

Relationship between Intellectual Capital and Financial Performance: The Moderating Role of Knowledge Assets

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Abstract

Beyond the recent studies on intellectual capital (IC), we investigate whether knowledge assets (KA) moderate the relationship between IC and firm performance (FP). We use the recent data of all Australian Stock Exchange (ASX) listed companies. To test the developed hypotheses, we use structural equation modeling (SEM) techniques. After ensuring the validity and reliability of measurement model, we find reliable evidence that KA strengthens the relationship between IC and FP, which suggest that the value of Australian listed firms can be synergized with IC and KA. In addition, our results show that IC and its components are positively associated with firms' financial performance. Similarly, KA is also positively associated with improved firm performance. This study contributes towards the literatures because this is the first study that explores the moderating role of KA in measuring the impact of intellectual capital on the firm's financial performance.

Keywords: knowledge intensity, market knowledge, R&D intensity, human capital, structural capital.

1. Introduction

The start of the new millennium has registered growth in many aspects of human life. The success in different fields has also changed the way of doing business. This digital era is becoming more and more complex with the existence of intangible resources.

Globalization has made the business environment more competitive by the free movement of tangible and intangible resources. The setting up of quota free zones in World Trade Organization environment now requires the business to be more efficient, resourceful and competent.

In the manufacturing era, the success of the business depended on the limited number of physical and financial resources commonly referred to as factors of production (namely Land, Labor, Capital, and Enterprise). The paradigm shift from manufacturing to knowledge era has also changed the critical success factors and key performance indicators. Global economic challenges have led to an increase in the value of knowledge base resources which are the key indicators in obtaining and sustaining competitive edge of the firm. This is due to the shift from labor to a knowledge-driven economy. During the late 90's the concept of intellectual capital (IC) gained so much popularity and several scholars such as Bontis (1998) and Sullivan (1999) put their research efforts into exploring this area. As a result, the IC was conceptualized as a mixture of knowledge and competencies that can evidently give a company a sustainable competitive advantage (Roos & Roos, 1997; Sullivan, 1999).

During the last century, the productivity of the workforce increased by about 50 fold due to the process of knowledge creation and utilization (Steele, 2013). Now the focus of companies is to invest in IC and on acquiring knowledge asset (KA) to obtain and sustain competitive advantage. According to Cabrita and Vaz (2005), the development of IC is the main driver of the continuous growth of national and global knowledge economy. Nowadays, the growth of the business can be measured by efficiency and novelty supported by the valuable management of both visible and invisible assets knowingly as IC (Xinyu, 2014). IC considered as essential corporate assets that influence the strategic performance of the business. Value creation capabilities of the firm are dependent upon the better utilization of IC and the impact of IC efficiency on financial performance vary from sector to sector (Joshi et al., 2013). Thus the growth of the knowledge economy has pushed the users to identify and measure IC for its effective management (Cahill & Myers, 2000).

Many scholars have argued that the knowledge economy is becoming the dominant form of commerce, companies will largely depend upon the performance of IC for growth and value maintenance (Jordão & Almeida, 2017; Sardo & Serrasqueiro, 2017; Stewart, 2007; Sveiby, 1997; Wood, 2003). In this growing knowledge economy, the objective of the company is not to survive but to be successful. So according to Porter (1990) companies can be successful either by becoming cost leader (reducing the prices of the products) or either by differentiation (producing products that are differentiated from the products of the competitor). Therefore, the IC not only provides the differentiation but also competitive advantage to the business, which ultimately leads to the better financial performance (Jordão & Almeida, 2017; Sardo & Serrasqueiro, 2017). Therefore, it is the consensus of most of the scholars that successful management of intangibles and more precisely the IC is likely to provide the company competitive advantage.

Codified KA such as investment in research and development, patents, copyrights, customer list, software's, licenses, product development, products in pipeline and business combinations are reported in annual reports of a company and considered as the key drivers for strategic growth and profitability. The growth of a firm not only based on internal research and development but also on the business combination of KA from

external resources as well. Although the economic wealth of a business has been acknowledged through the management of KA and IC as well as its wisely application.

E-business, globalization, higher rivalry, change in the consumption pattern and modifying economic and political structure are the challenges in the business world. In this regard business organizations need to promote clearly defined strategies to obtain and sustain the competitive advantage and these strategies would not be possible without identification of knowledge capabilities. Knowledge capabilities are assessed through KA and IC efficiency. It includes procedures, manuals, culture and trade secrets at the organizational level; personal skills, experience and talent of employees at the individual level. Continues strategic growth is only possible due to better utilization of knowledge abilities.

A number of scholar established relationship between IC efficiency and firm's performance concluded that greater IC efficiency leads to superior strategic financial performance (Sardo & Serrasqueiro, 2017; Sardo et al., 2018). On the other hand, a few researchers attempt to explore the relationship of KA and firm's performance as the knowledge is one of the most important resources to obtain and sustain competitive advantage because it is considered as value creation source (Wang & Chang, 2007). Following the previous studies we first investigate the direct relationship of IC and KA with firm's performance, and then we investigate the moderating role of KA in measuring the impact of IC on firm's performance. In this background following questions are being developed for the study:

- Does the value of knowledge assets effect or determine the business performance of Australian listed companies?
- Does the IC efficiency effect or determine the business financial performance of Australian listed companies?
- Does the moderation effect of KA between the relationships of IC and firm's financial performance create a synergy in business performance?

Our study contributes to the literature in two ways. First, the main contribution of the study is that, this is the first study which investigates the moderating role of KA in the relationship between IC and firm performance. Second, we contribute to the literature because to our knowledge there is no study that examines the joint effect of KA and IC on firm's financial performance by using the quantitative data of Australian listed companies. Using the recent data of all ASX listed companies we find that KA strengthens the relationship between IC and FP, which suggest that the value of Australian listed firms can be synergized with IC and KA. Our results also show that both IC and KA are positively associated with firms' financial performance.

2. Literature Review

2.1 Intellectual Capital and Firm Performance

IC is something that can't be visible but having a great contribution towards financial value (Edvinsson & Malone, 1997). As IC defined by above-given experts "the sum of knowledge a company is able to use in process of conducting business to create value – a value added for the company." According to Pulic (2000, 2004) IC is the combination of human capital (HC), structural capital (SC), and capital employed (CE). The inter-

relatedness of IC with the performance of firm has been studied at an increasing pace since the early years of the 2000s. A variety of measurement models has been used and the findings were mixed. On the basis of those findings, it is far more complex to answer the research question concerning whether IC has any systematic influence on the firm performance?”

The majority of empirical literature suggests that IC and its components are associated with improved firm performance (Jardon & Martos, 2012; Kamukama et al., 2010; Kim et al., 2011; Kim et al., 2012; Maditinos et al., 2009; Sharabati et al., 2010). Building their interrelationship it is observed from the literature that HC is involved in establishing SC- the pile of knowledge for the firm- in turn, SC is needed to build relational capital (Jardon & Martos, 2012). In the same manner, researchers also argued that the growth of the firm is dependent on its ability to transform the knowledge possessed by employees into organizational knowledge (González-Loureiro & Dorrego, 2012) and the firms who have strong structural and human capital have higher chances of being innovative (Leitner, 2011).

Moreover, Castro et al. (2013) found that skillful, experienced and creative employees along with the network of customers of the company go ahead to a higher number of product inventions. From this finding, it can be inferred that the internal expertise of the firm, when combined with knowledge of external relations, can pace up developments even in the absence of strong capital and structural support. Similarly, Hormiga et al. (2011) stated that new ventures get most of the benefits from internal skill, knowledge and as well from the factors associated with firm performance, connectivity, support and accessibility of its network. Additionally, firm performance is strongly influenced by the interaction of relational and human capital particularly by staff training and education level (Huang & Hsueh, 2007) and the joint impact of relational and human capital perks up the organizational learning abilities and new product development (Hsu & Fang, 2009). Verily many research articles provided a testimonial that human capital provide support to the other dimensions of IC which as a result have a direct influence firm performance (Bontis, 1998; Cabrita & Bontis, 2008; Kim et al., 2012)

In contrast to that Bozbura (2004) identified a different aspect regarding the interaction between the dimensions of IC. According to his study creative activities in a firm is triggered by the supporting infrastructure i.e. structural capital, which allows human and relational capital to enhance the performance of the firm.

From the above-viewed literature, it is evident that the performance of the firm is largely dependent on the interaction between the dimensions of IC. Some scholars suggest that human capital provides the essential skills to build a knowledge base of the organization which enhances the performance of the firm, while other studies argue that the knowledge of employees along with external functional network leads to success (Ozkan et al., 2017; Sardo & Serrasqueiro, 2017). The main theme behind these findings is that the organizational supporting structure, employees, and the established relations do have a little value separately, but jointly they strongly affect the organizational performance. Thus, it can be assumed that firms with the overall higher level of IC efficiency are significantly able to get better performance than those companies who have less IC efficiency (Youndt et al., 2004). Therefore, we expect that overall increase in total IC leads to improved firm performance.

2.2 Knowledge Assets and Firm Performance

Knowledge assets are widely acknowledged as the resources that play a vital role in value creation. According to the resource-based view, the performance of the firm depends on resource endowment especially knowledge assets (KA) who are sometimes also referred to as “intangibles” (Brown & Kimbrough, 2011). Nonaka and Takeuchi (1995) state that knowledge assets are the specific resources of a company, that is essential in creating value for the firm, and they are considered as the inputs, outputs, and moderators to create the value. It emphasizes the importance of firm-specific factors more than the industry-specific factors. These factors act as strategic resources and helps the organization in achieving competitive advantage because of its scarcity (Teece, 2006).

Literature has classified knowledge assets into two categories “Tacit” and “codified”. Tacit knowledge is difficult to measure because it includes people and processes of the organization, on the other hand, codified knowledge is identifiable because it consists on inputs, outputs, and research and development activities (Denicolai *et al.*, 2014). Companies can achieve a strategic competitive advantage by efficient utilization of codified KA because when corporations codify their knowledge, they pack it into those formats that facilitate knowledge in codes, formulas, and expert systems etc.

This research paper emphases on codified intangible knowledge assets which are depicted in the financial statements i.e. copyrights, patent rights, licenses, innovative software, design models and other capitalized development cost for the creation of new knowledge. Codified knowledge assets are further distributed into two classifications: internally generated knowledge assets and externally generated knowledge assets (Denicolai *et al.*, 2015; Denicolai *et al.*, 2014; Kianto *et al.*, 2014). Because the generation of knowledge assets is not only possible from internal activities, for example, R&D, but also from the external activities such as acquiring copyrights, patent rights, licences or co-development of patents (Denicolai *et al.*, 2014).

During the last decade a large number of scholars have done valuable work on the role of intangibles as critical success factor, particularly focusing on the type of assets, such as Brand (Balmer *et al.*, 2009; O’Cass & Weerawardena, 2010), human resources (Wright *et al.*, 2001), customer base (Coltman, 2007; Rapp *et al.*, 2010) and organisational routines (Becker, 2004; Leonard, 1992).

Majority of the initial research is based on conceptual articles supporting that knowledge asset are the main source through which firms can achieve competitive advantage (Harvey & Lusch, 1997; Nonaka & Takeuchi, 1995), arguing that corporations enjoy competitive advantage if they know how to grow, disseminate and exploit the internal knowledge and competencies of the organisation (Szulanski, 1996), if they know how to guard their knowledge from expropriation and replicating by competitors (Liebeskind, 1996), if they know how to effectively receive, transfer and share knowledge with business partners (Mowery *et al.*, 1996), and if they are able to source knowledge effectively from remote locations (Almeida, 1996). Therefore, firm performance depends on how well managers build resources that are inimitable, valuable, rare, and lack of substitutes (Barney, 1991). The economic prosperity of the firm relies on knowledge and its useful application.

Modern empirical research on KA adopted the conceptual models and found that effective management of KA impact business performance (Carlucci *et al.*, 2004).

According to Barth et al. (1998) brand value is positively associated with market returns, stock prices, sales growth, and future returns, which is the outcome of KA (Seethamraju, 2003). Denicolai et al. (2014) explored the positive relationship of KA with international firm performance and also concluded that KA is complementary assets to achieve superior performance.

Summarizing the literature review on IC and KA, it is inferred that the firm performance is the outcome of IC and KA. Some scholars argued that IC is the main driver of organizational capabilities while others suggest that other organizational capabilities help in the formation of IC. By taking into account the organizational capabilities assets and activities one can understand the question concerning how much extent do IC influence firm performance with the interaction of knowledge assets. Furthermore, this is a unique study of nature in the subject of IC and KA because there is no literature available that has identified the codified knowledge assets using annual reports of ASX. Moreover, very limited studies tried to explore the impact of KA on firm's performance there is no study that examines the joint impact of KA and IC on firm's financial performance by using the quantitative data of Australian listed companies. Finally, the study is also unique because in the literature there is no single study that tries to explore the moderating role of KA in measuring the impact of IC on firm's financial performance by using data of Australian listed companies.

3. Theoretical Framework and Hypothesis Development

Previous researches adopt theoretical framework based on the resource-based view (RBV) which argues that the difference in profitability across firms is due to the difference in resource portfolio of the company and how these resources are being utilized (Penrose, 1995). Thus, it is inferred that those businesses that have a unique combination of resources and an art of articulating them in a proper way are more profitable as compared to those who do not possess such a combination of resources.

As per RBV internal capabilities and resources are more important to obtain and sustain competitive advantage (Barney & Peteraf, 2014; Peteraf, 1993; Wernerfelt, 1984). The nature, magnitude, and type of business capabilities and resources are the determinants of profitability (Amit & Schoemaker, 1998). It is not the only resources that can achieve the desired results but superior performance can be achieved by effective management and efficient utilization of these resources (Grant, 1996; Hedlund, 1994). When firms resources are valuable, rare, inimitable and cannot be substituted then they generate sustainable competitive advantage (Barney, 1991). Dierickx and Cool (1989) proposes the characteristics of resources and asset accumulation necessary for inimitability and thus contribute to the sustained competitive advantage. They focused on process, system, and mechanism that operate across the time period and inferred that "the strategic asset is the cumulative result of adhering to a consistent set of policies over a tie period". The outcome of effective management of the unique combination of resources is IC and KA.

Another theory related to the current research is the knowledge-based view (KBV). According to this view, the most important intangible strategic asset that is vital to business survival and growth is knowledge (Spender & Grant, 1996). The success of the firm depends on how the firms create, use and transfer knowledge. Therefore, the following hypothesis can be drawn:

H₁: Knowledge assets have a positive influence on firm's performance.

As for knowledge-intensive firms, IC is the most critical resource. Though, literature still does not have the conclusive definition of IC, but all the components proposed by different scholars are necessary and essential. The most accepted three components of IC namely human capital, structural capital, and capital employed efficiency do have the capability to produce such products/services/outcome that is differentiated from a competitor, thus, leading to competitive advantage. Different scholars added different components which are largely intertwined. Additional components supported by the literature is research capital measured through R&D expenditure and patent activities (Chen, 2005; Mickey & Goo, 2005)

The human capital theory proposes that employees should also be considered assets to the organization and investment in them will produce a maximum financial return. They are a powerhouse of the organization as they are the source of idea generation. They are working at the grass root level, so they are in a better position to understand the working of the organization and can suggest a better solution for problems arising (Brown & Kimbrough, 2011). However, in evaluating the contribution of human capital to financial performance it is important to differentiate between general and specific human capital in the context of pre and post-human investment activities (Karimi, 2014). Human capital is not only associated with the physical work they do for the business but it also includes their mental contribution. Employees are in best position to give suggestion about how to improve a product, process, service, market position, sales, and even financial position. They are considered to be the brain of the organization (Lepak & Snell, 1999). Moreover, not only the human capital but the structural and relational capital which are also the components of IC provides the supports to the better performance of the organization (Coltman, 2007). Thus, on the above-based view the hypothesis developed is as:

H₂: Intellectual capital has a positive influence on firm's performance.

Research and development and better strategies are also associated with resource-based theory and all are the result of better human capital. Both of them (human capital and knowledge assets) are rare and cannot be imitated, substituted by its competitor so plays an important role in attaining competitive advantage (Brown & Kimbrough, 2011). Thus, the presence of knowledge assets enhances the value of intellectual capital.

The direct relationship between IC and firm's financial performance has been explained in some prior researches but this argument is not conclusive, whereas, the direct relationship of KA and firm's performance is also debated in literature but not concluded. Therefore, this study is an attempt to explore another relationship that is the moderating effect of KA between the direct relationship of IC and firm's financial performance of Australian listed companies. According to Pulic (2004) "IC can't create value by itself" so, we assume that value creation can be enhanced with KA capabilities and it is hypothesized that KA moderates the relationship between IC efficiency and firm's financial performance. The greater level of KA and IC efficiency leads to greater business performance and make the business competitive.

To make the IC more effective, organizations must be aware of the changes in micro and macro environment to develop dynamic capabilities accordingly (Wu et al., 2007). Knowledge-based capabilities have a great interaction effect with IC to enhance the business performance. Conceptually, the value creation process of an organization

depend upon both IC and knowledge assets (Kianto et al., 2014). Superior organizational performance is combined through IC with the interaction effect of KA. Interaction effect has been created to take the synergy benefits. Theoretically, some studies suggested that knowledge is a moderator to robust business performance but not examined empirically. In this study, we try to explore the moderating effect of KA between the direct link of IC and firm's performance. Accordingly, the hypothesis drawn is as follow:

H₃: Knowledge Assets moderate the relationship between intellectual capital and the firm's performance.

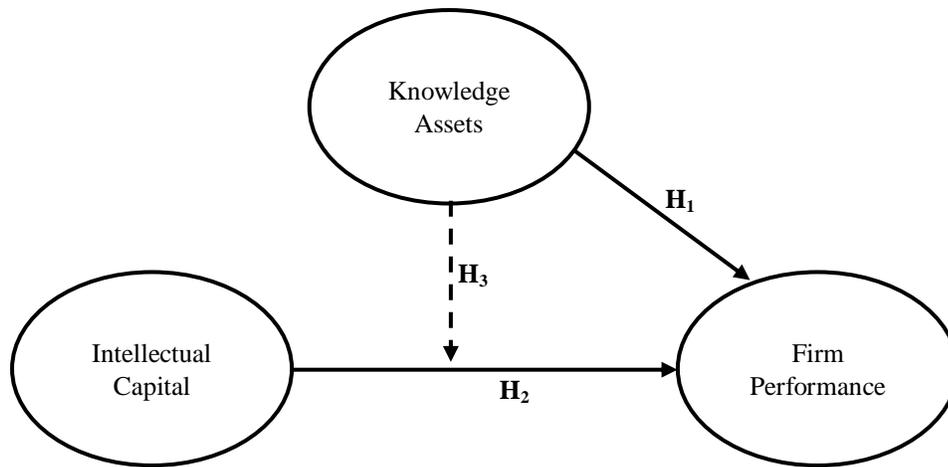


Figure 1: Research Framework

4. Methodology and Data Analysis

4.1 Population and Data Source

The first objective of this study is to explore the impact of IC and KA on firm's performance (FP) and the second objective of the study is to measure the interaction effect of KA between the IC and FP by using the data of ASX listed companies. ASX is one of the leading stock markets that offers a high regulatory environment as per the highest global standards and it provides a full range of services including trading, listing, clearing, and settlement across a wide range of asset classes. ASX is a world leader in mobilizing the capital and consistently ranking among the first five exchanges of the world. With a market capitalization of around \$1.5 trillion, ASX is home to a portion of the world's leading resource, finance, and technology companies. Furthermore, it includes almost 2177 listed entities of 26 diversified sectors.

The study is based on positivist research paradigm. It explains the idealistic outline of the subject being contemplated and connotations for research design and methodology of the study (Crossan, 2003; Johnson & Onwuegbuzie, 2004; Wahyuni, 2012). According to Crossan (2003), the positivist approach is being used to deduct inferences, hypotheses testing, and to investigate causal relationships of quantitative data. As per this research paradigm, quantitative data of IC, KA, and firm performance has been collected from the published annual reports of ASX listed companies for the year 2014. The annual reports

are publically available on the company's websites and missing reports were collected through electronic email communication.

4.2 Sample and Data Collection

The data of this study has been collected in three main steps by using purposive sampling approach. At the first step, the annual reports of 2177 (all listed companies in ASX) companies have been collected through electronic data sources like the company's website or other electronic databases. At the second stage the analysis of the company's annual reports has been conducted to shortlist the companies to the nature of the study by applying the following criteria:

- Companies have been removed from the population that provides ambiguous detail of intangible assets such as patents, copyrights, capitalized development, etc. because intangible assets are the main source for the codification of knowledge assets. Vague detail of intangibles leads unclear measurement of KA.
- The companies that don't follow the IAS-38 are removed from the study because these companies fail to provide the clear-cut distinction between internally generated knowledge assets and externally generated knowledge.
- The companies that fail to provide the details about the research and development activities are also removed from the sample as the research and development investment is the key extension of KA quantification.
- The companies that are unable to provide the full disclosure about the needed values of VAIC are also removed from the sample as the missing values lead to injudicious results.
- The companies that suffer into huge losses and whose statement of financial position depicted negative net worth are also eliminated from the sample.
- The companies are also suspended from the sample whose annual reports are not available at any database.
- For comparison purpose, only those companies are retained in the sample whose accounting period ends on 30th June 2014.

By applying these conditions successfully, we left 1600 companies that are the 73.50 percent of the total population. The material, Real Estate, Energy and financial sector are the leading sectors in the sample. Moreover, the financial sector also has a great retention ratio as the industry composition ratio 91.84% is higher than the other industries.

The third stage of data collection is related to actual gathering the information from the annual reports regarding the variables used in the study like VAIC, knowledge assets and profit indicators.

4.3 Measurement of Variables

4.3.1 Intellectual Capital (Predictor Variable)

There are several methods to measure the IC such as Tobin's Q, EVA and MVA, Skandia Navigator, Balance Scorecard, the Intangible Assets Score Sheet, and VAIC. In this study, we use VAIC to assess the value of IC. The VAIC model was developed by Pulic (2000, 2004) to examine the efficiency and size of IC. VAIC is a most popular model of IC measurement because it is based on audited financial reports (Amin *et al.*, 2014). It is

the combination of three IC efficiency measures: Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE) and Capital Employed Efficiency (CEE).

Following equation of VAIC and three IC efficiencies:

$$VAIC=HCE+SCE+CEE$$

Where:

VAIC = Value Added Intellectual Coefficient

HCE = Human Capital Efficiency, Calculated as $HCE=VA/HC$

SCE = Structural Capital Efficiency, Calculated as $SCE=SC/VA$

CEE = Capital Employed Efficiency, Calculated as $CEE=VA/CE$

VA = Value Added, it is the sum of operating profit, depreciation, amortization and salaries and wages of all employees

$$VA=OP+D+A+EC$$

Where: VA = Value Added, D= Depreciation, A = Amortization,

EC = Employee Cost or the salaries and wages of all the employees

HC = Human Capital, salaries and wages of all the employees

SC = Structural Capital, it is the difference between HC and VA

CE = Capital Employed, it is equal to the book value of net assets of a firm

4.3.2 Knowledge Assets (As Moderator)

The KA of a firm can be defined in terms of annual stocks or flows of knowledge. Accumulation of knowledge or stock of knowledge is a suitable measure to assess the knowledge intensity (KI), because it is easily calculated by using the data of annual reports. Basically, KI is defined as the net book value of all externally and internally generated knowledge assets reported in the statement of financial position divided by the net book value of non-current assets. Internally generated knowledge assets include the book value of internally generated patents, copyrights, licenses and software's, design models or the internal development costs. Whereas, the externally generated knowledge assets includes the acquired patents, copyrights, licenses, etc., that are not developed within an organization. External knowledge intensity (EKI) is used to assess the level inward knowledge flow or the level of acquired knowledge and it is measured as the net book value of externally generated knowledge assets divided by the net book value of total knowledge assets. Internal knowledge intensity (IKI) is also a proxy to measure the knowledge form internal activities and it is calculated as the internal knowledge assets or the intangibles assets excluding goodwill divided by the book value of non-current assets.

R&D intensity (RDI) and royalty income (RYLI) both are used as the proxies of knowledge input for knowledge assets generation and utilization, because development of new products or improvement in existing products are positively correlated with the measure of knowledge assets and firm performance (Hitt et al., 1997). It is measured as the ratio of investment in R&D divided by sales. Whereas, RYLI is the ratio of compensation received from other organization against the legal utilization of knowledge assets (such as patents, copyrights, licensing, and franchising) to firms total sales. Furthermore, some scholars argue that capital market securities prices offer a strong

estimate for the value of knowledge assets that are assessed through market transactions (Ross & Roos, 1997). In this study, the market knowledge (MK) is calculated by taking the difference between the market price and book price (please note that if the difference is positive then it reflects the value of knowledge assets). The calculations of these measures are as follows:

$$KI = \text{Net Book Value of Internal Generated Knowledge Assets and External Generated Knowledge Assets} / \text{Net Book Value of Non-Current Assets}$$

$$EKI = \text{Net Book Value External Generated Knowledge Assets} / \text{Net Book Value of Total Knowledge Assets}$$

$$IKI = \text{Intangible Assets (Internal)} / \text{Net Book Value of Non-Current Assets}$$

$$MK = \text{Market Price Per Share} - \text{Book Value Per Share}$$

$$RDI = \text{Investment in Research and Development} / \text{Sales}$$

$$RYLI = \text{Royalty Income} / \text{Sales}$$

4.3.3 Measurement of Firm Performance (Dependent Variable)

Firm Performance (FP) is measured through traditional accounting measures such as return on assets (ROA), Return on Equity (ROE), Earnings Per Share (EPS), Growth in Sales (SALESGR), Assets Turnover Ratio (ATO) and Market to Book Ratio (MB) used in different previous IC studies (Amin *et al.*, 2014; Antonio Lerro *et al.*, 2014; Kamath, 2008; Makki & Lodhi, 2014; Nimtrakoon & Chase, 2015). ROA, ROE, and EPS are the indicators of profitability whereas; SALESGR is the indicator of market value or market performance. The calculations of these measures are as follows:

$$ROA = \text{Net Profit after Tax and Preferred Dividend} / \text{Total Assets}$$

$$ROE = \text{Net Profit after Tax and Preferred Dividend} / \text{Book Value of Common Stock Equity}$$

$$EPS = \text{Net Profit after Tax and Preferred Dividend} / \text{Number of Common Shares Outstanding}$$

$$SALESGR = (\text{Current Year Sales 2014} - \text{Previous Year Sales 2013}) / \text{Previous Year Sales 2013}$$

4.4 Data Analysis

Structural Equation Modeling (SEM) is a prominent second-generation multivariate statistical technique that is used to estimate a series of casual inter-relationships among multiple dependent and independent constructs (Gefen *et al.*, 2000) that are represented by different indicators. Generally, there are two approaches of SEM: one is the covariance-based SEM (CB-SEM) and the second one is the variance based or the component based SEM approach that is called partial least square SEM (PLS-SEM). CB-SEM is a theory-driven approach which tends to calculate the parameters using maximum likelihood estimation (Vinzi *et al.*, 2010). Its main objective is to reproduce the theoretical covariance matrix without concentrating on explained variance (Hair *et al.*, 2012a). Whereas, PLS-SEM is a soft modeling SEM approach. It becomes a good alternative to CB-SEM because it requires fewer assumptions. Originally, it was developed by (Wold 1974, 1980, 1982). The main objective of PLS-SEM is to maximize

the explained variance of the endogenous construct (Hair et al., 2012a). It is suitable for theory building and theory confirmation (Gefen et al., 2000). PLS-SEM becomes the good substitute for CB-SEM when the data set is too small, not normally distributed and the model includes formative indicators. Moreover, PLS-SEM is also used for secondary data analysis (Sarstedt et al., 2014). PLS-SEM is an appropriate tool for this study because it is based on secondary data and data is not normally distributed. Furthermore, PLS-SEM is also suitable because the study used IC as a formative construct.

We use SmartPLS software to analyze the data. It is a window based software that provides a friendly graphical user interface (Hair et al., 2014a, 2017; Ringle et al., 2005). It was originally developed by Ringle et al. (2005) and then modified it with a series of versions and sub-versions. Its latest version 3.2.3 was released in October 6, 2015 (Ringle et al., 2015). We use this latest version because it's a free, user-friendly modeling package for PLS-SEM approach. This software handles both reflective and formative measurement models. Moreover, it offers automatically two stages moderation approach and also provides the Heterotrait-Monotrait Ratio of Correlations (HTMT) criteria for discriminant validity.

PLS-SEM is unable to provide global goodness-of-fit criteria, therefore, several criteria's has been used for the evaluation of PLS-SEM. But in practice, a very common approach is to evaluate the results of PLS-SEM into two stages: evaluation of measurement model and evaluation of structural model. The first step is related to the examination of validity and reliability according to the specific set of criteria's that are related to reflective and formative measurement models specification. At this stage, if the measurement model provides the satisfactory result then we can proceed to second step that is related to the examination of structural model to test the hypotheses and the strength of relationship between the latent constructs.

4.4.1 Evaluation of Measurement Model

The measurement model stipulates the relationship among the observed manifest and the underlying latent constructs. Generally, there are two types of measurement model: one is reflective and the other one is the formative and both have different evaluation criteria. This study includes three constructs: IC, KA, and FP. IC is measured through formative measurement model because the indicators of IC are defining the characteristics of the IC construct and all indicators have different content (Tseng et al., 2013). But, KA and firm performance are measured through a reflective measurement model. The manifest of the KA and FP are similar to each other, easily interchangeable and the causality direction mover from indicator to construct, therefore they are classified as reflective rather than formative (Calantone et al., 2002; Chen et al., 2004; Fedor et al., 2003; Kaynak, 2003; Morgan et al., 2003; Roy et al., 2012; Swink et al., 2007; Tseng et al., 2013; Tu et al., 2006).

The reflective measurement model is interpreted on the basis of individual indicator reliability, internal consistency, convergent validity, and discriminant validity. A standardized loading is used to assess the indicator's reliability. It is suggested that the standardized outer loading should be greater than 0.7 in confirmatory studies and should be greater than 0.4 in explanatory studies (Hair et al., 2014a; Hair et al., 2011; Hair et al., 2014b; Hulland, 1999). It's an exploratory study and all the indicators have a loading greater than 0.4 (please see Table 1), which confirms the indicators reliability. Internal consistency is assessed through Cronbach's alpha and Composite Reliability (CR). It is

suggested that both Alpha and CR values should be greater than 0.7 to establish meaningful internal consistency, moreover, 0.6 is also accepted in the exploratory study (Chin, 1998; Götz *et al.*, 2010; Hair *et al.*, 2012b). In this study both reflective measurement constructs (i.e., KA and FP) confirm the internal consistency because Alpha and CR values are greater than 0.7 minimum threshold that is depicted in Table 1.

Table 1: Results Summary of Reflective Measurement Model

Constructs	Indicators	KA	Alpha	CR	AVE	HTMT
KA	EKI	0.552	0.823	0.871	0.537	0.837
	IKI	0.841				
	KI	0.850				
	MK	0.779				
	RDI	0.743				
	RYLI	0.573				
FP	EPS	0.744	0.730	0.833	0.558	
	ROA	0.585				
	ROE	0.848				
	SALESGR	0.786				

The convergent validity examines the extent to which a latent construct converges in underlying indicators by explaining their variance (Sarstedt *et al.*, 2014). The most common criteria to measure the convergent validity is average variance extracted (AVE) and a value 0.5 or higher of AVE indicates a satisfactory level of convergent validity (Fornell & Larcker, 1981; Hair *et al.*, 2014a; Hair *et al.*, 2011; Sarstedt *et al.*, 2014). The AVE value for this study exceeds from 0.5 (please see table 1) for the reflective constructs (KAAVE = 0.537, FPAVE = 0.558), that confirms the requirement of convergent validity.

Discriminant validity is used to measure the level to which a construct is really different from the other constructs in the structural model. Traditionally, the square root of AVE is used as a measure of discriminant validity but Henseler *et al.* (2015) introduced new criteria for discriminant validity that is HTMT. As a rule of thumb, the square root of AVE for each latent construct should be higher than other correlation values among the reflective latent constructs (Fornell & Larcker, 1981). Table 2 provides the square root values and depicts the possession of discriminant validity.

Table 2: Square Root of AVE

	FP	IC	KA
FP	0.805		
IC	0.747	Formative Construct	
KA	0.726	0.538	0.733

The square root of AVE is the dominant approach for the examination of discriminant validity for variance based SEM but this approach is unable to detect the lack of discriminant validity (Henseler et al., 2015). In this regard, Henseler et al. (2015) proposed HTMT, new criteria for the assessment of lack of discriminant validity and suggested that the value of HTMT should be lesser than one ($HTMT < 1$) to establish a discriminant validity. If the value of HTMT is greater than one ($HTMT > 1$), it indicates the lack of discriminant validity. Table 1 shows that the HTMT ratio ($0.837 < 1$) between two reflective constructs (KA and FP) is lesser than one, which implies that discriminant validity has been established and these two latent constructs are empirically distinctive.

The evaluation of formative measurement model is different from the reflective measurement model. The formative measurement model is evaluated on the basis of multicollinearity and statistical significance of indicator's weight. Multicollinearity of the formative indicators is assessed through the variance inflation factor (VIF) and it is suggested that the value of VIF should be lesser than 5 (Chin, 1998; Götz et al., 2010; Hair et al., 2011; Hair et al., 2012b; Henseler & Chin, 2010). Hair et al. (2014a). In this study, multicollinearity is not a problem because the VIF value of all the formative indicators is lesser than 5 depicted in Table 3.

Table 3: Result Summary of Formative Measurement Model

Indicators	VIF	Weight	t-value	p-values
IC <- CEE	1.001	0.259*	1.745	0.084
IC <- HCE	2.027	0.938***	29.376	0.000
IC <- SCE	2.698	0.214***	3.382	0.001

Critical t-values for two-tailed test: 1% = 2.57, 5% = 1.96, 10% = 1.65; *p < .10, **p < .05, ***p < .01

Indicator's outer weight provides the relative contribution of the indicator for the construction of the formative latent construct (Hair et al., 2014a). These weights are evaluated on the basis of two-tailed t-value that is calculated through bootstrapping technique of PLS-SEM by using 5000 subsamples. Table 3 shows the empirical values of weights and their significance of IC formative construct. It is observed that all the indicators of IC are significant. HCE and SCE the components of IC are significant at 1% as the t-value is greater than 2.57 critical value, whereas, CEE is significant at 10% because t-value is greater than 1.65 critical value. Moreover, the values provide support that HCE is a major component of IC and this finding is consistent with the previous IC studies (Amin et al., 2014; Kamath, 2008; Komnencic & Pokrajcic, 2012; Makki & Lodhi, 2014; Mehralian et al., 2012; Morariu, 2014).

4.4.2 Evaluation of Structural Model

After the evaluation of the measurement model, the next step is to evaluate the structural model. Structural model results enable the researchers to find the empirical support to confirm the hypothesized relationships among the latent constructs. The structural model of PLS-SEM is evaluated on the basis of coefficients of determination (R²), predictive relevance (Q²), and significance of path coefficients.

Coefficients of determination (R²) is the measure of model predictive accuracy and it shows the proportion of the explained variance in the endogenous construct by its all

predictors latent constructs. It is very challenging to decide the minimum value of R2 as a rule of thumb because it depends upon the nature of study, model complexity, and field of study (Hair et al., 2014a). However, it is necessary that the values ought to be adequately high for the model to have a minimum level of explanatory power (Chin, 1998). Similarly, Chin (1998) deliberates that in the field of social sciences and marketing the R2 values nearly 0.670 have “substantial” explanatory power, values around 0.333 have “moderate” explanatory power, and values of 0.190 and lower have “weak” explanatory power. Whereas, the modern scholars suggested that the R2 value of 0.75, 0.50, or 0.25 for endogenous latent construct in the PLS-SEM can be described as substantial, moderate, and weak respectively and it is considered as a rough rule of thumb (Hair et al., 2011; Henseler et al., 2009). It is observed that the R2 of FP (0.769) latent construct can be considered as the substantial explanatory power because 0.769 (please see Table 4) is greater than 0.75 and 0.67 thresholds that are suggested by the Hair et al. (2011) and Chin (1998) respectively. It indicates that IC and KA jointly explain FP construct 76.9% in the context of ASX.

Table 4: Structural Model Results (Without Moderation)

Structural Relationships	Path Coefficients (β)	t-value	p-values	R² Value	Q² Value
KA -> FP	0.411***	5.423	0.000	0.769	0.456
IC -> FP	0.584***	6.258	0.002		

Critical t-values for two-tailed test: 1% = 2.57, 5% = 1.96, 10% = 1.65; *p < .10, **p < .05, ***p < .01

In addition, to evaluate the extent of R2 values as a measure of predictive accuracy, researches should also suggest examining the non-parametric Stone Geisser test of predictive relevance (Q2). It is applied to measure the predictive relevance of exogenous construct towards endogenous. This test can be used for additional assessment of model fit and predictive relevance in PLS-SEM analysis (Geisser, 1974; Stone, 1974). Q2 values greater than zero (Q2 > 0) of an endogenous latent variable indicates that the model has predictive relevance for the specific construct (Chin, 2010; Hair et al., 2011). In this study, Q2 of FP endogenous latent construct (0.456 > 0) is greater than zero providing support that the model has a predictive relevance.

After running the PLS-SEM model, path coefficients (β) are obtained for the structural model which represent the strength of hypothesized relationships among the latent constructs. The standardized value of the path coefficients is ranged from between -1 to +1. Chin (1998) suggested that the value of path coefficients should be around 0.2 to establish a meaningful relationship and 0.3 or above for the establishment of the ideal relationship among the latent constructs. Commonly the interpretation of path coefficients relies on the significance of two-tailed t-value that is calculated by applying bootstrapping technique with 5000 subsamples.

Table 4 depicts the bootstrapping results of PLS-SEM structural model. The first hypothesis of this is related to the impact of KA on firm's performance. The calculated value of path coefficients ($\beta = 0.411$, t-value = 5.423, *p < 0.01) is highly significant at

1% because t-value is greater than the critical value 2.57 and these results confirms the H1. Moreover, the path coefficient value is also greater than the ideal relationship threshold ($\beta = 0.411 > 0.3$), which implies that there is an ideal relationship between the KA and FP latent construct. These results also describe that investment in R&D and KA assets leads to greater firm's financial performance. The second hypothesis of this study is related to the relationship between IC and FP. The empirical value also supports to H2 because the path coefficients ($\beta = 0.584$, t-value = 6.258, *p < 0.01) of IC and FP is highly significant at 1% and these values also greater than the ideal relationship threshold ($\beta = 0.584 > 0.3$) which denotes that greater IC has a positive and significant impact on firm's financial performance in context of ASX. It is also summarized that listed companies in ASX are rich in IC efficiency and this IC efficiency leads to obtain and sustain competitive advantage and superior financial performance and this finding statistically significant and better than the previous IC related studies (Bontis et al., 2007; Chen et al., 2005; Chien & Chao, 2011; Hsu & Sabherwal, 2012; Joshi et al., 2010; Kim et al., 2012; Leitner, 2011; Maditinos et al., 2011; Mathuramaytha, 2012; Sharabati et al., 2010; Stewart, 2007).

4.4.3 Moderation Analysis

The second objective of this study is to measure the moderating role of KA in measuring the impact of IC on FP. For this purpose, we used two-stage approach of moderation because it is suitable where the predictor latent construct or the moderator latent construct or the endogenous latent construct measured through formative measurement model and pairwise multiplication of manifest is not possible (Chin et al., 2003; Henseler & Fassott, 2010). Moreover, it is also used in case of continuous moderator variable rather than categorical.

Evaluation of the interaction term is still a debatable topic because different scholars suggest different approaches for interaction interpretation. Henseler & Fassott (2010) and Henseler & Chin (2010) suggested the following criteria to evaluate the interaction effect:

- Moderating effect size (f^2) of R2
- Path coefficient of moderating effect and its significance

The results show that the R2 value with an interaction term is 7% higher than the simple effect because in simple model IC and KA explain FP 76.9%, whereas, with the interaction term of KA the value rise up to 83.9%. R2 value plays a significant role in the evaluation of interaction term but the decision is not only based on the change in R2, the decision is based on the effect size of moderating R2. Effect size (f^2) shows the strength of the theoretical relationship and states an approximation of the degree to which a phenomenon occurs in a population. Interaction effect size is assessed by contrasting the R2 of the simple model with the R2 of moderating model and it is calculated as:

$$f^2 = \frac{R^2 \text{ With Moderator} - R^2 \text{ Without Moderator}}{1 - R^2 \text{ With Moderator}}$$

$$f^2 = \frac{0.839 - 0.769}{1 - 0.839} = 0.435$$

It is suggested that the value of 0.02 is considered as weak effect size, value of 0.15 considered as a moderate effect size, and value of 0.35 large effect size (Cohen, 1988).

Moreover, Chin *et al.* (2003) suggested that weak effect size does not mean that the underlying interaction effect is negligible because small effect size is also meaningful for assessing the effect of the interaction term. In this study, the effect size of moderation term is (0.435 > 0.35) that is greater than the value of larger effect size which implies that knowledge assets have a larger moderating effect to influence the relationship between the intellectual capital and firm's financial performance.

Table 5: Structural Model Results (With Moderation)

Structural Relationships	Path Coefficients (β)	t-value	p-values	R ² Value	Q ² Value
KA -> FP	0.601**	2.477	0.014	0.839	0.450
IC -> FP	0.348***	2.890	0.004		
Moderating Effect (IC * KA) -> FP	0.472***	3.396	0.000		
IC = Intellectual Capital; KA = Knowledge Assets; FP = Firm Performance					

Critical t-values for two-tailed test: 1% = 2.57, 5% = 1.96, 10% = 1.65; *p < .10, **p < .05, ***p < .01

In case of moderation, path coefficient of interaction and its significance is also considered to confirm the moderating effect. Table 5 depicts that in the moderation model of this study the direct effect of IC on FP remains significant at 1% ($\beta = 0.348$, t-value = 3.396, *p < 0.01) like the simple model and the direct impact of KA on FP also remains significant and 5% ($\beta = 0.601$, t-value = 2.477, *p < 0.05).

Moreover, the moderating effect path coefficient (IC *KA) has positive impact on FP because 0.472 is greater than zero and this path also significant at 1% ($\beta = 0.472$, t-value = 3.396, *p < 0.01). These empirical values clearly state that KA has a significant moderating effect between the direct relationship of IC and FP because it leads to a substantial change in R2 with larger effect size and it confirms H3. So, it is concluded that ASX listed companies can enhance their business performance and achieve superior business performance by taking the benefits of KA as well as IC.

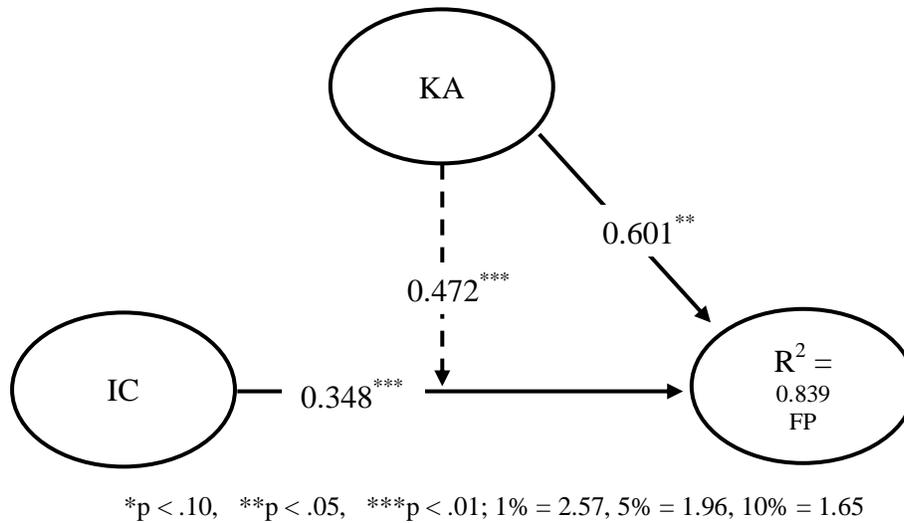


Figure 2: Structural Model

5. Discussion and Conclusion

In this study we first investigate the direct relationship of IC and KA with firm's performance, and then we investigate the moderating role of KA in measuring the impact of IC on firm's performance. It is observed that the financial performance does not solely rely on physical and financial capital but it also influenced by the intangible capabilities such as IC and KA. Using the ASX listed companies data we find that KA have positive and significant relationship with firm's financial performance This finding is consistent in terms of hypothesis confirmation with the study of Denicolai et al. (2014) and Denicolai et al. (2015) but this study is unique from the previous studies because it has significantly higher predictive power. Acquired knowledge assets and market knowledge are the dominant indicators of KA as they have higher t-value in comparison of other KA indicators. Furthermore, the empirical values provide support to the idea that KA is crucial in fostering the firm's superior financial performance.

In the knowledge driven economy, IC has become the dominant resource to obtain a competitive advantage and to achieve superior business performance. Our results show that IC has a significant positive impact on firm's financial performance of listed companies on ASX This result is consistent with the studies of Firer and Williams (2003); Gan & Saleh (2008); Cabrita & Bontis (2008) and Clarke et al. (2011) but the R² value of this study is extremely greater than these studies. As this study provides 76.9% explanatory power without moderation whereas, previous IC related studies provide maximum 56% explanatory power. Moreover, all the components of VAIC like CEE, HCE, and SCE are also significant and play a vital role to achieve superior business performance. Consistent with Joshi et al. (2010) and Clarke et al. (2011) we find that HCE is a highly significant component of IC because its t-value is extremely higher than the CEE and SCE. These results indicate that the value creation of Australian firms mainly depends upon human capital and it is suggested that an escalation in HC investment enhances the financial performance of ASX listed companies. However, SCE and CEE are also significant indicators of IC but they have less weight in comparison to

HCE to achieve superior performance in Australian background and show that firm's success is not only relies on HCE but it also depends upon physical and financial capital.

To make IC more effective, it is necessary to assess the moderating role of KA between the direct relationship of IC and firm's performance. As per the literature, no prior study assesses the moderating role of KA in measuring the impact of IC on firm's performance in Australian background. To bridge this gap moderating role of KA has been suggested and tested empirically. The empirical values strongly support the interaction effect of KA among the direct relationship of IC and firm performance). Moreover, our empirical values clearly state that KA have a significant moderating effect between the direct relationship of IC and FP because it leads to a substantial change in R2 with larger effect size. The findings of this study provide support to several theories and also provide some unique linkage. Firstly, this study confirms and provides the support to the knowledge-based view of the firm because the knowledge assets have a significant positive impact on firm's financial performance and on the basis of these findings they are considered as the strategic assets to obtain and sustain competitive advantage. Secondly, this study also provides support to the resource-based view because IC has a significant impact on a firm's financial performance and it is also considered as an integral part to obtain and sustain competitive advantage. Thirdly, this study is able to provide support to human capital theory because the empirical values show that human capital is a highly significant component of IC which depicts that investment in personnel leads to superior performance.

5.1 Implications of the Study

The key findings of this study have several implications for practitioners and academicians to develop and understand the conceptual framework of KA and IC. Firstly, the study demonstrates the impact of KA on firm's performance and implies that KA leads to strategic competitive advantage. Secondly, the study clarifies that knowledge assets enhance the business performance with the combination of IC. The empirical values also support the moderating role of knowledge assets. The empirical findings of the study provide several practical implications not only for business managers but also for policymakers, regulators, and investors, especially in context of Australian business market. Moreover, the study is useful for the managers and decision makers who want to increase the business performance by achieving competitive advantage, they may need to invest in knowledge assets such as copyrights, patents, and trademarks. Apart from the managers, Australian investors also need to realize the importance of KA and IC because these strategic resources will assist them in finalizing their decision about investment portfolio. This is also useful for the Australian accountants for the measurement and reporting of IC and KA.

5.2 Limitations and Future Directions

In spite of contributions and implications, the study is not free from limitations. It has some limitations that are acknowledged here. Firstly, the study can't be generalized around the world because it covers the data from only listed companies in ASX and the findings are restricted only to Australian listed companies. Secondly, the study only uses the quantitative data of IC and knowledge assets that are available in published annual reports and ignores the qualitative aspects of IC and KA. Thirdly, the study uses only the

cross-sectional data to examine the structural relationship and ignores the lagged effect. Future research may be conducted to overcome these limitations. Finally, this study is the first study to consider KA as moderating variable in IC and firm performance relationship. However, someone may argue that the KA (such as patents, copyrights, customer list, software's, licenses, product development, products in pipeline and business combinations) is the outcome of IC, therefore, it will be more useful to consider KA as mediating variable rather than moderating variable. So, the future study is needed to investigate the mediation effect of KA on IC and firm performance relationship.

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