC truly defines their performance and their resource reallocation decisions. Furthermore, stakeholders can obtain insights on the factors driving the performance of the firms. This study tries to extend the IC literature and justifies the link between IC and firm FP to ensure that the inclusion of IC disclosures on balance sheets by accounting managers is fruitful.

The paper is designed into following parts. Section 2 deals with the literature review related to IC, measurement of firm performance and formulation of the hypotheses. Section 3 discusses the variables and research methodology used. Sections 4 and 5 deal with the findings of the empirical analysis and discussion of the results, respectively, followed by limitations and future implications in the last section.

2. Background

2.1 Review of the IC measurement and its sub-components

The total of hidden values of the firm also referred as IC (Sardo and Serrasqueiro, 2017) is responsible for the increase in the market value of stock of many firms in comparison to the replacement cost of their tangible resources (Vishnu and Gupta, 2014).

Peteraf and Barney (2003) argued that firm's resource-based view emphasizes over sustaining competitive strategies by utilizing the resources present inside an organization. Resources must possess certain characteristics like they should be unique, inimitable and cannot be replaced and can be observed in the form of employee's skills and experience gained over time and the organizational process. Such internal resources have the capability of generating wealth and are perceived as intangible assets or IC. The significance of intangible assets in firm performance and market value is increasing rapidly (Dženopoljac *et al.*, 2016). Despite numerous efforts to provide clear links between IC and firm financial indicators, the effects of IC on firm performance remain unclear (Dženopoljac *et al.*, 2016). This lack of clarity may reflect the use of different features of intellectual assets and the varying relationships between them.

Researchers across the globe have defined and classified IC in their own way (Stewart, 1997). IC is described as a reservoir of experience and skills gained by the employees, the relationship with the customer, which gives competitive verge in the market over its competitors (Edvinsson and Malone, 1997). Moreover, it assures perspective profit in the absence of tangible assets (Lev, 2004).

Sveiby (1997) classified IC into three major components – structural capital (SC), customer or PC and HC. Bontis (1996) subsequently replaced customer capital with relational capital, and this change has been adopted by other researchers (Mouritsen *et al.*, 2001; Kamath, 2008; Nadeem *et al.*, 2017).

HC is the amalgamation of skills, capabilities, experience and expertise of employees acquired through their experience, and training (Ahangar, 2011). The experience gained by an employee is carried with him when he changes jobs (Spender, 1996; Roos *et al.*, 1997). According to the resource-based view, Abeysekera (2010) claimed that the performance of a firm is associated with the proper utilization of human resources in all potential and legal ways. Employees are perceived as assets of the firm, and hence HC is a vital component of firm value creation. The service and manufacturing sectors demand complex knowledge to acquire a competitive edge over other sectors.

SC also known as the organization capital includes the organization and its system, structure and processes, which comprise factors such as databases, management processes, organizational plans and corporate approaches (Roos *et al.*, 1997; Nonaka, 1994; Szulanski, 2002) and help in supporting their employee's performance and business performance (Bontis, 1998; Bollen *et al.*, 2005). Njuguna (2009) argued that based on organizational learning theory, firms can acquire long-term wealth and sustainability by following continuous learning. SC can be classified into two types. The first includes knowledge innovation, such as databases and intellectual assets such as patents, copyrights and trade and service marks. The second type encompasses infrastructural resources involved in organizational activities. Thus, SC reflects innovations in products and services in response to market demands (Goh, 2003; Keong Choong, 2008; Nadeem *et al.*, 2017).

Relational capital refers to all intellectual assets involved in managing and regulating the external relationships of a firm, including organizational relationships with suppliers, customers, stakeholders, marketing channels and the knowledge governing these associations (Bontis, 2001; Bollen *et al.*, 2005; Tether and Tajar, 2008; Meles *et al.*, 2016). It is also referred as the relationships between suppliers and customers (Sveiby, 1997).

Measuring IC successfully in monetary terms is a challenge. Existing accounting standards followed across the globe do not mandate IC disclosure. IC disclosure also remains voluntary according to Indian Accounting Standards (Ind AS) 28. The conception of IC is still new in developing economies like India (Vishnu and Gupta, 2014). Researchers have developed the method to measure IC, among which the most prominent ones are the Skandia Navigator developed by Edvinsson and Malone (1997), Sveiby's (1997) the Intangible Assets Monitor, the balanced scorecard approach by Kaplan and Norton (1996),

direct intellectual capital methods, market capitalization methods, and, most recently, Pulic's (2000) value-added intellectual coefficient (VAIC). Clarke *et al.* (2011) stated that the complicity appears while measuring IC such as the unavailability of needed info to the intruders. Even if intruders get the information, its rationality and validity are again questionable. Further, conversion of this information into financial term is difficult. Researchers have applied the VAIC model to assess the impact of IC and its dimensions on the financial and economic performance of firms as it employs the quantitative, publically accessible, carefully scrutinized information (Meles *et al.*, 2016).

Considering shareholder's view, this model evaluates the efficiency of the firm's intangible and tangible assets to embellish shareholder's worth (Meles *et al.*, 2016). This model is discussed in details in Section 3.2 under subsection, independent variable.

2.2 IC Literature review

For South African listed firms, Firer and Mitchell Williams (2003) observed a significant influence of IC on firm performance as well as a positive impact of capital employed efficiency (CEE) on a firm's market value. Using the same model, Pal and Soriya (2012) conducted a comparative analysis of the pharmaceutical and textile industries and showed that the profitability of these industries was positively correlated with IC; by contrast, no significant correlations of IC with productivity and market valuation were observed.

A study conducted by Yalama and Coskun (2007) to examine the influence of IC and their sub-components on the profitability of Istanbul banks and observed a significant role of IC compared to CEE. Mavridis (2004) used the same model to conclude that HC is having the highest degree of correlation with the performance indicator of the banks in Japan. In a study of the influence of VAIC on FP, Ismail and Karem (2011) found significant correlations of CEE and HCE with bank performance in Bahrain, although their analysis failed to note any significant correlation between SCE and corporate performance.

Appuhami (2007) obtained similar results for companies listed on Thailand's stock market using VAIC as the proxy of IC. This empirical research supports the resource-based theory and shows that IC is important in the creation of value and strategic asset management. Kamath (2008) found that HC has a major impact only on ROA in the Indian pharmaceutical sector, with no significant relationships of IC with productivity and market value. In contrast to these results, Chan (2009a, b) found no significant links between IC and productivity, profitability and market valuation among listed firms on the Hong Kong Stock Exchange. Instead, physical assets were identified as the most important component in improving firm productivity, profitability and market valuation. Vishnu and Gupta (2014) found similar evidence in an analysis of the Indian pharmaceutical industry, which showed that all components of VAIC except CEE significantly and positively influenced corporate performance as measured by ROA and return on sales. These findings provide insights on the Indian knowledge-based sector like pharmaceutical, where stakeholders still perceive firm performance in terms of tangible assets rather than intangible assets.

In a study of the impact of IC on profitability, revenue growth and employee productivity in the manufacturing industry in Thailand, Phusavat *et al.* (2011) observed significant and positive contribution of IC compared to firm performance. Consistent results were obtained by Nimtrakoon (2015) for ASEAN countries.

Further, unfolding the influence of IC on FP and ownership concentration and owner involvement of non-financial European registered firms, Sardo and Serrasqueiro (2017) observed that IC is an important tool to boost firm's FP and market value. Among VAIC components, the greatest contributors to firm profit were human capital efficiency (HCE) and CEE. By contrast, HCE and structural capital efficiency (SCE) were the greatest contributors to firm market value.

2.3 Theories related to IC

Different theories, put forward by some theorist, made the researchers across the globe realize the importance of IC in enhancing firm performance. One such theory is resource-based view put forward by Wernerfelt (1984), which stated that resources are the physical and intangible resources which belong to the firm (as shown in Table I). This theory focuses over-analysis of the heterogeneous, imitable and immobile resources present with the firm. Supporting this view, Nadeem *et al.* (2017) found a positive significant relationship between firm performance and IC except for market value in five emerging countries, namely BRICS. Thus, IC and PC are perceived as a proxy of resource-based view (Nadeem *et al.*, 2017). Accordingly, few more theories which identify the exclusive nature of IC and its components in increasing firm strategic management and performance were established. One such theory is organizational learning theory (Njuguna, 2009) which recognizes the process of continuous learning inside the organization and brings innovation in product and process. The insight of the external environment such as the change in the customer demand, their preferences about any product or services can be understood well. Further, linking this theory with the SC of the firm, Nadeem *et al.* (2017) supported Goh's (2003) argument that these need can be met with the investment in the research and development to safeguard modernization. The third theory is resource dependency theory (Salancik and Pfeffer, 1978), which considers the organization as an open system, which relies upon the opportunities in the external environment. Thus to understand the performance of an organization, one should realize the ecological surrounding of the organization. Hence, linking this view with the HC component of IC, the relationship with the external environment can be efficiently maintained by the internal resources of the firm like human resources, process learning of these organizations (Abeysekera, 2010; Nadeem *et al.*, 2017).

2.4 Hypothesis development

IC is non-monetary and intangible in nature and adds immensely to value creation (Bontis, 2004; Youndt *et al.*, 2004; Vishnu and Gupta, 2014). IC enhances firm

Industry	Firms in the database	Less: observation with incomplete or missing data or without paired firm	Final sample
Food and agro-based product	140	50	93
Drug and pharmaceutical	107	31	76
Textile	178	75	103
Health services	16	8	8
Transport services	39	18	21
Information technology	102	42	60
Communication	13	5	8
Electricity	21	14	7
Metal and metal products	152	85	67
Hotel and tourism	33	7	26
Constructional material	77	16	61
Business services and consultancy	43	31	11
Recreational services	39	27	12
Consumer goods	69	28	41
Machinery	160	42	120
Total	1,189	479	710

Source: CMIE Prowess Database

Table I. Sample selection process based on the data availability

performance irrespective of firm size and geographic location (Nadeem *et al.*, 2017). VAIC is proxy for value creation efficiency of IC of the firm and is the summary of the value-added efficiency of HCHC, SC and PC. It is the indicator of performance and is directly proportional to the efficiency of the company (Chen Goh, 2005). In other words, it can be said that increase in VAIC results in the increase in firm efficiency and vice versa. Using Taiwanese 4,254 firm-year observation, Chen *et al.* (2005) found that IC positively influenced profitability, market value, productivity and SG. In a study by Nimtrakoon (2015), reported no association between IC and market value in ASEAN countries, except in Thailand. Nadeem *et al.* (2017) supported this positive relation in BRICS listed firms using ROA, ATO, ROE and market value as firm performance indicators (Pulic, 2000). VAIC is the proxy for IC. Simultaneously, we expect a positive significant impact of VAIC on Indian service and manufacturing firm using productivity (ATO), profitability (ROA), market value (Tobin's *Q*) and SG. Hence, we propose:

H1a. IC performance positively affects firm productivity.

H1b. IC performance positively affects firm profitability.

H1c. IC performance positively affects firm SG.

H1d. IC performance positively affects firm market value.

VAIC creates IC efficiency by employing physical and financial resources of the firm. Pulic argues that without PC, IC resources cannot perform well. Nahapiet and Ghoshal (1998) stated that customer capital includes the firm's relationships with external environment or with the customers. This was earlier included in the SC by Edvinsson and Malone (1997) and signifies relational capital as it covers all the relations with external shareholders including customer (Ramírez *et al.*, 2017). CEE is a proxy for customer or physical, financial capital dimension of IC and is discussed in detail in independent variable section. In a study on Taiwanese listed firms, Chen *et al.* (2005) reported a highly significant correlation of PC with SG, ROA, assets turnover (ATO) and market value. The PC was found to consistently influence the asset turnover ratio, employee productivity and profitability of Indonesian bank (Ang and Hatane, 2014). Nadeem *et al.* (2017), while studying BRICS economies report, supported this positive and significant correlation between physical, financial capital and profitability, productivity and market valuation of the firm. Based on these observations, we expect that CEE, in our study, influences firm's profitability, productivity, Tobin's *q* and SG positively and significantly. Thus, we propose:

H2a. CEE positively affects firm productivity.

H2b. CEE positively affects firm profitability.

H2c. CEE positively affects firm SG.

H2d. CEE positively affects firm market value.

SC includes the organization and its system, structure and processes, which comprise factors such as databases, management processes, organizational plans and corporate approaches (Roos *et al.*, 1997; Nonaka, 1994; Szulanski, 2002) and help in supporting their employee's performance and business performance (Bontis, 1998; Bollen *et al.*, 2005). SCE is a proxy for the value-added efficiency of SC (Pulic, 2000; Lee *et al.*, 2015). Moreover, as per the organizational learning theory, the firm can build long-term sustainability by continuous upgrading of knowledge, which, in turn, contributes to innovation which helps in meeting the market demand (Goh, 2003). Nadeem *et al.* (2017) in their study observed

that SC has a positive impact on profitability and market value. Li and Zhao (2018) observed a significant positive relationship between SCE and SG in both labor-intensive and capital-intensive Chinese firms. Based on this, the study considers that SC is associated with the better firm performance. Hence, based on the above discussion, the following relationship is expected:

H3a. SCE positively affects firm productivity.

H3b. SCE positively affects firm profitability.

H3c. SCE positively affects firm SG.

H3d. SCE positively affects firm market value.

HC refers to the professional skills, competencies and experience possessed by employees. Although HC is a central element of crafting IC, HC is unique in that it may be lost when workers leave the firm (Bontis, 1999). HCE is an indicator for measuring the value-added efficiency by HC (Pulic, 2000; Lee *et al.*, 2015). Chen Goh (2005) evidenced that HCE is responsible for creating more values in Malaysian bank. A similar result was observed by Meles *et al.* (2016) in a study conducted on US commercial banks. Their observation confirmed were similar to the findings of El-Bannany (2008), who confirmed that human resource is an important contributor to the banking industry. Chen *et al.* (2005) reported a highly significant correlation between HC and SG, ROA, ATO and market value of Taiwanese firm. Sardo and Serrasqueiro (2017) found that HCE has a notable effect on market value in listed western-European firms. Based on these observations, our study expects the following relation:

H4a. HCE positively affects firm productivity.

H4b. HCE positively affects firm profitability

H4c. HCE positively affects firm SG.

H4d. HCE positively affects firm market value.

3. Sample selection and research methodology

3.1 Database

The data required for this paper were manually selected from the electronic database "PROWESS," which is maintained by the Centre for Monitoring Indian Economy (CMIE). All relevant variables were readily available in this database.

The annual data for all firms in 15 industries included in the CMIE Overall Share Price Index (COSPI) were obtained from the CMIE database for 2001–2016. COSPI is a set of 2,500 registered Indian companies in different sectors that trade on a minimum of 66 percent of trading days. As shown in Table I, the 15 industries included production-oriented and service-oriented industries. Bell *et al.* (2004) supported the view of Coviello (1994) and stated that any firm which uses the sophisticated scientific high-added value in their product and process are knowledge-intensive firms, hence production-oriented firms are also a part of knowledge-intensive firms. Bell *et al.* (2004) further stated that capital intensive are those firms which depend greatly on their manufacturing skills. These industries are capital intensive and knowledge intensive in nature and thus are ideal segments for analyses of IC performance (Sharabati *et al.*, 2010).

Firms with missing data for more than three years were excluded. Thus, the final sample consisted of 710 publicly listed firms (see Table I). We used panel data in this study. Panel data provide a greater variation of data, in-depth information and a higher degree of

freedom of data by merging cross-sectional observations with time series. The use of repeated cross-sections of observations in panel data analysis enables the measurement of the impact of dynamics of change that cannot be simply observed in pure cross-section or pure time-series data. Thus, panel data analysis is preferred above cross-section or time-series data.

The 16-year period was selected because system generalized method of moments (SGMM) may produce biased results when the data set is too small (Wintoki *et al.*, 2012) and because most research on IC has been performed from the year 2000 onward (Firer and Mitchell Williams, 2003; Chan, 2009a, b; Sardo and Serrasqueiro, 2017).

3.2 Variable measurement

The variables used in the analysis can be broadly classified into three categories: dependent, control and independent variables. Their measurement is shown in Table II.

Dependent variables. Four performance indicators are taken as the dependent variables. They are:

(1) ROA indicates the competence of a firm in utilizing total assets and shows the profitability of a firm (Firer and Mitchell Williams, 2003; Kamath, 2008; Sardo and Serrasqueiro, 2017).

(2) ATO is the ratio of total revenue to the book value of total assets and measures firm productivity (Kamath, 2008; Calisir *et al.*, 2010; Nadeem *et al.*, 2017).

Variables	Measurement	References
Dependent variable		
ATO (asset turnover ratio)	Total revenue/total assets (natural logged)	Kamath (2008), Calisir *et al.* (2010)
ROA (return on assets)	Operating income/total assets (natural logged)	Firer and Mitchell Williams (2003), Kamath (2008), Sardo and Serrasqueiro (2017)
Tobin's *Q* (market value)	(Market value of equity + book value of debt)/Total sales (natural logged)	Sarkar and Sarkar (2000), Sardo and Serrasqueiro (2017)
Sales growth (SG)	(Current year's sales/last year's sales)−1 × 100 (natural logged)	Chen *et al.* (2005), María Díez *et al.* (2010), Kamath (2015), Li and Zhao (2018)
Control variable		
Size	Sales = Log(sales)	Riahi-Belkaoui (2003)
Physical capacity (PC)	Fixed assets/Total assets (natural logged)	Pal and Soriya (2012)
Independent variables		
VA	$O+P+D+A$	Pulic (2000, 2004)
HC	Salaries and wages of the employees in the firm	
SC	VA – HC	
CE	Total asset – intangible asset	
HCE (human capital efficiency)	VA/HC (natural logged)	
SCE (structural capital efficiency)	SC/VA	
CEE(capital employed efficiency)	VA/Net worth (natural logged)	
VAIC (value-added intellectual capital efficiency)	HCE + SCE + CEE	

Source: Author's Compilation

Table II.
Definition of variables used and their measurement

(3) SG measures the deviations in a firm's sales and typically indicates a firm's growth probability (Chen *et al.*, 2005; María Díez *et al.,* 2010; Kamath, 2015; Li and Zhao, 2018).

(4) Tobin's *Q* is taken as a proxy for the market value of a firm (Sarkar and Sarkar, 2000; Sardo and Serrasqueiro, 2017).

Control variables. Researchers have used physical capacity, firm size, age and industry dummy as control variables. Since our study consists of firms from several different industries, hence we will use industry dummy, firm size and physical capacity as the control variable. Their measurement is shown in Table II:

- PC intensity regulates the effect of fixed assets on firm performance (Pal and Soriya, 2012).
- Natural log (Sales) is used as an indicator of firm size.
- MAN is assigned 1 if the firm belongs to the manufacturing industry and else 0. This dummy variable examines sector-specific risk.
- SER is assigned 1 if the firm belongs to the service industry and else 0. This dummy variable examines sector-specific risk.

3.3 Independent variables: VAIC framework

Pulic's VAIC (2000, 2004) is employed to measure firm IC. VAIC uses financial report data and estimates the total efficiency of the IC and asset value of a company. This model is important for the decision making by the management. VAIC has been used in a number of studies as an indicator for VA by IC coefficient (Mavridis, 2004; Kamath, 2008; Joshi *et al.*, 2013; Purohit and Tondon, 2015). The audited financial data are used and the values obtained are easy to use and compare cross-sectional firm data. Further, it can be used by the stakeholders to get an insight into the intangible assets of the firm. In Pulic's method, VAIC is the total of CEE, SCE and HCE. The calculation of VAIC is a three-step process. The first step is to estimate the VA by a firm.VA is calculated to determine the effective usage of IC in a firm, thus the firm can classify the extra value created by the resources. The intention is to generate the maximum value or worth by using the limited of tangible and intangible resources. It is represented in Table II. VA is calculated as follows:

$$\mathrm{VA} = D + A + \mathrm{OP} + \mathrm{EC}, \tag{1}$$

where D is depreciation, A is amortization, OP is operating profits and EC is total employee expenses. The second step is to calculate the IC efficiency, which is the summary of HCE and SCE:

$$\mathrm{ICE} = \mathrm{HCE} + \mathrm{SCE}. \tag{2}$$

Following Ramírez *et al.* (2017), HCE is an indicator of the VA efficiency of the HC. It measures the relation between VA and HC, which, in turn, denotes the quantity of VA produced on an investment of one monetary unit on the employees and is determined as:

$$\mathrm{VA}/\mathrm{HC} = \mathrm{HCE}. \tag{3}$$

HC is wages and salaries of employees. Categorizing firm resources into HC and capital employed which are a proxy for tangible or physical and intangible resources, respectively.

This is in line with the resource-based view of the firm which states that firm internal resources are the key to firm performance and competitiveness (Riahi-Belkaoui, 2003; Chen *et al.*, 2005). SC is the difference among VA and HC. SCE evaluates the VA efficiency of SC. It is determined as given below:

$$\mathrm{SC/VA} = \mathrm{SCE}. \tag{4}$$

The third part of the model includes calculation of the efficiency of firm's PC. CEE evaluates the relation between VA and CE. Following Pulic (2000) and Chen *et al.* (2005), CEE, as shown in Equation (4), evaluates the contribution of CE is the proxy for the VA efficiency of capital employed, is defined as follows:

$$\mathrm{VA/CE} = \mathrm{CEE}, \tag{5}$$

where CE is capital employed in the firm in past and is calculated as the difference between total assets and intangible assets. Hence, it can be said that VAIC method emphases over defining the relative input of IC, physical and financial capital to the creation of value:

$$\mathrm{VAIC} = \mathrm{ICE} + \mathrm{CEE}, \tag{6}$$

or:

$$\mathrm{VAIC} = \mathrm{SCE} + \mathrm{HCE} + \mathrm{CEE}.$$

Drawbacks of VAIC model. In spite of the advantages, VAIC has been criticized by few researchers (Ståhle *et al.*, 2011; Maditinos *et al.*, 2011).

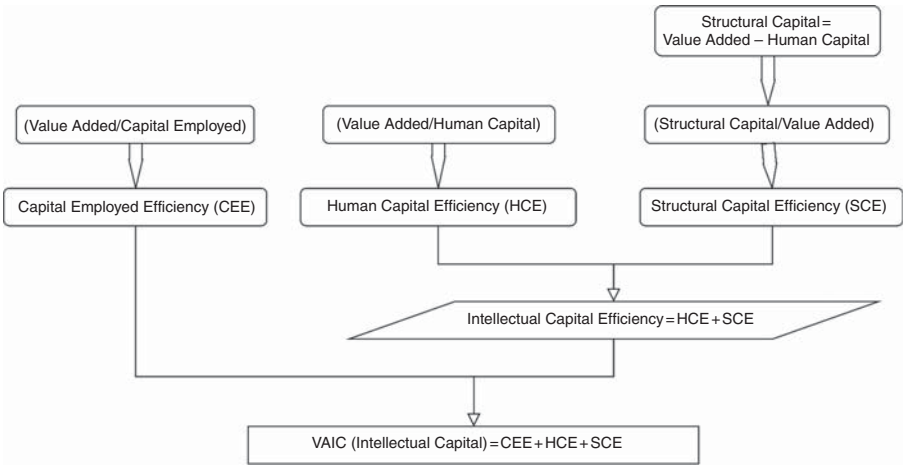
Maditinos *et al.* (2011) questioned the reliability of VAIC model and argued that this method overlooks the risk and negative operating profit or book value of the firm, which results in the decrease in output values than the input value.

Ståhle *et al.* (2011) observed that VAIC model does not include the firm's relational assets and innovation capability. VAIC measures only the operational efficiency of the firm. For instance, this method considers employees' salaries and wages as HC and ignores the knowledge and skills acquired with experience or the investment in training, motivation of the employees. Moreover, VA is the summary of depreciation (*D*), amortization (*A*), operating profit (OP) and employee cost (EC). Amortization and depreciation do not depend on the value generated by the firm. Similarly, SC does not cover relational capital and is the determined by the difference between VA and HC. Computation of VAIC method does not include relational capital. Further, the HCE is derived by dividing VA by HC. This signifies that lesser HC value will give higher HCE. Nimtrakoon (2015) attempted to overcome the limitation by modifying this model by including market cost as relational capital.

However, in spite of the shortcomings, this model is broadly acknowledged among the practitioners and researchers as an indicator for calculating IC and its components (Clarke *et al.*, 2011; Amin *et al.*, 2014; Kamath, 2015; Dženopoljac *et al.*, 2016; Nadeem *et al.*, 2017). This model easily computes the efficiency of IC and also enables the user to comparative analysis across different sectors and countries (Young *et al.*, 2009). Department of Business, Innovation and Skills situated in the UK employs this an indicator of IC (Zeghal and Maaloul, 2010). Hence, this paper too uses VAIC model to analyze IC (Figure 1).

3.4 Estimation method

Focusing on the objective of the paper to evaluate the link between IC, its components and performance indicators, we used the dynamic panel regression. Because the firms in our study



Source: Author's compilation

Figure 1.
Showing the pictorial representation of VAIC model

had missing values for some variables, our data set can be considered unbalanced panel data. This data set allowed us to study the firm performance and IC relationship for several firms over several consecutive years. Our regression models can be represented as follows.

Model 1:

$$\mathrm{ATO}_{i,t} = \propto + \beta_1 \mathrm{ATO}_{i,t-1} + \beta_2 \mathrm{HCE}_i + \beta_3 \mathrm{SCE}_{i,t} + \beta_4 \mathrm{CEE}_i + \beta_5 \mathrm{HCE}_{i,t-1} + \beta_6 \mathrm{SCE}_{i,t-1} + \beta_7 \mathrm{CEE}_{i,t-1} + \beta_8 \mathrm{MAN} + \beta_9 \mathrm{SER} + \beta_{10} \mathrm{PC}_{i,t} + \beta_{11} \mathrm{SIZE}_i + \eta_i + \varepsilon_{i,t},$$

Model 2:

$$\mathrm{ATO}_{i,t} = \propto + \beta_1 \mathrm{ATO}_{i,t-1} + \beta_2 \mathrm{VAIC}_{i,t} + \beta_3 \mathrm{SER} + \beta_4 \mathrm{MAN} + \beta_5 \mathrm{PC}_{i,t} + \beta_6 \mathrm{SIZE}_{i,t-1} + \eta_i + \varepsilon_{i,t},$$

Model 3:

$$\mathrm{ROA}_{i,t} = \propto + \beta_1 \mathrm{ROA}_{i,t-1} + \beta_2 \mathrm{HCE}_i + \beta_3 \mathrm{SCE}_{i,t} + \beta_4 \mathrm{CEE}_i + \beta_5 \mathrm{HCE}_{i,t-1} + \beta_6 \mathrm{SCE}_{i,t-1} + \beta_7 \mathrm{CEE}_{i,t-1} + \beta_8 \mathrm{MAN} + \beta_9 \mathrm{SER} + \beta_{10} \mathrm{PC}_{i,t} + \beta_{11} \mathrm{SIZE}_i + \eta_i + \varepsilon_{i,t},$$

Model 4:

$$\mathrm{ROA}_{i,t} = \propto + \beta_1 \mathrm{ROA}_{i,t-1} + \beta_2 \mathrm{VAIC}_{i,t} + \beta_3 \mathrm{SER} + \beta_4 \mathrm{MAN} + \beta_5 \mathrm{PC}_{i,t} + \beta_6 \mathrm{SIZE}_{i,t-1} + \eta_i + \varepsilon_{i,t},$$

Model 5:

$$\text{Tobin's } Q_{i,t} = \propto + \beta_1 \text{Tobin's} Q_{i,t-1} + \beta_2 \mathrm{HCE}_i + \beta_3 \mathrm{SCE}_{i,t} + \beta_4 \mathrm{CEE}_i + \beta_5 \mathrm{HCE}_{i,t-1} + \beta_6 \mathrm{SCE}_{i,t-1} + \beta_7 \mathrm{CEE}_{i,t-1} + \beta_8 \mathrm{MAN} + \beta_9 \mathrm{SER} + \beta_{10} \mathrm{PC}_{i,t} + \beta_{11} \mathrm{SIZE}_i + \eta_i + \varepsilon_{i,t},$$

Model 6:

$$\text{Tobin's } Q_{i,t} = \propto + \beta_1 \text{Tobin's } Q_{i,t-1} + \beta_2 \mathrm{VAIC}_{i,t} + \beta_3 \mathrm{SER} + \beta_4 \mathrm{MAN} + \beta_5 \mathrm{PC}_{i,t} + \beta_6 \mathrm{SIZE}_{i,t-1} + \eta_i + \varepsilon_{i,t},$$

Model 7:

$$SG_{i,t} = \propto + \beta_1 SG_{i,t-1} + \beta_2 HCE_i + \beta_3 SCE_{i,t} + \beta_4 CEE_i + \beta_5 HCE_{i,t-1} + \beta_6 SCE_{i,t-1} + \beta_7 CEE_{i,t-1} + \beta_8 MAN + \beta_9 SER + \beta_{10} PC_{i,t} + \beta_{11} SIZE_i + \eta_i + \varepsilon_{i,t},$$

Model 8:

$$SG_{i,t} = \propto + \beta_1 SG_{i,t-1} + \beta_2 VAIC_{i,t} + \beta_3 SER + \beta_4 MAN + \beta_5 PC_{i,t} + \beta_6 SIZE_{i,t-1} + \eta_i + \varepsilon_{i,t},$$

Model 9:

$$VAIC_{i,t} = \propto \text{ or } \alpha + \beta_1 VAIC_{i,t-1} + \beta_2 ROA_{i,t} + \beta_3 MAN + \beta_4 SER + \beta_5 PC_{i,t} + \beta_6 SIZE_{i,t} + \eta_i + \varepsilon_{i,t},$$

where the dependent variables are $ATO_{i,t}$ is the productivity, $ROA_{i,t}$ is the profitability, Tobin's $Q_{i,t}$ is firms' market value and $SG_{i,t}$ is the SG of the firm of the current year. Following, the independent variables of firm performance indicators of the previous year are: $ATO_{i,t-1}$, $ROA_{i,t-1}$, Tobin's $Q_{i,t-1}$, $SG_{i,t-1}$, $HCE_{i,t-1}$, $SCE_{i,t-1}$, $CEE_{i,t-1}$ and $VAIC_{i,t}$, $HCE_{i,t}$, $SCE_{i,t}$ and $CEE_{i,t}$ of the current year. MAN and SER represent the product-oriented and service-oriented industry dummy variables. η_i are un-observable time-invariant firm effects and $\varepsilon_{i,t}$ are error term is i, at current time period t.

4. Empirical results

4.1 Descriptive statistics

The mean, standard deviation, median, minimum and maximum values of all variables are shown in Table III. The aggregate value of ROA was 4.929 showing the highest value among the dependent variables, indicating that the firms earned huge profits, followed by Tobin's Q. With the mean value of 2.807, Tobin's Q reflects that firm's market value is

Variables	Observations	Mean	SD	Minimum	Maximum
ATO	10,791	0.7720611	1.005562	−4.60517	10.1536
ROA	11,360	4.929777	9.961	−166.67	115.83
SG	9,963	1.585713	1.150871	−4.60517	4.75212
Tobin's Q	9,212	2.807047	1.181495	−4.60517	11.7672
HCE	11,154	1.338691	1.041567	−7.04131	9.1598
CEE	10,720	−0.5548764	1.248919	−8.91767	9.12726
SCE	10,757	−0.3444109	0.5876456	−7.52394	5.77702
VAIC	10,923	1.771849	0.8974727	−5.03288	9.82034
PC	8,271	0.4762724	1.057563	−3.91202	8.06271
Firm Size	11,297	−1.161308	1.390271	−4.60517	13.2339
SER	11,360	0.2014085	0.4010701	0	1
MAN	11,360	0.0098592	0.0988069	0	1
NOE	9,723	2,111.397	7,562.542	−28,285.2	156,721
AP	11,331	1,015.927	6,184.727	−119,062.3	126,930
REV	11,312	9,809.148	36,206.62	4.3	540,340

Notes: In this table, ATO stands for asset turnover ratio, ROA stands for return on assets, SG for sales growth, Tobin's Q as market value, HCE as value-added efficiency of human capital, CEE as capital employed efficiency, SCE as value added by efficiency of structural capital, VAIC as the value added by the intellectual coefficient. PC stands for physical capacity, SER stands for dummy of the service sector, MAN stands for dummy of the manufacturing sector, AP stands for average profit, REV for revenue and NOE stands for the number of employees. SD stands for standard deviation

Source: Author's compilation

Table III.
Descriptive statistics of the variables for the firms

greater than its book value. SG shows mean value of 1.587 and low standard deviation value of 1.150 indicates that low variation in SG among firms. ATO had the lowest mean value, suggesting that the firms faced difficulties in generating optimum productivity.

The sample firms created more value from HCE, which has a value of 1.338, than from CEE (−0.558) and SCE (−0.344). The sum of mean values of HCE and SCE also known as IC efficiency is 0.994, which is more than the mean value of physical assets, i.e. CEE (−0.558), indicating that the firms created more value from the intangible components of VAIC than from the physical and financial components.

The aggregate value of VAIC is 1.771, which indicates that the firm produced an average value of INR1.771 for each one INR employed. This finding is in line with the prior researcher (Firer and Mitchell Williams, 2003) indicating that more wealth is created by intellectual resources. IC plays an important role and is a significant contributor in creating wealth. The mean value for the average profit of the firm is 1,015.927. The mean value of revenue is 9,809.148 and the firm has the maximum of 1,567,121 number of employees.

As the firms belong to different industries, descriptive statistics of the variables of each industry are shown in Table IV.

Among the components of VAIC, the industries with highest mean value are recreational services, electricity and construction material. Industries with lowest mean HCE value are health services. Metal and metals show the highest mean value of CEE and construction materials show the lowest mean value. Regarding the mean value of SCE, machinery forms the highest and consumer goods have lowest mean value. Industries with highest mean value for VAIC are business consultancies and metal and metals. Electricity and information technology are evidenced to have highest and lowest mean value of ROA, respectively.

4.2 Correlation matrix

Table V shows the outcome of correlation analysis of the Indian listed firms. The dependent and independent variables were positively and significantly correlated with each other. SG showed a negative correlation with VAIC of the current and previous years. Moreover, the insignificant relationship between SG and SCE and HCE (both current year and previous year) except CEE of previous year showed that the previous year tangible resources of the firm affect the present growth of the firm. Thus, CEE had a long-term effect on firm growth. In contrast to this Tobin's Q (previous and present year) shows a significant but negative correlation with CEE (previous and present year), suggesting that CEE has a negative influence on the company's market value in the long run. Among all components of IC, CEE exhibits significantly positive and highest correlation with the dependent variables, ATO of the present (p-value of $CEE_{i,t} = 0.424$, $CEE_{i,t-1} = 0.370$) and previous year (p-value of $CEE_{i,t} = 0.343$, $CEE_{i,t-1} = 0.430$). Thus, CEE of a firm contributed more than its IC efficiency, i.e., HCE and SCE to firm productivity and market value in the study sample. Hence, the roles of physical or financial capital as major contributors to firm value creation cannot be ruled out.

Tobin's Q (present year) was significantly correlated with VAIC (p-value = 0.043) and HCE (p-value = 0.069) of the present year, suggesting that the market value of the firms was positively associated with corporate IC and HCE. This outcome is similar to the findings of Sardo and Serrasqueiro (2017). Overall, VAIC (present value) was significantly related to productivity, growth and market value of the present year. By contrast, firm profitability was positively and significantly associated with HCE of the current year (p-value = 0.019), indicating that human resources played a significant role in enhancing the profitability of Indian listed firms. This observation is consistent with the argument of Kamath (2008) that HC is the driving component affecting firm FP in developing economies.

The correlation exceeded 0.8 in the case of VAIC and HCE (p-value = 0.856), implying a multicollinearity problem (Kennedy, 1985; Gujarati, 2012) between the current and previous periods.

Table IV.
Industry wise descriptive statistics of the variables

Industry/Variables	HCE	CEE	SCE	VAIC	ATO	ROA	SG	Tobin's Q	PC	Size	NOE	AP	Revenue
Business services and consultancy													
Mean	8.27	0.47	0.71	9.45	0.67	5.87	46.11	23.71	0.28	5.90	349.22	186.10	1,216.22
SD	18.37	0.73	0.47	18.93	1.32	15.87	273.70	48.34	0.2	1.97	682.32	760.89	1,753.23
Metal and metal products													
Mean	9.43	−0.68	0.82	9.57	3.94	4.46	60.63	2.24	0.38	8.77	4,721.33	2,474.00	30,573.97
SD	78.59	41.62	3.88	89.03	4.49	9.99	957.97	12.85	0.16	1.66	16,105.31	10,945.08	77,101.8
Textiles													
Mean	4.45	1.23	0.28	5.96	2.53	0.05	77.14	2.59	0.25	7.09	1,988.18	103.89	4,501.24
SD	7.37	11.95	20.79	25.47	12.85	0.17	2,301.18	5.53	0.17	1.99	3,698.41	1,242.16	12,273.72
Food and agro-based product													
Mean	5.74	0.63	0.69	7.06	4.611	3.76	21.85	1.36	0.37	7.54	2,138.96	681.25	8,887.48
SD	13.83	1.12	0.92	13.96	11.96	8.57	198.24	3.79	0.17	1.80	5,379.33	5,503.73	32,361.30
Communication													
Mean	7.24	0.30	0.759	8.30	4.472	−0.015	1.31	1,434.50	1.78	4.32	6,738.09	4,474.26	50,431.37
SD	5.94	3.81	0.33	7.19	31.89	0.105	3.62	12,063.74	2.27	14.10	13,960.62	19,732.68	102,486.5
Drugs and pharmaceuticals													
Mean	4.34	0.53	0.95	5.82	2.27	0.0561	1.75	1.7	0.348	7.17	2,222.83	926.53	6,109.92
SD	3.63	0.72	3.63	5.27	3.95	0.117	3.82	2.49	0.154	1.87	3,918.61	4,739.78	13,668.26
Health services													
Mean	3.21	0.83	0.753	4.79	2.15	0.062	48.39	1.08	0.579	5.77	3,337.77	243.70	3,262.38
SD	1.63	0.84	0.615	1.91	2.06	0.314	36.18	1.49	0.221	2.56	7,996.88	646.99	8,466.65
Transport													
Mean	8.18	0.83	0.753	4.79	2.15	0.062	2.51	2.51	7.42	7.44	2,136.69	14,926.45	723.43
SD	9.18	0.83	0.615	1.91	2.06	0.314	3.46	0.44	0.22	2.85	3,254.17	28,408.48	3,693.24
Electricity													
Mean	9.70	0.59	3.29	0.59	1.15	1.431	0.45	8.39	0.47	−2.69	6,283.52	4,846.01	21,316.02
SD	2.95	0.526	3.66	0.53	1.88	1.36	0.18	3.42	−1.88	1.29	7,024.46	6,242.19	20,864.77

(*continued*)

Industry/Variables	HCE	CEE	SCE	VAIC	ATO	ROA	SG	Tobin's Q	PC	Size	NOE	AP	Revenue
Hotel and tourism													
Mean	3.722	0.577	0.877	5.18	0.84	0.045	4.42	1.42	0.47	5.85	1,313.34	148.29	2,040.32
SD	4.642	1.328	1.748	5.68	7.82	0.07	3.75	2.12	0.27	2.409	1,909.44	697.06	3,807.44
Constructional materials													
Mean	9.17	1.30	0.61	4.61	1.15	1.43	0.45	2.39	2.03	−2.69	1,435.77	843.72	11,345.51
SD	2.95	2.63	0.66	5.63	1.88	1.36	0.18	3.43	1.39	1.29	2,949.847	2,625.29	21,361.71
Recreational													
Mean	9.91	0.37	0.80	1.077	0.954	0.04	2.46	1.42	0.32	6.15	989.92	394.47	2,869.09
SD	1.88	0.39	0.49	1.12	0 0.81	0.10	2.18	1.72	0 0.22	1.36	1,466.91	1,327.89	6,464.11
Consumer goods													
Mean	5.88	3.48	−2.23	7.156	4.796	0.07	4.06	3.16	0 0.27	7.83	932.35	1,303.54	20,644.76
SD	1.44	6.34	3.57	7.06	2.11	0.086	1.029	5.92	0.17	2.57	1,573.08	4,416.86	49,434.94
Information technology													
Mean	3.32	0.73	0.30	4.336	1.32	0.06	168.04	2.15	0.22	6.48	4,113.34	1,777.66	8,308.52
SD	5.83	2.01	6.14	8.83	3.14	0.22	3,696.66	4.61	0.17	2.18	14,224.56	9,638.83	38,379.88
Machinery													
Mean	4.06	0.58	0.99	5.65	2.80	0.05	15.56	2.56	0.23	7.23	1,438.84	502.45	8,176.55
SD	5.01	1.99	6.28	8.29	14.07	0.17	46.73	6.21	0.15	1.79	4,625.35	3,806.38	30,283.31

Notes: In this table, descriptive statistics of each industry is given. SD stands for standard deviation, ATO stands for asset turnover ratio, ROA stands for return on assets, SG for sales growth, Tobin's *Q* as market value, HCE as value-added efficiency of human capital, CEE as capital employed efficiency, SCE as value added by efficiency of structural capital, VAIC as the value added by the intellectual coefficient. PC stands for physical capacity, SER stands for dummy of the service sector, MAN stands for dummy of the manufacturing sector, NOE stands for the number of employees, AP as average profit and REV as revenue. SD stands for standard deviation
Source: Author's compilation

Table IV.

Table V.
Correlation matrix for dependent, independent and control variables

Variables	ATO	ATO_{t-1}	ROA	ROA_{t-1}	SG	SG_{t-1}	Tobin's Q	Tobin's Q_{t-1}	VAIC	VAIC $_{t-1}$	HCE	HCE_{t-1}	CEE	CEE_{t-1}	SCE	SCE_{t-1}	PC	Firm Size	SER	MAN
ATO	1																			
ATO_{t-1}	0.824*	1																		
ROA	−0.048	−0.056*	1																	
ROA_{t-1}	−0.067*	−0.061	0.587*	1																
SG	−0.073*	−0.070*	0.790*	0.507*	1															
SG_{t-1}	−0.089*	−0.077*	0.513*	0.790*	0.632*	1														
Tobin's Q	−0.069*	−0.064*	0.110*	0.104*	0.106*	0.102*	1													
Tobin's Q_{t-1}	−0.106*	−0.073*	0.121*	0.134*	0.112*	0.129*	0.225*	1												
VAIC	0.144*	0.114*	0.015	0.004	−0.037*	−0.037*	0.043*	0.035*	1											
$VAIC_{t-1}$	0.099*	0.140*	0.017	0.033*	−0.028*	−0.024*	−0.011	0.043*	0.724*	1										
HCE	0.040*	0.043*	0.019*	0.003	0.028	−0.033*	0.069*	0.062*	0.856*	0.633*	1									
HCE_{t-1}	0.030*	0.033*	0.003	0.023*	0.032	−0.027	0.035*	0.073*	0.655*	0.857*	0.695*	1								
CEE	0.424*	0.343*	0.009	−0.01	0.009	−0.012	−0.024*	−0.038*	0.558*	0.306*	0.361*	0.242*	1							
CEE_{t-1}	0.370*	0.430*	0.020*	0.017	0.024*	0.016	−0.082*	−0.029*	0.348*	0.539*	0.252*	0.338*	0.644*	1						
SCE	0.057*	0.068*	0.014	0.020*	0.024	−0.016	0.014	0.025*	0.433*	0.286*	0.467*	0.287*	0.007	0.008	1					
SCE_{t-1}	0.041*	0.044*	0.007	0.020*	0.017	−0.018	0.043*	0.019	0.309*	0.431*	0.296*	0.478*	−0.022*	−0.003	0.392*	1				
PC	−0.318*	−0.288*	0.123*	0.125*	0.146*	0.1645*	0.083*	0.060*	0.006	0.013	−0.012	−0.005	−0.101*	−0.089*	0.024*	0.037*	1			
Firm Size	−0.018	−0.021*	−0.042*	−0.042*	−0.060*	−0.061*	−0.069*	−0.072*	0.231*	0.220*	0.064*	0.066*	0.317*	0.285*	0.044*	0.0418*	−0.01	1		
SER	−0.425*	−0.427*	0.054*	0.054*	0.075*	0.074*	0.086*	0.096*	−0.129*	−0.127*	−0.012	−0.100*	−0.075*	−0.077*	−0.091*	−0.092*	−0.143*	0.319*	1	
MAN	−0.127*	−0.118*	−0.005	−0.005	−0.030*	−0.030*	−0.071*	−0.073*	0.176*	0.166*	−0.004	−0.001	0.254*	0.230*	−0.021*	−0.020*	0.087*	0.829*	−0.050*	1.00

Notes: *,**Significant at the 0.05 and 0.10 levels, respectively
Source: Author's compilation

4.3 Diagnostic tests

To confirm the stationarity of our data, Fisher–Type unit root test is applied. It is employed on unbalanced panel data set. The *p*-value of 0.000 this analysis confirms the alternate hypothesis, showing that the data are stationary. It can be said that data have no unit root. Moreover, the multicollinearity was checked using variance inflation factor (VIF) test and the highest value of VIF, 11.21. Usually, VIF value exceeding ten symbolizes multicollinearity in data (Neter *et al.*, 1990), hence the presence of multicollinearity was confirmed in data. Additionally, Breusch–Pagan test was applied in data set to check the heteroscedasticity. The null hypotheses were rejected, thus confirming the existence of heteroscedasticity.

To solve the multicollinearity and endogenous nature of data dynamic SGMM was applied. It uses instrumental variables and decreases the endogenous nature of data. Blundell and Bond (1998) confirmed that SGMM estimator is suitable than GMM estimator. Employing differencing followed by the level equation, SGMM increases the effectiveness of the outcomes with the smaller time period and the larger number of firms.

4.4 Impact of IC on firm performance indicators

To obtain further insights on the relationship between firm performance and IC, a dynamic SGMM regression analysis of models was performed as described in Section 3.3. Table VI presents the nine regression outcomes. The results of regression model 1 show that ATO_{t-1} (coefficient = 0.844 and *p*-value = 0.055), SCE (coefficient value = 0.170), CEE_{t-1} (coefficient = 0.116), HCE (coefficient = 0.014) and firm size (coefficient value = 0.004) were significantly and positively related to firm productivity. By contrast, HCE_{t-1}, SCE_{t-1}, industry type and physical capacity had significant but negative impacts on ATO. The results for the model 2 showed that ATO of the previous period, VAIC and physical capacity had positive impacts on firm productivity.

Regression model 3 showed that ROA_{t-1} (coefficient = 0.511) and CEE (coefficient = 0.473) had positive impacts on firm profitability, whereas HCE_{t-1} (coefficient = −1.630) had negative impacts.

Model 4 showed significant and positive impacts of IC on firm profitability (coefficient = 0.008) at the 1 percent level of significance. The findings reveal that IC can be used as a potential tool for generating wealth.

Following the study by Sardo and Serrasqueiro (2017), models (5) and (6) were estimated using Tobin's *Q* as a dependent variable. Result for regression models (5) and (6) revealed that Tobin's $Q_{t-1,}$ $VAIC_{t-1}$, SCE, CEE, SCE_{t-1} and CEE_{t-1} had positive impacts on firm market value. By contrast, HCE_{t-1} and firm size had significant negative impacts on the market value of the Indian listed firms.

About firm SG, the results for the model 7 showed that SG_{t-1}, SCE, CEE and CEE_{t-1} had influenced the firm SG positively and significantly. These findings imply that Indian firms generate revenues from their investment in R&D and innovation along with physical capacity. Model 8 shows that VAIC had significant impacts on firm SG.

Finally, the last regression result, model 9, showed that IC was statistically positively significant at the 5 percent level of confidence. The distinction between service-oriented firms and product-oriented firms had no influence on VAIC, inconsistent with the findings of Kianto *et al.* (2010). This discrepancy suggests that companies moving toward a service orientation need to change their approach to IC stocks and management.

Further, the firms were segregated into the manufacturing and service sectors and the regression model was applied to check the influence of VAIC and its dimensions on the indicators of firm performance. Tables VII–X represent the model where ATO is the dependent variable. The findings show that VAIC contributes significantly and positively on the four firm performance indicators taken irrespective of sectors.

Table VI.
Regression result of model (1), (2), (3), (4), (5), (6), (7), (8), (9) for financial performance (FP) of firms

Variables	Model 1: ATO	Model 3: ROA	Model 5: Tobin's *Q*	Model 7: SG	Variables	Model 2: ATO	Model 4: ROA	Model 6: Tobin's *Q*	Model 8: SG	Variables	Model 9: VAIC
ATO_{t-1}	*0.844**				ATO_{t-1}	*0.461***				$VAIC_{t-1}$	*0.243*
	(0.055)					*(0.062)*					*(0.068)*
ROA_{t-1}		*0.511**			ROA_{t-1}		*0.517***				
		(0.053)					*(0.048)*				
Tobin's Q_{t-1}			*0.838***		Tobin's Q_{t-1}			*0 0.819**			
			(0.029)					*(0.043)*			
SG_{t-1}				*0.533**	SG_{t-1}				*0.564**		
				(0.038)					*(0.320)*		
HCE	*0.014**	1.570	−0.056	0.163	VAIC	*0.869***	*1.569**	*0.263**	*0.320**	ROA	*0.008***
	(0.214)	(0.151)	(0.093)	(0.118)		*(0.195)*	*(0.509)*	*(0.082)*	*(0.099)*		*(0.004)*
SCE	*0.170***	0.631	*0.274**	*0.119**							
	(0.079)	(0.500)	*(0.074)*	*(0.061)*							
CEE	*−0.133**	*0.473***	*0.156**	*0.119***							
	(0.064)	*(0.320)*	*(0.031)*	*(0.043)*							
HCE_{t-1}	*−0.005**	*−1.630***	*−0.165***	*−0.276**							
	(0.199)	*(0.954)*	*(0.094)*	*(0.108)*							
CEE_{t-1}	*0.116**	*0.086*	*0.051**	*0.049***							
	(0.052)	*(0.214)*	*(0.025)*	*(0.029)*							
SCE_{t-1}	*−0.017***	*−0.111*	*0.051**	*−0.006*							
	(0.030)	*(0.190)*	*(0.025)*	*(0.028)*							
Size	*0.004**	*−0.263**	*0.047**	*−0.055**	Size	*0.073**	*−0.305**	*0.062**	*−0.053***	Size	*0.113**
	(0.002)	*(0.100)*	*(0.019)*	*(0.014)*		*(0.057)*	*(0.095)*	*(0.025)*	*(0.016)*		*(0.031)*
PC	*−0.072**	*0.681***	*0.230**	*0.073**	PC	*0.137**	*0.652**	*0.234*	*0.060*	PC	0.018
	(0.022)	*(0.159)*	*(0.026)*	*(0.019)*		*(0.030)*	*(0.159)*	*(0.034)*	*(0.020)*		(0.018)
SER	*−6.612**	*3.011***	*0.408**	*−0.385 **	SER	*1.224**	*−2.178*	*−6.612**	*1.880*	SER	0.271
MAN	*−6.445**	*0.002*	*0.0208*	*0.132*	MAN	*1.651**	*−3.375**	*−6.445**	*2.710*	MAN	0.094
Constant	*0.303**	*4.259**	*0.560***	*0.560***	Constant	2.037	−0.806	*−0.411**	0.102	Constant	*1.293***
	(0.159)	*(0.604)*	*(0.094)*	*(0.048)*		(0.300)	(1.010)	*(0.159)*	(0.208)		*(0.138)*
Observation	7,049	7,091	6,101	5,364	Observation	6,889	7,854	6,737	7,346	Observation	7,676
AR(2)	0.808	0.392	0.781	0.363	AR(2)	0.412	0.242	0.313	0.16	AR(2)	0.087
Hansen test	0.400	0.420	0.990	0.640	Hansen test	0.311	0.742	0.828	0.536	Hansen test	0.206
No. of instrument	118	118	202	202	No. of instrument	62	62	62	62	No. of instrument	62
No. of groups	524	524	459	513	No. of groups	516	528	461	518	No. of groups	528

Notes: AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Variables	Model 2: ATO	
	Service sector	Manufacturing sector
ATO_{t-1}	*0.185* (0.086)*	*0.011* (0.004)*
VAIC	*0.147** (0.097)*	*0.189* (0.218)*
Size	0.029 (0.032)	−0.71 (0.022)
PC	−0.009 (0.007)	−0.231 (0.024)
Constant	*0.803 *(0.177)*	0.743 (0.102)
Observation	2,255	9,165
AR(2)	0.219	0.415
Hansen test	0.148	0.179
No. of instrument	89	77
No. of groups	144	574

Notes: In this table, ATO stands for asset turnover ratio of the current year, ATO_{t-1} stands for asset turnover ratio of the previous year. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively
Source: Author's compilation

Table VII.
Regression result of model (2) for productivity (ATO) of the service and manufacturing sector

Variables	Model 4: ROA	
	Service sector	Manufacturing sector
ROA_{t-1}	*0.709* (0.138)*	*0.473* (0.097)*
VAIC	*0.128* (0.081)*	*0.008** (0.073)*
Size	*0.047* (0.006)*	*0.083* (0.035)*
PC	−0.006 (0.003)	0.234 (0.034)
Constant	*−0.294* (0.021)*	*−0.439** (0.258)*
Observation	2,255	9,165
AR(2)	0.308	0.612
Hansen test	0.180	0.232
No. of instrument	89	77
No. of groups	144	574

Notes: In this table, ROA stands for return on assets of the current year, ROA_{t-1} stands for asset turnover ratio of the previous year. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significance at 0.05 and 0.10 levels, respectively
Source: Author's compilation

Table VIII.
Regression result of model (4) for profitability (ROA) of the service and manufacturing sector

Taking into account that each component of VAIC has different effects on the firm performance (Chen *et al.*, 2005), the outcomes of the regression model are shown in Tables XI–XIV, where the dependent variables are ATO, ROA, Tobin's *Q* and SG. Findings from Table XI indicate that the dimensions of VAIC do not influence the productivity of the service firms except SCE_{t-1} (coefficient value = 0.062), whereas the manufacturing sector shows no significant association with the components of VAIC. In Table XII, profitability of the service firms is influenced positively by HCE (coefficient value = 0.178) and CEE (coefficient value = 0.074) at 5 and 10 percent, respectively, whereas the HCE shows a positive influence on ROA. The manufacturing firms are influenced positively with HCE (coefficient value = 0.096).

The results from Table XIII clearly show that the market value of service firm and manufacturing firms are influenced negatively by HCE and CEE, respectively. Further, CEE is significantly influencing the service sector market value. PC is influencing the SG of the service firm positively, as shown in Table XIV.

Variables	Model 6: Tobin's Q	
	Service sector	Manufacturing sector
Tobin's Q_{t-1}	*0.860** (*0.075*)	*0.304** (*0.121*)
VAIC	*1.170** (*0.822*)	*0.280** (*0.021*)
Size	*−0.194*** (*0.112*)	−0.030 (0.129)
PC	*0.076** (*0.045*)	*−2.27** (*0.6678*)
Constant	1.275 (0.773)	*3.602** (*1.097*)
Observation	1,939	7,435
AR(2)	0.386	0.805
Hansen test	0.772	0.211
No. of instrument	89	87
No. of groups	124	466

Table IX.
Regression result of model (6) for market value (Tobin's Q) of the service and manufacturing sector

Notes: In this table, Tobin's Q stands for the market value of the current year, Tobin's Q_{t-1} stands for the market value of the previous year. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Variables	Model 8: sales growth (SG)	
	Service sector	Manufacturing sector
SG_{t-1}	*0.748** (*0.028*)	*0.006** (*0.013*)
VAIC	*0.226** (*1.64*)	*0.146** (*0.017*)
Size	0.005 (0.029)	0.759 (0.261)
PC	*0.996** (*0.625*)	*0.035* (*0.431*)
Constant	0.041 (0.059)	−2.03 (0.029)
Observation	2,255	9,165
AR(2)	0.180	0.194
Hansen test	0.165	0.654
No. of instrument	89	77
No. of groups	114	574

Table X.
Regression result of model (8) for sales growth (SG) of the service and manufacturing sector

Notes: In this table, SG stands for sales growth, SG_{t-1} stands for sales growth of the previous year. VAIC stands for intellectual capital of the current year. AR(2) is Arellano–Bond test for second-order auto-correlation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

4.5 Robustness check and validity of the results

Specification tests of SGMM such as AR(2) (see Table VI) satisfy the first-order autocorrelation and rejects second-order autocorrelation. Hansen's J test assumes that all instruments are valid as null hypothesis is that all instruments are valid. The p-value of this analysis accepts the null hypothesis as shown in Table VI.

Moreover, a different Hansen test with the null hypothesis that all instruments are exogenous also has p-values above the level of significance, indicating that this null hypothesis also cannot be rejected. The number of group should be more than the number of instruments is another thumb rule which verifies the validity of this instrument (Roodman, 2006).

Classic ordinary least squares or fixed effect analysis ignores the dynamic relationships between a dependent variable and independent variables (Baltagi, 1995; Nerlove and Balestra, 1992), whereas Roodman (2006) argued that SGMM exploits the dynamic nature of dependent and independent variables by employing internal

Variables	Model 1: ATO Service sector	Manufacturing sector
ATO_{t-1}	*0.198** (*0.089*)	*0.008** (*0.007*)
HCE	0.113 (0.083)	0.110 (0.073)
SCE	*0.194*** (*0.139*)	−0.062 (0.077)
CEE	0.015 (0.046)	0.076 (0.093)
HCE_{t-1}	−0.101 (0.076)	−0.020 (0.057)
CEE_{t-1}	−0.179 (0.129)	−0.090 (0.120)
SCE_{t-1}	*0.062*** (*0.036*)	−0.003 (0.005)
Size	0.041 (0.038)	−0.460 (0.432)
PC	−0.098 (0.124)	*−1.06** (*4.57*)
Constant	*0.668** (*0.183*)	2.32 (3.19)
Observation	2,255	8,958
AR(2)	0.178	0.302
Hansen test	0.997	0.203
No. of instrument	144	200
No. of groups	201	574

Notes: In this table, ATO stands for Asset turnover ratio of the current year and ATO_{t-1} stands for the asset turnover ratio of the previous year. HCE stands for the human capital efficiency of the current year, HCE_{t-1} stands for the human capital efficiency of the previous year. SCE and SCE_{t-1} is the structural capital efficiency of the current and previous year, respectively. CEE stands for the capital employed efficiency of the current and previous year, respectively. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Table XI. Regression result of model (1) for IC components and productivity of the service and manufacturing sector

Variables	Model 3: ROA Service sector	Manufacturing sector
ROA_{t-1}	*0.719** (*0.1375*)	*0.424** (*0.094*)
HCE	*0.178** (*0.081*)	*0.095*** (*0.038*)
SCE	*−0.016*** (*0.056*)	0.010 (0.009)
CEE	*0.074*** (*0.042*)	0.002 (0.001)
HCE_{t-1}	*−0.171*** (*0.110*)	*−0.053** (*0.011*)
CEE_{t-1}	−0.056 (0.038)	0.001 (0.008)
SCE_{t-1}	−0.019 (0.024)	0.003 (0.06)
Size	0.026 (0.021)	*0.149** (*0.062*)
PC	*−0.008** (*0.004*)	*0.062** (*0.440*)
Constant	−0.075 (0.211)	*−0.695*** (*0.451*)
Observation	2,255	8,958
AR(2)	0.283	0.210
Hansen test	0.998	0.365
No. of instrument	144	200
No. of groups	201	574

Notes: In this table, ROA stands for return on assets of the current year and ROA_{t-1} stands for the return on assets of the previous year. HCE stands for the human capital efficiency of the current year, HCE_{t-1} stands for the human capital efficiency of the previous year. SCE and SCE_{t-1} is the structural capital efficiency of the current and previous year respectively. CEE stands for the capital employed efficiency of the current and previous year, respectively. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Table XII. Regression result of model (3) for IC components and profitability of the service and manufacturing sector

Variables	Model 5: Tobin's Q	
	Service sector	Manufacturing sector
Tobin's Q_{t-1}	*0.872** (*0.060*)	*0.342** (*0.136*)
HCE	*−0.934*** (*0.853*)	−0.004 (0.008)
SCE	1.236 (0.235)	−0.004* (0.007)
CEE	*0.401** (*0.087*)	*−0.296** (*0.003*)
HCE_{t-1}	0.114 (0.205)	0.003 (0.006)
CEE_{t-1}	0.395 (0.116)	0.0250 (0.022)
SCE_{t-1}	−0.224 (0.410)	−0.001 (0.002)
Size	0.133 (0.490)	*0.198** (*0.074*)
PC	0.097 (0.160)	*−2.861*** (*0.559*)
Constant	0.677 (0.494)	0.789 (0.522)
Observation	2,051	7,288
AR(2)	0.282	0.972
Hansen test	0.998	0.047
No. of instrument	124	199
No. of groups	201	466

Notes: In this table, Tobin's Q stands for the market value of the current year and Tobin's Q_{t-1} stands for the market value of the previous year. HCE stands for the human capital efficiency of the current year, HCE_{t-1} stands for the human capital efficiency of the previous year. SCE and SCE_{t-1} is the structural capital efficiency of the current and previous year, respectively. CEE stands for the capital employed efficiency of the current and previous year, respectively. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Table XIII.
Regression result of model (5) for IC components and market value of the service and manufacturing sector

Variables	Model 7: SG	
	Service sector	Manufacturing sector
SG_{t-1}	*0.069** (*0.030*)	*0.0561** (*0.002*)
HCE	−0.209 (0.213)	−0.270 (3.01)
SCE	*−0.034** (*0.141*)	−0.044 (1.010)
CEE	*0.735*** (*0.931*)	*−1.66** (*0.099*)
HCE_{t-1}	*−1.08*** (*0.191*)	−1.60 (1.423)
CEE_{t-1}	−0.996 (0.9175)	−0.055 (0.095)
SCE_{t-1}	−0.896 (0.113)	0.007 (0.149)
Size	0.816 (0.058)	*6.47** (*0.135*)
PC	0.094 (0.123)	0.546 (0.476)
Constant	0.733 (0.523)	−0.329 (0.214)
Observation	2,255	8,958
AR(2)	0.151	0.697
Hansen test	0.995	0.565
No. of instrument	144	200
No. of groups	201	574

Notes: In this table, SG stands for sales growth of the current year and SG_{t-1} stands for sales growth of the previous year. HCE stands for the human capital efficiency of the current year, HCE_{t-1} stands for the human capital efficiency of the previous year. SCE and SCE_{t-1} is the structural capital efficiency of the current and previous year, respectively. CEE stands for the capital employed efficiency of the current and previous year, respectively. AR(2) is Arellano–Bond test for second-order autocorrelation. Sample period: 2001–2016. Robust standard errors are in parentheses. *,**Significant at 0.05 and 0.10 levels, respectively

Source: Author's compilation

Table XIV.
Regression result of model (7) for IC components and sales growth of the service and manufacturing sector

instrument thus producing consistent and robust results. Furthermore, the SGMM estimator accepts that our model embraces all variables that could possibly influence the dependent variables and independent variable (Hansen and Singleton, 1982; Nadeem *et al.*, 2017). Thus, we cannot reject the instrument validity. The proposition of the presence of second-order autocorrelation is confirmed. Outcomes of the SGMM dynamic estimator are robust and can be used to support our analysis of the empirical results (Blundell and Bond, 1998; Roodman, 2006; Sardo and Serrasqueiro, 2017). Hence, SGMM estimator is used in this paper.

5. Discussion of the empirical results

The findings and analysis in this paper successfully establish significant relationships of firm market value, productivity, profitability and SG with IC and its components. The hypotheses validation is shown in Table XV.

Findings of the models (2), (4), (6) and (8) indicate that VAIC is positively related with Indian firm performance indicators stating that IC plays a significant and crucial part in enhancing firm performance and generating wealth and growth in developing economies (Sardo and Serrasqueiro, 2017). These findings validate the resource-based theory in the Indian context. Hence, supports our *H1a–H1d* and are consistent with the findings of Amin and Aslam (2017) and Nadeem *et al.* (2017).

Concerning the components of VAIC, findings of the model 1 clearly show that HCE_b, SCE_t and size of the firm have a positive impact on ATO and supports *H3a* and *H4a*. This signifies that the IC efficiency components, HCE and SCE together, affect the productivity of the firm in India. This is in line with the study of Chen *et al.* (2005) who found a positive relation between ATO and HCE and SCE. The manufacturing and service sectors also show the significant influence of VAIC on firm performance, whereas CEE_t was found to have statistical significance impact but the negative relation gives a direction which rejects the *H2a*. It also shows that both industry types have a significant but negative impact on firm productivity.

Results from the models (3), (5) and (7) display that CEE is correlating significantly with the four performance indicators such as profitability, productivity, SG and market valuation of the Indian firms, hence supporting *H2b–H2d* propositions but the negative relation with productivity leads to the rejection of *H2a*. Further, the positive relationship with the CEE of

Hypothesis	Supported/Rejected
H1a. Intellectual capital performance positively affects firm productivity	Supported
H1b. Intellectual capital performance positively affects profitability	Supported
H1c. Intellectual capital performance positively affects sales growth	Supported
H1d. Intellectual capital performance positively affects market valuation	Supported
H2a. Capital employed efficiency positively affects productivity	Rejected
H2b. Capital employed efficiency positively affects profitability	Supported
H2c. Capital employed efficiency positively affects sales growth	Supported
H2d. Capital employed efficiency positively affects market valuation	Supported
H3a. Structural capital is positively correlated with productivity	Supported
H3b. Structural capital is positively correlated with profitability	Rejected
H3c. Structural capital is positively correlated with sales growth	Supported
H3d. Structural capital is positively correlated with market value	Supported
H4a. Human capital efficiency positively affects firm productivity	Supported
H4b. Human capital efficiency positively affects firm profitability	Rejected
H4c. Human capital efficiency positively affects firm sales growth	Rejected
H4d. Human capital efficiency positively affects firm market value	Rejected

Source: Author's compilation

Table XV.
Hypotheses testing

the previous year reveals the significance of physical or financial capital in generating better firm performance in the long term. Overall, significant association of CEE leads to the conclusion that tangible assets are main drive behind the firm performance in Indian firms. This finding is in line with the research conducted by Nadeem *et al.* (2017) and Ang and Hatane (2014) taking firms from emerging economies, BRICS and Indonesia, respectively, where the researcher found that CEE was a major contributor in profitability, the market value of the firm.

H3a–H3d are supported by the regression result as shown in the models (3), (5) and (7), indicating that SCE has a significant and positive influence on ATO, Tobin's *Q* and SG in Indian firms except for ROA. The analysis shows that SCE has insignificant influence on the profitability of the Indian firms. This implies that the Indian firms are proficient in employing their internal resources in enhancing knowledge of their employees and applying this knowledge in innovation, patents and process of the organization, which, in turn, supports organizational learning theory. This result is in line with the study of Chen *et al.* (2005) who observed a significant relationship between market value, productivity and SG of the firm.

Considering the effect of HCE on Indian firm performance indicators, the regression analysis from the models (3), (5) and (7) shows that only ATO was positively correlated by the HCE of the firm, whereas rest firm performance indicators were affected significant but have a negative relation with HCE. Thus, leading to rejecting *H4b–H4d* and supports *H4a*. This is similar to the report of Li and Zhao (2018) who used data from Chinese listed firms and found no significant relationship between firm values, namely; ROA, ROE, Growth and capital market return except in capital-intensive firms.

The insignificant and negative link between firm profitability, SG and market value findings suggests that the investors are still reluctant in investing on their human assets. The HCE which exists in the form of employee's knowledge, aptitude and skills gained with experience within an organization. The investors fail to recognize the importance of human resources. Overall, the SCE and CEE among the components of VAIC were observed to have as major contributors as VA for Indian listed firms cannot be ruled out.

6. Conclusion

IC is gradually being accepted as wealth generator toward firm's performance thus creating competitive advantage and sustainability in business. Using 710 firms from Indian service and manufacturing industries for the time period of 2001–2016, this paper aimed to investigate the association between IC, its three components (HC, SC and customer capital) and indicators of firm performance, i.e., productivity, profitability, SG and market value. We used VAIC method as a proxy for IC performance and its component to examine the hypotheses concerning the link between IC and firm performance indicators. It is clearly observed from empirical results that IC is a fundamental cause aimed at enhancing firm productivity, profitability, growth and market value. The results contribute to the literature by signifying that IC has a significant role in Indian firm's value creation. Customer capital and SC were the greatest contributors to firm performance, among the components of VAIC. The dynamic panel data analysis also reveals that CEE_{t-1} and SCE_{t-1} positively influenced the firm market value of the current year. This result suggests that investments in the previous year internal and external resources like product, process, and culture and customer relationship are significant to present market value of Indian service and manufacturing sector. Hence, it boosts the long-term association with the investors. These findings are consistent with the conclusion of Bontis *et al.* (2015) and Nimtrakoon (2015) that IC can boost the performance of the firm. The empirical evidence in the current study seeks to identify IC as an important contributor to firm performance, growth and market value. The positive correlation of previous year firm performance with the present year firm performance further indicates consistency in the firm performance indicators.

6.1 Implications

The findings of the paper have suggestions for academics, managers and policymakers for better financial decision making and utilization of IC and its components.

6.2 Implication for managers and policymakers

The findings from our study suggest that IC is positively and significantly related with all the FP indicators of the firm. It was evidenced that VAIC showed highest correlation with the Tobin's *Q* indicator in both service and manufacturing firms. This shows that IC significantly influences firm's market value irrespective of the firm type.

Regarding the sub-components of VAIC, SCE was found to have a positive influence on the productivity of the service sector in India. The insignificant influence of SCE on manufacturing firm's performance indicator draws the attention of regulators over immediate proper utilization of internal resources, corporate process along with the investment on the research and development of sub-sectors like textile, food and agro products. Nadeem *et al.* (2017) supported the view of Shah (2006) and argued that the regulators must provide tax incentives research and development to bring more innovation in services and product of these sub-sectors.

The managers who attempt to revive the firm performance and market value must invest in the programs for skill development of HC which exists within the organization as employees. This will lead to the enhancement of the knowledge of the knowledge workers (employees), which, in turn, will enhance the innovation in product and process.

Policymakers and regulators can propose incentive programs to encourage investment in innovation, research and development for better efficiency of firm's SC.

Overall, the statistical result shows strong significant relation among CEE and ROA, SG, Tobin's *Q*. This supports resource-based theory and will help the investors in an efficient allocation of the efficiency of the physical, financial capital for comprehensive improvement of value creation.

6.3 Implications for researchers

This paper is perhaps the only paper to investigate the impact of IC on a firm's performance with special reference to endogeneity of data by employing SGMM in the manufacturing and service sectors. Researchers have generally focused over single industries (Kamath, 2017), and have overlooked the input of the service and manufacturing sectors as a whole. This paper offers a new insight into the area of IC and its relation with firm performance indicators within manufacturing and service industries by addressing the endogeneity of the variables. The findings indicate that the FP of the firm is influenced greatly by CEE except for ATO.

The findings of the present study are subject to limitations that provide avenues for future research. This study, for instance, emphasize over registered firms from the service and manufacturing sectors of an emerging economy, India. This study could be extended to comparative analyses of other sectors and other countries. Finally, it would be useful to measure the influence of corporate governance variables like gender ratio, family involvement in these manufacturing and service sectors.

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