2016

Assessing Knowledge Management Values by Using Intellectual Capital to Measure Organizational Performance

Thuan L. Nguyen
Nova Southeastern University, tn391@nova.edu

Assessing Knowledge Management Values
By Using Intellectual Capital to Measure Organizational Performance

by

Thuan Luong Nguyen

A dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy
in
Information Systems

College of Engineering and Computing
Nova Southeastern University

2016

We hereby certify that this dissertation, submitted by Thuan Nguyen, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctor of Philosophy.

Timothy J. Ellis, Ph.D.
Chairperson of Dissertation Committee

Date

Ling Wang, Ph.D.
Dissertation Committee Member

Date

Maxine S. Cohen, Ph.D.
Dissertation Committee Member

Date

Approved:

Yong X. Tao, Ph.D., P.E., FASME
Dean, College of Engineering and Computing

Date

College of Engineering and Computing
Nova Southeastern University

2016

An Abstract of a Dissertation Submitted to Nova Southeastern University
in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

Assessing Knowledge Management Values
By Using Intellectual Capital to Measure Organizational Performance

by
Thuan Luong Nguyen
November 2016

Measuring knowledge management performance was one of, if not the most challenging knowledge management activities. This study suggested using intellectual capital as a proxy for knowledge management performance in evaluating its impact on organizational performance. The Value Added Intellectual Coefficient model was employed to measure intellectual capital. Although being used widely in research, the model had its limitations. Also, for intellectual capital measurement, there was a lack of guidelines supported by empirical evidence or best practices. The present study aimed to test the classic and a modified version of this model, and based on the results, shed light on whether the classic version was good enough or the modified one should be highly recommended. The financial fundamental and market data of 425 randomly selected publicly listed firms were collected, and the structural equation modeling technique was employed to test the models. Chi-square difference test was performed to determine whether there was a statistically significant difference between these two models. The results of the tests indicated that the difference between them was insignificant. Therefore, it was concluded that the classic model is adequate, and it can be used effectively to measure intellectual capital. Adding two new efficiency elements – research and development efficiency and relational capital efficiency – in the model did not provide any significant benefit.

Acknowledgements

This dissertation represents not only my work on the research topic; it is a milestone in my journey of studying and doing research. My experience at the Nova Southeastern University (NSU) has been nothing short of amazing. This dissertation could not have been completed without the great support that I have received from many people. I wish to offer my most heartfelt thanks to them.

First and foremost, I would like to express the deepest appreciation to my committee chair Dr. Timothy Ellis, whose expertise, understanding, and patience, added considerably to my experience of doing research. I appreciate his vast knowledge in many areas that helped me come up with the topic. I am also grateful for his engaging me in new ideas and graciously demanding a high quality of work in all the phases of my dissertation. Thank you very much for your advice, guidance, and suggestions that helped me tremendously.

I would also like to express my profound gratitude to my dissertation committee members, Dr. Maxine Cohen and Dr. Ling Wang, for their advice, valuable suggestions, and insightful recommendations that helped me immensely while I was working on my dissertation.

I am greatly appreciative to Dr. Yair Levy and Dr. Steven Terrell with whom I took the statistics courses that helped me extremely in my dissertation research. I would also be grateful to the professors, Dr. Marlyn Kemper Littman, Dr. Junping Sun, and Dr. Sauren Paul, from whom I learned so much while I was completing the course work of the doctoral program. Additionally, special thanks to the professors, Dr. Kannan Ramanathan, Dr. Carol Flannery, and Ms. Lynn Hankins, the Master Program Coordinator, at the School of Management, the University of Texas at Dallas. They kindly wrote academic and professional recommendations for me so that I could be accepted into the Nova Southeastern University's Ph.D. program.

I would like to thank my father and have a deep sense of gratitude to the spirit of my mother, who passed away many years ago, for sacrificing their whole life, literally and figuratively, for the welfare of their children, especially mine. Finally, I would also like to thank my wife and my son for their understanding and support while I pursued the Ph.D. program.

Table of Contents

List of Tables

Tables

List of Figures

Figures

Chapter 1

Introduction

Background

For hundreds of years, business leaders and academic researchers have tried to find out how to manage scarce resources efficiently (Pucar, 2012). The traditional economic model has been built on the foundation of the law of supply and demand with which the market price or value is mostly based on the scarcity. The scarcer a product is, the more value it has (Pucar, 2012).

Now, in the knowledge-based economy, the competitive environment moves and changes with warp speed (Singh & Gupta, 2014) whereas knowledge, as a crucial resource, enables organizations to employ other resources much more efficiently (Argote & Miron-Spektor, 2011). In order to survive and thrive, a firm must manage the knowledge it has and create more new knowledge in the forms of talent, skills, and competencies. (Grant, 1996a; Kase, Paauwe, & Zupan, 2009; Nonaka, 1994; Singh & Gupta, 2014).

It is interesting that, for knowledge, the higher the supply, the greater the value (Pucar, 2012). The knowledge-based view of the firm recognizes that knowledge is one of the most important factors that can help businesses achieve growth and gain competitive advantage. The more knowledge a firm possesses, the better it is in competition (Filieri & Alguezaui, 2014; Rusly, Sun, & Corner, 2014; Semdergaard, Kerr, & Clegg, 2007; Witherspoon, Bergner, Cockrell, & Stone, 2013).

In the present knowledge economy, knowledge, information, and information technology are the dominating resources (Mondal & Ghosh, 2012). Academic researchers and business leaders have paid significant attention to the role of knowledge in global competitiveness. They all believe that intellectual capital (IC) enables firms to maintain competitive advantage and sustain corporate performance (Gamerschlag, 2013; Jardon & Martos, 2009; Mention & Bontis, 2013; Mondal & Ghosh, 2012; Vishnu & Gupta, 2014). The assets of firms are no longer solely based on tangible assets. It is the intangible assets or IC that may determine the firm's real value (Hashemnia, Naseri, & Mozdabadi, 2014; Mention & Bontis, 2013; Mondal & Ghosh, 2012). In extreme cases, some firms only depend on their intangible assets to survive and thrive in the new economic environment (Mondal & Ghosh, 2012). IC is now the primary resource for companies to create, gain, and sustain competitive advantage (Mondal & Ghosh, 2012).

As early as 1850, Senior wrote: "The intellectual and moral capital of Great Britain far exceeds all her material capital, not only in importance, but even in productiveness" (Senior, 1850, p. 134). IC has been recognized as a valuable asset of firms long ago, which can explain why the market value of companies is typically much higher than their total book assets (Pucar, 2012). Lev (2001) found that intangible assets often represented about two-thirds of the real value of a firm. The ratio between the market value and the book value of a firm could be as high as three or four times as revealed in Handy's (1989) study.

In the present knowledge-based economy, IC is considered as the essential element that helps firms create value and build wealth (Martın & Delgado, 2012; Ramirez & Cordillo, 2013). A company can employ IC as a lever for increasing its business

performance and enhancing organizational value (Bontis, Chua, & Richradon, 2000; Mondal & Ghosh, 2012; Roos & Roos, 1997). Additionally, IC is a valuable resource not only for firms but also for national economies (Kapyla, Kujansivu, & Lonnqvist, 2012; Labra & Sanchez, 2013; Lin & Edvinsson, 2010; Stahle, 2014). IC forms the foundation on which a company or a nation can build its business or economy (Choudhury, 2010; Labra & Sanchez, 2013; Lin & Edvinsson, 2010; Mondal & Ghosh, 2012; Stahle, 2014).

According to Kianto, Ritala, Spender, and Vanhala (2014) and Kaya, Sahin, and Gurson (2010), IC is closely related to knowledge within an organization. The close relationship is illustrated via their shared intangible nature and their role as a strategic resource of the firm. According to Ibrahim and Reid (2010), one of the most significant factors in the modern enterprise management is the recognition of knowledge as a strategic resource of firms. In the resource-based view (RBV) of the firm, some organizational resources lead to stronger competitiveness and better performance because they are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991; Grant, 1996; Han & Li, 2015; Mehri, Umar, Saeidi, Hekmat, & Naslmosavi, 2013; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984; Zeghal & Maaloul, 2010). Besides physical and financial assets, IC has been considered as strategic resources because they help firms gain competitive advantage and achieve superior performance (Al-Musali & Ku Ismail, 2014; Mehri et al., 2013; Zeghal & Maaloul, 2010). As an extension of the RBV and developed by Reed, Lubatkin, and Srinivasan (2006), the IC-based view of the firm postulates that IC is the only strategic resource of the firm. For the new theory, it is very difficult, even impossible, to imitate or duplicate IC. Unlike IC, physical resources are readily substitutable, and financial ones are not hard to acquire via borrowing (Al-Musali

& Ku Ismail, 2014). Importantly, IC and knowledge in an organization (or organizational knowledge) are the same things if both are viewed from the static perspective of corporate assets (Kianto et al., 2014). Therefore, IC can be considered as an organization's stock of knowledge at any time (Ragab & Arisha, 2013). In other words, IC is comprised of knowledge that has been acquired and formalized to be used in creating value and gaining competitive advantage (Kianto et al., 2014; Ragab & Arisha, 2013).

Problem Statement

In the knowledge-based view (KBV) of the firm, knowledge and knowledge management (KM) have a crucial role in organizations (Bogner & Bansal, 2007; Rusly et al., 2014; Singh & Gupta, 2014). The advent of KM became one of the most important phenomena in business (Salmaninezhad & Daneshvar, 2012), and an effective implementation of KM was recognized as one of the key factors for companies to be successful (Chien, 2015; Chen, Huang, & Cheng, 2009; Liao & Wu, 2009). KM has been the focus of research as it enables corporate management to employ knowledge assets more effectively, helping firms to achieve and sustain a competitive advantage (Rowe & Widener, 2011; Tan & Wong, 2014).

It is commonly accepted that KM is critical to a firms' success (Ibrahim & Reid, 2010), and evaluation of the impact of KM implementation on organizational performance has become more and more important (Tan & Wong, 2014; Zaied, Hussein, & Hassan, 2012). Organizations recognized knowledge as a strategic resource and used it to gain competitive advantage and achieve superior performance (Chen et al., 2009;

Han & Li, 2015; Ibrahim & Reid, 2010; Rusly et al., 2014; Singh & Gupta, 2014). As a result, managing knowledge became an important issue (Chen et al., 2009; Massingham, 2014; Ragab & Arisha, 2013; Salmaninezhad & Daneshvar, 2012; Singh & Gupta, 2014). According to Moballeghi and Moghaddam (2011), to manage knowledge successfully, an organization had to be able to measure the impact of KM on organizational performance. Good data resulting from measuring KM performance could help business leaders implement KM initiatives more effectively (Andreeva & Kianto, 2012; Chen et al., 2009; Chen & Chen, 2006; Mahapa, 2013) and justify corporate expenditure on KM strategies (Kankanhalli & Tan, 2008; Liebowitz, 2005). Successful evaluation of KM performance could provide the stakeholders of KM initiatives with measurable data demonstrating how KM practices impact the bottom-line of a firm (Kankanhalli & Tan, 2008; Liebowitz, 2005). Moreover, the assessment of the implementation of KM initiatives was critical not only for the purposes of evaluation but also for helping managers decide what should be done next: follow the current course or make any necessary adjustment for performance improvement (Andone, 2009; Moballeghi & Moghaddam, 2011; Tan & Wong, 2014).

Tan and Wong (2014) suggested that if something could not be measured, it could not be managed. Recognizing the value added to organizations as the outcome of implementing KM initiatives could help understanding how KM affects organizational performance (Ibrahim & Reid, 2010). However, it is widely acknowledged in the KM literature that measuring KM performance was one of, if not the most challenging KM activities. As a result, it was a daunting task to evaluate the impact of KM implementation on organizational performance (Carrillo, Robinson, Anumba, & Al-

Ghassani, 2003; Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Liebowitz, 2005; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014).

According to a survey conducted by Harlow (2012), almost all the participants did not think that their companies could successfully assess the impact of KM implementation on their organizations. Therefore, although large investments were made on KM initiatives, many of the performance results were not clear (Harlow, 2012). Without successful measuring KM performance, companies could not determine how well KM initiatives had been implemented, what worked, and what did not, which in turn could retard organizational improvements (Andone, 2009; Ibrahim & Reid, 2010; Tan & Wong, 2014). Additionally, corporate management always wanted to know what value-added could be generated and to see the impact on the "bottom line" from operating expenses, especially from big projects such as KM initiatives (Liebowitz, 2005). Without convincing quantitative data that showed a positive impact on organizational performance, it would be hard for KM projects to be expanded or for a new KM strategy to be adopted (Carillo et al., 2003; Liebowitz, 2005).

More importantly, there was a lack of empirical studies showing the connection between KM and organizational performance (Andreeva & Kianto, 2012; Feng, Chen, & Liou, 2004; Holsapple & Wu, 2011; Massignham, 2014; Rasula, Vulsic, & Stemberger, 2012; Tanriverdi, 2005; Tubigi, Alshawi, & Alshawi, 2013; Zack, Mckeen, & Singh 2009). Furthermore, it was still unclear how KM impacted corporate business performance (Andreeva & Kianto, 2012; Holsapple & Wu, 2011; Ibrahim & Reid, 2010; Tanriverdi, 2005).

Spender and Grant (1996) suggested a plausible explanation for the difficulty in measuring KM performance: measurement of constructs that were not directly observable and identifiable was inherently difficult. KM deals with intangible assets (Chen et al., 2009; Harlow, 2012; Liebowitz, 2005; Ragab & Arisha, 2013; Tan & Wong, 2014). The intangible nature of knowledge made it enormously difficult to assess the impact of KM (Chen et al., 2009; Harlow, 2012; Liebowitz, 2005; Kankanhalli & Tan, 200; Ragab & Arisha, 2013). Additionally, measuring KM performance became a problem for researchers and practitioners because it was very difficult (Gigante & Previati, 2011), complex, demanding, lengthy, time-consuming (Morariu, 2014), and overburdening of companies' departments (Chiucchi, 2013).

In the KM literature, to address the problem, various approaches were discussed (Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Shakina & Bykoya, 2011; Tan & Wong, 2014). One suggestion among these methods was measuring IC for KM performance while evaluating the impact of KM on organizational performance (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Ragab & Arisha, 2013).

Using IC as a Proxy for KM Performance to Evaluate the KM Impact

Karl-Erik Sveiby, a pioneer researcher in both fields – KM and IC – said that "A term is best defined by its use, and therefore, it is probably still correct to regard IC and KM as twins" (FijalKowska, 2008, p. 42). KM and IC are closely related (Kianto et al., 2014; Shakina & Bykova, 2011).

While studying the theoretical foundations of KM, Baskerville and Dulipovici (2006) recognized that IC was one of the three theoretical concepts that motivate KM. From this

view, organizational knowledge was considered as a capital asset, which implied that "knowledge management regards balancing a knowledge portfolio. Therefore, the portfolio is coordinated and exploited for maximized return-on-investment" (Baskerville & Dulipovici, 2006, p. 86).

Practically, Kankanhalli and Tan (2008) found that evaluating the impact of KM on organizations could be focused on measuring IC. Kankanhalli and Tan (2008) also discussed six methods to measure KM performance via measuring IC. Among these methods were the three well-known approaches in the IC literature: the Skandia Navigator, Intellectual Capital Index, and Intangible Assets Monitor.

The Skandia Navigator is a method of measuring IC based on the presumption that IC represents the difference between the market value and the book value of a company (Berge, 2010; Edvinsson & Malone, 1997). Intellectual Capital Index (IC-Index) is a list of indices that can be used to capture the total IC of a company, including its knowledge, processes, business strategy, efficiency, effectiveness, to name a few (Berge, 2010; Roos, Roos, Dragonetti, & Edvinsson, 1997). Intangible Asset Monitor is a method to measure intellectual assets based on Nonaka and Takeuchi's (1994) four modes of knowledge conversion: socialization, externalization, combination, and internalization. This method covers both financial and non-financial measures of IC (Berge, 2010; Sveiby, 1997).

Kankanhalli and Tan's (2008) findings were supported by Chen et al. (2009) that classified KM performance measurement approaches into eight categories. Interestingly, the last category labeled as "organizational-oriented analysis" included only one method to measure KM performance. It was "measuring IC." This category got so named,

"organizational-oriented analysis," because its objective was to estimate the impact of KM on the whole organization (Chen et al., 2009).

Again, according to Ibrahim and Reid (2010), IC emerged as one great concept that could be used to evaluate the impact of KM practices. Similar to Kankanhalli and Tan (2008), Ibrahim and Reid (2010) presented several methods that could be used to measure KM performance via measuring IC. These methods included the balanced scorecard, Skandia Navigator, Intellectual Capital Index, and Intangible Asset Monitor (Ibrahim & Reid, 2010).

In the KM literature, it is pointed out that organizations implemented KM initiatives with the goal to accumulate IC (Ragab & Arisha, 2013; Seleim & Khalil, 2011; Ahmed & Omar, 2011). So, it is reasonable to measure IC, and then use the IC measurement – as an indicator of KM performance – to evaluate the impact of KM. Two other reasons explain why companies were likely interested in measuring IC in attempts to assess the impact of KM. First, the IC literature provides a large variety of methods that can be used to measure IC in organizations (Ragab & Arisha, 2013; Sveiby, 2010). Therefore, practitioners could quickly find some approach that was deemed fit for specific purposes of the task and the characteristics of their business environment. Second, the IC literature has long established a strong link between IC measurement and organizational performance, especially the financial performance or net income, i.e. the "bottom-line", of the firm (Bontis, Chua, & Richardson, 2000; Chien, 2015; Morariu, 2014; Sharabati, Jawad, & Bontis, 2010; Tseng & James, 2005; Wang, 2008, 2011). By measuring IC and then using the IC measurement to evaluate the impact of KM on business performance, the stakeholders of KM initiatives could convincingly prove to the top corporate

management how well the projects have been done. They could also provide robust justifications for large expenses on KM implementation in the firm (Khalifa, Yu, & Shen, 2008; Ragab & Arisha, 2013).

In summary, evaluation of KM performance has been a crucial part of implementing KM initiatives (Chen et al., 2009; Tan & Wong, 2014; Zaied et al., 2012). However, it was very challenging to measure KM performance directly, which made it enormously difficult to evaluate the impact of KM (Harlow, 2012; Ibrahim & Reid, 2010; Ragab & Arisha, 2013; Shakina & Bykova, 2011). One of the solutions was to measure IC and then use the IC measurement to study the KM impact (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Ragab & Arisha, 2013). As discussed, different approaches could be used to measure IC of firms (Ragab & Arisha, 2013; Sveiby, 2010). One among these methods was Pulic's (1998, 2000) Value Added Intellectual Coefficient (VAIC) that was widely used to measure IC in the literature (Fathi, Farafmand, & Khorasani, 2013; Joshi, Cahill, Sidhu, & Kansal, 2013; Kweh, Chan, & Ting, 2013; Mondal & Ghosh, 2012; Morariu, 2014; Pal & Soriya, 2012; Pucar, 2012).

Limitations of Pulic's (1998, 2000) Original VAIC Model

The VAIC model, developed by Pulic (1998, 2000), aims to provide a simple, but effective, approach to measuring IC of firms (Al-Musali & Ku Ismail, 2014; Joshi et al., 2013; Khanhossi, Nikoonesbati, Heire, & Moazez, 2013; Svanadze & Kowalewska, 2015). It is widely recognized that IC consists of three major components: human capital (HC), structural capital (SC), and relational capital (RC) (Nemati, Jalilian, & Akbari, 2013; Roos et al., 1997; Sveiby, 1997).

Human Capital (HC) represents the collective knowledge, skills, creativity, experience, and even enthusiasm of employees of a firm (Joshi et al., 2013; Suraj & Bontis, 2012). At the micro level, HC belongs to each employee and cannot be separated from the owner (Joshi et al., 2013; Suraj & Bontis, 2012). Structural Capital (SC) indicates the institutionalized experience and codified knowledge generated by an organization as a whole such as corporate structures, processes, technology models and inventions, patents, copyright, business strategy, and information systems (Han & Li, 2015; Hsu and Wang, 2012). Relational Capital (RC) represents the value generated through the relationship with customers, suppliers, and other external stakeholders (Sveiby, 1997).

With the VAIC method, first, the efficiency indicators – human capital efficiency (HCE), structural capital efficiency (SCE), and capital employed efficiency (CEE) – are calculated following precise steps using various data items annually reported in the official filing documents by publicly listed companies (Joshi et al., 2013; Kharal et al., 2014; Pal & Soriya, 2012; Piri, Alghyanib, Sadaghianic, & Nejad, 2014; Svanadze & Kowalewska, 2015). Then, the VAIC value is obtained by adding all the efficiency indicators together (Al-Musali & Ku Ismail, 2014; Joshi et al., 2013; Kharal et al., 2014, Piri et al., 2014).

The VAIC model is based on the concept of value added that is a measurement reflecting the contribution of employees, management, and other resources of a firm to create value (Pulic, 1998, 2000, 2008). More importantly, value added normally leads to the creation of wealth in the company (Pulic, 2008).

The total value added (VA) can be computed with the following formula (Al-Musali & Ku Ismail, 2014; Chan, 2009a; Piri et al., 2014):

VA = Operating Profit + Employee Expenses + Depreciation + Amortization (1)

Next, the efficiency indicators (HCE, SCE, and CEE) are computed as follows (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Joshi et al., 2013; Kharal et al., 2014; Morariu, 2014; Piri et al., 2014; Pouraghajan, Ramezani, & Mohammadzadeh, 2013; Samardi, 2013; Svanadze & Kowalewska, 2015):

HCE = VA / (HC: Human Capital). (2)

Where HC is the employee expenses, normally the total salaries and wages

SCE = SC (Structural Capital) / VA, (3)

where SC = VA – HC. (4)

CEE = VA / CE (Capital Employed). (5)

Where CE = Property, Plant & Equipment + Current Assets – Current Liabilities (6)

Finally, the VAIC value is the sum of the three efficiency indicators (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Joshi et al., 2013; Kharal et al., 2014; Morariu, 2014; Piri et al., 2014; Pouraghajan et al., 2013; Samardi, 2013; Svanadze & Kowalewska, 2015):

VAIC = HCE + SCE + CEE (7)

Then, the set of efficiency indicators (HCE, SCE, and CEE) or the VAIC value is used straightforwardly as IC measurement in research (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Kharal et al., 2014; Morariu, 2014; Samardi, 2013; Pouraghajan et al., 2013). VAIC is considered better than other methods for measuring IC because it is simple and transparent (Joshi et al., 201; Khanhossi et al., 2013), and it provides a basis for standard measurement (Khanhossi et al., 2013). Additionally, the research data are

collected from the annual filing documents reported by firms whose data have been audited by third parties and available on the websites of the companies or governmental agencies that oversee securities markets (Joshi et al., 201; Khanhossi et al., 2013).

However, Pulic's (1998, 2000) original VAIC model was not free from limitations (Chang & Hsieh, 2011; Chen et al., 2005; Joshi et al., 2013; Maditinos, Chatzoudes, Tsairidis, & Theriou, 2011; Pal & Soriya, 2012; Stahle, Stahle, & Aho, 2011; Svanadze & Kowalewska, 2015; Vishnu & Gupta, 2014). The criticisms against this method were mainly focused on two limitations: the missing contribution of research and development (R&D) expenses and the absence of relational capital efficiency (RCE) from the set of elements used to calculate the VAIC value (Chen et al., 2005; Stahle et al., 2011; Vishnu & Gupta, 2014). These limitations were considered as the causes of vague results in some studies and inconsistent findings in some others (Joshi et al., 2013; Maditinos et al., 2011; Stahle et al., 2011; Vishnu & Gupta, 2014).

Although structural capital, represented by structural capital efficiency (SCE), was found positively associated with and significantly contributing to the impact of IC on business performance in many studies (Fathi et al., 2013; Mondal & Ghosh, 2012; Morariu, 2014; Pal & Soriya; 2012; Sharabati et al., 2010; Shih, Chang, & Lin, 2010), it was believed that research and development (R&D) expenses also played a significant role as an element of IC (Chen et al., 2005; Joshi et al., 2013; Vishnu & Gupta, 2014). In their investigation of the relationship between IC and business performance, Chen et al. (2005) studied the role of R&D expenses. They found that R&D expenses had a significant contribution to firm performance. In another study, Vishnu and Gupta (2014) examined the relationship between IC and performance of pharmaceutical firms in India

and obtained similar results. The authors found that R&D expenses had a significant and positive influence on firm performance, too.

For the last several years, the debate on the role of R&D expenses as an element of IC was much more intense. The critics pointed out that R&D expenses were left out from the equation (Chang & Hsieh, 2011; Chen et al., 2005; Joshi et al., 2013; Vishnu & Gupta, 2014), whereas R&D expenses became more and more prominent since they covered the research and development of knowledge management systems (KMS). More importantly, KMS is now considered the drive for firms' competitive advantages and growth (Chen et al., 2005; Rusly et al., 2014; Singh & Gupta, 2014).

It was also criticized that relational capital efficiency (RCE) was not included in the set of efficiency indicators to calculate the VAIC value (Chang & Hsieh, 2011; Chen et al., 2005; Joshi et al., 2013; Maditinos et al., 2011; Stahle et al., 2011; Vishnu & Gupta, 2014) although the research community commonly accepts that IC is comprised of three main components: human capital (HC), structural capital (SC), and relational capital (RC) (Fathi et al, 2013; Joshi et al., 2013; Kweh et al., 2013; Mondal & Ghosh, 2012; Pal & Soriya, 2012; Pucar, 2012; Suraj & Bontis, 2012).

The Challenging Question

On the one hand, the above-mentioned limitations of the classic VAIC model was widely recognized in the literature (Chang & Hsieh, 2011; Chen et al., 2005; Joshi et al., 2013; Maditinos et al., 2011; Pal & Soriya, 2012; Stahle et al., 2011; Vishnu & Gupta, 2014). Also, various studies found that R&D expenses and RCE had a significant positive influence on firm performance (

Chen et al., 2005; Joshi et al., 2013; Vishnu & Gupta, 2014).

On the other hand, the classic VAIC model – not including R&D expenses and RCE – was still used by many researchers to study the impact of IC on business outcomes (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Kharal et al., 2014; Morariu, 2014; Pouraghajan et al., 2013; Samardi, 2013; Svanadze & Kowalewska, 2015).

Therefore, researchers planning to use the VAIC method were confronted by the challenging question of whether the classic VAIC model was good enough to describe the business reality, or should it be adjusted to address its limitations and appropriately reflect the business landscape (Joshi et al., 2013; Maditinos et al., 2011)? Additionally, for IC measurement with the VAIC model, there was a lack of clear guidelines supported by empirical evidence or best practices (Maditinos et al., 2011; Svanadze & Kowalewska, 2015).

As discussed, it was very difficult to evaluate the impact of KM implementation on firm performance (Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014). It was also well-known that the VAIC model – though being criticized due to the aforesaid limitations – was used widely in the literature to study the relationship between IC and corporate performance (Fathi et al., 2013; Mondal & Ghosh, 2012; Morariu, 2014; Pal & Soriya; 2012; Sharabati et al., 2010; Shih et al., 2010). An attempt to propose a modified VAIC model that could address these limitations, test it, and based on the test results, to answer the above challenging question, and provide an empirically supported guideline for IC measurement would not only make a significant contribution to the literature on KM and IC but also have important practical implications for enterprise management.

Dissertation Goals

As mentioned earlier, researchers who planned to use the VAIC model were faced with the challenging question of whether the classic VAIC model was good enough to be used, or should it be modified by including R&D expenses and RCE (Joshi et al., 2013; Maditinos et al., 2011)? Also, there was a lack of clear guidelines supported by empirical evidence or best practices for researchers to consider if they planned to use the VAIC method (Maditinos et al., 2011; Svanadze & Kowalewska, 2015).

The purpose of this study was to test the classic VAIC model and a modified version that includes RCE and RDE (R&D expenses efficiency), and then based on the results, to provide a clear answer to the above challenging question. The answer could be used as an empirically supported guideline for IC measurement.

The new model would address the two limitations of the classic VAIC version. The modified VAIC model was used to calculate the new set of efficiency indicators – HCE, SCE, CEE, RCE, and RDE – and the modified VAIC value. These values were employed as IC measurement to evaluate the impact of KM implementation on organizational performance.

The goal was achieved by conducting a quantitative causal modeling study. This type of research was considered a highly effective approach to assessing or predicting effects of one set of variables on another set (Bontis & Serenko, 2009). The quantitative causal modeling research was successfully used in both the KM literature (Chien, 2015; Ngah & Ibrahim, 2010; Staples & Webster, 2008; Wang, Wang, & Liang, 2014; Zaied et al., 2012) and the IC literature (Chen, Cheng, & Hwang, 2005; Han & Li, 2015; Joshi et al.,

2013; Khalique, Bontis, Shaari, & Isa, 2015; Khanhossi et al., 2013; Morariu, 2014; Sharabati et al., 2010; Shih et al., 2010; Vishnu & Gupta, 2014). For example, in the KM literature, with data collected from 223 public listed companies in the integrated-circuit design industry in Taiwan, Chien (2015) used structural equation modeling (SEM) to show that KM has a positive influence on firms' operating outcomes. Similarly, Zaied et al. (2012) conducted quantitative causal modeling research on a sample of 302 Egyptian companies to study the role of KM in improving organizational performance. In the IC literature, Khalique et al. (2015) successfully performed multiple linear regression analysis on the collected data, finding that IC has a positive influence on business performance in 106 small-and-mid-sized enterprises (SME) in Pakistan.

Research Questions

With the quantitative causal modeling research, the study would address the following research questions:

1. How appropriate is IC as a proxy for KM performance in evaluating the influence of KM implementation on organizational performance?
2. Which version – the classic VAIC model or the modified one that includes R&D expenses and RCE – better describes the impact of IC on organizational performance?

Relevance and Significance

According to Drucker (1999), one of the most important metrics of corporate success in the 21st century would be how much the productivity of knowledge workers is increased. Not only did firms recognize that knowledge is one of, if not the most crucial resources, they also tried to manage organizational knowledge more effectively and efficiently (Salmaninezhad & Daneshvar, 2012). Therefore, it was critical for companies to have the capability to manage knowledge, and KM was considered as a key determinant for success of firms (Chen et al., 2009). According to Tan and Wong (2014) and Chen et al. (2009), the need to be able to measure KM performance – to understand how well KM initiatives have been implemented – became vital. However, it was enormously difficult to measure the value added to organizations as the outcomes of implementing KM initiatives (Ibrahim & Reid, 2010; Harlow, 2012; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014). As a result, it was very challenging to evaluate KM impact on organizational performance (Carrillo et al., 2003; Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Liebowitz, 2005; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014).

The present study suggested measuring IC as a proxy for KM performance and then using the IC measurement in evaluating the KM impact. Although the VAIC model was popular in IC research, a preliminary review of the KM literature suggested a gap in KM research that explored how to apply the model in attempts to evaluate the impact of knowledge management. This study closed this gap. It contributed to the KM literature by providing an empirical study that related the application of the VAIC model to the evaluation of KM impact on organizational performance.

Additionally, in the KM literature, there was a lack of empirical studies demonstrating the connection between KM and organizational performance (Andreeva & Kianto, 2012; Feng, Chen, & Liou, 2004; Holsapple & Wu, 2011; Massignham, 2014; Rasula et al., 2012; Tanriverdi, 2005; Tubigi et al., 2013; Zack et al., 2009). Therefore, it was still unclear how KM impacts corporate business performance (Andreeva & Kianto, 2012; Holsapple & Wu, 2011; Ibrahim & Reid, 2010; Tanriverdi, 2005). As another significant contribution to the KM literature, this study provided an empirical analysis whose results contributed to the effort of illuminating the impact of KM implementation on organizational performance.

In the present study, employing the quantitative causal modeling research was also a significant contribution to the KM literature. As pointed out by Wong and Aspinwall (2004) and Zack et al. (2009), case-based research had been popular in studies on KM. With the use of causal modeling approach, this study helped to strengthen the empirical trend in KM research and provided a model for future research on the impact of KM initiatives.

With the description of a modified VAIC model that was empirically tested, this study made significant contributions to both fields: KM and IC. For the KM literature, although the findings in the study revealed that adding two new efficiency elements, RCE and RDE, to the model did not provide any significant benefit in comparison with the classic VAIC method, this study introduced researchers to a new model that could be used to measure IC in attempts to assess the impact of KM on organizations. For the IC literature, the VAIC model was widely used to measure IC performance despite two major limitations. The present study made a significant contribution to the literature

confirming that the classic VAIC version is adequate. It can be used effectively to measure IC.

As pointed out by Joshi et al., 2013 and Maditinos et al., 2011, while trying to use the VAIC method for IC measurement, researchers were challenged by the question of whether the classic model was good enough to be used, or should it be modified by including R&D expenses and RCE? Additionally, there was a lack of clear guidelines that were supported by empirical evidence or best practices for researchers to follow (Svanadze & Kowalewska, 2015; Maditinos et al., 2011). This study made another significant contribution to both the KM and IC literature by providing a clear answer to the above question. For IC measurement, the answer could be used as an empirically supported guideline that helps researchers confidently select the approach they would like to take.

The present study also had practical implications for management in enterprises. A good model for measuring IC would help firms improve their capability of measuring IC (Molodchik, Shakina, & Barajas, 2014). According to Marr, Gray, and Schiuma (2014), the capability of measuring IC helped companies formulate their business strategy and then evaluate their execution of the plan. More importantly, the capability of measuring IC facilitates the assessment of the impact of KM on corporate performance, which in turn helps business leaders fine-tune their execution of business plans related to implementing KM initiatives (Andone, 2009). Being able to evaluate the outcome of KM implementation, firm managers can make judgment regarding what to continue, what to improve, and what to discard (Tan & Wong, 2014), which ultimately leads to organizational improvements (Chen et al., 2009).

Additionally, this study made various recommendations to professional organizations as well as entrepreneurs and business leaders. As per the findings, it is recommended that business leaders and entrepreneurs should heavily invest in their employees via training and staff development. If a company aims to make more profits, the corporate executive officers should pay more attention to the following activities: increasing the capital employed (CEE), investing more in their employees (HCE), and focusing more on research and development (RDE). If a company tries to improve productivity, the business leaders should consider more investments in three areas: the capital employed (CEE), their employees (HCE), and advertising and marketing (RCE). It is also recommended that if an enterprise seeks to gain competitive advantage, the board of directors should not overlook the impact of increasing advertising expenses (RCE).

Furthermore, the present study had implications and recommendations to economic policymakers of industries or a national economy. If the goals are to boost competition in some industry or to strengthen the entire economy, it is recommended that policymakers should consider encouraging firms to improve their relational capital efficiency (RCE) by increasing expenses on advertising and marketing. Not only did these findings contribute to the fields of economics and marketing, but they also supported the view that KM has a far-reaching influence on various aspects of a knowledge-based economy, another significant contribution to the KM and IC literature.

Barriers and Issues

As discussed, the goal of this study was to test the classic VAIC model and a modified version that included RCE and RDE, and then based on the results, to provide a

clear answer to the challenging question of whether the classic version was good enough to be used or the modified approach was strongly recommended. The answer could be used as an empirically supported guideline for IC measurement.

Using the VAIC model required access to corporate data in the official 10K filing documents of firms. The data included details of operating revenues such as total revenue and sales numbers, operating expenses such as depreciation, amortization, interest expenses, taxes, operating profits such as net income, and operating assets such as capital employed. Additionally, organizational performance was measured via its three indicators: ROA (return-on-assets) for profitability, ATO (asset-turnover) for productivity, and market value. All these pieces of data were extracted from official documents submitted by corporate entities at the end of their fiscal year. This method of collecting data provided tremendous advantages for the present study. All the data were available to the public. For example, corporate 10K filing documents were posted on the official websites of SEC – U.S. Securities and Exchange Commission. The data were reliable and valid (Molodchik et al., 2014; Sydler, Haefliger, & Pruksa, 2014; Trisnowati & Fadah, 2014). However, extracting dozens of targeted pieces of information – piece by piece – from the 10K filing documents of hundreds of companies posed challenges concerning time-consuming. To mitigate this barrier, the online service of financial analytics S&P Capital IQ Platform provided by McGraw Hill Financial was used to collect data for the study.

Another potential barrier concerned the lack of uniformity in reporting business data in the annual filing documents. According to Sydler et al. (2014), in 2009, less than 50% of publicly listed companies reported R&D expenses, and only approximately 30%

reported sales/marketing/advertising expenses. It was very challenging to find out which pieces of data have been reported and which have not for thousands of listed companies. As a way to alleviate the issue, the online service of financial analytics S&P Capital IQ Platform was also used in the process of determining firms to be included in the research sample.

Assumptions, Limitations, and Delimitations

Assumptions

1) It was assumed that the sample drawn for the study was representative of a meaningful population.
2) It was assumed that all the publicly listed companies included in the research sample of the study accurately published their business data in the annual reports, as required by law.
3) It was assumed that the online company screening service of S&P Capital IQ Platform always operated correctly as expected.
4) It was assumed that the online company screening service of S&P Capital IQ Platform accurately extracted data from the reported 10K filing documents of publicly listed companies.
5) It was assumed that the online company screening service of S&P Capital IQ Platform accurately provided search results based on the data it has extracted from the reported 10K filing documents of publicly listed companies.

Limitations

The primary limitation of the study was that only publicly listed companies that had reported their annual R&D expenses, besides other financial data needed for the study, in their annual reports were included in the research sample. According to Sydler et al. (2014), in 2009, less than 50% of publicly traded companies reported R&D expenses. This limitation could have had an impact on the validity of the study. As a way to mitigate the issue, a large sample for the study (more than 400 firms) was used in the present study, and the company screening feature of the online service of financial analytics S&P Capital IQ Platform was employed to select firms included in the research sample.

Another limitation of this study was the selection of companies that successfully generated revenues and reported them for the fiscal year 2014-2015. Such a limitation could have impacted the validity of the study. However, the limitation was necessary because it ensured that the companies included in the research sample were able to employ their IC in developing real products or services and selling them. In other words, more or less, these firms were able to leverage their knowledge resources to generate revenues and spur business growth (Chang & Chuang, 2009; Tubigi et al., 2013).

Delimitations

Delimitations are intentional restrictions imposed on the scope of the study to make it manageable. The extant literature showed that the role of KM and IC in companies varied considerably, depending on the industry to which the firms belong. For businesses in knowledge-intensive sectors, KM and IC had the central role in their daily operation as

well as the long-termed business strategy (Chang & Lee, 2012; Jasour, Shagagi, & Rezazadeh, 2013; Pal & Soriya, 2012; Vishnu & Gupta, 2014; Wu, Lee, & Wang, 2012). KM and IC were also the key determinants of the success and growth of these companies (Chang & Lee, 2012; Jasour et al., 2013; Vishnu & Gupta, 2014; Wu et al., 2012). However, for firms in labor-intensive industries, the role of KM and IC might not be significant at all (Pal & Soriya, 2012). KM and IC might attract very little attention and effort, if any, of the business management in these firms (Pal & Soriya, 2012). As a result, a delimitation of the study was to select companies in the knowledge-intensive industries for the research sample. Accordingly, two industries – the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences – were chosen. These industries were considered among the most knowledge-intensive and innovative ones (Pal & Soriya, 2012; Vishnu & Gupta, 2014). They were also viewed as preferred sectors of research by scholars for studying the relationship between IC and organizational performance (Jasour et al., 2013; Pal & Soriya, 2012).

This delimitation might have some impact on the generalizability of the study. However, it was alleviated by the number of prior studies that had validated the choices (Bramhandkar, Erickson, & Applebee, 2007; Chang & Lee, 2012; Chouldhury, 201; Jasour et al., 2013; Libo, Sin, & Xu, 2011; Rahman & Ahmed, 2012; Sharabati et al., 2010; Shil, Chen, & Morrison, 2010; Vishnu & Gupta, 2014; Wu et al., 2012).

Definitions of Terms

The key terms used in this document are defined below:

Asset Turn-Over Ratio (ATO) is the ratio of net sales to average total assets. ATO measures a firm's ability to generate sales from its assets. This ratio represents how efficiently a company can employ its resources to generate sales. For example, an ATO ratio of 0.5 indicates that the firm can make 50 cents of sales for each dollar of its assets (My Accounting Course, 2016a; Peterson & Fabozzi, 1999).

Balanced scorecard, proposed by Kaplan and Norton (1992), is a method to measure IC. The authors suggest that to improve the management of intellectual assets, firms must integrate the measurement of these assets into their management system (Kaplan, 2010; Kaplan & Norton, 1992). It includes both financial and non-financial measures that cover four areas: financial assets, customers, internal processes, and learning and growth (Kaplan, 2010; Kaplan & Norton, 1992; Morariu, 2014). The method aims to provide business managers with tools to manage intangible assets while simultaneously monitoring financial results (Kaplan & Norton, 1992; Morariu, 2014). The method was widely adopted by both private companies and government agencies in the 1990s. However, the resulting measurement was very specific for a particular company, and it was hard to compare the measurement of different firms (Morariu, 2014).

Human Capital (HC) represents the collective knowledge, skills, creativity, experience, and even enthusiasm of employees of a firm. HC can be seen at the micro level in individuals, such as personal attributes, skills, or at the macro level in organizations, such as teamwork or working environment (Joshi et al., 2013; Suraj & Bontis, 2012). At the micro level, HC belongs to each employee and cannot be separated

from the owner. When an employee leaves the company, he/she takes all the personal HC along with him/her, which causes a loss to the firm (Joshi et al., 2013; Suraj & Bontis, 2012).

Human Capital Efficiency (HCE) is a major element of the VAIC value (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013). In the VAIC model, HCE is calculated using Formula 1 and Formula 2 (Samardi, 2013; Svanadze & Kowalewska, 2015):

VA = Operating Profit + Employee Expenses + Depreciation + Amortization (1)

HCE = VA / (HC: Human Capital). (2)

Where HC is the employee expenses, normally the total salaries and wages

Intangible Asset Monitor is a method to measure intellectual assets, which was developed by Karl-Eric Sveiby (Berge, 2010; Sveiby, 1997). The model was based on Nonaka and Takeuchi's (1994) four modes of knowledge conversion: socialization, externalization, combination, and internalization. According to Sveiby, the market value of a company consists of its outstanding equity and three types of intangible assets: external structure, internal structure, and individual competence. This method also covers both financial and non-financial measures that include firms' ability of growth or renewal, efficiency, and stability scored across the three types mentioned above of intangible assets (Berge, 2010).

Intellectual Capital Index (IC-Index) is a list of indices that can be used to capture the total IC of a company, including its knowledge, processes, business strategy, efficiency, effectiveness, to name a few (Berge, 2010; Roos et al., 1997). The list was created by Goran and Johan Roos of London-based Intellectual Capital Services (Berge, 2010; Roos et al., 1997). The underlying concept of IC-Index is that IC consists of three main

components: human capital, organizational capital, and customer and relationship capital. The organizational capital is in turn comprised of business renewal and development capital and business processes capital (Berge, 2010; Roos et al., 1997). The list of indices is divided into four categories: human capital indices, organizational capital indices, relationship capital indices, and innovation capital indices (Berge, 2010; Roos et al., 1997).

Market capitalization (market cap) is the total value of the outstanding shares of a publicly listed company (Investopedia, 2016a).

Relational Capital (RC) indicates the value generated through the relationship with customers and suppliers (Sveiby, 1997). RC is also considered as the knowledge available within the interactions with customers, suppliers, or any other institutions (Han & Li, 2015; Hsu & Wang, 2012; Nahapiet & Ghoshal, 1998). In other words, for a firm, RC is the ability to create added value with its external stakeholders via their relationships (Joshi et al., 2013). A company can build up its RC via customer and brand loyalty, customer satisfaction, market image and good will, as well as the power to negotiate (Joshi et al., 2013).

Relational Capital Efficiency (CEE) is a major element of the VAIC value (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013). In the VAIC model, CEE is calculated using Formula 1, Formula 5, and Formula 6 (Samardi, 2013; Svanadze & Kowalewska, 2015):

VA = Operating Profit + Employee Expenses + Depreciation + Amortization (1)

CEE = VA / CE (Capital Employed). (5)

Where CE = Property, Plant & Equipment + Current Assets – Current Liabilities (6)

Return on Assets (ROA), a.k.a. the return on total assets, is a ratio of net income to the average total assets. This ratio measures how efficiently a firm can leverage its assets to produce profits during a period. ROA helps management assess how well a company can convert its investments in assets into profits (My Accounting Course, 2016b; Peterson & Fabozzi, 1999).

Skandia Navigator is another method to measure intangible assets. It was originally developed by a team led by Leaf Edvinsson at the Swedish company Skandia (Berge, 2010; Edvinsson & Malone, 1997). The IC Navigator was created on the presumption that IC represents the difference between the market value and the book value of a company (Berge, 2010; Edvinsson & Malone, 1997). The method also covers both financial and non-financial measures in five areas: financial, customers, processes, renewal and development, and human (Edvinsson & Malone, 1997; Morariu, 2014). Skandia Navigator recognizes the important role of customer capital in creating value (Morariu, 2014). However, it is difficult to compare measurements obtained with the method in different firms (Morariu, 2014).

Structural Capital (SC) indicates the knowledge or IC generated by an organization as a whole (Joshi et al., 2013). Different from HC and inseparable from the organization, SC can help employees enhance their capability, but it is not related to each employee at the individual level (Sveiby, 1997). SC represents the institutionalized experience and codified knowledge residing within corporate structures, concepts, routines, processes, technology models and inventions, patents, copyright, business strategy, and information systems (Han & Li, 2015; Hsu and Wang, 2012; Joshi et al., 2013; Subramaniam and Youndt, 2005; Sveiby, 1997). SC also includes the organizational culture that has a

significant influence on how a company runs its business (Joshi et al., 2013; Sveiby, 1997).

Structural Capital Efficiency (SCE) is a major element of the VAIC value (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013). In the VAIC model, SCE is calculated using Formula 1, Formula 3, and Formula 4 (Samardi, 2013; Svanadze & Kowalewska, 2015):

VA = Operating Profit + Employee Expenses + Depreciation + Amortization (1)

SCE = SC (Structural Capital) / VA (3)

Where SC = VA – HC. (4)

List of Acronyms

ATO: Asset Turnover

BEP: Basic Earning Power (the ratio of operating income to total assets)

CE: Capital Employed

CEE: Capital Employed Efficiency

CFD: Corporate Financial Data

DR: Debt Ratio

EP: Employee Productivity

EPS: Earning Per Share

GPM: Gross Profit Margin

GR: Growth of Revenue

HC: Human Capital

HCE: Human Capital Efficiency

IC: Intellectual Capital

KM: Knowledge Management

LR: Liquidity Ratio (the ratio of liquid assets to liabilities of an institution)

OIS: Operating Income-to-Sales

OP: Organizational Performance

RC: Relational Capital

RCE: Relational Capital Efficiency

RDE: Research and Development Efficiency

ROA: Return on Assets

ROI: Return-on-Investments

ROS: Return-on-Sales

R&D: Research and Development

SC: Structural Capital

SCE: Structural Capital Efficiency

SPC: Spiritual Capital

TEC: Technology Capital

Summary

In summary, evaluation of KM performance has been a crucial part of implementing KM initiatives. However, it was a daunting task to measure KM performance directly. One of the solutions was to measure IC using the VAIC model and then use the IC measurement to study the KM impact. Although being criticized due to the limitations mentioned earlier, the VAIC model was used widely in the literature to examine the relationship between IC and corporate performance. Researchers who planned to use the

model had to be faced with the challenging question of whether the classic version was good enough to be used or it should be modified by including R&D expenses and RCE. Besides, there was a lack of clear guidelines supported by empirical evidence or best practices for researchers to consider if they planned to use the VAIC method. To provide a clear answer to the question and an empirically supported guideline for IC measurement, a modified VAIC model was proposed and tested using the data reported in the 10K filing documents of publicly listed companies.

The structure of the paper is as follows: After the introduction, a detailed review of the literature to examine the role of KM and IC in firms and their influence on organizational performance is presented. This is followed by a discussion on the methodology of the study, and the paper concludes with the results and conclusions.

Chapter 2

Review of the Literature

Overview

The focus of this chapter is to review the prior literature on the crucial role of KM in firms including its definitions and theoretical foundations, the tight relationship between KM and IC, the methods of measuring IC, and the impact of IC on organizational performance. The review was also performed on the role of the VAIC model in IC measurement, and how the business performance of firms can be assessed. These topics represented an overall foundation on which further critical analysis was carried out for this study.

Knowledge Management

Theoretical Foundations

There exist various theories that postulate different views of the firm. Although there may be many differences in what these theories state, the central question all of them try to answer is what makes firms different from each other (Al-Musali & Ku Ismail, 2014; Grant, 1996a, 1996b; Huang, 2011; Nelson, 1991; Verona & Ravasi, 2003; Zack et al., 2009). Why does this firm compete against its competitors much better than another one (Andreeva & Kianto, 2012; Slavkovic & Babic, 2013)? How can a firm achieve much better business performance than others in the same industry (Mehri et al., 2013; Mills & Smith, 2011)? One of the theories of the firm most-mentioned in the literature is the

resource-based view (RBV). To the above question, the theory provides an answer that some of organizational resources possessed by a firm – labeled as strategic resources – and how these resources are managed enable it to gain competitive advantage and achieve superior performance (Al-Musali & Ku Ismail, 2014; Andreeva & Kianto, 2012; Barney, 1991; Grant, 1996a, 1996b; Han & Li, 2015; Liao & Wu, 2009; Mehri et al., 2013; Patton, 2007; Verona & Ravasi, 2003; Wernerfelt, 1984; Zack, 1999; Zollo & Winter, 2002). This theory argues that strategic resources help a firm compete better and operate more efficiently because they are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991; Han & Li, 2015).

According to Slavkovic and Babic (2013), when the human society transitioned into the knowledge era with a knowledge-based economy, the focus of resource-based perspective has been extended to the knowledge-based view (KBV) of the firm. The new theory considers knowledge as a firm strategic resource (Andreeva & Kianto, 2012; Grant, 1996a, 1996b; Kianto et al., 2014; Kogut & Zander, 1992; McEvily & Chakravarthy, 2002; Miller, 2002; Narasimha, 2001; Spender, 1996; Zack et al., 2009). In the knowledge-based perspective, firms create, acquire, and distribute knowledge as a strategic asset to gain competitive advantage and achieve superior performance (Andreeva & Kianto, 2012; Grant, 1996a, 1996b; Kianto et al., 2014; Kogut & Zander, 1992; McEvily & Chakravarthy, 2002; Miller, 2002; Narasimha, 2001; Spender, 1996; Zack et al., 2009). It is noticeable that not only does the new view point out knowledge as a strategic resource but also focuses on how this crucial resource is employed and coordinated to create value for firms, i.e. how knowledge is managed or knowledge management (Andreeva & Kianto, 2012).

RBV and KBV are supported by another separate stream of research. Based on Michael Porter's value chain analysis (Porter, 1985), Holsapple and Singh (2001) developed the knowledge chain theory (KCT) identifying nine KM activities that enable a firm to capitalize on its knowledge resource, gain competitive advantage, and then achieve superior performance. These KM activities are classified into five primary activities and four secondary ones (Holsapple & Joshi, 2004; Holsapple & Singh, 2001). According to Holsapple and Singh, the five primary activities in the knowledge chain model are knowledge acquisition, knowledge selection, knowledge generation, knowledge internalization, and knowledge externalization.

Knowledge acquisition refers to the activity of acquiring knowledge from the organization's external environment and transforming it into a suitable representation that is ready for subsequent use (Holsapple & Singh, 2001). Examples of knowledge acquisition include acquiring a company rich in intellectual assets, conducting an external survey, sending employees to external training, acquiring patents, hiring new employees (and bringing their personal knowledge, skills, and talent into the organization) (Holsapple & Singh, 2001). In the case of employees' off-campus training activities, they capture new knowledge from instructors via lectures, discussion, and hands-on practice. Each employee internalizes the newly-learned knowledge (Holsapple & Singh, 2001). After the training, the employees may transfer the new knowledge to their organization via performing presentation to colleagues, using the knowledge to improve existing processes or even creating more new knowledge by making decisions (Holsapple & Singh, 2001).

Knowledge selection indicates the activity of selecting knowledge from some internal sources and making it suitable for subsequent use (Holsapple & Singh, 2001). Knowledge selection is similar to knowledge acquisition except for the fact that knowledge selection is involved with existing knowledge resources of an organization, not those in the external environment (Holsapple & Singh, 2001). It is considered as the most important KM activity within an organization (Holsapple & Singh, 2001). All other KM activities must interact with the existing knowledge of the organization via knowledge selection (Holsapple & Singh, 2001). Examples of this activity include assigning qualified employees to work on a brand-new project, choosing an appropriate process to perform some tasks in a company, or extracting needed information from a repository database to provide customer support (Holsapple & Singh, 2001). In the case of selecting employees to join a team that will develop a new product or service, appropriate employees – and their appropriate knowledge – are identified, chosen, and given responsibilities to shoulder the development work. The example clearly illustrates how vital knowledge selection activity is for corporate operation (Holsapple & Singh, 2001).

Knowledge generation is related to the activity of creating knowledge by either discovering or deriving the new intellectual resources from existing knowledge (Holsapple & Singh, 2001). Discovery generates knowledge via imagination, creativity, and synthesis. Based on both existing descriptive knowledge (data, information) and process knowledge (procedures, rules), derivation produces new descriptive and process knowledge via analysis, reasoning, and constructive skills (Holsapple & Singh, 2001). Examples of knowledge generation include recognizing and solving problems, making decisions, brainstorming, forecasting new trends in business or technology, and creating a

software algorithm (Holsapple & Singh, 2001). In the knowledge-intensive process of decision making, new knowledge is produced about some course of action that needs to be taken (Holsapple & Singh, 2001). Before the decision is made, the knowledge about what course of action should be taken does not exist. In this case, the new knowledge is typically generated based on existing procedural knowledge, reasoning knowledge, and constructive knowledge (Holsapple & Singh, 2001).

Knowledge internalization refers to activities that change the state of existing organizational knowledge resources that have been acquired, selected, or generated via distributing and storing (Holsapple & Singh, 2001). Examples of knowledge internalization include knowledge sharing, populating a data warehouse, in-house training, posting an idea on an intranet, changing organizational culture, and making experts' knowledge available via an expert system (Holsapple & Singh, 2001). In the case of modifying organizational culture, this activity involves an organization's principles, values, rules, procedures, and norms (Holsapple & Singh, 2001). For example, if the knowledge that a positive attitude towards risk taking is critical to a company's success becomes a fixture of its culture, this cultural shifting can encourage employees to be more creative and innovative in their work (Holsapple & Singh, 2001), which leads to more success in the firm's business.

Knowledge externalization is related to activities that employ available knowledge to produce organizational outputs that are released into the external environment (Holsapple & Singh, 2001). Examples of knowledge externalization include manufacturing a new product or service, giving lectures or presentation to employees of other organizations, providing technical support to customers, developing an advertisement, and publishing

market research (Holsapple & Singh, 2001). For product manufacturing, some product is produced to target a specific demographic of customers. This activity requires product design knowledge and process knowledge (Holsapple & Singh, 2001). When the product has been manufactured, it is released into the external environment to reach customers (Holsapple & Singh, 2001).

Besides the five primary activities, Holsapple and Singh also discussed at length the four secondary activities of the knowledge chain model that are knowledge leadership, knowledge coordination, knowledge control, and knowledge measurement.

Knowledge leadership enables conditions that make the implementation of KM initiatives successful through other activities (Holsapple & Singh, 2001). This activity is distinguished by such characteristics of being inspiring, sowing trust and respect, cultivating a creative and innovative culture, and establishing a vision (Holsapple & Singh, 2001). Knowledge leadership is crucial to an enterprise's KM strategy. Otherwise, it cannot effectively leverage intellectual resources to achieve strategic business goals (Holsapple & Singh, 2001).

Knowledge coordination involves guiding the implementation of KM initiatives in an organization (Holsapple & Singh, 2001). This activity manages the dependencies and interactions among knowledge resources, among KM activities, between intellectual resources and other resources including physical and financial resources, and between knowledge resources and KM activities (Holsapple & Singh, 2001). Examples of knowledge coordination include setting up programs to encourage learning, establishing incentives to cultivate KM behaviors, and assigning appropriate coordinators to promote KM activities across different departments and divisions within an organization

(Holsapple & Singh, 2001). With programs that foster organizational learning, for example, at a consulting firm, employees are expected to document what they have learned while doing their jobs. A part of their compensation is based on how often their documentation has been used by other colleagues in their jobs. It is evident that the coordination activity has a significant impact on the employees' KM behavior (Holsapple & Singh, 2001).

Knowledge control is related to ensuring that needed intellectual resources are available for use adequately – in both quantity and quality – subject to constraints and within the guideline of protection (Holsapple & Singh, 2001). Examples of knowledge control include developing technological capability to safeguard intellectual assets, ensuring sufficient knowledge resources, guaranteeing an adequate quality of data retrieved from a database system, and establishing and enforcing controls over KM activities (Holsapple & Singh, 2001). It is noticeable that having the ability to measure knowledge resources can enhance the capacity to manage intellectual assets, which leads to effective management of knowledge activities (Holsapple & Singh, 2001).

Knowledge measurement involves the valuation of knowledge resources and assessing how effectively these intellectual assets are managed (Holsapple & Singh, 2001). This activity includes performance review, benchmarking, quantitative methods, and qualitative assessment. Knowledge measurement is the basis for evaluating how well other secondary KM activities – knowledge leadership, knowledge coordination, and knowledge control – have been conducted (Holsapple & Singh, 2001). The activity helps to identify and recognize value-adding intangible assets. Most importantly, knowledge measurement is the foundation for assessing the execution of KM activities and for

evaluating the impact of KM implementation on organizational performance (Holsapple & Singh, 2001).

According to KCT, the combination of all these KM activities – both primary and secondary – has a significant impact on firms' operating outcomes (Holsapple & Jones, 2005; Holsapple & Joshi, 2004). The theory also postulates that each of these activities can be carried out individually for the improvement of competitiveness and performance (Holsapple & Jones, 2005; Holsapple & Wu, 2013, 2011). Moreover, these KM activities help firms achieve better performance in four main areas: superior productivity, agility, innovation, and reputation (PAIR) (Holsapple & Wu, 2013, 2011).

As discussed, knowledge and knowledge management (KM) have a crucial role in organizations (Bogner & Bansal, 2007; Rusly et al., 2014; Singh & Gupta, 2014). Therefore, researchers and academic scholars have tried to understand what knowledge management is. Although numerous articles and books have discussed this topic, the research community has not agreed on a commonly accepted definition of KM because KM has been studied and viewed in different ways and from different perspectives (Abraham & Reid, 2010; Moballeghi & Moghaddam, 2011).

Defining KM

KM may be explored with the focus on knowledge from the angle of dynamic processes (Massingham, 2012; Wigg, 1997). This view emphasizes how knowledge is generated, transformed, and employed, and how such processes can support businesses in their operation (Massingham, 2012). KM can also be referenced under the scope in which knowledge is viewed as static assets that can help organizations achieve their business

goals (Massingham, 2012; Tanriverdi, 2005). Another approach targets KM from both perspectives (Andreeva & Kianto, 2012; Gold, Malhotra, & Segars, 2001; Lee and Choi, 2003).

According to Wigg (1997), for a firm, KM was originally introduced to deal with the management of knowledge via processes such as sharing, using, and organizing intellectual assets with ultimate goals to create value and achieve competitive advantage. Chong, Holden, Wilhelmij, and Schmidt (2000) concurred with Wigg and defined KM as the ability to identify, share, transfer, transform, use, and manage intellectual assets of an organization. Abarahim and Reid (2010) also supported Wigg's definition and believed that KM is a set of processes related to the usage, development, renewal and application of knowledge. In the same manner, Petrash (1996) stated that KM is a process in which the right knowledge is delivered to the right people at the right time so that the best decision can be made.

In line with the above definitions, Scarborough, Swan, and Preston (1999) and Pension, Nyasha, Sheiller, and Vhuramai (2013) believed that KM is a process in which knowledge is created, shared, captured, acquired, and used for the purpose of improving learning capability and enhancing organizational performance. Rasula et al. (2012) considered KM as a process of creating, accumulating, organizing, and utilizing knowledge. Through this process, individual knowledge is transformed into organizational knowledge with which organizations can improve their performance.

Several researchers tightly coupled KM concepts with knowledge processes and corporate strategy. O'Leary (2002) viewed KM as the practices and strategies employed by companies to facilitate the adoption of strategic business insights across various

divisions whose operation focuses on different short-term targets. Similarly, Harlow (2012) believed that KM is the process that determines what intellectual assets could be employed to execute the firm business strategy. This process should make right knowledge available to whoever needs it at the right time and in the right place.

Andreeva and Kianto (2012) accepted that KM concepts include processes such as knowledge sharing, creation, acquisition, and transfer. However, they sided with Lee and Choi (2003) and Gold et al. (2001) that KM should also be viewed beyond the scope of knowledge processes and studied with the focus on other factors like infrastructures, capabilities, and management activities. According to Andreeva and Kianto, KM aims to identify and leverage all knowledge properties to create added-value and help a firm be successful in its business. In other words, KM can be defined as a set of activities that aim to manage knowledge assets of a company and enable it to improve competitiveness and achieve superior performance.

This definition is strongly supported by Tubigi et al. (2013) who defined KM as the systematic processes and activities of managing intellectual assets for an organization's competitive advantage. Likewise, Bhatti, Zaheer, and Rehman (2011) agreed with Bukowitz and Williams (1999) that KM is a procedure through which a company can generate value from its intangible properties. Also, Slavkovic and Babic (2013) thought that KM refers to activities of identifying, developing, and leveraging organizational knowledge to obtain competitive advantage and achieve superior performance.

Agreeing with Andreeva and Kianto (2012), Massingham (2014) went further to opine that KM consists of three types of management activities that cover three areas - resources, flows, and enablers. First, KM tries to manage knowledge resources with

activities such as decision making and corporate-governance delivery related to resource planning, risk management, and budgeting (Massingham, 2014). Second, KM aims to manage the flows that move intellectual assets around the organization to support its operation and benefit its business (Massingham, 2014). Finally, KM attempts to manage the systems and infrastructures that enable such flows of knowledge (Massingham, 2014). These flows and enablers help firms create value from knowledge resources and improve organizational performance (Massingham, 2014). Similarly, Moballeghi and Moghaddam (2011) suggested KM refers to the set of systematic and disciplined actions taken by a firm to create the greatest value out of available knowledge resources for competitive advantages. Also, Jennex (2007) defined KM as the practice of applying experiences of decision-making activities in the past to the current ones or those in the future.

KM Research

Knowledge management has an important role in firms' operation. It has a significant influence on operating outcomes such as efficiency, competitiveness, innovation, productivity, and ultimately organizational performance (Chen & Chen, 2005; Rusly et al., 2014; Volkel & Haller, 2009).

Chuang (2004) conducted a quantitative study with structural equation modeling (SEM) and tried to establish the relationship between KM capabilities and competitive advantage. Chuang classified KM capabilities into two groups: technical KM resources and social KM resources that can be further divided into three types: structural, cultural,

and human resource. For data collection, a survey was sent to the R&D managers of 544 manufacturing firms in Taiwan.

Chuang's analysis of 177 usable responses found that human KM resource ($\beta = 0.130$; $t = 2.174$; $p = 0.031$), structural KM resource ($\beta = 0.192$; $t = 3.206$; $p = 0.002$), and cultural KM resource ($\beta = 0.246$; $t = 4.105$; $p = 0.000$) were all significantly and positively related to firms' competitive advantage. Therefore, the social KM resource had a significant positive impact on firms' competitiveness. However, the results showed that the association between technical KM resource and competitive advantage was not significant (Chuang, 2004). The author explained that the inconsistent findings of the association between the technical KM resource and competitiveness might be attributed to the incomplete understanding of the technical resource and its KM capability existing in various Taiwanese industries (Chuang, 2004).

For practical implications, the study recommended that business leaders should focus more on managing KM resources and KM capability so that the companies could enhance and sustain competitive advantage. The authors concluded that KM capability was significantly related to corporate competitive advantage (Chuang, 2004).

Liao and Wu (2009) made attempts to verify the relationship among KM, organizational learning (OL), and corporate performance. The authors agreed with Grant (1996) and Lei et al. (1999) that OL, from a strategic perspective, can be considered as a source of internal heterogeneity of an organization, which could become a foundation to enhance competitiveness (Liao & Wu, 2009). They considered OL under the scope of four dimensions: management commitment, system perspective, openness and experimentation, and knowledge transfer and integration (Liao & Wu, 2009). For

organizational performance, Liao and Wu adopted the suggestion that financial performance, operational performance, and organizational effectiveness should be involved. Additionally, based on the RBV, the researchers supported the opinions that OL is a reaction to the organization-wide KM implementation. Moreover, the authors defined KM as the processes of knowledge acquisition, knowledge conversion, and knowledge application (Liao & Wu, 2009).

For data collection, the authors administered a survey and distributed copies of a questionnaire to 600 companies randomly selected from the list of Commonwealth Magazine's Top 1000 manufacturers and Top 100 financial firms in 2007 (Liao & Wu, 2009).

Liao and Wu used a quantitative analysis with SEM to analyze the data extracted from 327 completed responses. The findings indicated that KM has a significant positive relationship with organizational performance ($\beta = 0.34$; $t = 2.74$), and the impact of KM on OL is also significant ($\beta = 0.78$; $t = 11.79$). For OL, only its influence on the partnership performance was positive and significant ($\beta = 0.35$; $t = 2.66$) whereas its relationship with financial performance and marketing performance was not confirmed (Liao & Wu, 2009). Therefore, the results partially supported the hypothesis that OL has a significant positive impact on organizational performance. The authors concluded that KM had a critical role in improving corporate performance and recommended that business leaders should support and implement KM initiatives thoroughly (Liao & Wu, 2009).

Similarly, Hui, Radzi, Kheirollahpour, and Radu (2013) studied the association between KM and organizational learning (OL), and their influence on three aspects of

business performance – financial performance, marketing performance, and partnership performance. The authors used three constructs to represent KM: knowledge acquisition, knowledge conversion, and knowledge application. Like Liao and Wu (2009), Hui et al. considered four dimensions of OL: management commitment, system perspective, openness and experimentation, and knowledge transfer and integration.

The authors collected data by administering a survey. They distributed copies of a questionnaire to the chief executive officers, managing directors, and senior managers of 650 companies in the manufacturing food industry in Taiwan, China, and Malaysia (Hui et al., 2013).

Hui et al. analyzed the data extracted from 174 valid responses employing a quantitative method with SEM. The results showed that KM had a significant positive relationship with OL ($\beta = 4.976$; $p < 0.01$). The authors also found that KM had a significant positive impact on all three dimensions of organizational performance: financial performance ($\beta = 6.046$; $p < 0.01$), marketing performance ($\beta = 5.878$; $p < 0.01$), and partnership performance ($\beta = 5.854$; $p < 0.01$) (Hui et al., 2013).

Different from Liao and Wu (2009), however, the findings of this study indicated that OL only significantly and positively influenced market performance ($\beta = 5.00$; $p < 0.01$) whereas the impact of OL on financial performance and partnership performance was insignificant. The authors concluded that KM has a positive relationship with OL, and more importantly, KM has a significant positive impact on business performance (Hui et al., 2013).

Chang and Chuang (2009) conducted a quantitative study with structural equation modeling (SEM) and tried to establish the relationship among corporate management

characteristics, corporate competitive strategy, KM activities, and organizational performance. The authors considered corporate management characteristics via three aspects: organizational culture, organizational structure, and information technology. Chang and Chuang suggested that the goals of the corporate competitive strategy of a firm are to create and sustain competitive advantages with which the company can leverage all available resources to be successful in its business. They focused their study on three dimensions of corporate strategy: low-cost strategy, focus strategy, and differentiation (Chang & Chuang, 2009).

For KM activities, the researchers agreed with Beckman's (1997) definition that KM involves knowledge selection, knowledge access, knowledge storing, and knowledge sharing. Additionally, the authors supported the concept that KM activities should be based on the corporate strategy to improve competitive advantages so that a firm can compete successfully against its competitors and win the market (Chang & Chuang, 2009).

Chang and Chuang analyzed 135 valid responses to a survey in which copies of a questionnaire were distributed to the managers and employees of four large manufacturing companies in Taiwan. The results indicated that corporate management characteristics had a positive impact on some but not all KM activities – corporate culture on knowledge selection ($\beta = 0.453$, $p < 0.001$); corporate structure on knowledge access ($\beta = 0.493$, $p < 0.01$); information technology on both knowledge selection ($\beta = 0.222$, $p < 0.01$) and knowledge storing ($\beta = 0.456$, $p < 0.01$) (Chang & Chuang, 2009). However, no corporate management characteristics had a significant positive influence on knowledge sharing. The findings also partially supported the hypothesis that corporate

strategy is significantly and positively related to KM activities – low-cost strategy to knowledge selection ($\beta = 0.171$, $p < 0.05$) and knowledge sharing ($\beta = 0.179$, $p < 0.01$); focus strategy to knowledge selection ($\beta = 0.584$, $p < 0.001$), knowledge access ($\beta = 0.482$, $p < 0.001$), and knowledge sharing ($\beta = 0.490$, $p < 0.001$). Nevertheless, no empirical evidence was obtained for a significant positive link between differentiation strategy and any of the KM activities (Chang & Chuang, 2009).

Most importantly, the results confirmed that all KM activities have a significant positive impact on corporate performance – knowledge selection ($\beta = 0.891$, $p < 0.05$); knowledge access ($\beta = 0.625$, $p < 0.05$); knowledge storing ($\beta = 0.621$, $p < 0.05$); knowledge sharing ($\beta = 0.688$, $p < 0.05$) (Chang & Chuang, 2009). The authors concluded that firms can effectively manage their operation and improve their competitiveness by leveraging their available knowledge resources and successfully executing KM strategy (Chang & Chuang, 2009).

Slavkovic and Babic (2013) employed a quantitative analysis with ordinary least square (OLS) regression to study the impact of KM on innovativeness and organizational performance. The authors defined KM as knowledge processes that include knowledge creation, knowledge transfer, and knowledge embedding. For innovativeness, Slavkovic and Babic focused on two dimensions: process innovation and administrative innovation. For data collection, the authors administered a survey and distributed copies of a questionnaire to 200 Serbian companies, each with more than 50 employees. The firms were randomly selected from the list of companies registered with the Serbian Business Registers Agency (Slavkovic & Babic, 2013).

Slavkovic and Babic's analysis of the data extracted from the usable responses showed that each of the three KM processes – knowledge creation ($\beta = 0.649$; $p < 0.01$), knowledge transfer ($\beta = 0.601$; $p < 0.01$), and knowledge embedding ($\beta = 0.596$; $p < 0.01$) – had a significant positive influence on process innovation. The results also indicated that all the three KM processes – knowledge creation ($\beta = 0.748$; $p < 0.01$), knowledge transfer ($\beta = 0.736$; $p < 0.01$), and knowledge embedding ($\beta = 0.792$; $p < 0.01$) – had a significant positive relationship with administrative innovation (Slavkovic & Babic, 2013). Additionally, the findings confirmed that KM processes – knowledge creation ($\beta = 0.632$; $p < 0.01$), knowledge transfer ($\beta = 0.598$; $p < 0.01$), and knowledge embedding ($\beta = 0.662$; $p < 0.01$) – had a significant positive impact on organizational performance (Slavkovic & Babic, 2013).

Based on the results, the authors recommended that companies should put more effort into creating a working environment that promotes and encourages employees to exchange knowledge and experience for better performance. Besides, the business leaders should pay more attention to improving the effectiveness of implementing KM processes across different internal departments (Slavkovic & Babic, 2013).

Summary of the Literature Review on Knowledge Management

The resource-based view (RBV) of the firm postulated that organizational resources possessed by a firm - labeled as strategic resources - and how these resources are managed enable it to gain competitive advantage and achieve superior performance (Al-Musali & Ku Ismail, 2014; Andreeva & Kianto, 2012; Han & Li, 2015; Liao & Wu, 2009; Mehri et al., 2013; Patton, 2007). In other words, the theory suggests the important

role of KM in company operation. The knowledge-based view (KBV) goes further to consider knowledge as the sole strategic resource, confirming the critical influence of KM on corporate success (Kianto et al., 2014; Kogut & Zander, 1992; McEvily & Chakravarthy, 2002; Miller, 2002).

RBV and KBV are supported by the knowledge chain theory (KCT) that discusses in detail nine KM activities that can enable a firm to capitalize on its knowledge resource, gain competitive advantage, and then achieve superior performance (Holsapple and Singh, 2001). Among these KM activities, knowledge measurement is considered as not only the basis for evaluating how well other KM activities have been conducted but also the foundation for evaluating the impact of KM implementation on organizational performance (Holsapple & Singh, 2001).

Although numerous articles and books have discussed KM and its role in the corporate environment, the research community has not agreed on a commonly accepted definition of KM because KM has been studied and viewed in different ways and from different perspectives (Abraham & Reid, 2010; Moballeghi & Moghaddam, 2011). KM may be explored with the focus on knowledge from the angle of dynamic processes (Massingham, 2012; Wigg, 1997), or under the scope in which knowledge is viewed as static assets (Massingham, 2012; Tanriverdi, 2005), or both (Andreeva & Kianto, 2012; Gold et al., 2011; Lee and Choi, 2003).

Finally, the KM literature has shown that knowledge management has an important role in firm operation. It has a significant influence on operating outcomes such as efficiency, competitiveness, innovation, productivity, and ultimately organizational performance (Chen & Chen, 2005; Rusly et al., 2014; Volkel & Haller, 2009).

KM-IC Relationship

Intellectual Capital (IC)

In the resource-based view (RBV) of the firm, some organizational resources lead to stronger competitiveness and better performance because they are valuable, rare, inimitable, and non-substitutable (VRIN) (Han & Li, 2015; Mehri et al., 2013; Zeghal & Maaloul, 2010). Besides physical and financial assets, IC has been considered as a strategic resource because it helps firms gain competitive advantage and achieve superior performance against competitors (Al-Musali & Ku Ismail, 2014; Mehri et al., 2013; Zeghal & Maaloul, 2010). Extended from the RBV and developed by Reed, Lubatkin, and Srinivasan (2006), the IC-based view of the firm points out that IC is a strategic resource of the firm whereas physical and financial assets are not. For the new theory, IC is comprised of knowledge resources that have been acquired and formalized to be used in creating value and gaining competitive advantage (Kianto et al., 2014; Ragab & Arisha, 2013).

The concept of IC is believed to be first discussed in detail by the Economist John Kenneth Galbraith in 1969 (Lentjushenkovaa & Lapinab, 2014; Kaya, Sahin, & Gurson, 2010). Since then, the concept of IC in organizational meaning has been widely known and studied thanks to Thomas Stewart's articles about "brainpower" published by Forbes magazine in 1991 (Stewart, 1997, 1994, 1991).

In the 1990's, with the blossom of research in IC and the contribution of information technology and management information systems, different terms were coined. They have been used interchangeably to address the same concept. For example, intellectual

capital, intangible assets, intangibles, knowledge assets (Bontis, 2001; Kaufmann & Schneider, 2004; Kujansivu, 2005).

As opined by Nonaka (1994, p. 15), "knowledge is a multifaceted concept with multilayered meaning." Intellectual capital is, too. It is not easy for all scholars to reach a definitive description of IC (Ahonen & Hussi, 2002; Mayo, 2001) because there is no standard definition for it (Kaufmann & Schneider, 2004). According to Daou, Karuranga, and Su (2014), researchers offered different definitions for the concept of IC because they belonged to different schools of thought. IC was defined as "the knowledge and knowing capabilities of a social collectivity" by Nahapiet and Ghoshal (1998, p. 245) while Bontis (1998, p. 65) stated that this type of knowledge "is the stock unit of organizational learning flows." Brooking (1996) predicted the success of enterprises in the 21st century would be determined by their knowledge assets that should include proper training, workforce, and know-how. With Edvinsson (1997, p. 368), IC was defined as "the possession of knowledge, applied experience, organizational technology, customer relationships, and professional skills."

KM – IC: A Twin Relationship

Karl-Erik Sveiby, a pioneer researcher in both fields – KM and IC – said that "A term is best defined by its use, and therefore, it is probably still correct to regard IC and KM as twins" (FijalKowska, 2008, p. 42). KM and IC are closely related (Kianto et al., 2014; Shakina & Bykova, 2011).

While studying the theoretical foundations of KM, Baskerville and Dulipovici (2006) recognized that IC is one of the three theoretical concepts that motivate KM. From this

view, organizational knowledge is considered as a capital asset, which implies that "knowledge management regards balancing a knowledge portfolio. Therefore, the portfolio is coordinated and exploited for maximized return-on-investment" (Baskerville & Dulipovici, 2006, p. 86).

According to Molodchik et al. (2014), in the early days of KM and IC, the first question that a firm needed to answer when planning to implement KM initiatives was not about KM itself, but about which elements constitute IC because a correct understanding of IC elements would lead to managers' making KM-related effective decisions.

Another major factor shared by KM and IC is that knowledge resources have the central role in both in the corporate environment. IC is considered as all the intangible assets that enable companies to operate (Libo et al., 2011) while KM aims to create, store, share and apply knowledge resources for a firm to be able to survive and succeed (Pension et al., 2013). It is believed that the intangibles are vital to firms' ability to generate strategic business value, gain competitive advantages, and achieve superior performance (Adams and Oleksak, 2010; Edvinsson and Malone, 1997; Lev, 2001; Molodchik et al., 2014; Stewart, 1997).

IC: The Proxy for KM Performance

As aforementioned, KM is critical to a firms' success (Ibrahim & Reid, 2010), and the evaluation of the impact of KM implementation on organizational performance has become more and more important (Tan & Wong, 2014; Zaied et al., 2012). However, it

is widely acknowledged in the KM literature that measuring KM performance is one of, if not the most challenging KM activities (Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014).

In the KM literature, to address the problem, various approaches have been discussed (Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Shakina & Bykoya, 2011; Tan & Wong, 2014). One suggestion among these methods is using IC as a proxy for KM performance while evaluating the impact of KM on organizational performance (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Ragab & Arisha, 2013).

Kankanhalli and Tan (2008) found that evaluating the impact of KM on organizations can be focused on measuring IC. Kankanhalli and Tan (2008) also discussed six methods to measure KM performance via measuring IC. Among these methods are the Skandia Navigator, Intellectual Capital Index, and Intangible Assets Monitor.

Kankanhalli and Tan's (2008) findings are supported by Chen et al. (2009) that classified KM performance measurement approaches into eight categories. Interestingly, the last category labeled as "organizational-oriented analysis" includes only one method to measure KM performance. It is "measuring IC." This category got so named, "organizational-oriented analysis," because its objective is to estimate the impact of KM on the whole organization (Chen et al., 2009).

Again, according to Ibrahim and Reid (2010), IC has emerged as one great concept that can be used to evaluate the impact of KM practices. Similar to Kankanhalli and Tan (2008), Ibrahim and Reid (2010) presented several methods that can be used to measure KM performance via measuring IC. These methods include the balanced scorecard,

Skandia Navigator, Intellectual Capital Index, and Intangible Asset Monitor (Ibrahim & Reid, 2010).

In the KM literature, it is pointed out that organizations implement KM initiatives with the goal to create, accumulate, and maximize IC (Ahmed & Omar, 2011; Huang, 2011; Ragab & Arisha, 2013; Seleim & Khalil, 2011; Zhou & Fink, 2003). So, it is reasonable to measure IC, and then use the IC measurement – as a proxy for KM performance – to evaluate the impact of KM. Two other reasons explain why companies are likely interested in measuring IC in attempts to assess the impact of KM. First, the IC literature provides a large variety of methods that can be used to measure IC in organizations (Ragab & Arisha, 2013; Sveiby, 2010). Therefore, practitioners can quickly find some approach that is deemed fit for specific purposes of the task and the characteristics of their business environment. Second, the IC literature has long established a strong link between IC measurement and organizational performance, especially the financial performance or net income, i.e. the "bottom-line", of the firm (Bontis et al., 2000; Chien, 2015; Morariu, 2014; Sharabati et al., 2010; Tseng & James, 2005; Wang, 2008, 2011). By measuring IC and then using the IC measurement to evaluate the impact of KM on business performance, the stakeholders of KM initiatives can convincingly prove to the top corporate management how well the projects have been done. They can also provide robust justifications for large expenses on KM implementation in the firm (Khalifa et al., 2008; Ragab & Arisha, 2013).

Summary of the Literature Review on KM-IC Relationship

As postulated by the IC-based view of the firm, IC is the only strategic resource that firms can leverage for survival and success (Reed et al., 2006). IC is comprised of knowledge resources that have been acquired and formalized to be used in creating value, gaining competitive advantage, and achieving superior business performance (Kianto et al., 2014; Ragab & Arisha, 2013).

KM and IC are tightly related to each other (Kianto et al., 2014; Shakina & Bykova, 2011), positively influencing each other (Chien, 2015), and even considered as twins (FijalKowska, 2008; Sveiby, 1997).They are viewed as two facets of the same thing – organizational knowledge (Kianto et al., 2012). It is IC if the assets are observed from the angle of static resources, and it is the KM processes if the capabilities are referenced from the dynamic perspective of management flows (Kianto et al., 2012).

Most importantly, the tight relationship between KM and IC reflected in the literature supports the proposal that IC measurement can be used as a proxy for KM performance while examining the impact of KM implementation on organizational performance (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008).

Measuring IC and the VAIC Model

Overview

Evaluation of KM performance has been a crucial part of implementing KM initiatives (Chen et al., 2009; Tan & Wong, 2014; Zaied et al., 2012). However, it is very challenging to measure KM performance directly, which makes it enormously difficult to evaluate the impact of KM (Harlow, 2012; Ibrahim & Reid, 2010; Ragab & Arisha, 2013;

Shakina & Bykova, 2011). One of the solutions is to measure IC and then use the IC measurement to study the KM impact (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Ragab & Arisha, 2013).

Various methods can be used to measure IC in firms. Skandia Navigator, Balanced Scorecard, survey, and VAIC are the well-known ones (Chan, 2009; Pal & Soriya, 2012; Ragab & Arisha, 2013; Sveiby, 2010). Proposed by Kaplan and Norton (1992), Balanced Scorecard includes both financial and non-financial measures that cover four areas: financial assets, customers, internal processes, and learning and growth (Kaplan, 2010; Kaplan & Norton, 1992; Morariu, 2014). This approach is mostly used in management reporting but rarely found in IC research (Pal & Soriya, 2012).

Based on Balanced Scorecard, Skandia Navigator is another method that measures intangible assets. It was originally developed by a team led by Leaf Edvinsson at the Swedish company Skandia (Berge, 2010; Edvinsson & Malone, 1997). This method measures IC on the presumption that IC represents the difference between the market value and the book value of a company (Berge, 2010; Edvinsson & Malone, 1997; Pal & Soriya, 2012). Although being one of the earliest approaches introduced to the research community, Skandia Navigator is still used in some recent studies (Bramhandkar et al., 2007)

Many scholars used a survey to collect data on the perceived measurement of IC and its major components (HC, SC, and RC) (Hashemnia et al., 2014; Kalkan, Bozurt, & Arman, 2014; Khalique & Bontis, 2015). Besides, the VAIC model is widely used to measure corporate IC and its efficiency elements: HCE, SCE, and CEE (Al-Musali & Ku

Ismail, 2014; Hudgins, 2014; Kehelwatenna & Premaratne, 201; Kharal et al., 2014; Sarmadi, 2013; Uadiale & Uwugbe, 2013; Zeghal & Maaloul, 2010)

Value Added Intellectual Coefficient (VAIC) Model

Developed by Pulic (1998, 2000), the VAIC model aims to calculate the set of efficiency indicators (HCE, SCE, and CEE) and the VAIC. The values can be used to represent the measurement of IC in firms (Joshi et al., 2013; Kweh et al., 2013; Morariu, 2014). Although not being free from limitations, the model provides a simple, effective approach to measuring IC and then using the measurement to evaluate the influence of IC on firm performance (Joshi et al., 2013; Kehelwatenna & Premaratne, 2012; Kharal et al., 2014). According to Khanhossini et al. (2013), the VAIC model is much better than other methods of measuring IC thanks to the following characteristics:

1. The VAIC method is very simple and transparent. It provides a solid foundation for standard measurement.
2. The VAIC model provides an easy approach to measuring IC because the efficiency indicators (HCE, SCE, and CEE) and the VAIC value can be easily derived from audited data items reported in financial statements. The data is considered as highly reliable and valid.
3. The VAIC model is based on both performance evaluation and creation value of tangible and intangible assets of a company.

The VAIC model has been widely used by researchers to study the impact of IC on organizational performance in various industries in different countries (Al-Shubiri, 2013;

Chen et al., 2005; Deep & Narwal, 2014; Hudgins, 2014; Morariu, 2014; ,Pal & Soriya, 2012; Piri et al., 2014; Trisnowati & Fadah, 2014).

Measuring IC in Research

Bramhandkar, Erickson, and Applebee (2007) conducted a quantitative study to investigate the impact of IC on organizational performance in the pharmaceutical industry in the USA. To measure IC, the authors employed the Skandia Navigator method subtracting the book value from the market value (Berge, 2010; Edvinsson & Malone, 1997; Pal & Soriya, 2012). They also selected ROA, ROE, and ROI (return-on-investment) as the indicators of firm performance. For data collection, the researchers accessed the financial reports of 139 companies publicly listed on New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotation System (NASDAQ.

Bramhandkar et al. used the ANOVA technique to analyze the data and test the hypothesis that the firms with better IC management should achieve higher business performance. The authors divided all the companies into two groups based on their IC measurement: one with the higher level of intellectual assets and another one with the lower level. The results showed that there was a significant difference in ROA between the pharmaceutical firms with the higher levels of IC and those with the lower levels (μ = -6.57 and μ = -25.89; $p < 0.01$). However, the difference is insignificant for both other indicators of firm performance, ROE and ROI. The authors concluded that better IC management leads to better returns of ROA.

Shil, Chen, and Morrison (2011) studied the relationship among the three components of IC (HC, SC, RC) and their impact on business performance in Taiwanese design industry. They proposed a conceptual model in which HC has a significant positive influence on both SC and RC, and these two components have a direct significant positive relationship with corporate performance. In this model, the indirect influence of HC on firm performance exists via the mediating role of SC and RC (Shil et al., 2011).

To collect data, the authors administered a survey employing an amended version of questionnaire items originally authored by Cabrita and Bontis (2008). The survey aimed to measure the three IC components (HC, SC, RC) and business performance. Shil et al. distributed copies of a questionnaire via email to all the design firms registered with Taiwan Design Center (TDC). The researchers received 87 valid responses (Shil et al., 2011).

Shil et al. performed a quantitative analysis employing partial least squares (PLS) regression, a structural equation modeling technique, to analyze the data and test the hypotheses. The findings found that HC had a significant positive influence on SC ($\beta = 0.870$; $p < 0.001$) but not on RC (Shil et al., 2011). The results also revealed that SC was significantly and positively related to RC ($\beta = 0.616$; $p < 0.001$). However, the study only confirmed the direct impact of RC ($\beta = 0.521$; $p < 0.05$) on the business performance, but not that of SC (Shil et al., 2011).

Based on the findings, HC heavily influenced SC. It is suggested that employees' talent and skills were very crucial to the business of a design company. In reality, designers work in teams to complete tasks (Shil et al., 2011). When a staff quits, he/she

would bring along all the human capital that he/she possessed. Therefore, if several employees unexpectedly left, the team – and even the firm – would be in trouble (Shil et al., 2011). The authors recommended that the design firms should continue building a supportive culture and a flexible working environment in which all the designers have opportunities to develop new ideas and products (Shil et al., 2011). Besides, the managers might need to offer better compensation and benefits so that they can retain talents. However, they also needed to have a plan to handle the situation of several staffs' unexpected leave (Shil et al., 2011).

Additionally, the results showed that RC had a direct significant positive impact on business performance and confirmed the critical role of the relationship between design firms and their customers (Shil et al., 2011). The authors suggested that design firms should keep focusing on cultivating good relationships with clients and partners so that they can leverage available relational capital in their business (Shil et al., 2011).

Hashemnia, Naseri, and Mozdabadi (2014) conducted a quantitative research to investigate the impact of IC components (HC, SC, RC) on organizational performance in commercial banks in Iran. The authors collected data by administering a survey using the Bontis Standard Questionnaire that was designed and validated by Bontis (2000). They distributed copies of a questionnaire to the president and deputies of 280 Iranian bank branches and received 261 completed and valid responses (Hashemnia et al., 2014).

The authors employed multiple linear regression to analyze the data and test the models. The results indicated that all the three IC components had a significant positive impact on the business performance of Iranian commercial banks: HC ($\beta = 0.151$; $p < 0.01$), SC ($\beta = 0.171$; $p < 0.01$), and RC ($\beta = 0.452$; $p < 0.01$) (Hashemnia et al., 2014).

As per the findings, among the IC components, the impact of RC on the bank performance was dominant. (Hashemnia et al., 2014). It is comprehended that the banks focused much of their effort on cultivating and sustaining good relationships with customers. Therefore, they strongly built up RC because it was vital to their business (Hashemnia et al., 2014). The authors recommended that the banks should pay more attention to investing in their employees and advanced information technologies. By doing that, they can leverage all types of intellectual assets to gain competitive advantage and achieve higher performance (Hashemnia et al., 2014).

Djamil, Razafindrambinina, and Tandeans (2013) made attempts to understand the impact of IC on market performance in the banking sector in Indonesia. The authors accessed the annual reports of 25 Indonesian commercial banks to collect data for their research. Djamil et al. measured IC and its efficiency indicators (HCE, SCE, CEE) using Pulic's (1998, 2000) VAIC model. They also employed stock return (SR) and stock return growth (SRG) as the indicators of market performance (Djamil et al., 2013).

For data analysis, the authors used multiple linear regression. The results found that, among the three IC efficiency indicators, only HCE had a significant positive impact on stock return ($\beta = 0.435$; $p < 0.001$) while the influence of both SCE and CEE was insignificant (Djamil et al., 2013). The findings also showed that VAIC did not significantly and positively influence firms' stock return. In summary, the results indicated that IC did not have a significant effect on the stock performance of the Indonesian banking sector (Djamil et al., 2013).

As per the findings, it is hinted that if any change of stock returns occurred in the banking sector of Indonesia, the cause might not be from the impact of IC (Djamil et al.,

2013). It might be an external one such as the change of inflation level or some socio-economic conditions. Djamil et al. suggested that Indonesian banks should improve the management of IC components other than HC so that they can leverage all knowledge resources to maximize the financial performance and improve the stock returns (Djamil et al., 2013).

Rehman, Rehman, Rehman, and Zahid (2011) made attempts to investigate the impact of IC on business performance in Pakistani firms. For IC measurement, the VAIC model was used to calculate the IC efficiency indicators: HCE, SCE, and CEE. The authors selected return-on-equity (ROE), return-on-investment (ROI), and earning-per-share (EPS) as the indicators of organizational performance (Rehman et al., 2011).

The researchers employed a quantitative analysis with multiple linear regression to analyze the public financial data reported by 12 firms. The results revealed that SCE had a significant positive influence on EPS ($\beta = 0.042$; $p < 0.05$), but its effect on both ROE and ROI were insignificant. CEE had a significant positive impact on ROE ($\beta = 0.027$; $p < 0.05$) and ROI ($\beta = 0.022$; $p < 0.05$), but not on EPS. Noticeably, HCE did not have a significant positive relationship with any of the three performance indicators (Rehman et al., 2011).

The findings indicate that the companies in Pakistan mostly depended on physical and financial capital for their business (Rehman et al., 2011). The authors suggested that the firms should invest more in human resources, information technologies, and better manage intellectual assets so that they could operate efficiently, gain competitive advantage, and improve business performance (Rehman et al., 2011).

Al-Shubiri (2013) performed a quantitative research to investigate the impact of IC and its efficiency indicators (HCE, SCE, and CEE) on business performance of companies in Jordan. The author collected data from 96 firms publicly listed on Amman Stock Exchange in 11 different industrial sectors such as chemical, pharmaceutical and medical, mining and extraction, electrical, engineering and construction, to name a few (Al-Shubiri, 2013). The author employed the VAIC methodology to measure IC and all its efficiency indicators (HCE, SCE, CEE). The researcher also selected ROA, ATO, liquidity ratio (LR: the ratio between the liquid assets and all the liabilities of an institution), and debt ratio (DR: the ratio between the total debt and total assets of an institution) as the indicators of organizational performance (Al-Shubiri, 2013).

The author used multiple linear regression to analyze the data and test the models. The results indicated that HCE had a significant positive impact on ROA ($\beta = 1.920$; $p < 0.001$) and ATO ($\beta = 0.026$; $p < 0.001$), but its influence on LR and DR was insignificant. The findings also showed that CEE had a significant positive effect on ROA ($\beta = 1.920$; $p < 0.001$) and ATO ($\beta = 1.920$; $p < 0.001$) while SCE significantly and positively impacted only LR ($\beta = 1.920$; $p < 0.001$) (Al-Shubiri, 2013).

Based on the results, Al-Shubiri recommended that Jordanian corporations should pay attention to building up intellectual assets, especially HC. Firms should put more effort into staff development and create a flexible working environment in which creativity and innovation are promoted (Al-Shubiri, 2013). The author also suggested that the companies should invest more in information technology. By doing that, they can leverage all the types of knowledge resources to enhance competitiveness and improve performance (Al-Shubiri, 2013).

Chang and Hsieh (2011) conducted a quantitative research to investigate the role of innovation capital in the creation of added-value for enterprises. Also, the authors examined the impact of IC and R&D investment on business performance. The authors agreed with Bontis (1998) that IC is "not only a static intangible asset per se, but an ideological process." (Chang & Hsieh, 2011, p. 4). In other words, Chang and Hsieh supported the shift from "having knowledge and skills" to "using knowledge and skills."

The researchers considered R&D investment as innovation capital. Besides, the authors employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE (Chang & Hsieh, 2011). They chose GPM (Gross Profit Margin) to represent operating performance, ROA and ROE for financial performance, and EPS (Earning Per Share) for market performance as the elements of corporate performance. For the study, the authors collected data by accessing the annual reports of 367 semiconductor companies listed on Taiwan Stock Exchange (Chang & Hsieh, 2011).

Chang and Hsieh employed multiple linear regression to analyze the data and test the models. The results showed that CEE ($\beta = 0.163$; $p < 0.05$) and R&D investment ($\beta = 0.170$; $p < 0.001$) had a significant positive impact on operating performance. It was also found that R&D investment significantly and positively influenced both financial performance ($\beta = 0.290$; $p < 0.001$) and stock performance ($\beta = 0.196$; $p < 0.001$) (Chang & Hsieh, 2011). In summary, R&D investment was the only predictor that had a significant positive effect on all the three elements of firm performance (Chang & Hsieh, 2011).

Based on the findings, the authors suggested that R&D investment should be considered as a permanent element of IC while measuring IC (Chang & Hsieh, 2011). Additionally, the results indicated that the semiconductor industry in Taiwan had been able to leverage R&D investment in their operation and generate profit (Chang & Hsieh, 2011). The authors recommended that the business leaders should pay more attention to the management of human resources. By doing that, the companies could leverage all the types of intellectual assets to create more value and improve performance (Chang & Hsieh, 2011).

Summary of the Literature Review on Measuring IC and the VAIC Model

It is a daunting task to measure KM performance directly, which makes it enormously difficult to evaluate the impact of KM (Harlow, 2012; Ibrahim & Reid, 2010; Ragab & Arisha, 2013; Shakina & Bykova, 2011). Therefore, it is suggested that IC measurement should be used as a proxy for KM performance studying the impact of KM implementation on organizational performance (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Ragab & Arisha, 2013). There are various approaches to measuring IC (Chan, 2009; Pal & Soriya, 2012; Ragab & Arisha, 2013; Sveiby, 2010), and the VAIC model may be the most widely used one (Khanhossini et al., 2013; Kharal et al., 2014).

The VAIC model aims to calculate the set of efficiency indicators (HCE, SCE, and CEE) and the value-added intellectual coefficient (VAIC). The values can be used to represent the measurement of IC in firms (Joshi et al., 2013; Kweh et al., 2013; Morariu, 2014). Although it is not free from limitations (Chen et al., 2005; Joshi et al., 2013;

Maditinos et al., 2011; Svanadze & Kowalewska, 2015), the method is popular within the IC research community thanks to its simplicity and transparency (Khanhossini et al., 2013; Kharal et al., 2014). Moreover, the model enables researchers to employ officially reported financial data of firms in their study. The data is considered highly valid and reliable (Khanhossini et al., 2013; Kharal et al., 2014). As a result, the method has been used to examine the impact of IC on organizational performance in various industries in different countries (Khanhossini et al., 2013; Kharal et al., 2014).

IC and Organizational Performance

Overview

The resource-based view (RBV) of the firm argues that competitiveness and superior performance of a firm come from some strategic resources it possesses and how these resources are managed (Al-Musali & Ku Ismail, 2014; Barney, 1991; Grant, 1996a, 1996b; Han & Li, 2015; Mehri et al., 2013; Patton, 2007; Verona & Ravasi, 2003; Wernerfelt, 1984; Zack, 1999). The view provides a theoretical link between the management of firm resources and organizational performance (Barney, 1991).

As an extension of RBV, the knowledge-based view of the firm posits that knowledge is a strategic resource because it is valuable, rare, inimitable, and non-substitutable (Kianto et al., 2014; Kogut & Zander, 1992; Spender 1996; Zack et al., 2009). With this theory, knowledge and its management are vital sources of a firm's competitive advantage and superior performance (Andreeva & Kianto, 2012; Grant 1996a, 1996b; McEvily & Chakravarthy, 2002; Miller, 2002; Narasimha, 2001).

Similarly, extended from the RBV and developed by Reed, Lubatkin, and Srinivasan (2006), the IC-based view of the firm points out that IC is a strategic resource of the firm whereas physical and financial assets are not. For the new theory, IC is comprised of knowledge resources that have been acquired and formalized to be used in creating value and gaining competitive advantage (Joshi et al., 2013; Kianto et al., 2014; Ragab & Arisha, 2013; Suraj & Bontis, 2012). It is expected that IC has a significant impact on corporate performance (Hudgins, 2014; Sarmadi, 2013; Kalkan et al., 2014).

Measuring Organizational Performance Using Surveys

In the literature, if data collection is done via a survey, the perceived firm performance can be measured using a questionnaire, as did Mention and Bontis (2013). The authors examined the impact of IC and its components (HC, SC, RC) on corporate business outcomes. For data collection, they administered a survey in which copies of a questionnaire were distributed by electronic and postal mail to 200 banks in Belgium and Luxembourg. To measure IC, its components, and the firm performance, the researchers used an amended version of the original questionnaire developed and validated by Bontis (1998). The lightly revised version of Bontis' questionnaire was comprised of 71 items: 20 for HC, 16 for SC, 25 for RC and 10 for performance. Mention and Bontis received 69 completed and valid questionnaires that could be used for the study (Mention & Bontis, 2013).

While analyzing the data, besides examining the effect of each component as a separate predictor, the authors also investigated the impact of the interaction of the components: HC and SC, HC and RC, and SC and RC. Mention and Bontis tested the

hypotheses employing partial least squares (PLS), a structural equation modeling technique.

The results revealed that HC significantly and positively influenced both SC ($\beta = 0.633$; $p < 0.001$) and RC ($\beta = 0.497$; $p < 0.001$), as did SC to RC ($\beta = 0.267$; $p < 0.001$) (Mention & Bontis, 2013). The findings also showed that only HC ($\beta = 0.205$; $p < 0.001$) had a significant positive impact on the business performance of the banks while the influence of SC and RC was insignificant. However, the study did not find any significant positive impact of the interaction of IC components on the business outcomes of these banks (Mention & Bontis, 2013).

As per the findings, it is suggested that HC has a dominant role in influencing the other two IC components and impacting the bank performance. Therefore, HC may provide accurate insights into the business performance of the banks in Luxembourg and Belgium (Mention & Bontis, 2013). The authors recommended that the banks should continue building up HC via staff training and development, offering better compensation and benefits, and creating a flexible working environment to retain talents. Additionally, Mention and Bontis suggested that the financial firms should also pay attention to investing in information technology and promoting good relationships with customers and partners. By doing that, the banks can leverage all the types of knowledge resources to enhance competitiveness and improve performance (Mention & Bontis, 2013).

Huang and Hsueh (2010) conducted a quantitative study with structural equation modeling to examine the association between IC and organizational performance in the Taiwanese engineering consulting industry. The authors administered a survey to collect

data for the three IC components (HC, SC, RC) and business outcomes (Huang & Hsueh, 2010).

With HC, the researchers focused on employees' capability, knowledge exchange among them, and corporate effort to educate and train staffs. For SC, overall business process, organizational design, and information system framework were the main dimensions (Huang & Hsueh, 2010). For RC, the surveyed items were concentrated on the level of cooperation with customers, relationship with partners, and the investments to promote good relationships with clients and partners (Huang & Hsueh, 2010). The authors surveyed the financial performance and operating performance for firm performance. Huang and Hsueh distributed 738 questionnaires to all Taiwanese engineering consulting companies and received 101 valid responses of which 70% had been filled out by senior managers or higher-level officers (Huang & Hsueh, 2010).

The authors' analysis found that HC had a significant positive influence on both SC ($\beta = 0.685$; $p < 0.01$) and RC ($\beta = 0.506$; $p < 0.01$). The results also revealed that among all the three IC components, only RC had a significant positive impact on business performance ($\beta = 0.312$; $p < 0.05$) while the effect of HC and SC was insignificant (Huang & Hsueh, 2010).

Based on the findings, although there was no direct impact of HC on the firm performance, it is hinted that HC might indirectly influence business outcomes of Taiwanese companies via the mediating role of RC (Huang & Hsueh, 2010). The authors suggested that the business leaders should focus more on investing in their staffs and create a flexible working environment that promotes creativity and innovation. By doing

that, the firms could leverage human capital to create value, gain competitive advantage, and improve business performance (Huang & Hsueh, 2010).

Sharabati, Jawad, and Bontis (2010) made attempts to investigate the relationship between IC and organizational performance in the pharmaceutical industry of Jordan. For IC, the authors focused on its components: HC, SC, and RC. In the study, for HC, Sharabati et al. considered the following dimensions: learning and education (L&E), experience and expertise (E&E), and innovation and creation (I&C). The researchers concentrated on systems and programs (S&P), research and development (R&D), and intellectual proprietary rights (IPRs) as the major aspects of SC (Sharabati et al., 2010). The survey questions for RC were directed to strategic alliances, licensing agreements (ALA), relation with partners, suppliers, and customers (RPSC), and knowledge about partners, suppliers, and customers (KPSC). For business performance, the authors focused on profitability, productivity, and market value (Sharabati et al., 2010).

To collect data, the authors distributed copies of a questionnaire to 200 top and middle-level managers of all 15 companies listed as the members of Jordanian Association of Pharmaceutical Manufacturers. They received 140 responses, but only 132 completed questionnaires could be used for the study. Sharabati et al. employed the path analysis, one of the structural equation modeling techniques, to analyze the data and test their hypotheses.

The results revealed that HC significantly and positively influenced both SC ($\beta = 0.659$; $p < 0.01$) and RC ($\beta = 0.699$; $p < 0.01$), as SC had a significant positive impact on RC ($\beta = 0.687$; $p < 0.01$). Additionally, the findings showed that all the three IC

components had a significant positive influence on organizational performance: HC ($\beta = 0.647$; $p < 0.05$), SC ($\beta = 0.557$; $p < 0.01$), and RC ($\beta = 0.670$; $p < 0.01$) (Sharabati et al., 2010).

The results of this study confirmed almost all what had been found in Bontis's previous research (Bontis, 1999). The only difference is that Bontis did not find a significant positive relationship between SC and RC. Most importantly, Sharabati et al.'s work has confirmed the significant positive impact of IC via its components on organizational performance (Sharabati et al., 2010).

Nemati, Jalilian, and Akbari (2013) tried to study the relationship between IC and business performance of the dairy industry in Iran. To collect data, the authors administered a survey and distributed copies of a questionnaire to the managers and employees of 180 dairy firms. The questionnaire consisted of 34 questions with 15 for IC and 19 for firm performance (Nemati et al., 2013). For the performance, the researchers made attempts to measure the perceived performance in five areas: financial, non-financial like innovation and competitiveness, product, market, and customer. Additionally, they measured IC with the questionnaire items about its components: HC, SC, and RC (Nemati et al., 2013).

The authors' analysis found that HC had a significant positive relationship with non-financial performance ($\beta = 0.700$; $p < 0.01$) and market performance ($\beta = 0.310$; $p < 0.01$), but not with financial performance, product and customer (Nemati et al., 2013). Similarly, SC was significantly and positively associated with non-financial performance ($\beta = 0.36$; $p < 0.01$) and market performance ($\beta = 0.500$; $p < 0.01$). However, RC had a

significant positive relationship only with non-financial performance ($\beta = 0.230$; $p < 0.01$) (Nemati et al., 2013).

The results suggest that IC was significantly and positively associated with non-financial performance and market performance. Nevertheless, IC had no significant positive influence on financial performance, product, or customer (Nemati et al., 2013). The findings provide a hint that the firms might not yet recognize the crucial role of knowledge resources and leverage them for business advantage. (Nemati et al., 2013).

The authors recommended that the companies should invest more in technologies to improve product quality. The companies should also pay more attention to cultivating and retaining good relationships with customers. By doing that, the Iranian dairy firms may be able to create more intellectual assets and improve business performance in the future (Nemati et al., 2013).

Nour, Sharabati, and Shamari (2013) conducted a quantitative analysis to study the impact of IC on business performance of telecommunication companies in Jordan. The authors administered a survey by distributing copies of a questionnaire to 150 managers of the firms. The questionnaire was used to collect data on IC components (HC, SC, RC) and the perceived company performance (Nour et al., 2013).

Nour et al. employed multiple linear regression to analyze the data and test the models. The results revealed that among all the three IC components, only RC ($\beta = 0.378$; $p < 0.01$) had a significant positive influence on the organizational performance of the firms. The impact of both HC and SC was insignificant (Nour et al., 2013).

The findings can be explained that customer service has always been vital to the business of telecommunication companies (Nour et al., 2013). However, the results also suggest that the executive officers of Jordanian telecommunication companies should better manage human resources and use more advanced technologies. By doing that, the firms could leverage all the types of intellectual assets to gain competitive advantage and achieve higher performance (Nour et al., 2013).

Kalkan, Bozkurt, and Arman (2014) made attempts to examine the influence of IC, innovation, and organizational strategy on business performance in the insurance sector of Turkey. To collect data, the authors administered a survey and distributed copies of a questionnaire to the middle and senior managers of the firms. They received 186 completed and valid responses. Kalkan et al. used perceived data of IC, innovation, and organizational strategy as predictors to study their impact on the firm performance of insurance companies.

The authors employed multiple linear regression to analyze the data and test the models. The findings showed that all the predictors (IC, innovation, and organizational strategy) had a significant positive influence on the business performance of Turkish insurance companies: IC ($\beta = 0.218$; $p < 0.001$), innovation ($\beta = 0.196$; $p < 0.05$), and organizational strategy ($\beta = 0.283$; $p < 0.001$) (Kalkan et al., 2014). For the role of IC, the study suggested that the corporate leaders should pay attention to creating more knowledge resources and managing them effectively. As a result, the companies can leverage available intellectual assets to gain competitive advantage and improve organizational performance (Kalkan et al., 2014).

Kianto, Andreeva, and Pavlov (2013) tried to investigate the effects of IC on firm competitiveness and financial performance in Finland, China, and Russia. To collect data, the authors administered a survey using a web-based format in the three countries. They received 261 responses of which 26 were dropped. Finally, Kianto et al. could use 234 completed online copies of a questionnaire for their research.

To measure perceived competitiveness, following Lee and Choi (2003), the authors used the method developed and validated by Deshpande et al. (1993) and Drew (1997). With this approach, Kianto et al. focused on five major factors: the organization's market share, profits, growth, innovativeness, and overall success against competitors. To measure perceived financial performance, the researchers applied the concepts introduced by Singh et al. (2006) and emphasized the change in revenue over the previous year (Kianto et al., 2013).

Kianto et al. employed structural equation modeling to analyze the data and test the hypotheses. The results showed that IC had a significant positive influence on firm competitiveness ($\beta = 0.345$; $p < 0.001$), but a direct impact of IC on business performance was not supported. However, competitiveness was found to influence firm performance significantly and positively ($\beta = 0.254$; $p < 0.001$) (Kianto et al., 2013).

As per the findings, it is suggested that IC has an indirect effect on business outcomes via the mediating role of competitiveness. The study confirmed that managing knowledge resources is a key managerial task that needs to be done correctly and effectively company-wide (Kianto et al., 2013). It is recommended that firms in Finland, Russia, and China should put more effort into creating intellectual assets and better manage them so

that they can gain competitive advantage and achieve better performance (Kianto et al., 2013).

Khalique and Bontis (2015) tries to evaluate the impact of IC on business performance in small and medium enterprises (SMEs) in Pakistan. The authors proposed six components of IC: human capital (HC), structural capital (SC), customer capital (CUC), social capital (SOC), technological capital (TEC), and spiritual capital (SPC) (Khalique & Bontis, 2015). With HC, they focused on knowledge, expertise, skills, intellectual agility, and attitudes. The researchers put emphasis on systems, infrastructure, systems, procedures, and policies for SC. With customer capital, they measured customer satisfaction and loyalty. For social capital, the authors paid attention to culture, relationships, and exchange (Khalique & Bontis, 2015). R&D and information technology knowledge were major aspects of technological capital while religious and ethical values were the main facets of spiritual capital. Additionally, Khalique and Bontis addressed four dimensions of organizational performance: financial, customer, learning and growth, and internal process.

To collect data, the authors administered a survey and distributed 550 copies of a questionnaire to the CEO's and owners, directors, general managers, managers, assistant managers, senior staffs, and technicians of 106 SMEs in Pakistan. They received 247 completed and valid responses that could be used in the study (Khalique & Bontis, 2015).

Khalique and Bontis employed multiple linear regression to analyze the data and test the models. The results revealed that five among six IC components were shown to have a significant positive impact on firm performance: Structural capital ($\beta = 0.203$; $p < 0.01$), customer capital ($\beta = 0.232$; $p < 0.001$), social capital ($\beta = 0.232$; $p < 0.001$),

technological capital ($\beta = 0.151$; $p < 0.01$), and spiritual capital ($\beta = 0.134$; $p < 0.05$). As found in Trisnowati and Fadah (2014), noticeably, the effect of human capital was insignificant (Khalique & Bontis, 2015).

As per the findings, almost all IC components had a significant positive impact on the firm business outcomes, but HC did not. The results provide a hint that, as often observed in emerging markets, the firms might not yet pay enough attention to the management of human resources (Khalique & Bontis, 2015). The authors suggested that the company leaders should invest more in employees. They should try to create a working environment in which creativity and innovation are promoted. By doing that, Pakistani SMEs would be able to leverage all types of knowledge resources for competitive advantage and better performance (Khalique & Bontis, 2015).

Yeganeh, Sharahi, Mohammadi, and Beigi (2014) performed a quantitative analysis to examine the impact of IC on organizational performance in private insurance companies in Iran. The authors administered a survey, distributed copies of a questionnaire to the staffs of 15 firms, and collected data on IC, its components (HC, SC, RC), and business performance (Yeganeh et al., 2014). Like Hashemnia et al. (2014), the researchers used the Bontis Standard Questionnaire designed and validated by Bontis (2000) for the survey. They received 342 completed and valid responses that could be utilized for the research (Yeganeh et al., 2014).

Yeganeh et al. employed multiple linear regression to analyze the data and test the models. The results indicated that both HC ($\beta = 0.442$; $p < 0.05$) and SC ($\beta = 1.085$; $p <$

0.001) had a significant positive impact on the business performance of Iranian insurance companies. However, the influence of RC was insignificant (Yeganeh et al., 2014).

As per the findings, it is comprehended that insurance firms invested heavily in human resources and advanced technologies (Yeganeh et al., 2014). The authors suggested that the companies should also pay more attention to cultivating and retaining good relationships with customers and partners for even more business opportunities and better performance (Yeganeh et al., 2014).

Measuring Organizational Performance Using Corporate Financial Data

In the literature, corporate performance can also be measured using various indicators selected from a broad spectrum of business data items including total revenue, asset turnover (ATO), return-on-assets (ROA), return-on-equity (ROE), sales growth, profit margins, return-on-sales (ROS), market value, and earning per share (EPS), to name a few (Agbim, Orarewo, & Owutuamor, 2013; Huang, 2011; Trisnowati & Fadah, 2014; Vorhies & Morgan, 2005; Zeghal & Maalou, 2010).

Some data items, e.g. ATO, are used to indicate productivity (Kalkan et al., 2014; Chan, 2009a). Other data items, e.g. ROA, ROE, or profit margin, are considered as the indicators of profitability (Morariu, 2014; Samadi, 2013). Some data items, e.g. total revenue, reflect the overall business performance (Tubigi et al., 2013). Some others, e.g. market capitalization (MC) or stock price, represent the stock performance (Mehri et al., 2013; Trisnowati & Fadah, 2014).

A few authors selected only one data item to represent firm performance (Piri et al., 2014; Joshi et al., 2013). Many researchers decided to use two indicators for the same

purpose (Al-Musali & Ku Ismail, 2014; Sarmadi, 2013; Vishnu & Gupta, 2014). Numerous authors preferred a combination of three different indicators of organizational performance (Bramhandkar et al., 2013; Deep & Narwal, 2014; Khanhossini et al., 2014; Morariu, 2014; Rehman et al., 2013; Zeghal & Maaloul, 2010).

Hudgins (2014) tried to investigate the impact of IC on organizational performance of the property-casualty personal lines insurance companies in the USA. For the research, the data were drawn from the financial reports (available on the Mergent database) of 11 active firms in the sector and publicly listed on the New York Stock Exchange (NYSE). The author used the VAIC model to measure IC and its efficiency elements: HCE, SCE, and CEE. Also, ROA was selected as the single indicator of business performance.

Hudgins employed multiple linear regression to analyze the data and test the models. The results showed that SCE ($\beta = 0.073$; $p < 0.001$) and CEE ($\beta = 0.071$; $p < 0.05$) both had a significant positive impact on firm performance, but HCE did not. The findings indicate that the U.S. property-casualty personal lines insurance firms have invested heavily in advanced technology and processes, which fits very well with the business of this sector. The companies also much depend on physical and financial capital for their profit. The author suggested that the business leaders of the industry should pay more attention to investing in their employees via staff training and development as well as better compensation and benefits. By doing that, the firms would be able to leverage all types of intellectual assets for better competitiveness and improved performance.

Uadiale and Uwuigbe (2011) tried to study the impact of IC on organizational performance in Nigeria. For companies, the researchers recognized that ability to assess business performance is crucial to the execution of firm strategy and achieving the

overall corporate goals. The researchers took advantage of the audited public financial statements reported by 32 Nigerian firms listed on the Nigeria Stock Exchange to collect data for their study. Uadiale and Uwuigbe used the VAIC model to measure IC and selected ROA and ROE as the indicators of organizational performance (Uadiale & Uwuigbe, 2011).

The authors employed a structural equation modeling technique, partial least squares (PLS), in their data analysis. The results showed that IC had a significant positive impact on both ROA ($\beta = 0.797$; $p < 0.001$) and ROE ($\beta = 0.815$; $p < 0.001$). The findings reinforce the empirical support for IC's significant positive influence on organizational performance (Uadiale & Uwuigbe, 2011). The authors suggested that Nigerian business leaders should put even more effort into creating knowledge resources and better managing them so that firms can leverage all available intellectual assets to improve competitiveness and achieve higher performance (Uadiale & Uwuigbe, 2011).

Pal and Soriya (2012) examined the relationship between IC and organizational performance in two Indian industries: the pharmaceutical and the textile. The authors employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE. They also chose ROA and ROE to represent profitability, ATO for productivity, and market value for stock performance as the indicators of business performance (Pal & Soriya, 2012).

The researchers accessed the Prowess database maintained by Center for Monitoring Indian Economy (CMIE) to collect the financial data of 105 pharmaceutical companies

and 102 textile firms. These companies are listed on both National Stock Exchange (NSE) and Bombay Stock Exchange (BSE) of India (Pal & Soriya, 2012).

The authors employed ordinary least squares (OLS) regression to analyze the data and test the regression models. The results showed that IC, represented by VAIC, had a significant positive impact on ROA in both the industry: pharmaceutical ($\beta = 0.011$; $p < 0.01$) and textile ($\beta = 0.019$; $p < 0.01$) (Pal & Soriya, 2012). Its influence on ROE was significant and positive in the pharmaceutical industry ($\beta = 0.018$; $p < 0.01$) but not in the textile (Pal & Soriya, 2012). However, the findings revealed that IC did not significantly affect either ATO or market value of either industry. In other words, the study only found that IC had a significant positive impact on the profitability of both the industries (Pal & Soriya, 2012).

Based on the findings of the insignificant effect of IC on both the productivity and stock performance in both the industries, the authors provided an explanation that Indian firms, like those in other emerging economies, still mainly focused on making short-term profits (Pal & Soriya, 2012). The authors recommended that business leaders should pay more attention to investing in employees and information systems so that the companies in both industries become more innovative, competitive, and successful (Pal & Soriya, 2012).

Chen, Cheng, and Hwang (2005) conducted a quantitative study with structural equation modeling to examine the influence of IC on corporate performance. The authors employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE. They also chose ROA, ROE, growth of revenue (GR), employee productivity (EP),

and market value as the indicators of business performance. The authors collected data by accessing the annual reports of 425 companies publicly listed on Taiwan Stock Exchange, most of which were in the electronic industry (Chen et al., 2005).

In their analysis, addition to HCE, SCE, CEE, VAIC, the authors used R&D expenses (R&D) and advertisement expenses (AD) as the predictors. The results showed that all the IC efficiency indicators (HCE, SCE, and CEE) had a significant positive impact on the market value: HCE ($\beta = 1.053$; $p < 0.05$), SCE ($\beta = 0.112$; $p < 0.05$), and CEE ($\beta = 7.221$; $p < 0.05$). The findings also revealed that R&D expenses had a significant positive influence on the market value ($\beta = 11.781$; $p < 0.05$), but the impact of advertisement expenses was insignificant (Chen et al., 2005). At the aggregate level, it was confirmed that VAIC significantly and positively influenced the market value ($\beta = 0.065$; $p < 0.05$).

The results also found that VAIC had a significant positive effect on all other indicators of firm performance: ROA ($\beta = 0.199$; $p < 0.05$), ROE ($\beta = 0.396$; $p < 0.05$), GR ($\beta = 0.360$; $p < 0.05$), and EP ($\beta = 0.308$; $p < 0.05$) (Chen et al., 2005). Additionally, Chen et al. reported that the impact of IC efficiency indicators (HCE, SCE, and CEE) on business performance varied from one performance indicator to another. For ROE, HCE ($\beta = 0.158$; $p < 0.05$) and CEE ($\beta = 35.210$; $p < 0.05$) had a significant positive influence but SCE, R&D, and advertisement expenses (AD) did not.

For ROA, all the three components – HCE ($\beta = 0.066$; $p < 0.05$), SCE ($\beta = 0.135$; $p < 0.05$), CEE ($\beta = 19.473$; $p < 0.05$) – and R&D ($\beta = 2.885$; $p < 0.05$) had a strong effect, but AD did not (Chen et al., 2005). For GR, HCE ($\beta = 0.968$; $p < 0.05$), CEE ($\beta = 56.151$; $p < 0.05$), and R&D ($\beta = 132.811$; $p < 0.05$) had a significant impact while the influence

of SCE and AD were insignificant. Finally, for EP, only the impact of HCE ($\beta = 266$; $p < 0.05$) and CEE ($\beta = 6.932$; $p < 0.05$) was significantly positive (Chen et al., 2005).

Based on the findings, the authors suggested that managing existing knowledge resources and creating new intellectual assets should be the top priority of the corporate strategy. By doing that, firms in developing countries would be able to create more value and compete better in the global market (Chen et al., 2005).

Trisnowati and Fadah (2014) tried to analyze the influence of IC on business performance in Indonesian commercial banks using multiple linear regression. The authors collected data by accessing the annual reports of 21 banks publicly listed on Indonesia Stock Exchange. The researchers employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE. They also chose ROA, ROE, market value, and revenue as the indicators of the business performance of the banks (Trisnowati & Fadah, 2014).

The authors' analysis showed that IC, represented by VAIC, significantly and positively influenced ROA ($\beta = 0.003$; $p < 0.05$), ROE ($\beta = 0.038$; $p < 0.05$), but its impact on both revenue and market value were insignificant (Trisnowati & Fadah, 2014). For the IC efficiency indicators, SCE had a significant positive effect on ROA ($\beta = 0.013$; $p < 0.05$), ROE ($\beta = 0.133$; $p < 0.05$), and revenue ($\beta = 2{,}198$; $p < 0.05$), but not on market value. Additionally, CEE significantly and positively impacted ROE ($\beta = 0.266$; $p < 0.05$). Noticeably, there was no significant positive relationship between HCE and any performance indicator (Trisnowati & Fadah, 2014).

As per the findings, among all the three IC efficiency indicators, SCE had the dominant role in influencing firm performance in Iranian corporations. It is hinted that the companies mostly focused their investments in non-human resources such as information technologies and organizational structure (Trisnowati & Fadah, 2014). The absence of a significant positive impact of HC on any of the performance indicator suggested that the business leaders might not yet pay adequate attention to the management of human resources (Trisnowati & Fadah, 2014).

Similarly found in Piri et al. (2014), the author suggested that the firms should invest more in their employee and set up a flexible organizational structure that promotes creativity and innovation. By doing that, the companies can shore up HC and leverage all the types of intellectual assets, especially staffs' talent and skills, to achieve even better business performance in the future (Trisnowati & Fadah, 2014).

Kehelwalatenna and Premaratne (2012) made attempts to examine the relationship between IC and organizational performance in the banking sector in the USA. To collect data, the authors accessed the financial reports of 191 commercial banks publicly listed on the New York Stock Exchange (NYSE). They measured IC and its efficiency indicators (HCE, SCE, and CEE) using the VAIC model. The researchers also selected ROA, ROE (for profitability), ATO (for productivity), and market value as the indicators of the business performance of the firms.

Kehelwalatenna and Premaratne analyzed the data and tested the models using multiple linear regression. The results showed that IC had a significant positive relationship with all the indicators of firm performance: ROA ($\beta = 0.050$; $p < 0.01$), ROE ($\beta = 0.250$; $p < 0.01$), ATO ($\beta = 0.130$; $p < 0.001$), and market value ($\beta = 0.140$; $p <$

0.01). The findings empirically support that IC significantly and positively influences corporate business outcomes. The authors suggested that the firms should pay adequate attention to building up intellectual assets and leverage them for competitive advantage and better performance.

Al-Musali and Ku Ismail (2014) conducted a quantitative analysis with multiple linear regression to study the effect of IC on organizational performance in Saudi Arabian commercial banks. The authors accessed the annual reports of the banks listed on TADAWEL Saudi Stock Exchange and collected data for a total of 33 observations (Al-Musali & Ku Ismail, 2014). The researchers employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE. They also selected ROA and ROE as the indicators of business performance (Al-Musali & Ku Ismail, 2014).

The authors' analysis revealed that IC, represented by VAIC, had a significant positive impact on both ROA ($\beta = 0.898$; $p < 0.001$) and ROE ($\beta = 0.834$; $p < 0.001$). However, for the IC efficiency indicators, only HCE significantly and positively influenced both ROA ($\beta = 0.724$; $p < 0.001$) and ROE ($\beta = 0.447$; $p < 0.001$) while CEE had a significant positive relationship with ROA ($\beta = 0.455$; $p < 0.001$). The effect of SCE on both indicators of business outcomes was insignificant (Al-Musali & Ku Ismail, 2014).

The services offered by commercial banks, not only in Saudi Arabia, normally require face-to-face contact with customers (Al-Musali & Ku Ismail, 2014). As per the findings, on the one hand, it is comprehended that the banks focused their effort on investing in employees, and HC had a dominant role in influencing the firm performance (Al-Musali & Ku Ismail, 2014). On the other hand, the results provide a hint that the bank executive

officers did not pay adequate attention to employing advanced information technologies in their operation (Al-Musali & Ku Ismail, 2014). The authors recommended that the banks should continue investing in their staffs, but they also need to shore up SC. By doing that, they can leverage all the types of intellectual assets to gain competitive advantages and get even better performance (Al-Musali & Ku Ismail, 2014).

Sarmadi (2013) made attempts to study the relationship between IC and business performance of petrochemical companies in Iran. The author employed the VAIC model to measure IC and its efficiency indicators (HCE, SCE, and CEE). Sarmadi also selected ROE and return-on-sales (ROS) as the indicators of firm performance in the research. The researcher collected data by accessing the annual financial statements of 36 petrochemical companies publicly listed on Tehran Stock Exchange (Sarmadi, 2013).

The author employed least square regression to analyze the data and test the models. The results showed that all the three IC efficiency indicators – HCE ($\beta = 0.036$; $p < 0.05$), SCE ($\beta = 1.518$; $p < 0.01$), and CEE ($\beta = 0.786$; $p < 0.05$) – had a significant positive relationship with ROE. Similarly, they were also significantly and positively associated with ROS: HCE ($\beta = 0.011$; $p < 0.001$), SCE ($\beta = 0.299$; $p < 0.01$), and CEE ($\beta = 0.422$; $p < 0.001$) (Sarmadi, 2013).

As per the findings, there was a significant positive relationship between IC and firm performance (Sarmadi, 2013). The author suggested that business leaders should put more effort into building up intellectual assets and better managing them. By doing that, the companies can leverage available knowledge resources to gain competitive advantage and achieve even higher performance (Sarmadi, 2013).

Khanhossini, Nikoonesbati, Kheire, and Moazez (2013) examined the influence of IC and its components on organizational performance in Iranian companies involved in developing renewal energy. The authors collected the financial data published in the annual reports of the energy firms belonging to the MAPNA group. To measure IC and its efficiency indicators (HCE, SCE, CEE), they used the VAIC method. The researchers also chose ROA, ROE, and basic earning power (BEP: the ratio of operating income to total assets) as the indicators of business performance (Khanhossini et al., 2013).

Khanhossini et al. employed a structural equation modeling technique, partial least squares, to analyze the data and test the regression models. The results showed that SCE ($\beta = 0.141$; $p < 0.01$) and CEE ($\beta = 0.184$; $p < 0.001$) significantly and positively impacted ROA, but the effect of HCE was insignificant. Additionally, only CEE ($\beta = 1.040$; $p < 0.05$) had a significant positive relationship with ROE while BEP was significantly and positively influenced only by SCE ($\beta = 0.316$; $p < 0.05$) (Khanhossini et al., 2013).

As per the findings, SCE and CEE had a significant positive impact on the business performance of Iranian energy companies. However, HCE did not have a significant positive relationship with any performance indicator (Khanhossini et al., 2013). The results suggest that the firms mainly depended on the structural capital as well as the physical and financial capital to run their business. It is also hinted that the companies of MAPNA Group invested heavily in technologies and R&D (Khanhossini et al., 2013). The authors recommended that Iranian companies should manage their human resources better by investing more in their employees. They also need to create a supportive corporate culture in which innovation and creativity are encouraged. By doing that, the

companies may be able to leverage all available intellectual assets to gain competitive advantage and improve even better performance in the future (Khanhossini et al., 2013).

Zeghal and Maaloul (2010) studied the impact of IC on organizational performance in British firms. They employed multiple linear regression, a quantitative method, to analyze the data collected from 300 UK companies publicly listed on London Stock Exchange (LSE) and available in the "Value Added Scoreboard" database. The sample was selected mostly from the following industries: high-tech, services, and traditional manufacturing. The researchers measured IC using the VAIC model. In their study, HCE and SCE were aggregated together as one value besides the normal capital employed efficiency (CEE) (Zeghal & Maaloul, 2010).

The authors suggested that corporate investments in IC would allow companies to improve their performance in three main areas: economic performance, financial performance, and stock performance. They also selected ROA, OI/S (the ratio of operating income to total sales), and market value as the indicators of firm performance (Zeghal & Maaloul, 2010).

According to Zeghal and Maaloul, the economic performance is mainly related to the operating profitability whose indicators may be an economic surplus or an economic margin that shows the difference between sales revenue and production costs. For financial performance, the focus was on the profitability gained by the ability to invest available capital for some profit. With stock performance, the market value of the firm is in the spotlight (Zeghal & Maaloul, 2010).

The results revealed that only the aggregated HCE-SCE had a significant positive impact on economic performance (OI/S) ($\beta = 0.693$; $p < 0.05$), but CEE did not. Additionally, both the aggregated HCE-SCE ($\beta = 0.243$; $p < 0.05$) and CEE ($\beta = 2.712$; $p < 0.05$) significantly and positively influenced financial performance. It was also found that CEE had a significant positive effect on the market value ($\beta = 0.550$; $p < 0.05$), but the aggregated HCE-SCE did not (Zeghal & Maaloul, 2010).

Based on the findings, Zeghal and Maaloul (2010) concluded that IC has a significant positive impact on firm performance although the level of influence may be varied for different components. The authors also believed that VAIC is a crucial tool for business decision makers to use and gain insights into whether their companies have successfully leveraged available intellectual assets to create values, enhance competitiveness, and improve the performance or not.

Morariu (2014) tried to provide empirical evidence of the impact of IC and its components on corporate performance in Romanian firms. The author collected data by accessing the annual reports of 72 companies publicly listed on Bucharest Stock Exchange. Morariu employed the VAIC model to measure IC and its efficiency indicators: HCE, SCE, and CEE. The researcher also chose ROE, ATO, and market value as the indicators of business performance.

The author used multiple linear regression to analyze the data and test the models. The results revealed that IC, represented by VAIC, did not have a significant positive influence on any of the performance indicators (Morariu, 2014). Similarly, there was no significant positive relationship between any IC efficiency element (HCE, SCE, CEE)

and any business performance indicator. In summary, the impact of IC on the business performance of Romanian corporations was insignificant (Morariu, 2014).

The findings provide a hint that little attention has been paid to managing knowledge resources and leveraging them to create value and improve performance in Romanian corporations (Morariu, 2014). The reason can be that Romania is still seen as an emerging market in the context of a post-communist country. As a result, business leaders may not yet recognize the crucial role of IC in the short-term plan as well as in the long-term strategy of the company (Morariu, 2014).

Deep and Narwal (2014) tried to study the relationship between IC and business performance in the Indian textile sector. To collect data for the research, the authors accessed the annual reports of 100 textile firms publicly listed in both the Indian stock exchanges: NSE (National Stock Exchange) and BSE (Bombay Stock Exchange). Deep and Narwal employed the VAIC method to measure IC and its efficiency indicators: HCE, SCE, and CEE. They also chose ROA, ATO, and market value to represent business performance (Deep & Narwal, 2014).

The researchers used both the fixed effect model (FEM) and the random effect model (REM) of the ordinary least regression technique to analyze the data and test the models. The results indicated that IC, represented by VAIC, had a significant positive impact on ROA (FEM: $\beta = 0.013$; $p < 0.01$; REM: $\beta = 0.012$; $p < 0.01$). However, there was no significant relationship between IC and ATO, nor between IC and market value (Deep & Narwal, 2014).

As per the findings, IC had a significant positive influence on profitability (represent by ROA), but it did not have any significant role in impacting either productivity (represented by ATO) or market performance (represented by the market value) in Indian textile companies (Deep & Narwal, 2014). Similarly found in Pal and Soriya (2012) and often observed in emerging economies, Indian firms might only focus their investments on short-term profits, and they did not pay enough attention to improving productivity or shoring up stock value (Deep & Narwal, 2014). The reason is that they may not yet recognize the critical role of intellectual assets that can help them create value, enhance performance, and make profits - not only now but also in the future (Deep & Narwal, 2014). The authors suggested that the business leaders of Indian textile firms should put more effort into training and developing employees, employ advanced technologies in the production, and improve relationships with customers and partners (Deep & Narwal, 2014).

Joshi, Cahill, Sidhu, and Kansal (2013) conducted a quantitative study to investigate the relationship between IC and business performance of the financial sector of Australia. The authors measured IC and its efficiency indicators (HCE, SCE, CEE) using the VAIC model. They also selected ROA as the single indicator of organizational performance. To collect data for the research, Joshi et al. accessed the annual reports of 33 top companies listed in the financial sector of the Australian Stock Exchange. These firms were classified under five sub-sectors: banks, diversified financials, insurance, investment companies, and real estate investment trusts (REITs) (Joshi et al., 2013).

The authors employed multiple linear regression to analyze data and test the models. The results indicated that CEE ($\beta = 0.609$; $p < 0.01$) significantly and positively

influenced the value creation capability and the business performance of the Australian financial sector (Joshi et al., 2013). However, the impact of HCE and SCE was found insignificant. Additionally, the results revealed that IC did not have a significant positive influence on firm performance (Joshi et al., 2013).

As per the findings, the financial firms in Australia seemed to depend mainly on the physical and financial capital for their profits (Joshi et al., 2013). For the insignificant impact of IC on the business performance, the authors explained that the VAIC method is not free from limitations as discussed in Chen et al. (2005), Maditinos et al. (2011), and Vishnu and Gupta (2014). Therefore, the results might sometimes be inconsistent. Joshi et al. recommended a similar future research that may be done in another country where the financial sector is very strong, and knowledge resources are better managed (Joshi et al., 2013).

The authors also suggested that the financial companies in Australian should invest more in their employees via staff training and development. The business leaders may also need to focus on shoring up structural capital, e.g. using advanced technologies. By doing that, the financial firms can leverage their intellectual assets to gain competitive advantage and achieve higher performance (Joshi et al., 2013).

Kharal, Zia-ur-Rehman, Abrar, Khan, and Kharal (2014) made attempts to study the relationship between IC and business performance in the oil and gas industry of Pakistan. The authors accessed the annual reports of the firms publicly listed on Karachi Stock Exchange and collected data for a total of 78 observations. Kharal et al. used the VAIC model to measure IC and its efficiency elements (HCE, SCE, and CEE). They also

selected ROA, ROE, EPS, sales growth, and market value as the indicators of company performance (Kharal et al., 2014).

The authors employed ordinary least squares (OLS) regression to analyze the data and test the models. The results showed that IC had a significant positive impact on ROA ($\beta = 0.772$; $p < 0.001$), ROE ($\beta = 0.496$; $p < 0.001$), EPS ($\beta = 0.449$; $p < 0.001$), and market value ($\beta = 0.248$; $p < 0.05$), but not on sales growth (Kharal et al., 2014).

As per the findings, the influence of IC on sales growth was insignificant. It could be explained that there would be not much room for business expansion due to the nature of the oil and gas market that has been mature and saturated in Pakistan (Kharal et al., 2014). Additionally, the significant positive impact of IC on the market value could suggest that knowledge resources potentially create great long-term value for these companies (Kharal et al., 2014). The authors suggested that the business leaders of Pakistani oil and gas firms should pay more attention to creating more knowledge resources and effectively managing them. As a result, the firms could even improve profitability as the significant positive influence of IC on ROA, ROE and EPS did provide a strong hint (Kharal et al., 2014).

Piri, Alghyanib, and Sadaghianic (2014) made attempts to provide empirical evidence of the relationship between IC and business performance. For their research, the authors extracted data from the annual reports of 1035 companies listed on Tehran Stock Exchange. Piri et al. used the VAIC method to measure IC and its efficiency elements: HCE, SCE, and CEE. They also selected the ratio of operating income to sales (OIS) as the sole indicator of firm performance (Piri et al., 2014).

The authors employed multiple linear regression to analyze the data and test the models. The results found that IC had a significant positive impact on OIS ($\beta = 0.450$ $p < 0.001$). It was also revealed that both SCE ($\beta = 0.584$; $p < 0.001$) and CEE ($\beta = 0.352$; $p < 0.001$) significantly and positively influenced the business performance of companies in Iran. However, there was no significant positive relationship between HCE and OIS (Piri et al., 2014).

The findings provide a hint that Iranian firms had focused much effort on applying new technologies to the company operation and cultivating good relationships with customers and partners (Piri et al., 2014). Nevertheless, the business leaders might not yet pay adequate attention to the management of human resources. The authors suggested that the firms should increase investment in employees so that they can leverage all the types of intellectual assets, especially staff talents and skills, to gain competitive advantage and improve business performance (Piri et al., 2014).

Summary of the Literature Review on the Impact of IC on Organizational Performance

In a broad perspective, the review of the literature supports the accumulated empirical evidence that IC has a significant positive impact on firm performance (Al-Musali & Ku Ismail, 2014; Bramhandkar et al., 2013; Chen et al., 2005; Kalkan et al., 2014; Nemati et al., 2013; Piri et al., 2014; Uadiale & Uwugbe, 2011). However, the results varied considerably from one industry to another, or from one country to a different one, considering the influence of IC components – HC, SC, RC, or the effect of efficiency elements – HCE, SCE, CEE, on corporate business outcomes. In many studies, the results showed that all the components or all the efficiency elements of IC significantly and

positively impacted the business performance (Al-Shubiri, 2013; Khalique & Bontis, 2015; Mention & Bontis, 2013; Sarmadi, 2013; Sharabati, 2010). In others, the findings found that only a subset of the components or efficiency elements had a significant role (Hashemnia et al., 2014; Huang & Hsueh, 2010; Hudgins, 2014; Khanhossini et al., 2013). In some research, it was reported that only one component or efficiency element had a significant positive relationship with firm performance (Djamil et al., 2013; Joshi et al., 2013; Nour et al., 2013). In one study, Morariu (2014), the results revealed that no efficiency element had any significant positive impact on the business outcomes of firms in Romania. The author provided an explanation that the Romanian economy has not yet been totally out of a post-communist context in which business leaders paid little attention to building up intellectual assets or leveraging them for competitive advantage and better performance.

Table 1 summarizes the reviewed literature on the impact of IC on organizational performance. The following acronyms are used in Table 1:

BEP: Basic Earning Power (the ratio of operating income to total assets)

CFD: Corporate Financial Data

DR: Debt Ratio;

EP: Employee Productivity;

EPS: Earning Per Share

GPM: Gross Profit Margin

GR: Growth of Revenue

LR: Liquidity Ratio (the ratio of liquid assets to liabilities of an institution)

OIS: Operating Income-to-Sales

OP: Organizational Performance

ROI: Return-on-Investments

ROS: Return-on-Sales

SOC: Social Capital

SPC: Spiritual Capital

TEC: Technology Capital

Citation	Measuring IC	Measuring Performance	Predictors	Performance Indicators	Results ('→' means "impact significantly and positively")	Country/Region
Al-Musali and Ku Ismail (2014)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, ROE	IC → ROA, ROE; HCE → ROA, ROE; CEE → ROA	Saudi Arabia / Middle East
Al-Shubiri (2013)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, ATO, LR, DR	HCE → ROA, ATO; SCE → LR; CEE → ROA, ATO	Jordan / Middle East
Bramhandkar et al. (2007)	Skandia Navigator	CFD	IC	ROA, ROE, ROI	IC → ROA	USA / North America
Chen et al. (2005)	VAIC	CFD	IC – HCE, SCE, CEE R&D Expenses	ROA, ROE, GR, EP, Market Value	IC → ROA, ROE, GR, EP, Market Value; R&D → Market Value	Taiwan / Far East Asia
Chang and Hsieh (2011)	VAIC	CFD	IC, R&D Expenses	ROA, ROE, EPS, GPM	CEE → GPM; R&D → EOA, ROE, EPS, GPM	Taiwan / Far East Asia
Deep and Narwal (2014)	VAIC	CFD	IC	ROA, ATO, Market Value	IC → ROA	India / South Asia
Djamil et al. (2013)	VAIC	CFD	IC – HCE, SCE, CEE	Stock Return	HCE → SR	Indonesia / Southeast Asia
Hashemnia et al. (2014)	Survey	Survey	IC – HC, SC, RC	OP	HC → SC; RC → OP	Iran / Central Asia
Hudgins (2014)	VAIC	CFD	IC – HCE, SCE, CEE	ROA	SCE → ROA; CEE → ROA	USA / North America
Huang and Hsueh (2010)	Survey	Survey	IC – HC, SC, RC	OP	HC → SC, RC; RC → OP	Taiwan / Far East Asia
Joshi et al. (2013)	VAIC	CFD	IC – HCE, SCE, CEE	ROA	CEE → ROA	Australia
Kalkan et al. (2014)	Survey	Survey	IC – HC, SC, RC	OP	IC → OP; Innovation → OP; Org. Strategy →OP	Turkey / Europe
Kehelwalatenna and Premaratne (2012)	VAIC	CFD	IC	ROA, ROE, ATO, Market Value	IC → ROA, ROE, ATO, Market Value	Sri Lanka / South Asia
Khalique and Bontis (2015)	Survey	Survey	IC – HC, SC, RC, SOC, TEC, SPC	OP	SC, RC, SOC, TEC, SPC → OP	Pakistan / South Asia
Khanhossini et al. (2013)	VAIC	CFD	IC	ROA, ROE, BEP	SCE → ROA, BEP; CEE → ROA, ROE	Iran / Central Asia

Table 1. Summary of the reviewed literature on the impact of IC on firm performance

Citation	Measuring IC	Measuring Performance	Predictors	Performance Indicators	Results	Country/Region
Kharal et al. (2014)	VAIC	CFD	IC	ROA, ROE, EPS, Sales Growth, Market Value	IC → ROA, ROE, EPS, Market Value	Pakistan / South Asia
Kianto et al. (2013)	Survey	Survey	IC	Competitiveness, OP	IC → Competitiveness → OP	Finland, Russia, China/ Europe and Asia
Mention and Bontis (2013)	Survey	Survey	IC – HC, SC, RC	OP	HC → SC, RC; SC → RC; HC → OP	Luxembourg and Belgium / Europe
Morariu (2014)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, ATO, Market Value		Romania / East Europe
Nemati et al. (2013)	Survey	Survey	IC – HC, SC, RC	OP	IC → OP	Iran / Central Asia
Nour et al. (2013)	Survey	Survey	IC – HC, SC, RC	OP	RC → OP	Jordan / Middle East
Pal and Soriya (2012)	VAIC	CFD	IC	ROA, ROE, ATO, Market Value	IC → ROA, ROE	India / South Asia
Piri et al. (2014)	VAIC	CFD	IC – HCE, SCE, CEE	OIS	IC → OIS;; SCE, CEE → OIS	Iran / Central Asia
Rehman et al. (2011)	VAIC	CFD	IC – HCE, SCE, CEE	ROE, ROI, EPS	SCE → EPS CEE → ROE, ROI	Pakistan / South Asia
Sarmadi (2013)	VAIC	CFD	IC – HCE, SCE, CEE	ROE, ROS	HCE, SCE, CEE → ROE, ROS	Iran / Central Asia
Sharabati et al. (2010)	Survey	Survey	IC – HC, SC, RC	OP	HC → SC, RC; SC → RC; HC, SC, RC → OP	Jordan / Middle East
Shil et al. (2011)	Survey	Survey	IC – HC, SC, RC	OP	RC → OP	Taiwan / Far East Asia
Trisnowati and Fadah (2014)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, ROE, Revenue, Market Value	IC → ROA, ROE; SCE → ROA, Revenue	Indonesia / Southeast Asia
Uadile and Uwugbe (2011)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, ROE	IC → ROA, ROE; SCE → ROA, ROE; CEE → ROE	Nigeria / Africa
Yeganeh et al. (2014)	Survey	Survey	IC – HC, SC, RC	OP	HC, SC → OP	Iran / Central Asia
Zeghal and Maaloul (2010)	VAIC	CFD	IC – HCE, SCE, CEE	ROA, OIS, Market Value	HCE, SCE → ROA, OIS; CEE → ROA, Market Value	England / West Europe

Table 1. Summary of the reviewed literature on the impact of IC on firm performance (Cont.)

Summary

The review of the literature identified the theoretical foundations of the critical role of KM in the corporate environment. The resource-based view (RBV) of the firm argues that the strategic resources of a firm and how they are managed help a company compete better and operate more efficiently because they are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991; Han & Li, 2015). The knowledge-based view (KBV) theory goes further to posit that knowledge is a firm strategic resource (Andreeva & Kianto, 2012; Kianto et al., 2014; Zack et al., 2009). It is knowledge and its management, i.e. KM, that enable corporations to gain competitive advantage and achieve superior performance (Andreeva & Kianto, 2012; Kianto et al., 2014; Zack et al., 2009).

RBV and KBV are supported by another separate stream of research, the knowledge chain theory (KCT) that identifies nine KM activities – five primary activities and four secondary ones (Holsapple & Joshi, 2004; Holsapple & Singh, 2001). According to KCT, the combination of all these KM activities or each of them has a significant impact on corporate operating outcomes (Holsapple & Jones, 2005; Holsapple & Joshi, 2004). Among all the nine activities is the activity of measuring intellectual assets of firms. By the theory, this activity is the foundation for assessing the execution of all other KM activities and for evaluating the impact of KM implementation on organizational performance (Holsapple & Singh, 2001).

The literature review showed that KM has been studied and viewed in different ways and from different perspectives. Therefore, the research community has not agreed on a commonly accepted definition of KM (Abraham & Reid, 2010; Moballeghi &

Moghaddam, 2011). The review also demonstrated the significant influence of KM on firm operating outcomes such as efficiency, competitiveness, innovation, productivity, and corporate performance (Chen & Chen, 2005; Rusly et al., 2014; Volkel & Haller, 2009).

More importantly, the literature review supported the common observation that it is very challenging to directly assessing KM impact on organizational performance (Carrillo et al., 2003; Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Liebowitz, 2005; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014). The review also revealed a lack of empirical studies demonstrating the connection between KM and organizational performance (Andreeva & Kianto, 2012; Feng, Chen, & Liou, 2004; Holsapple & Wu, 2011; Massignham, 2014; Rasula et al., 2012; Tanriverdi, 2005; Tubigi et al., 2013; Zack et al., 2009).

Additionally, the review of the literature illuminated the tight relationship between KM and IC that are considered as twins or two facets of the same thing (Kianto et al., 2014; Shakina & Bykova, 2011; Sveiby, 1997). Another major factor shared by KM and IC is that knowledge resources have the central role in both in the corporate environment (Libo et al., 2011; Pension et al., 2013). Most importantly, the review supports the proxy role of IC for KM performance in assessing the impact of KM implementation on organizational performance (Chen et al., 2009; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008).

The literature review also discussed various approaches to measuring IC, and the focus is on using the VAIC model for this purpose. The literature revealed that the method is very popular thanks to its simplicity and effectiveness in helping researchers

study the influence of IC on firm performance. However, the model is not free from limitations.

In the next chapter, a modified VAIC model is proposed to address its two major limitations. Furthermore, a study will be conducted to test the modified version, and then based on the results, to provide a clear answer to the challenging question of whether the classic VAIC model is good enough to be used, or should it be modified by including R&D expenses and RCE (Joshi et al., 2013; Maditinos et al., 2011).

Chapter 3

Methodology

Overview

This chapter describes the methods followed in conducting the study. First, the type of study, the setting, unit of analysis, and time horizon are discussed. Then, the discussion is followed by a synopsis of each step of the methodology.

Details of Study

The goal of this research was to address the question of whether the classic VAIC model or a modified version that includes R&D expenses and relational capital efficiency (RCE) is a better method to measure KM performance (Joshi et al., 2013; Maditinos et al., 2011). In order to achieve this goal, the study answered two research questions:

1. How appropriate is IC as a proxy for KM performance in evaluating the influence of KM implementation on organizational performance?

2. Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance?

First, a literature review and descriptive research in the form of content analysis were performed to determine the appropriateness of IC as a proxy for KM performance while assessing the impact of KM implementation on firm performance. Next, a quantitative

causal modeling study in the form of hypothesis testing was conducted to determine which version of the VAIC model – the classic or the modified model – better reflects the influence of IC on organizational performance.

Since the study examined the impact of IC on corporate performance, each company included in the research sample was treated as a data source. Therefore, the unit of analysis was the firms in two industries – the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences. These industries were chosen because the extant literature shows that the role of KM and IC in companies varies considerably, depending on the industry to which the firms belong.

For businesses in knowledge-intensive sectors such as the selected industries, KM and IC have the central role in their daily operation as well as the long-term business strategy (Chang & Lee, 2012; Jasour et al., 2013; Pal & Soriya, 2012; Vishnu & Gupta, 2014; Wu et al., 2012). KM and IC are also the key determinants of the success and growth of companies in these sectors (Chang & Lee, 2012; Jasour et al., 2013; Vishnu & Gupta, 2014; Wu et al., 2012). Therefore, they are viewed as preferred sectors of research by scholars for studying the relationship between IC and organizational performance (Jasour et al., 2013; Pal & Soriya, 2012).

Additionally, these companies are listed on the stock exchanges in the North America continent (USA and Canada), and developed European countries such as England, France, Germany, Norway, and Finland, where the two selected industries contributed significantly to the national economy as well as to the advance of the field (U.S. Department of Commerce, 2016). Most of the firms are publicly traded on the New York

Stock Exchange (NYSE), National Association Securities Dealers Automated Quotations System (NASDAQ), the London Stock Exchange (LSE), the SIX Swiss Exchange (SSE), the Euronext Stock Exchange (ESE) in France, the Deutsche Börse (DB) in Germany, the Oslo Stock Exchange (OSE) in Norway, Luxembourg Stock Exchange (LSE), and Helsinki Stock Exchange (HLSE) in Finland, to name a few.

The data collection for the study focused on the financial fundamentals and the market data of the chosen companies. The data items were extracted from the annual reports of the firms for only one fiscal year. Therefore, the time horizon for this study was cross-sectional (Sekaran & Bougie, 2009). The IC literature shows that cross-sectional data were used in previous studies that employed the VAIC model to measure IC and assess the impact of IC on organizational performance (Bramhandkar et al., 2007; Uadiale & Uwugbe, 2011; Zeghal & Maaloul, 2010).

Bramhandkar et al. (2007) conducted a cross-sectional study to investigate the impact of IC on organizational performance in the pharmaceutical industry in the USA. Similarly, Uadiale and Uwugbe (2011) performed a cross-sectional analysis to examine the relationship between IC and the business performance of Nigerian companies. Zeghal and Maaloul (2010) analyzed the effect of IC on corporate business outcomes in the UK. Rehman et al. (2011) investigated the influence of IC on firm performance in Pakistan, and Morariu (2014) studied the impact of IC on Romanian corporations. Figure 1 describes the high-level methodology approach, followed by the discussion of each step:

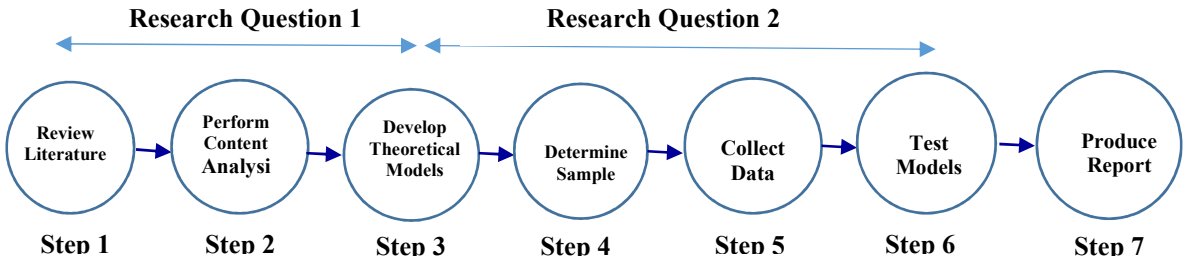

Figure 1. Methodology Approach

Step 1 – Review the Literature

For the first research question, an extensive review of the literature in both fields, KM and IC, was conducted in Chapter 2 to examine the relationship between KM and IC, focusing on the role of IC as a proxy for KM performance in assessing the impact of KM implementation on organizational performance. Fink (2005) observed that an essential purpose of reviewing the literature is to reveal any gaps that exist in the literature. Similarly, Crew (2003) opined that a literature review could help narrow the scope of inquiry, make it manageable, and identify specific topics necessary for a study. Most importantly, Levy and Ellis (2006) pointed out that the review of the literature is the foundation for academic research. They also suggested a model of three stages: input, processing, and output. The literature review in this study was conducted following this model.

In the input stage, quality literature from academic and research journals, conferences, chapters of books in both fields, KM and IC, was reviewed. The documents were obtained through search using keywords such as knowledge management, intellectual capital, measuring knowledge management performance, assessing the impact of knowledge management on organizational performance, measuring intellectual capital,

and intellectual capital and firm performance. As recommended by Florida Atlantic University Libraries (2016) and Webster and Watson (2002), both backward and forward searches were conducted on selected papers for better results. In the processing stage, the contents of the documents were described meaningfully. Interpretation and summary of the results of the studies helped demonstrate comprehension of the literature. Finally, in the output stage, the major concepts related to the study were identified and classified to prepare for the next step of conducting content analysis.

Step 2 – Perform Content Analysis

After the review of the literature had been done, a content analysis study was conducted to determine if IC is appropriate to be used as a proxy for KM performance in assessing the impact of KM on organizational performance. Content analysis is "a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding" (Stemler, 2001, p. 1). The technique enables researchers to sift through a large number of literature pieces to discover and describe the underlying concepts (Krippendorff, 1980; Neuendorf, 2002; Stemler, 2001; Zhang & Wildemuth, 2008). Moreover, it allows inferences to be made, then to be used in tandem with other techniques of data collection (Krippendorff, 1980; Neuendorf, 2002; Prasad, 2008; Stemler, 2001).

For example, Mosteller and Wallace (1963) conducted a content analysis based on word frequency to prove that Madison was the author of the Federalist papers. The technique has also been used in KM and IC research. Heisig (2009) performed a content analysis to compare 160 KM frameworks that had been used around the globe. Taylor

and Wright (2004) used the same technique to identify the antecedents of knowledge sharing. Dumay and Garanian (2013) conducted a content analysis study on research papers from 2000 to 2011 to determine the trends in the IC research during this period. The content analysis study consisted of six stages (Krippendorff, 1989):

1. Design
2. Unitizing
3. Sampling
4. Coding
5. Drawing inferences
6. Validation

Stage 1 – Design

According to Ahuvia (2000) and Berge (2001), content analysis is classified into two types: manifest and latent. Manifest content analysis looks for the obvious, straightforward meaning (Ahuvia, 2000) or the physically present element that can be counted (Berge, 2001) of the text. In contrast, latent content analysis tries to reveal the subtle meaning of the message (Ahuvia, 2000; Berge, 2001). Both the authors suggested that these two approaches can be employed in a content analysis study. In this study, both the manifest and latent method were used.

For example, the following excerpt was analyzed with a manifest content analysis: "Human being is the critical element in knowledge management. The strategies,

processes and decision making is done by humans and its effective usage will ensure minimization of risk strategic and financial matters." (Bhatti, Zaheer, & Rehman, 2011, p. 2848). In this example, the researcher coded the text as "KM-IC human resource management" or "KM-IC-HRM" because it showed the significant role of human factor as an element in knowledge management, which was similar to the role of human capital (HC) as a component of IC (See Table 2 for sample coding sheet).

An example of a latent content analysis could be demonstrated with the text: "We argue that new knowledge that is based on the firm's own prior new knowledge creations (which are now part of its existing knowledge base) has superior value. We begin by asserting that firms should have rare, in-depth understanding of the strengths and limitations of their earlier innovations, inventions, products or skills" (Bogner & Bansal, 2007, p. 170). Literally, a firm cannot have "skills." Only employees of a company can possess skills. The content of the text implied that firms should implement KM initiatives to manage their knowledge resources including human resources. In this example, the researcher also coded the text as "KM-IC human resource management" or "KM-IC-HRM."

Stage 2 – Unitizing

Stemler (2001) discussed various methods of defining the coding unit. One approach defines the units physically regarding "their natural or intuitive borders" (Stemler, 2001, p. 3). For example, magazine articles, chapters in books, and poems have their natural boundaries. Another method defines the units syntactically, e.g., words, sentences, or paragraphs (Stemler, 2001). The third way defines the units using references such as

referring to the President by the "nth President of the United States" instead of his full name. According to Weber (1990), sentences and paragraphs can be used as units if the researcher pays attention to "words or phrases that occur closely together" (p. 22). In the study, the coding unit used in the content analysis was sentences and paragraphs.

Stage 3 – Sampling

In this study, the purposive sampling method was used for the content analysis. As Creswell (2003) suggested, articles were selected based on their relevance to the goal of the study. The focus of the analysis was on research papers discussing topics related to both fields, KM and IC, within the domains of KM and IC in firms. The following areas were particularly targeted: KM-IC relationship, assessing KM performance in firms, measuring IC in companies, impact of KM on organizational performance, and influence of IC on corporate business outcomes.

As recommended by Levy and Ellis (2006), sources for the research papers in both fields, KM and IC, could be found in different databases. For example, ACM Digital Library, EBSCOHost, ELSEVIER, Emerald Insight Electronic Library, IEEE Xplore Digital Library, JSTOR, ScienceDirect Complete, Proquest, SpringerLink, and Wiley Online Library.

Stage 4 – Coding

The coding in the study was done by a single coder, the researcher. The literature has shown that many previous studies have successfully employed single coders. Mention (2012) used a sole coder to provide a content analysis of the relationship between IC,

innovation, and organizational performance. Foster (2004) was the single coder in the study of information seeking behaviors of scholars in interdisciplinary contexts. According to Ahuvia (2001), "in principle, a single coder is sufficient." (p. 145).

In the study, the content analysis was conducted using both inductive and deductive reasoning to determine the categories. Zhang and Wildermuth (2008) observed that content analysis is a process in which categories or themes are extracted from raw data using valid inference and interpretation, i.e. employing inductive reasoning. However, they agreed with Patton (2000) and Berge (2001) that deductive reasoning should not be excluded from this research method. Deriving concepts or variables from previous theories or literature is very helpful to the process of data analysis (Zhang & Wildermuth, 2008).

In the study, the coding categories were text that represents specific themes. The text could be words, phrases, sentences, or paragraphs. For instance, sentences or paragraphs that described any relationship between KM and IC, e.g. positively related to, being the twins, two facets of the same thing, or any associated synonyms were coded under the category of KM-IC Twin Relationship (KM-IC-TR). In another example, any piece of text that discussed the central role of knowledge resources in the domain of KM or IC was coded under the category of KM-IC Knowledge Resources (KM-IC-KR). According to Berg (2001) and Chelimsky (1989), these categories were linked to specific concepts that represent variables in typical research hypotheses. These concepts were identified during the content analysis review of each article. In the study, all the categories were associated with a single concept: IC – a proxy for KM performance.

The list of categories included KM-IC Knowledge Resources (KM-IC-KR), KM-IC Twin Relationship (KM-IC-TR), KM-IC Human Resource Management (KM-IC-HRM), KM-IC Structural Capital Management (KM-IC-SCM), KM-IC Relational Capital Management (KM-IC-RCM), KM-IC Impact on Organizational Performance or Firm Success (KM-IC-OP-FS), Measuring IC to Assess KM Performance (MICAKMP), and Creating IC as Goals of KM Implementation (CICGKMI).

Table 2 shows an example of the coding sheet that contains the following columns: 1) "Code #" is an alpha-numeric key used to identify the unit; 2) "Description" contains the unit's sentences or paragraphs extracted from the article; 3) "Citation" displays the citation, including the page number, of the article; 4) "Study Type" shows the type of research discussed in the article; 5) "Field" specifies the field with which the article is mainly associated. It is either KM, or IC, or both KM and IC; 6) "Category" refers to the categories under which the unit is classified; 7) "Concept" indicates an inferred variable that was used in the theoretical model.

Code #	Description	Citation	Study Type	Field	Category	Concept

Table 2. Sample of coding sheet

Stage 5 – Drawing Inferences

According to Berg (2001) and Chelimsky (1989), descriptive statistics can be used in a content analysis to reveal the significance of how many observations have been obtained. In the study, after the coding stage had been completed, the number of occurrences of the coded units under each category was recorded. Then, the frequency distribution of the numbers of occurrences was analyzed to determine the magnitude of observations. Special effort was made to avoid any type of miscounting during the process. The concept that was identified through the content analysis study determined the appropriateness of using IC as a proxy for KM performance in assessing the impact of KM implementation on organizational performance, addressing the first research question.

Stage 6 – Validation

As suggested by Chelimsky (1989) and Stemler (2001), it is important for researchers to make attempts of testing the reliability of the coding. Establishing reliability of unit coding is considered as an essential part of any content analysis (Kirilenko & Stepchenkova, 2016). In the study, a single coder (the researcher) was used for the coding process. It is recommended that "in a content analysis done by a single coder, the analyst tests the reliability against himself or herself at two points in time – referred to as stability in coding. This test tries to detect whether slippage has occurred in the single coder's understanding or application of the protocol definitions." (Riffe, Lacy, & Fico, 2005, p. 145).

To determine the minimum number of units to be randomly selected for the reliability test, Riffe et al. suggested the following formula:

$$n = \frac{(N-1)(SE)^2 + PQN}{(N-1)(SE)^2 + PQ} \quad (8)$$

in which

- n = the sample size of the reliability check
- N = the population size, i.e. the number of content units in the study
- P = the estimate of agreement in the population
- Q = 1 – P (9)
- SE = standard error

When the random sample had been chosen, the selected coding units were recoded, and the results were compared to the original coding. Then, the percentage of units whose results of the two times of coding match was recorded as the observed agreement. It was considered acceptable if a reliability level is above 70% agreement between the tests (Riffe et al., 2005).

Cohen's (1960) kappa coefficient was employed to determine whether a perfect agreement or an agreement by chance had occurred. The coefficient of agreement between the tests is "directly interpretable as the proportion of joint judgment in which there is agreement, after chance agreement is excluded. Its upper limit is +1.00, and its lower limit falls between zero and -1.00," (Cohen, 1960, p. 46).

So, theoretically, the range of kappa is from -1.00 and +1.00. However, because kappa is a measure of agreement, only non-negative values of the coefficient should be in researchers' interest (Kirilenko & Stepchenkova, 2016). A value of zero reveals an agreement of chance (Kirilenko & Stepchenkova, 2016). Any positive coefficient indicates an agreement level better than chance, and a 1.0 kappa marks a perfect agreement between the two tests (Kirilenko & Stepchenkova, 2016). Coefficient values between 0.61 and 0.80 are considered to be indicators of substantial agreement while those between 0.21 and 0.40 are viewed as fair agreement (Vierra & Garrette, 2005). The kappa value of 0.78, achieved in this study, was considered indicative of substantial agreement.

Step 3 – Develop Theoretical Models

This section describes the theoretical models and hypotheses for the conducted study. The second research question that the study addressed was:

Which version – the classic VAIC model or the modified one that includes R&D expenses and RCE – better describes the impact of IC on organizational performance?

For this question, two theoretical models – one for the classic VAIC method (Figure 2) and the other for the modified version (Figure 3) – were proposed to demonstrate the causal links between the independent variables (the efficiency indicators of IC) and the dependent variables (the indicators of organizational performance).

Classic VAIC Model (Figure 2 in Page 118)

The VAIC model aims to provide a simple, but effective, approach to measuring IC of firms (Al-Musali & Ku Ismail, 2014; Khanhossi et al., 2013; Joshi et al., 2013). With the classic version, the efficiency indicators of IC (HCE, SCE, CEE) and the VAIC value were calculated in the following five steps (Kharal et al., 2014; Piri et al., 2014; Al-Musali & Ku Ismail, 2014; Joshi et al., 2013; Chan, 2009a):

Step 1: Calculate the VA value, using Formula 1.

VA = Operating Profit + Employee Expenses + Depreciation + Amortization (1)

Step 2: Calculate human capital efficiency (HCE), using Formula 2.

HCE = VA / (HC: Human Capital) (2)

Where HC is the employee expenses, normally the total salaries and wages

Step 3: Calculate structural capital efficiency (SCE) using Formula 3 and Formula 4.

SCE = SC (Structural Capital) / VA (3)

Where SC = VA – HC. (4)

Step 4: Calculate capital employed efficiency (CEE) using Formula 5 and Formula 6.

CEE = VA / CE (Capital Employed) (5)

Where CE = Property, Plant & Equipment + Current Assets – Current Liabilities (6)

Step 5: Finally, calculate the VAIC value using Formula 7.

VAIC = HCE + SCE + CEE (7)

In this model, IC – as a proxy for KM performance – was the central predictor that was represented by its three traditional efficiency indicators: HCE, SCE, and CEE (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Kharal et al., 2014; Morariu, 2014; Piri et al., 2014; Pouraghajan et al., 2013; Samardi, 2013). Then, these efficiency indicators were used as the independent variables (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Kharal et al., 2014; Morariu, 2014; Piri et al., 2014; Pouraghajan et al., 2013; Samardi, 2013).

The dependent variables were the three indicators used to measure organizational performance: ROA (return-on-assets) representing profitability, ATO (asset-turnover) indicating productivity, and market value for market performance (Deep & Narwal, 2014; Hudgins, 2014; Kehelwalatenna & Premaratne, 2012; Morariu, 2014; Pal & Soriya, 2012; Pouraghajan et al., 2013; Vishnu & Gupta, 2014).

ROA (Return-on-Assets), a.k.a. the return on total assets, is a ratio of operating income to the average total assets (My Accounting Course, 2016b; Peterson & Fabozzi, 1999). This ratio represents firm profitability (Chan, 2009; Mehri et al., 2013; Pal & Soriya, 2012; Sharabati et al., 2010; Veltri, 2005). It measures how efficiently a firm can leverage its assets to produce profits during a period. ROA helps management assess how well a company can convert its investments in assets into profits (My Accounting Course, 2016b; Peterson & Fabozzi, 1999). The ratio can be calculated using the following formula (My Accounting Course, 2016b; Peterson & Fabozzi, 1999):

ROA = Net Income / Average Total Assets (10)

ATO (Asset Turnover) is the ratio of total sales to total assets (My Accounting Course, 2016a; Peterson & Fabozzi, 1999). This ratio indicates firm productivity (Chan, 2009; Mehri et al., 2013; Sharabati et al., 2010; Veltri, 2005). ATO measures a firm's ability to generate sales from its assets (My Accounting Course, 2016a; Peterson & Fabozzi, 1999). In other words, it measures how efficiently a company can employ its resources to generate sales (My Accounting Course, 2016a; Peterson & Fabozzi, 1999). For example, an ATO ratio of 0.5 indicates that the firm can make 50 cents of sales for each dollar of its assets (My Accounting Course, 2016a). The ratio can be calculated using the following formula (My Accounting Course, 2016a; Peterson & Fabozzi, 1999):

$$\text{ATO} = \text{Net Sales} / \text{Average Total Assets} \quad (11)$$

Market value, a.k.a. market capitalization (MC), is the total value of the outstanding shares (stock price multiplied by the total number of outstanding shares) of a publicly listed company (Investopedia, 2016a, 2016b). Market value reflects the market performance of firms, and its natural logarithm was used as one of the dependent variables (Mehri et al., 2013; Sharabati et al., 2010; Veltri, 2005).

Based on the reviewed literature, the following theoretical model was proposed:

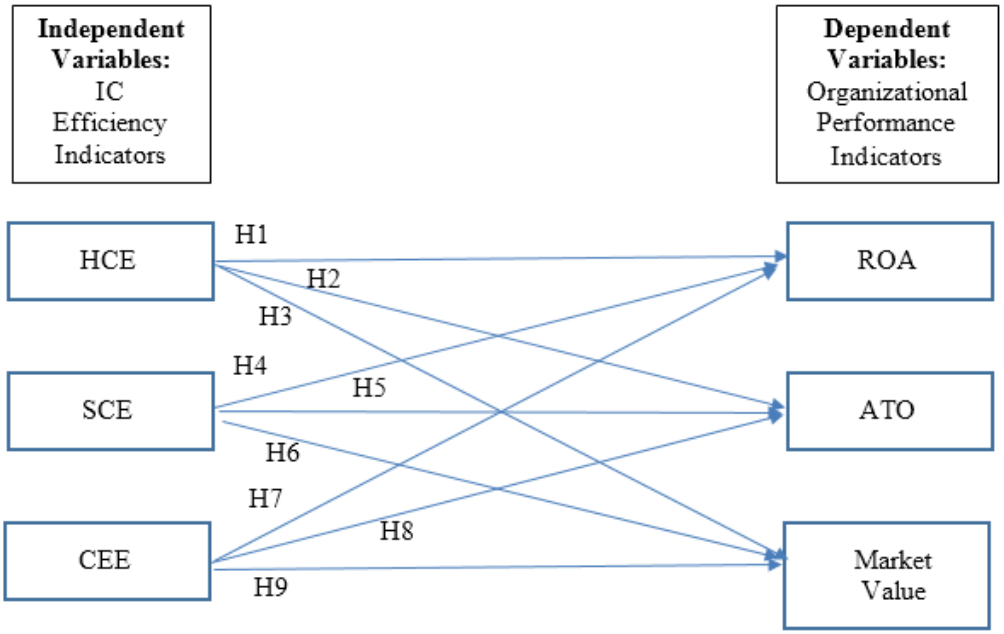

Figure 2: Proposed classic VAIC model

In the resource-based view (RBV) of the firm, IC has been considered as a strategic resource because it helps firms gain competitive advantage and achieve superior performance against competitors (Al-Musali & Ku Ismail, 2014; Han & Li, 2015; Mehri et al., 2013; Zeghal & Maaloul, 2010). Extended from the RBV and developed by Reed, Lubatkin, and Srinivasan (2006), the IC-based view of the firm points out that IC is the sole strategic resource of the firm whereas physical and financial assets are not (Al-Musali & Ku Ismail, 2014; Han & Li, 2015; Mehri et al., 2013; Zeghal & Maaloul, 2010). In the literature, IC and its efficiency indicators (HCE, SCE, CEE) have been found to have a significant positive influence on firm performance (Hudgins, 2014; Kehelwalatenna & Premaratne, 2012; Morariu, 2014; Muhammad & Ismail, 2009; Pouraghajan et al., 2013; Zehri et al., 2012).

Based on the theories of the firm and the reviewed literature, the following hypotheses were proposed:

H1: HCE has a significant positive impact on ROA.

H2: HCE has a significant positive impact on ATO.

H3: HCE has a significant positive impact on market value.

H4: SCE has a significant positive impact on ROA.

H5: SCE has a significant positive impact on ATO.

H6: SCE has a significant positive impact on market value.

H7: CEE has a significant positive impact on ROA

H8: CEE has a significant positive impact on ATO

H9: CEE has a significant positive impact on market value.

Modified VAIC Model (Figure 3 in Page 122)

As an attempt to address the limitations of the classic VAIC model, a modified approach to calculating the efficiency indicators and the VAIC value was proposed. In the modified version, research and development efficiency (RDE) and RCE were included in the VAIC model as new efficiency indicators beside the original ones (HCE, SCE, CEE).

For the modified VAIC model, the efficiency indicators (HCE, SCE, CEE, RCE, RDE) and the VAIC value were calculated in the following steps (all the referenced formulas are discussed in detail in Page 115):

Step 1: Calculate the VA value, using Formula 1.

Step 2: Calculate human capital efficiency (HCE), using Formula 2.

Step 3: Calculate structural capital efficiency (SCE) using Formula 3 and Formula 4.

Step 4: Calculate capital employed efficiency (CEE) using Formula 5 and Formula 6.

Step 5: Calculate research and development efficiency (RDE)

In their study of pharmaceutical firms in India, Vishnu and Gupta (2014) found that R&D expenses had a significant influence on firm performance, as did Chen et al. (2005). Vishnu and Gupta (2014) suggested that the contribution of R&D expenses to the VAIC value should be VA/R&D expenses. In this study, based on the work of Vishnu and Gupta (2014), the calculation of RDE was:

RDE = VA / (R&D expenses) (12)

Step 6: Calculate relational capital efficiency (RCE)

The results of various studies revealed that advertising and marketing expenses, the markers of relational capital, have long been viewed as an important factor that positively influences firms' business performance (Chen et al., 2005; Klock & Megna, 2000; Sydler et al., 2014; Vishnu & Gupta, 2014; Wyatt, 2008). According to Vishnu and Gupta (2014), the contribution of RCE to the VAIC value should be VA / (Marketing, Selling and Advertising Expenses). In the study, their proposal was adopted to compute RCE:

RCE = VA / (Marketing, Selling and Advertising Expenses) (13)

Step 6: calculate the modified VAIC value (M_VAIC)

Finally, the modified VAIC value (M_VAIC) was calculated by adding all the efficiency elements together (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Joshi et al., 2013; Morariu, 2014; Kharal et al., 2014; Piri et al., 2014; Pouraghajan et al., 2013; Samardi, 2013; Svanadze & Kowalewska, 2015):

$$M\_VAIC = HCE + SCE + CEE + RDE + RCE \quad (14)$$

Then the efficiency indicators – HCE, SCE, CEE, RDE, and RCE – were used as the independent variables (Al-Musali & Ku Ismail, 2014; Fathi et al., 2013; Joshi et al., 2013; Morariu, 2014; Kharal et al., 2014; Piri et al., 2014; Pouraghajan et al., 2013; Samardi, 2013; Svanadze & Kowalewska, 2015).

Similar to the classic version, the dependent variables were the three indicators of organizational performance: ROA (return-on-assets) representing profitability, ATO (asset-turnover) indicating productivity, and market value for market performance (Deep & Narwal, 2014; Hudgins, 2014); Kehelwalatenna & Premaratne, 2012; Morariu, 2014; Pal & Soriya, 2012; Pouraghajan et al., 2013; Vishnu & Gupta, 2014).

Based on the reviewed literature, the following theoretical model was proposed:

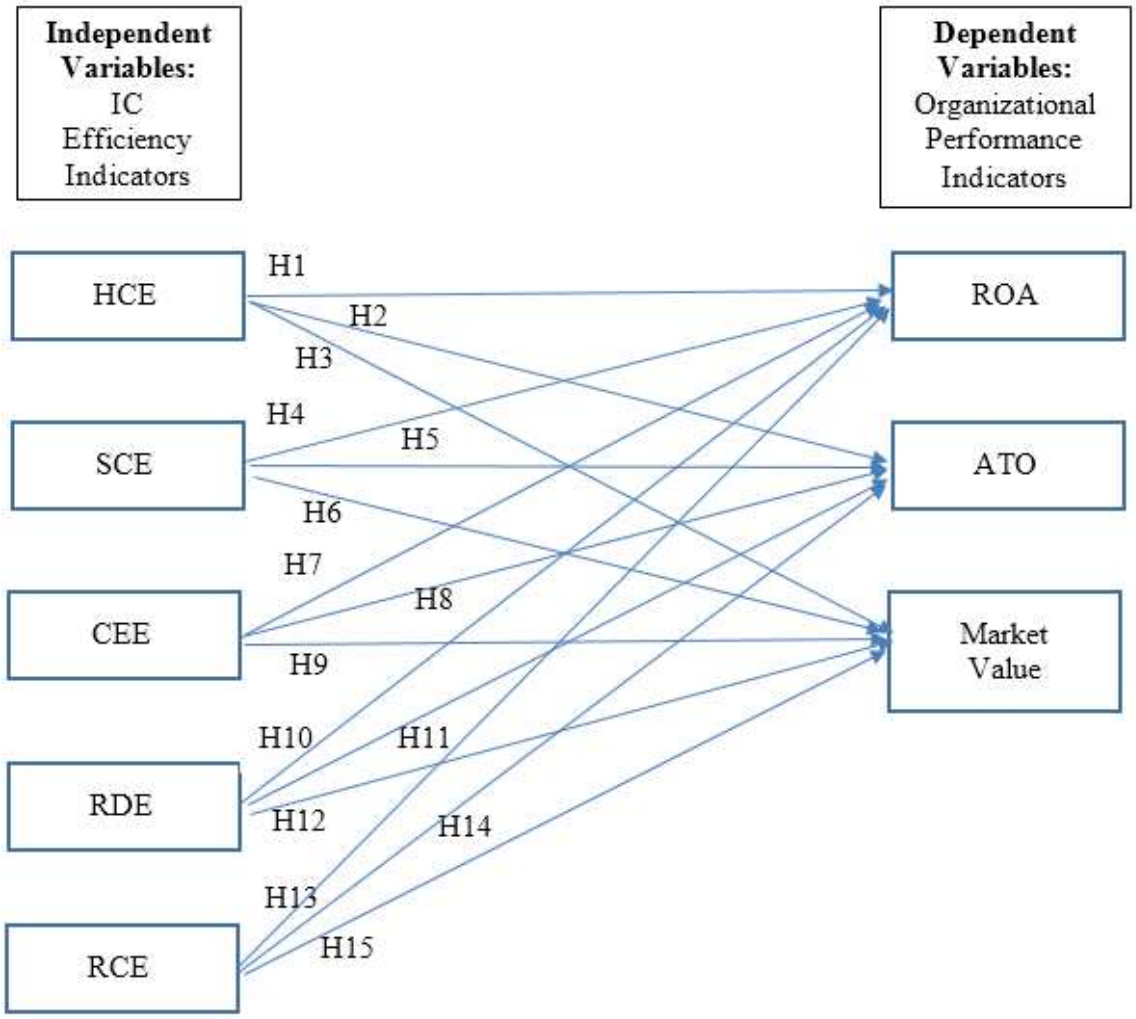

Figure 3: Proposed modified VAIC model

In their study of pharmaceutical firms in India, Vishnu and Gupta (2014) found that R&D expenses had a significant influence on firm performance, as did Chen et al. (2005). The results of various studies also revealed that advertising and marketing expenses, the markers of relational capital, have long been viewed as an important factor that positively influences firms' business performance (Vishnu & Gupta, 2014; Sydler et al., 2014; Wyatt, 2008; Chen et al., 2005; Klock & Megna, 2000).

Based on the reviewed literature, the following hypotheses were proposed:

H10: RDE has a significant positive impact on ROA.

H11: RDE has a significant positive impact on ATO.

H12: RDE has a significant positive impact on market value.

H13: RCE has a significant positive impact on ROA.

H14: RCE has a significant positive impact on ATO.

H15: RCE has a significant positive impact on market value.

The Classic versus the Modified

If two models are nested, researchers can employ the chi-square difference test to compare them and determine whether the difference between these two models is statistically significant (Eigdon, 1996; Idre UCLA, 2015; Newsom, 2015; Rigdon, 1996). The classic VAIC model and the modified version were nested, based on the definitions of nested models (Eigdon, 1996; Idre UCLA, 2015; Newsom, 2015). Therefore, the chi-square difference test was conducted to compare them and determine whether there was a statistically significant difference between the two models.

The modified version included both R&D expenses and RCE as new elements in calculating the VAIC value. In the literature, several studies have presented empirical evidence that R&D expenses positively and significantly impact organizational performance (Chang & Hsieh, 2011; Chen et al., 2005; Vishnu & Gupta, 2014). Other research papers also revealed that advertising and marketing expenses have long been viewed as an important factor that positively influences firms' business performance

(Chen et al., 2005; Klock & Megna, 2000; Sydler et al., 2014; Vishnu & Gupta, 2014; Wyatt, 2008). Therefore, it is reasonable to predict that the modified VAIC model would better describe the influence of IC on organizational performance.

Accordingly, the following hypothesis was proposed:

H16: The modified VAIC model significantly better describes the impact of IC on organizational performance.

Step 4 – Determine Population and Sample

This section describes the population of this study and its sample size. In the study, the classic VAIC model and the modified version were tested to address the second research question. In the test of each model, the impact of IC via its efficiency indicators on the business outcomes of companies was examined. As shown in the literature review, organizational performance can be measured using surveys or corporate data.

The extant literature shows that the method of collecting data by extracting financial fundamentals from the annual reports of publicly listed companies provides significant advantages for IC research, especially in the studies of the impact of IC on firm performance (Al-Musali & Ku Ismail, 2014; Chan, 2009a; Joshi et al., 2013; Khanhossini et al., 2013; Molodchik et al., 2014; Pal & Soriya, 2012; Sarmadi, 2013; Sydler et al., 2014; Trisnowati & Fadah, 2014). Therefore, in the present study, organizational performance was measured using financial data officially reported by firms. As a result, the population of the study was considered the entire group of publicly listed companies.

It is found in the literature that the role of KM and IC is not the same in companies in different industries. In knowledge-intensive sectors, KM and IC have an important role in enabling businesses to gain competitive advantage and achieve superior performance. (Chang & Lee, 2012; Jasour et al., 2013; Pal & Soriya, 2012; Vishnu & Gupta, 2014; Wu et al., 2012). In contrast, for firms in labor-intensive industries, KM and IC may not be considered significant at all (Pal & Soriya, 2012). KM and IC may attract very little attention and effort, if any, of the business management in these firms (Pal & Soriya, 2012).

Accordingly, the sample of participating companies was delimited based on the level of being knowledge-intensive of industries. The sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences were chosen because these industries are considered among the most knowledge-intensive and innovative ones (Pal & Soriya, 2012; Vishnu & Gupta, 2014). They are also preferred by researchers and scholars for studying the relationship between IC and organizational performance (Bramhandkar et al., 2007; Chang & Lee, 2012; Chouldhury, 201; Jasour et al., 2013; Pal & Soriya, 2012; Rahman & Ahmed, 2012; Sharabati et al., 2010; Shil et al., 2010; Vishnu & Gupta, 2014; Wu et al., 2012).

Furthermore, as found in the literature review, the impact of IC on firm performance varies considerably from one country to another. The participant companies, belonging to the two selected industries, were the corporations publicly listed on the stock exchanges of North America (U.S. and Canada) and the developed countries in Europe such as the United Kingdom (UK), France, Germany, Belgium, Italy, Norway, Denmark, and Switzerland. The stock exchanges include New York Stock Exchange (NYSE), National

Association of Securities Dealers Automated Quotations (NASDAQ), London Stock Exchange (LSE), Frankfurt Stock Exchange (FSE), SIX Swiss Exchange (SSE), Copenhagen Stock Exchange (CSE), Oslo Stock Exchange (OSE), Borsa Italiana, Euronext Brussels, and European Stock Exchange (ESE) in Paris, France. In these countries, both the industries – the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences – have been mature and strong, contributing significantly to the national economies and the advancement of the industries as a whole (U.S. Department of Commerce, 2016, 2010).

Additionally, the sample only included firms that successfully generated revenues and reported them for the fiscal year 2014-2015. Such limitation was necessary because it ensured that the participant companies were able to employ their IC in developing real products or services and selling them. In other words, more or less, these firms were able to leverage their knowledge resources to generate revenues and spur business growth (Chang & Chuang, 2009; Tubigi et al., 2013). Besides, the sample was determined by other delimitations and limitations that have been discussed in the sections of delimitations and limitations in Chapter 1.

The extant literature shows a wide range of recommendations regarding appropriate sample sizes. For multiple regression studies, Green (1991) suggested the following formula to determine the sample size:

$$\mathbf{N \geq 50 + 8m} \qquad (15)$$

N = sample size

m = the number of independent variables

With this formula, a study even with five independent variables can be done with a sample size of fewer than 100 observations.

According to Hair, Hult, Ringle, and Sarstedt (2014) and Reinartz, Haenlein, and Henseler (2009), SEM would perform well even with small sample sizes (less than 50). However, Hox and Bechger (1998) suggested that a great sample size for studies using SEM should be at least 200 observations, which is supported by Weston and Gore (2006) and Loehlin (1992).

In the literature, it is recommended that a larger sample size should be preferred for better results (Hair et al., 2014; Mertler & Vannatta, 2013; Hox & Bechger, 1998). According to Smith (2015), for a 95% confidence level, 0.5 standard deviation, and a margin of error (confidence interval) of +/- 5%, the sample size should be 385. Based on the suggestions in the literature, a sample size of at least 400 was targeted in the study.

Step 5 – Collect Data

Overview

This section describes how the data were collected for the study. As discussed, the extant literature shows that the method of collecting data by extracting financial fundamentals from the annual reports of publicly listed companies provides significant advantages for IC research, especially in the studies of the impact of IC on corporate performance (Al-Musali & Ku Ismail, 2014; Khanhossini et al., 2013). All the data were available to the public (Joshi et al., 2013; Pal & Soriya, 2012; Sarmadi, 2013). For example, the 10K filing documents of the publicly listed companies in the USA are

posted on the official websites of SEC – U.S. Securities and Exchange Commission. The data had been audited by third parties, so they are highly reliable and valid (Chan, 2009a; Molodchik et al., 2014; Sarmadi, 2013; Sydler et al., 2014; Trisnowati & Fadah, 2014). Therefore, in the study, the research data used in testing the models were the market data and financial fundamentals officially reported by firms. The data were collected using the online service of financial analytics S&P Capital IQ Platform provided by McGraw Hill Financial.

S&P Capital IQ Platform

Founded in 1999 by Near Goldman, Steer Turner, and Randall Winn, Capital IQ initially provided financial software, analytics, and data (S&P Capital IQ, 2016). After being acquired by McGraw Hill Financial in 2010, Capital IQ merged with S&P to form S&P Capital IQ of which the main product is S&P Capital IQ Platform, still often referred to as "Capital IQ" (S&P Capital IQ, 2016). Capital IQ enables researchers and professionals to access the market data, financial fundamentals, and business news of companies around the world.

One of the most important features provided by Capital IQ is the financial data screening that includes the capability of screening the fundamentals of companies. With the feature, Capital IQ enables the user to add criteria, one by one, into the screening to target exactly which companies and which data items to be collected. The researcher could only focus on the publicly listed firms. More criteria narrowed the selected firms to two industries, the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences. Next, the choices of companies could be made on those

domiciled in the USA, Canada, and the developed European countries. Then, Capital IQ allowed the user to collect the market data and financial fundamentals of the selected firms. Furthermore, the service automatically calculated and provided the data on the ratios such as ROA (return on assets) and ATO (asset turnover) applicable to a specific fiscal year of companies.

Collecting Data

The data collection for the study was performed using the online financial analytics service S&P Capital IQ Platform. The list of companies that were included in the sample were randomly selected based on the following criteria:

1. They are publicly listed companies.
2. They belong to either of the following two industries: information technology or pharmaceutical, biotechnology, and life sciences.
3. They are listed on the stock exchanges in the USA, Canada, or the developed European countries such as the UK, France, Germany, Switzerland, Italy, Belgium, Norway, Netherland, and Denmark.
4. They reported revenue for the fiscal year 2014 – 2015.
5. They reported R&D expenses for the fiscal year 2014 – 2015.

First, 425 companies included in the initial sample were randomly selected from the list of 61320 publicly listed firms as follows:

- The list of all 61320 publicly listed companies was obtained, rearranged alphabetically, and indexed numerically from 1 to 61320.
- A set of 425 random numbers within the range 1 – 61320 was generated.
- For each random number, if the corresponding firm (in the population list) satisfied the above criteria, it would be selected for the sample. Otherwise, the next, or the next, and so on, company in the population list was checked until one that satisfied all the criteria was found.

Next, for each of the chosen firms, the following market data and financial fundamentals were collected:

- Total revenue
- R&D expenses
- Operating income
- Depreciation and amortization
- Advertising expenses
- Net Property, Plant &Equipment
- Number of employees
- Total current assets
- Total current liabilities
- Market capitalization (market value)

- Return on assets (ROA)
- Asset turnover (ATO)

Step 6 – Test the Models

Screening Data

In preparation for testing the models, the data were screened for missing data, outliers, distributional properties, and multicollinearity (Mertler & Vannatta, 2013). For missing data, any firm record, i.e. the above list of collected data items of a company, with missing data was excluded from the final analysis (Fathi, Farahmand, & Khorasani, 2013; Mosavi, Nekoueizadeh, & Ghaedi, 2012).

Next, the distributional properties or the normality of the variables were examined. These data were screened for skewness, i.e. "a quantitative measure of the degree of symmetry of a distribution about the mean" or how far the distribution differs from a normal distribution (Mertler & Vannatta, 2013, p. 32), and kurtosis, i.e. "a quantitative measure of the degree of peakedness of a distribution" or how the data values concentrate (Mertler & Vannatta, 2013, p. 32). According to Rose, Spinks, and Canhoto (2015), with a confidence interval of 95%, a skew index with the absolute value less than 1.96 (or approximately 2.0) was acceptable. For kurtosis, a kurtosis index between -10.00 and 10.00 was accepted as a fine value (Kline, 2011).

The data was also screened for outliers that could potentially influence the results of analyzing the data and testing the models (Mertler & Vannatta, 2013). In this study, data were screened for both univariate outliers and multivariate outliers (Mertler & Vannatta,

2013). To detect univariate outliers, all the raw values were standardized by transforming the data into z-scores (Mertler & Vannatta, 2013). Normally, any value with the z-scores in excess of +/- 3.00 was considered as an outlier and removed. However, for a large sample size ($n > 100$), the rule should be extended to +/- 4.00 (Mertler & Vannatta, 2013; Stevens, 2001).

For multivariate outliers, a statistical procedure named "Mahalanobis distance" was used to delete them (Mertler & Vannatta, 2013, Steven, 2001). In the present study, a case was accepted as a multivariate outlier if its value for Mahalanobis distance was significant at $p < 0.001$ (Kline, 2011; Mertler & Vannatta, 2013).

Additionally, data was screened for multicollinearity, an issue that arises when a high inter-correlation exists among the predictors (Kline, 2011; Steven, 2001; Tabachnick & Fidell, 2007). In the study, multicollinearity was detected by running a regression in which one predictor (independent variable) was used as a dependent, and other predictors were independent variables (Kline 2011; Mertler and Vannatta, 2013). The level of multicollinearity among independent variables was evaluated via the variance inflation factor (VIF) (Mertler & Vannatta, 2013; Tabachnick & Fidell, 2007). In the study, any VIF value less than 10.00 was considered acceptable (Kline, 2011; Mertler & Vannatta, 2013, Steven, 2001; Tabachnick & Fidell, 2007).

Structural Equation Modeling Analysis

Structural equation modeling (SEM) has been one of the statistical techniques widely chosen by researchers across disciplines (Hooper, Coughlan, & Mullen, 2008). SEM is frequently employed in the IC literature to study the impact of IC on firm performance (Akhavan, Hosnavi, Ramezan, & Zahedi, 2014; Deep & Narwal, 2014; Huang & Hsueh, 2010; Khanhossini et al., 2013; Kianto et al., 2013; Mention & Bontis, 2013; Sarmadi, 2013; Sefidgar, Maleki, & Minouei, 2015; Sharabati, 2010; Shil et al., 2011; Tan et al., 2006).

A SEM analysis was performed using the AMOS software to test the models in the study. The estimation of the SEM models was conducted employing maximum likelihood estimation (MLE). MLE is a technique used to reveal the most likely function(s) that can explain, i.e., fit, observed data (Myung, 2003). MLE has been the most widely used fitting function for structural equation models (Bollen, 1989).

According to Myung (2003), MLE is considered as "a standard approach to parameter estimation and inference in statistics" (p. 90) because it provides many important advantages in estimation such as sufficiency, consistency, efficiency, and parameterization invariance. Further, many statistical inference methods are based on MLE, including the chi-square test (Myung, 2003). In other words, MLE is a prerequisite for this test (Myung, 2003). Therefore, MLE – via the statistical software tool AMOS – was used in the study for the estimation of the SEM models.

Once the estimation of the models had been completed, the evaluation of the model fit was performed. In this study, the following fit indices were used for this purpose:

Model chi-square ($\chi 2$), goodness-of-fit index (GFI), normed-fit-index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA).

The chi-square value ($\chi 2$) assessed the overall model fit (Hooper et al., 2008; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). To indicate a good model fit, the chi-square statistic must be insignificant at 0.05 threshold, i.e. $p > 0.05$ (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). In other words, a model with the probability level greater than 0.05, shown in the notes about the model in AMOS outputs, was considered a good fit.

The range of values of other fit indices was between 0 and 1 (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). For RMSEA, smaller values were better. Approximately, an RMSEA index value less than 0.10 was accepted adequate while a value less than 0.05 was considered very good (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). For other absolute and incremental fit indices such as CFI, GFI, and NFI, greater values were better. An index value greater than 0.90 was accepted as adequate while a value greater than 0.95 was considered very good (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009).

Chi-Square Difference Test

In the outputs of the model tests provided by AMOS, there were notes about the overall fit of the model (Wuensch, 2016). The notes included the chi-square value ($\chi 2$), the degrees of freedoms (df) of the model, and the probability level that indicated whether the model overall fit the data or not (Wuensch, 2016). If two models are nested,

their chi-square values ($\chi 2$) can be used in a chi-square difference test to compare the two models and find out whether the difference between them is statistically significant or not (Newsom, 2015; Werner & Schermelleh-Engel, 2010). The classic VAIC model and the modified version in the study were nested (Idre UCLA, 2015; Newsom, 2015; Werner & Schermelleh-Engel, 2010). Therefore, the chi-square difference test could be used to determine whether there was a statistically significant difference between them (Eigdon, 1996; Newsom, 2015; Werner & Schermelleh-Engel, 2010).

In the chi-square difference test, the model with fewer restrictions, i.e. more degrees of freedom, was called the reduced model (Eigdon, 1996; Newsom, 2015; Werner & Schermelleh-Engel, 2010). The other model with more restrictions, i.e. fewer degrees of freedoms, was called the full model (Eigdon, 1996; Newsom, 2015; Werner & Schermelleh-Engel, 2010). The chi-square difference test, a.k.a. likelihood ratio test, is "simply the difference between the full model and the reduced model, using the difference in degrees of freedom as the degrees of freedom for the test." (Newsom, 2015, p. 1).

$$(\chi_{diff})^2 = (\chi_{full})^2 - (\chi_{reduced})^2 \quad (16)$$

$$df_{diff} = df_{full} - df_{reduced} \quad (17)$$

The test was conducted by hand (Newsom, 2015; Werner & Schermelleh-Engel, 2010). First, the difference between the chi-square values, i.e. $(\chi_{diff})^2$, and the difference between the degrees of freedom of the two models, i.e. df_{diff}, were calculated (Newsom, 2015; Werner & Schermelleh-Engel, 2010). Then the difference between the chi-square values was used to compare with the chi-square critical values listed in a standard chi-

square table – using the difference in degrees of freedom as the degrees of freedom – to determine significance (Newsom, 2015; Werner & Schermelleh-Engel, 2010). If the difference between the chi-square values of the two models is greater than the chi-square critical value corresponding to the degrees of freedom for the test, it is concluded that the difference between these two models is statistically significant (Eigdon, 1996; Newsom, 2015; Werner & Schermelleh-Engel, 2010).

Step 7 – Produce the Report

The final stage was to produce a report of the results of the study. The results section were organized based on the research questions and the results from the conducted analyses. The number of occurrences of the coded units under each category revealed through the content analysis study was reported, and the descriptive statistics of the frequency distribution of these number of occurrences were displayed. The role of each IC efficiency indicator (HCE, SCE, or CEE) as well as that of each business performance indicator (ROA, ATO, or market value) in the study was presented, including comparing and contrasting with the extant literature in KM and IC to reveal the contribution of the study. Finally, implications and conclusion were discussed in support of the research questions, the generalizability of the research, and the relevance of the study to the accumulated knowledge body of both fields, knowledge management and intellectual capital.

Summary

This chapter discussed the methodology for this study. At the start, a review of both the KM and IC literature was done, and a content analysis was performed to answer the first research question that addressed how appropriate it is for IC to be used as a proxy for KM performance in the study of the impact of KM implementation on organizational performance. A process of three stages of reviewing the literature and another process of six stages of a content analysis study were presented. Next, for the second research question, theoretical models – one for the classic VAIC model and the other for the modified version – derived from the literature review and the content analysis were proposed. Then, the hypotheses were discussed, the process of collecting data was addressed, and the methods of testing the models were elaborated. Finally, the discussion focused on the steps of employing the chi-square difference test to determine if there was a statistically significant difference between the two models.

Chapter 4

Results

Introduction

Chapter 4 presents the results of the analyses and tests that were conducted to address the two research questions and to achieve the research goals of the study. The chapter starts with the results of the literature review and content analysis to answer the first research question: How appropriate is IC as a proxy for KM performance in assessing KM impact on organizational performance? Then, the chapter presents the results of the structural equation modeling analysis in support of the 16 hypotheses (proposed in Chapter 3) addressing the second research question: Which version – the classic VAIC model or the modified one that includes R&D expenses and relational capital efficiency (RCE) – better reflects the impact of IC on organizational performance? Finally, the chapter presents the results of the chi-square difference test to determine whether there is a statistically significant difference between these two models. The results of this test provided a clear answer to the question of whether the classic VAIC model is good enough to be used, or should it be modified by including R&D expenses and RCE (Joshi et al., 2013; Maditinos et al., 2011)? The answer can be used as a guideline for IC measurement using the VAIC model in studies related to the impact of IC on organizational performance.

Literature Review and Content Analysis

To determine the appropriateness of IC as a proxy for KM performance in assessing the impact of KM implementation on organizational performance, a total of 116 articles (Appendix A) were sampled as part of the literature review analysis. The articles were chosen from the following databases recommended by Levy and Ellis (2006): ACM Digital Library, Blackwell Publishers, EBSCO-Host, ELSEVIER, Emerald Insight Electronic Library, IBI Global Science Direct, IEEE Xplore Digital Library, JSTOR, Proquest, ScienceDirect Complete, SpringerLink, Taylor & Francis, and Wiley Online Library. The literature review analysis focused on the following themes that indicate the tight relationship between KM and IC and the potential usage of IC measurement as a proxy for KM performance:

- Knowledge resources have the central role in both KM and IC.
- KM and IC have a tight relationship.
- Human resources are critical to both KM and IC.
- Structural capabilities, i.e. structural capital, are critical to both KM and IC.
- Relational capabilities, i.e. relational capital, are critical to both KM and IC.
- KM and IC have a significant positive impact on organizational performance and firm success.
- Firms implement KM initiatives with the goals to create and accumulate IC.
- IC measurement can be used to assess KM performance.

Among these articles, 40% (47 articles) were in the domain of KM, 38% (43 articles) in the domain of IC, and 22% (26 articles) in both domains. Table 3 shows the frequency of occurrences of articles and percentages of the total number of articles for each theme. An article was counted as an occurrence for a particular theme if at least one reference to the theme was found in the article. The results showed that 45% of the articles contained at least one reference to the impact of KM or IC on the organizational performance or firm success. While 5% of the articles mentioned creating IC as goals of KM implementation, 37% of the articles discussed the close association of KM and IC with knowledge resources, and 25% of the articles referred to the tight relationship between KM and IC. Additionally, 12% of the articles contained references to measuring IC as a method to assess KM performance.

Themes	Percentage of articles
Knowledge resources have the central role in KM and IC	37% (43/116)
KM and IC have a tight relationship.	25% (30/116)
Human resources are critical to KM and IC.	29% (34/116)
Structural capabilities, or structural capital, are critical to KM and IC.	23% (27/116)
Relational capabilities are critical to KM and/or IC.	17% (20/116)
KM and IC have a significant positive impact on organizational performance and firm success.	45% (52/116)
Firms implement KM initiatives with the goals to create and accumulate IC.	5% (6/116)
IC measurement can be used to assess KM performance.	12% (14/116)

Table 3. Frequency of occurrences and percentage of articles for each theme

After the literature review analysis had been done, a content analysis study was performed on the same sample of 116 articles. In the coding phase, searches discussed in the methodology section of this study were used to eliminate 45 sources because there were no references to the concept of IC as a proxy for KM performance in these articles.

In the remaining 71 sources, a total of 209 references were identified and coded (Appendix B) under the following eight categories that were associated with only one variable – IC as a proxy for KM performance:

1. KM-IC Knowledge Resources (KM-IC-KR): This category represented the theme that knowledge resources have the central role in both KM and IC.

2. KM-IC Twin Relationship (KM-IC-TR): This category represented the theme that KM and IC have a tight relationship.

3. KM-IC Human Resource Management (KM-IC-HRM): This category represented the theme that human resources, i.e. people, are crucial to both KM and IC.

4. KM-IC Structural Capital Management (KM-IC-SCM): This category represented the theme that structural capabilities or structural capital is critical to both KM and IC.

5. KM-IC Relational Capital Management (KM-IC-RCM): This category represented the theme that relational capabilities or relational capital is important to both KM and IC.

6. KM-IC Impact on Organizational Performance and Firm Success (KM-IC-OP-FS): This category represented the theme that both KM and IC have a significant positive impact on organizational performance and firm success.

7. Creating IC as Goals of Knowledge Management Implementation (CICGKMI): This category represented the theme that firms implement KM initiatives with the goals to create and accumulate IC.

8. Measuring IC to Assess Knowledge Management Performance (MICAKMP): This category represented the theme that IC measurement can be used to assess KM performance.

Table 4 provides the frequency of occurrences and percentages of the total number of references for each category. The results indicated that nearly 50% of the references were coded under the category of KM-IC Twin Relationship (KM-IC-TR) that represented the tight relationship between KM and IC. While the category of Creating IC as Goals of Knowledge Management Implementation (CICGKMI) could be found in 4% of the references, the categories of KM-IC Knowledge Resources (KM-IC-KR) and KM-IC Impact on Organizational Performance and Firm Success (KM-IC-OP-FS) accounted for 45% and 44% respectively. Also, the category of Measuring IC to Assess Knowledge Management Performance (MICAKMP) was discussed in 17% of the references.

Categories	Percentage of references
KM-IC Knowledge Resources (KM-IC-KR)	45% (95/209)
KM-IC Twin Relationship (KM-IC-TR)	49% (103/209)
KM-IC Human Resource Management (KM-IC-HRM)	25% (53/209)
KM-IC Structural Capital Management (KM-IC-SCM)	20% (43/209)
KM-IC Relational Capital Management (KM-IC-RCM)	14% (29/209)
KM-IC Impact on Organizational Performance and Firm Success (KM-IC-OP-FS)	44% (93/209)
Creating IC as Goals of Knowledge Management Implementation (CICGKMI)	4% (8/209)
Measuring IC to Assess Knowledge Management Performance (MICAKMP)	17% (35/209)

Table 4. Frequency distribution and percentage of references for each category

The results of the literature review and content analysis indicated that it is appropriate for IC to be used as a proxy for KM performance in assessing KM impact on organizational performance, providing an answer to the first research question.

Data Screening

As discussed in Chapter 3, the data used in the model testing to address the second research question were the market data and financial fundamentals officially reported by firms. A sample of 425 publicly listed companies was randomly selected, and the data of these firms were collected using the online service of financial analytics S&P Capital IQ Platform provided by McGraw Hill Financial. In preparation for the model testing, the data were screened for missing data, outliers, distributional properties, and multicollinearity (Mertler & Vannatta, 2013).

Missing Data

For missing data, any firm record with missing data was excluded from the final analysis. Among 425 firm records collected for the sample, five (Case 1, 84, 257, 304, and 406) were found with missing data of one or more fields. These records were removed from the sample.

Univariate and Multivariate Outliers

In this study, the data were screened for both univariate outliers and multivariate outliers (Mertler & Vannatta, 2013). To detect univariate outliers, all the values were standardized by transforming the data into z-scores (Mertler & Vannatta, 2013). For a large sample size ($n > 100$), any value with the z-scores in excess of +/- 4.00 was considered as an outlier (Mertler & Vannatta, 2013; Stevens, 2001). Two univariate outliers were detected and deleted (Case 189 and 247).

For multivariate outliers, a statistical procedure named “Mahalanobis distance” was used to detect them (Mertler & Vannatta, 2013, Steven, 2001). Two cases with p = 0.00 (Case 181 and 331) were removed from the analysis. As a result, after screening the data for missing data and outliers, the sample was left with 416 firm records.

Normality

Next, the distributional properties or normality of the dependent variables in large sample sizes should be examined (Tabachnick & Fidell, 2007). The data were screened for skewness and kurtosis (Mertler & Vannatta, 2013). According to Rose, Spinks, and Canhoto (2015), with a confidence interval of 95%, a skew index with the absolute value less than 1.96 (or approximately 2.0) was acceptable. For kurtosis, a kurtosis index between -10.00 and 10.00 was accepted as a fine value (Kline, 2011). In the study, all the absolute values of skew index and kurtosis index were within the acceptable ranges.

Multicollinearity

Additionally, the data were screened for multicollinearity, an issue that arises when a high inter-correlation exists among the predictors (Kline, 2011; Steven, 2001; Tabachnick & Fidell, 2007). In the present study, multicollinearity was examined by running a regression in which one predictor (independent variable) was used as a dependent variable, and other predictors were independent variables (Kline 2011; Mertler and Vannatta, 2013). The level of multicollinearity among independent variables was evaluated using the variance inflation factor (VIF) (Mertler & Vannatta, 2013; Tabachnick & Fidell, 2007). Any VIF value less than 10.00 was considered acceptable

(Kline, 2011; Mertler & Vannatta, 2013, Steven, 2001; Tabachnick & Fidell, 2007). In the multicollinearity regression test, the predictor HCE was chosen as the dependent variable while all other predictors (SCE, CEE, RCE, and RDE) were used as independent variables. The results showed that all the VIF values (Table 5) were less than 10, within the acceptable range.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	**VIF**
1	(Constant)	-.458	.198		-2.316	.021		
	SCE	-.054	.087	-.031	-.615	.539	.811	**1.233**
	CEE	.161	.058	.136	2.775	.006	.868	**1.152**
	RCE	-.667	.189	-.195	-3.536	.000	.692	**1.445**
	RDE	.143	.022	.331	6.616	.000	.839	**1.191**

a. Dependent Variable: HCE

Table 5. VIF values of the multicollinearity test

Structural Equation Modeling Analysis

Structural equation modeling (SEM) has been one of the statistical techniques widely chosen by researchers across disciplines (Hooper, Coughlan, & Mullen, 2008). SEM is frequently employed in the IC literature to study the impact of IC on firm performance (Akhavan et al., 2014; Deep & Narwal, 2014; Huang & Hsueh, 2010; Khanhossini et al.,

2013; Kianto et al., 2013; Mention & Bontis, 2013; Sarmadi, 2013; Sefidgar et al., 2015; Sharabati, 2010; Shil et al., 2011; Tan, Plowman, & Hancock, 2006).

A SEM analysis was performed using the AMOS software to test the models in this study. The estimation of the SEM models was conducted employing maximum likelihood estimation (MLE). MLE is a technique used to reveal the most likely function(s) that can explain, i.e. fit, observed data (Myung, 2003). MLE has been the most widely used fitting function for structural equation models (Bollen, 1989).

The Classic VAIC Model

During the structural equation modeling analysis, the classic VAIC model was revised so that it could fit the data. A regression line was added between ROA (profitability) and MC (market capitalization or market value), and another was added between ATO (productivity) and MC. Additionally, covariance links were added between two pairs of predictors: (HCE, SCE) and (HCE, CEE). After being revised, the final classic VAIC model (Figure 4) fit the data, and all the thresholds of the targeted goodness-of-fit indices were met (Table 6).

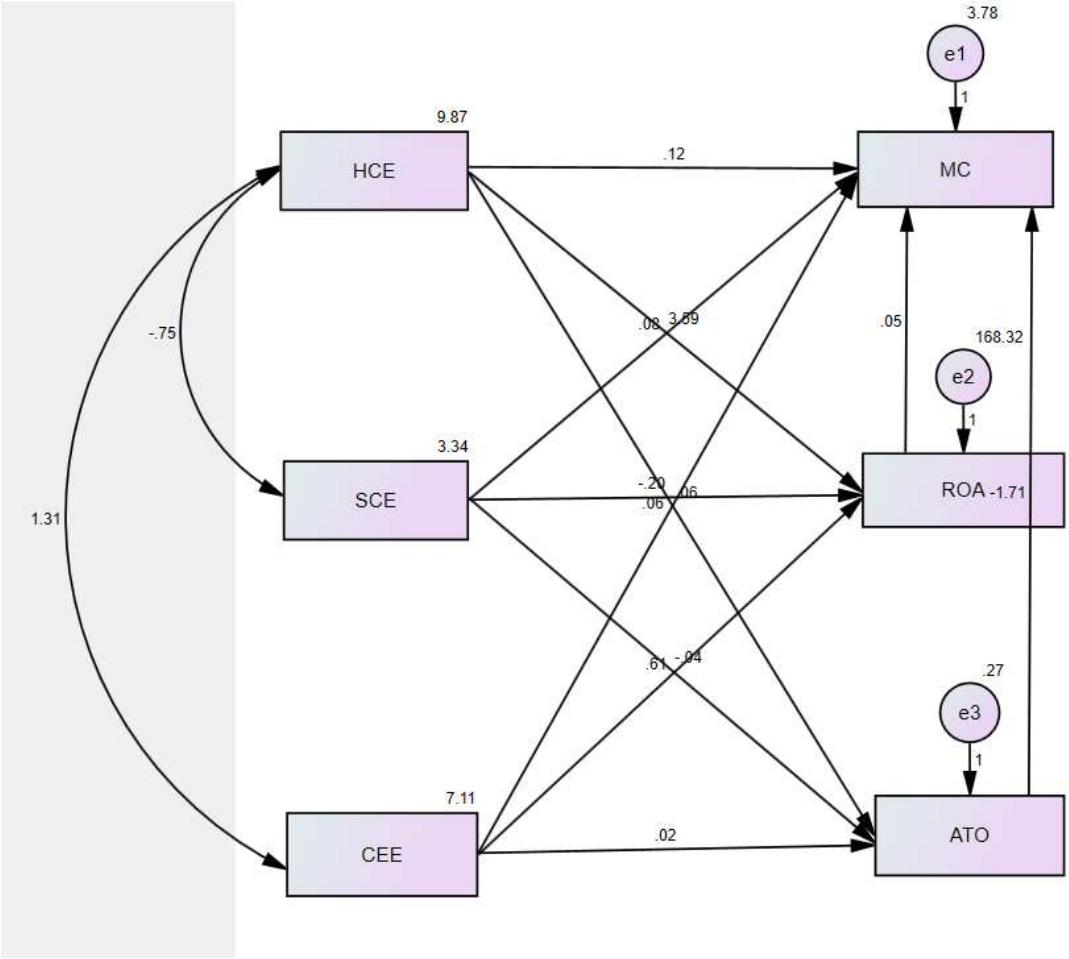

Figure 4. Final classic VAIC model

As aforementioned, the following fit indices were used for the evaluation of the model fit: Model chi-square ($\chi 2$), goodness-of-fit index (GFI), normed-fit-index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The chi-square value ($\chi 2$) assessed the overall model fit (Hooper et al., 2008; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). To indicate a good model fit, the chi-square statistic must be insignificant at 0.05 threshold, i.e. $p > 0.05$ (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). The results showed that the model fit the data: chi-square = 2.947, degrees of freedom = 2, and probability level = 0.229 (> 0.05).

For RMSEA, smaller values were better. Approximately, an RMSEA index value less than 0.10 was accepted adequate while a value less than 0.05 was considered very good (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). An RMSEA score of 0.034 (< 0.10) was obtained in the results. For other absolute and incremental fit indices such as CFI, GFI, and NFI, greater values were better. An index value greater than 0.90 was accepted as adequate while a value greater than 0.95 was considered very good (Hooper et al., 2008; Kline, 2011; UCDHSC, 2006; Wuensch, 2016; Zurbriggen, 2009). The results showed that the score for CFI was 0.998 (> 0.90), 0.998 (> 0.90) for GFI, and 0.994 (> 0.90) for NFI. Table 6 summarizes the goodness of fit values and thresholds for these fit indices:

Goodness-of-Fit Index	**Recommended Values**	**Values from this study**
Comparative Fit Index (CFI)	>0.90	0.998
Goodness-of-Fit Index (GFI)	>0.90	0.998
Normalized Fit Index (NFI)	>0.90	0.994
Root mean square error of approximation (RMSEA)	<0.10	0.034

Table 6. Values of goodness of fit indices: CFI, GFI, NFI, and RMSEA (Classic VAIC)

The SEM analysis of the classic VAIC model included the testing of the first nine hypotheses (H1 – H9) proposed in Chapter 3 as part of addressing the second research question: Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance? Table 7 shows the results of testing these nine hypotheses.

Hypothesis	Hypothesized Path	Coefficient (β)	Statistical Significance (p)	Supported or Rejected
H1	HCE → ROA	0.646	***	Supported
H2	HCE → ATO	0.336	***	Supported
H3	HCE → Market Value	0.165	**	Supported
H4	SCE → ROA	-0.021	0.562	Rejected
H5	SCE → ATO	-0.140	0.002	Rejected
H6	SCE → Market Value	0.062	0.134	Rejected
H7	CEE → ROA	0.094	*	Supported
H8	CEE → ATO	0.098	*	Supported
H9	CEE → Market Value	0.064	0.122	Rejected

*p < 0.05, **p < 0.01, ***p < 0.001

Table 7. Summary of results of testing the first nine hypotheses: H1 – H9

Hypothesis H1 proposed that HCE has a significant and positive impact on ROA. The results ($\beta = 0.646$, $p < 0.001$) supported this hypothesis confirming that HCE significantly and positively influences firm profitability. The findings of the present study are consistent with those found in the previous studies conducted by Al-Musali and Ku Ismail (2014), Al-Shubiri (2013), Deep and Narwal (2014), Kehelwalatenna and Premaratne (2012), Pal and Soriya (2012), Sarmadi (2013), and Zeghal and Malloul (2010). However, these results are different from those obtained by Joshi et al. (2013), Kalkan et al. (2014), Morariu (2014), Shil et al. (2011), and Uadiale and Uwugbe (2011). In these studies, the authors found that the impact of either HCE or IC on firm profitability was insignificant.

Hypothesis H2 proposed that HCE has a significant and positive impact on ATO. The results ($\beta = 0.336$, $p < 0.001$) supported this hypothesis confirming that HCE

significantly and positively influences firm productivity. The findings of the present study are consistent with Al-Shubiri (2013) and Kehelwalatenna and Premaratne (2012). However, these results are different from those obtained by Morariu (2014) and Pal and Soriya (2012). In these studies, the authors found that the impact of HCE or IC on productivity was insignificant.

Hypothesis H3 proposed that HCE has a significant and positive impact on market value. The results ($\beta = 0.165$, $p < 0.01$) supported this hypothesis confirming that HCE has a significant and positive effect on firms' market value. The findings of the present study are consistent with the earlier studies conducted by Chen et al. (2005), Kehelwalatenna and Premaratne (2012), and Kharal et al. (2014). However, these results are different from those obtained by Deep and Narwal (2014) and Zeghal and Malloul (2010). In these studies, the authors found that the impact of HCE or IC on market value was insignificant.

Hypothesis H4 proposed that SCE has a significant and positive impact on ROA. The results revealed that the effect of SCE on firm profitability was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Al-Shubiri (2013), Chang and Hsieh (2011), Morariu (2014), Rehman et ah. (2011), and Shil et al. (2011). However, these results are different from those obtained by Khanhossini et al. (2013) and Zeghal and Maaloul (2010). In these studies, the authors found that SCE significantly and positively impacted corporate profitability.

Hypothesis H5 proposed that SCE has a significant and positive impact on ATO. The results indicated that SCE had a negative effect on ATO, and this hypothesis was not

supported. The findings of the present study are consistent with the previous work conducted by Morariu (2014), in which the author also found that SCE had a significant negative influence on ATO. However, the results are different from those obtained by Kehelwalatenna and Premaratne (2012), in which the authors found that IC had a significant and positive impact on corporate productivity.

Hypothesis H6 proposed that SCE has a significant and positive impact on market value. The results showed that the influence of SCE on firms' market value was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Chang and Hsieh (2011), Deep and Narwal (2014), Morariu (2014), Pal and Soriya (2012), Shil et al. (2011), Trisnowati and Fadah (2014), and Zeghal and Maaloul (2010). However, the results are different from those obtained by Chen et al. (2005), Kehelwalatenna and Premaratne (2012), and Kharal et al. (2014). In these studies, the authors found that IC significantly and positively impacted firms' market value.

Hypothesis H7 proposed that CEE has a significant and positive impact on ROA. The results ($\beta = 0.094$, $p < 0.05$) supported this hypothesis confirming that CEE significantly and positively influences firm profitability. The findings of the present study are consistent with those obtained by Al-Musali and Ku Ismail (2014), Al-Shubiri (2013), Deep and Narwal (2014), Hudgins (2014), Joshi et al. (2013), Khahossini et al. (2013), Rehman et al. (2011), Sarmadi (2013), and Zeghal and Malloul (2010). However, these results are different from those obtained by Morariu (2014), Trisnomati and Fadah (2014), and Chang and Hsieh (2011). In these studies, the authors found that the impact of CEE or IC on profitability was insignificant.

Hypothesis H8 proposed that CEE has a significant and positive impact on ATO. The results ($\beta = 0.098$, $p < 0.05$) supported this hypothesis confirming that CEE significantly and positively influences firm productivity. The findings of the present study are consistent with the earlier work conducted by Al-Shubiri (2013) and Kehelwalatenna and Premaratne (2012). However, these results are different from those obtained by Morariu (2014) and Pal and Soriya (2012). In these studies, the authors found that the impact of CEE or IC on productivity was insignificant.

Hypothesis H9 proposed that CEE has a significant and positive impact on market value. The results indicated that the effect of CEE on firms' market value was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Deep and Narwal (2014), Morariu (2014), and Trisnowati and Fadah (2014). However, the results are different from those obtained by Chen et al. (2005), and Kehelwalatenna and Premaratne (2012). In these studies, the authors found that IC significantly and positively impacted firms' market value. In comparison and contrast to the previous studies, the results of testing the first nine hypotheses (H1 – H9) are summarized in the following table (Table 8).

Hypothesis	**Results**	**Consistent with**	**Contradicting**
H1	Supported	• Al-Musali and Ku Ismail (2014) • Al-Shubiri (2013) • Deep and Narwal (2014) • Kehelwalatenna and Premaratne (2012) • Pal and Soriya (2012) • Sarmadi (2013)	• Joshi et al. (2013) • Kalkan et al. (2014) • Morariu (2014) • Shil et al. (2011) • Uadiale and Uwugbe (2011)

		• Zeghal and Malloul (2010)	
H2	Supported	• Al-Shubiri (2013) • Kehelwalatenna and Premaratne (2012)	• Morariu (2014) • Pal and Soriya (2012)
H3	Supported	• Chen et al. (2005) • Kehelwalatenna and Premaratne (2012) • Kharal et al. (2014)	• Deep and Narwal (2014) • Zeghal and Malloul (2010)
H4	Rejected	• Al-Shubiri (2013) • Chang and Hsieh (2011) • Morariu (2014) • Rehman et ah. (2011) • Shil et al. (2011)	• Khanhossini et al. (2013) • Zeghal and Maaloul (2010)
H5	Rejected	• Morariu (2014)	• Kehelwalatenna and Premaratne (2012)
H6	Rejected	• Chang and Hsieh (2011) • Deep and Narwal (2014) • Morariu (2014) • Pal and Soriya (2012) • Shil et al. (2011) • Trisnowati and Fadah (2014) • Zeghal and Maaloul (2010)	• Chen et al. (2005) • Kehelwalatenna and Premaratne (2012) • Kharal et al. (2014)
H7	Supported	• Al-Musali and Ku Ismail (2014) • Al-Shubiri (2013) • Deep and Narwal (2014) • Hudgins (2014) • Joshi et al. (2013) • Khahossini et al. (2013) • Rehman et al. (2011) • Sarmadi (2013) • Zeghal and Malloul (2010)	• Morariu (2014) • Trisnomati and Fadah (2014) • Chang and Hsieh (2011)

H8	Supported	• Al-Shubiri (2013) • Kehelwalatenna and Premaratne (2012)	• Morariu (2014) • Pal and Soriya (2012)
H9	Rejected	• Deep and Narwal (2014) • Morariu (2014) • Trisnowati and Fadah (2014)	• Chen et al. (2005) • Kehelwalatenna and Premaratne (2012)

Table 8. Summary of consisentcy and contradiction of the results of testing the first nine hypotheses (H1 - H9) versus the previous studies

The Modified VAIC Model

During the structural equation modeling analysis, the modified VAIC model was also revised so that it could fit the data. A regression line was added between ROA (profitability) and MC, and another was added between ATO (productivity) and MC. Additionally, covariance links were added between each pair of predictors. After being revised, the final modified VAIC model (Figure 5) fit the data, and all the thresholds of the targeted goodness-of-fit indices were met (Table 8).

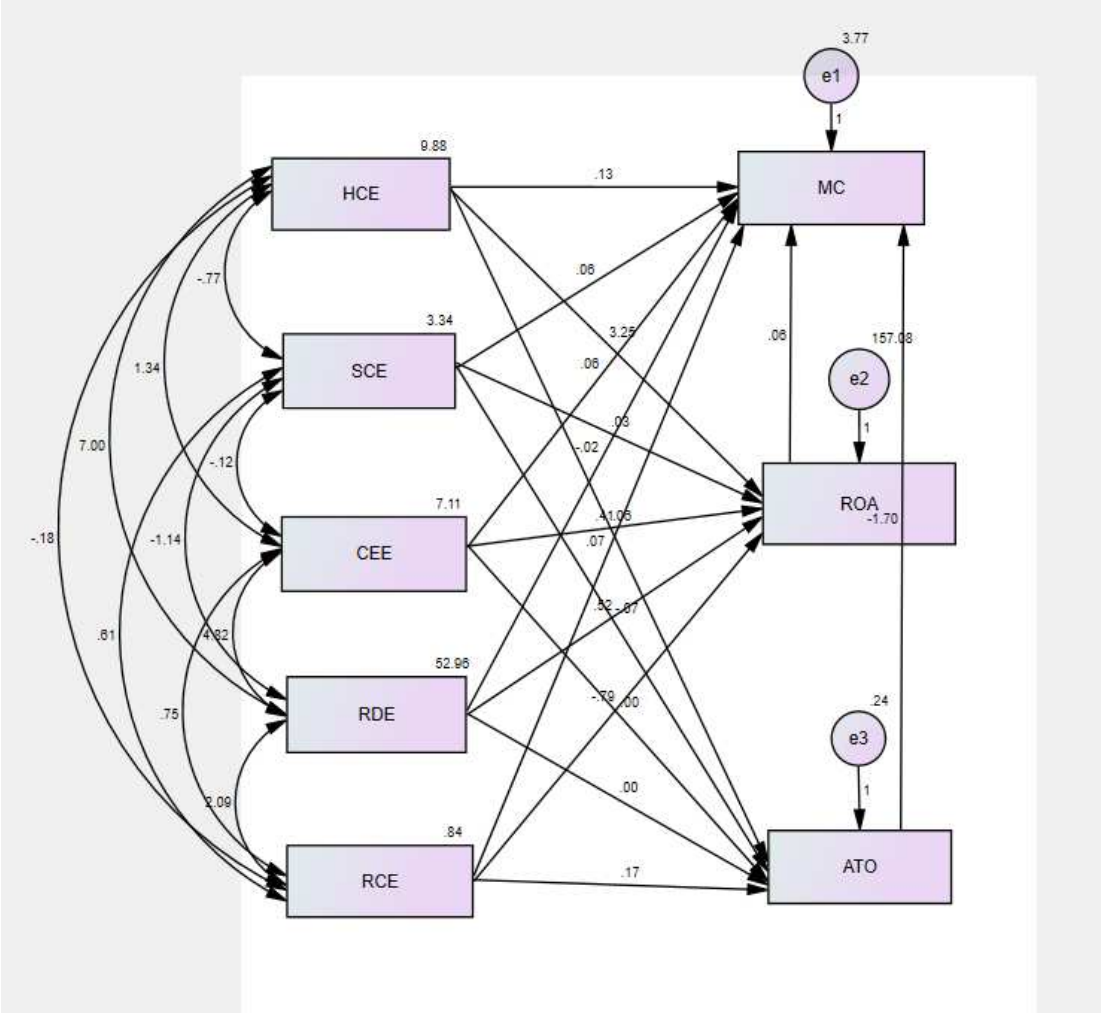

Figure 5. Final modified VAIC model

In the testing of the modified VAIC model, the following fit indices were used for the evaluation of the model fit: Model chi-square ($\chi 2$), goodness-of-fit index (GFI), normed-fit-index (NFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). The results showed that the model fit the data: chi-square = 1.328, degrees of freedom = 1, and probability level = 0.249 (> 0.05). For other goodness-of-fit indices (GFI, NFI, CFI, and RMSEA), Table 9 summarizes their values and thresholds:

Goodness-of-Fit Index	Recommended Values	Values from this study
Comparative Fit Index (CFI)	>0.90	1.0
Goodness-of-Fit Index (GFI)	>0.90	0.999
Normalized Fit Index (NFI)	>0.90	0.998
Root mean square error of approximation (RMSEA)	<0.10	0.028

Table 9. Goodness of fit indices: CFI, GFI, NFI, and RMSEA (Modified VAIC)

The SEM analysis of the modified VAIC model included the testing of the six hypotheses H10 – H15 proposed in Chapter 3 as part of addressing the second research question: Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance? Table 10 shows the results of testing these six hypotheses.

Hypothesis	Hypothesized Path	Coefficient (β)	Statistical Significance (p)	Supported or Rejected
H10	RDE → ROA	0.217	***	Supported
H11	RDE → ATO	0.062	0.211	Rejected
H12	RDE → Market Value	-0.060	0.216	Rejected
H13	RCE → ROA	-0.041	0.336	Rejected
H14	RCE → ATO	0.274	***	Supported
H15	RCE → Market Value	0.027	0.596	Rejected

*p < 0.05, **p < 0.01, ***p < 0.001

Table 10. Summary of results of testing six hypotheses: H10 – H15

Hypothesis H10 proposed that RDE has a significant and positive impact on ROA. The results ($\beta = 0.217$, $p < 0.001$) supported this hypothesis confirming that RDE significantly and positively influences firm profitability. The findings of the present study

are consistent with those obtained by Chen et al. (2005), Chang and Hsieh (2011), Deep and Narwal (2014), and Vishnu and Gupta (2014).

Hypothesis H11 proposed that RDE has a significant and positive impact on ATO. The results indicated that the effect of RDE on firms' productivity was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Deep and Narwal (2014), Mehralian, Rajabzadeh, Sadeh, and Rasekh (2012), Pal and Soriya (2012), and Ting and Lean (2009). However, the results are different from those obtained by Kehelwalatenna and Premaratne (2012). In this study, the authors found that IC had a significant and positive effect on corporate productivity.

Hypothesis H12 proposed that RDE has a significant and positive impact on market value. The results revealed that the effect of RDE on firms' market value was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Deep and Narwal (2014), Firer and Williams (2003), Kamath (2008), Maditinos et al. (2011), and Morariu (2014). However, the results are different from the earlier work conducted by Chen et al. (2005), Kharal et al. (2014), and Kehelwalatenna and Premaratne (2012). In these studies, the authors found that R&D expenses or IC had a significant and positive influence on corporate market value.

Hypothesis H13 proposed that RCE has a significant and positive impact on ROA. The results showed that the effect of RCE on firm profitability was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Vishnu and Gupta (2014). However, the results are different from those obtained by

Huang and Hsueh (2010). In this study, the authors found that RC significantly and positively impacted corporate performance.

Hypothesis H14 proposed that RCE has a significant and positive impact on ATO. The results ($\beta = 0.274$, $p < 0.001$) supported this hypothesis confirming that RCE significantly and positively influences firm productivity. The findings of the present study are consistent with Hashemnia et al. (2014), and Kehelwalatenna and Premaratne (2012). However, the results are different from those obtained by Deep and Narwal (2014) and Pal and Soriya (2012). In these studies, the authors found that the impact of RCE or IC on productivity was insignificant.

Hypothesis H15 proposed that RCE has a significant and positive impact on market value. The results indicated that the effect of RCE on firms' market value was insignificant, and this hypothesis was not supported. The findings of the present study are consistent with Deep and Narwal (2014) and Morariu (2014). However, the results are different from those obtained by Chen et al. (2005) and Kharal et al. (2014). In these studies, the authors found that IC had a significant and positive impact on corporate market value. In comparison and contrast to the previous studies, the results of testing the six hypotheses H10 – H15 are summarized in the following table (Table 11).

Hypothesis	**Results**	**Consistent with**	**Contradicting**
H10	Supported	• Chen et al. (2005) • Chang and Hsieh (2011) • Deep and Narwal (2014) • Vishnu and Gupta (2014)	

H11	Rejected	• Deep and Narwal (2014) • Mehralian et al. (2012) • Pal and Soriya (2012) • Ting and Lean (2009)	• Kehelwalatenna and Premaratne (2012)
H12	Rejected	• Deep and Narwal (2014) • Firer and Williams (2003) • Kamath (2008) • Maditinos et al. (2011) • Morariu (2014)	• Chen et al. (2005) • Kharal et al. (2014) • Kehelwalatenna and Premaratne (2012)
H13	Rejected	• Vishnu and Gupta (2014)	• Huang and Hsueh (2010)
H14	Supported	• Hashemnia et al. (2014) • Kehelwalatenna and Premaratne (2012)	• Deep and Narwal (2014) • Pal and Soriya (2012)
H15	Rejected	• Deep and Narwal (2014) • Morariu (2014)	• Chen et al. (2005) • Kharal et al. (2014)

Table 11: Summary of consistency and contradiction of the results of testing the six hypotheses H10 – H15 versus the previous studies

Summary of Structural Equation Modeling Analysis

Based on the results of the SEM analysis of the classic VAIC model and the modified version, it was found that both the models fit the data pretty well. The results showed that the hypotheses 1, 2, 3, 7, 8, 10, and 14 were supported while the hypotheses 4, 5, 6, 9, 11, 12, 13, and 15 were not. With the goodness-of-fit values obtained in the testing of these two models (Table 12), it looked like that the modified VAIC model fit the data better. However, a chi-square difference test had to be performed to determine whether there was a statistically significant difference between these two models (Newsom, 2015; Werner & Schermelleh-Engel, 2010).

Goodness of Fit Index	**Classic VAIC Model**	**Modified VAIC Model**
Comparative Fit Index (CFI) (Greater is better)	0.998	1.0
Goodness-of-Fit Index (GFI) (Greater is better)	0.998	0.999
Normalized Fit Index (NFI) (Greater is better)	0.994	0.998
Root mean square error of approximation (RMSEA) (Smaller is better)	0.034	0.028

Table 12. Goodness-of-fit values of the classic VAIC and the modified VAIC

Chi-square Difference Test

As discussed, for two nested models, their chi-square values ($\chi 2$) can be used in a chi-square difference test to compare the two models and find out whether the difference between them is statistically significant (Newsom, 2015; Werner & Schermelleh-Engel, 2010). The classic VAIC model and the modified version in this study were nested (Idre UCLA, 2015; Newsom, 2015; Werner & Schermelleh-Engel, 2010). Therefore, the chi-

square difference test was used to determine whether there was a statistically significant difference between them (Eigdon, 1996; Newsom, 2015; Werner & Schermelleh-Engel, 2010).

The test was conducted by hand (Newsom, 2015; Werner & Schermelleh-Engel, 2010). The results showed that the difference between the chi-square values of the two models is 1.619 and the difference between the degrees of freedom is 1. Comparing the difference between the chi-square values (1.619) and the chi-square critical value listed in a standard chi-square table for the degree of freedom of 1 at the significance level of 0.05 (3.841), it is found that the difference between the chi-square values (1.619) is smaller than the chi-square critical value listed in a standard chi-square table (3.841).

So, the difference between the two models is not statistically significant. As a result, Hypothesis 16 was not supported. Therefore, the results of the chi-square difference test showed that the classic VAIC model is adequate, and adding RCE and RDE as two new efficiency elements in the model does not provide benefit.

Summary

This chapter presented the results of the literature review analysis and the content analysis that were conducted to address the first research question: How appropriate is IC as a proxy for KM performance in evaluating the influence of KM implementation on organizational performance? To answer this question, a literature review of 116 articles in two fields, KM and IC, was performed. It identified eight themes that indicated the tight relationship between KM and IC and the potential usage of IC measurement as a proxy for KM performance. Then, a content analysis was conducted on the same 116

articles. The study identified 209 references under eight categories that were associated with only one concept – IC as a proxy for KM performance. The results of the literature review and the content analysis indicated that it is appropriate for IC to be used as a proxy for KM performance in evaluating the impact of KM implementation on organizational performance.

The chapter also presented the results of the data collecting, the data screening, the structural equation modeling analysis, and the chi-square difference test that were performed to address the second research question: Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance? As part of answering this question, a sample of 425 firms belonging to two knowledge-intensive industries – information technology and pharmaceutical, biotechnologies, and life sciences – was selected randomly from a population of 61320 publicly listed companies.

Then the data were screened for missing data, outliers, normality, and multicollinearity. After records with missing data or outliers were removed, the final sample of 416 firms was analyzed using the structural equation modeling technique. The results of the analysis found that both the models – the classic VAIC and the modified VAIC – fit the data pretty well. The results also showed that the hypotheses 1, 2, 3, 7, 8, 10, and 14 were supported while the hypotheses 4, 5, 6, 9, 11, 12, 13, and 15 were not.

Finally, a chi-square difference test was conducted to determine whether there was a statistically significant difference between the two models. The results showed that the difference between them was not significant, and the hypothesis 16 was not supported.

As a result, it is found that the classic VAIC model is good enough to be used. Moreover, it is optional for researchers to include RCE and RDE as the two new efficiency elements in the VAIC model if they plan to use it in measuring IC.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Introduction

The goal of this study was to answer the question of whether the classic VAIC model is good enough to be used, or should it be modified by including R&D expenses and relational capital efficiency (RCE) (Joshi et al., 2013; Maditinos et al., 2011)? Then, based on the answer to the above question, the present study aimed to provide researchers with an empirically supported guideline for IC measurement using the VAIC model. To achieve these goals, the study tested the two models – the classic VAIC and the modified version using the structural equation modeling technique. This study also performed the chi-square difference test to determine whether there was a statistically significant difference between these two models.

First, the chapter presents the conclusions that were derived from the results of these tests. Then, the implications for researchers and practitioners in both fields, KM and IC, were discussed, which was followed by recommendations, limitations, and potential future research. Finally, the chapter concludes with a summary of the study.

Conclusions

The VAIC model aims to provide a simple, but effective, approach to measuring IC of firms (Al-Musali & Ku Ismail, 2014; Khanhossi et al., 2013; Joshi et al., 2013). However, the classic VAIC model is not free from limitations (Chang & Hsieh, 2011;

Chen et al., 2005; Joshi et al., 2013; Maditinos et al., 2011; Pal & Soriya, 2012; Stahle et al., 2011; Svanadze & Kowalewska, 2015; Vishnu & Gupta, 2014). The criticisms against this method were mainly focused on two limitations: the missing contribution of research and development (R&D) expenses and the absence of relational capital efficiency (RCE) from the set of elements used to calculate the VAIC value (Chen et al., 2005; Stahle et al., 2011; Vishnu & Gupta, 2014).

Therefore, researchers planning to use the VAIC method to measure IC were confronted by the challenging question of whether the classic VAIC model is good enough to describe the business reality, or should it be adjusted to address its limitations and appropriately reflect the business landscape (Joshi et al., 2013; Maditinos et al., 2011)? Additionally, for IC measurement with the VAIC model, there was a lack of clear guidelines supported by empirical evidence or best practices (Maditinos, 2011; Svanadze & Kowalewska, 2015).

To provide a clear answer to the above question, this study aimed to address two research questions:

1. How appropriate is IC as a proxy for KM performance in evaluating the influence of KM implementation on organizational performance?

2. Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance?

For the first research question, an extensive review of both the KM and IC literature was done, and a content analysis was performed. The results of the literature review analysis revealed a tight relationship between KM and IC, a significant impact of both

KM and IC on firm performance, and a potential usage of IC measurement as a proxy for KM performance in assessing the impact of KM on business performance. Then, a content analysis was conducted to illuminate the above themes and firmly provide an answer to the first research question: it is greatly appropriate for IC to be used as a proxy for KM performance while evaluating the influence of KM implementation on organizational performance.

For the second research question, besides the classic VAIC model, a modified version that included RCE and RDE as the two new efficiency elements along with 16 hypotheses were proposed. Then, a SEM analysis was conducted to test both the models and the related hypotheses. Finally, a chi-square difference test was performed to determine if there was a statistically significant difference between the models. The results of the test indicated that the difference between them was insignificant. Therefore, it was concluded that the classic VAIC model is adequate.

Testing the Models and Related Hypotheses

Based on the results of testing the two models and all the first 15 hypotheses (H1 – H15), it was found that both the models fit the data pretty well. The findings also showed that the hypotheses H1, H2, H3, H7, H8, H10, and H14 were supported while the hypotheses H4, H5, H6, H9, H11, H12, H13, and H15 were not.

All the hypotheses related to HCE (H1, H2, and H3) were supported. In other words, HCE had a significant, positive influence on all three indicators of business performance of firms. As a result, it was found that HCE significantly and positively impacted firm performance. The findings could be explained by the human capital theories that have

long confirmed the overall importance of human factors in the corporate environment (Acemoglu & Autor, 2014; Becker, 1964; Gamerschlag, 2013; Mincer, 1958; Schultz, 1961; Smith, 1776). These theories propose that organizations can improve their efficiency and performance by investing in people, i.e. employees (Acemoglu & Autor, 2014; Becker, 1964; Gamerschlag, 2013; Mincer, 1958; Schultz, 1961; Smith, 1776).

Additionally, the human capital theories posit that sustainable growth of an economy or an organization is solely dependent on creating innovation, as is competitiveness (Becker, 1964; Bontis, 1998; Gamerschlag, 2013; Mincer, 1958; Schultz, 1961). Only people can be innovative. Therefore, companies' sustainable growth and competitiveness ultimately depend on human capital (Acemoglu & Autor, 2014; Bontis, 1998; Gamerschlag, 2013; Mankiw, Romer, & Weil, 1992; Zingales, 2000). According to these theories, human capital is the key determinant of firm competitiveness and success (Acemoglu & Autor, 2014; Bontis, 1998; Gamerschlag, 2013; Mankiw et al., 1992; Zingales, 2000). Similarly, according to these theories, human capital has a significant, positive impact on organizational performance, which is empirically supported by the findings of this study. Moreover, the results of testing the hypotheses H1, H2, and H3 were consistent with the earlier studies such as Bontis et al. (2000) who found that human capital had a greater influence on business outcomes than any other type of corporate resource.

As reported in the present study, human capital (HC) had a significant positive impact on all three indicators of firm performance: productivity, profitability, and market value. The significant, positive impact of HCE on ATO could be explained with a special relationship between human capital (HC) and firm productivity (Acemoglu and Autor,

2014; Becker, 1964, 1975). While discussing the basic theory of human capital, Acemoglu and Autor (2014) opined that "loosely speaking, human capital corresponds to any stock of knowledge or characteristics the worker has (either innate or acquired) that contributes to his or her 'productivity'" (p. 3). The authors went further and confirmed that "the standard approach in labor economics views human capital as a set of skills/characteristics that increase a worker's productivity" (p. 4). Acemoglu and Autor's suggestions are supported by the Becker view (Becker, 1964, 1975) in which human capital is considered as the main driver for a worker's increased productivity in all tasks.

Additionally, the findings of this study showed that HCE significantly and positively influenced profitability (ROA). The significant, positive relationship between HCE and profitability could be explained with various theoretical views regarding the impact of human capital on firm performance. These theories include the Becker view (Becker, 1964, 1975), the Garderner view (Acemoglu & Autor, 2014), and the Schultz/Nelson-Phelps view (Acemoglu & Autor, 2014). Such views posit that human capital takes the central role in increasing firms' profitability. A significant, positive impact of HCE on profitability found in the present study provided empirical evidence of these theoretical views.

Also, the results of testing the hypothesis H3 showed that HCE significantly and positively affected firms' market value. The significant, positive association of HCE with companies' market value could be explained with the resource-based view (RBV) and the knowledge-based view (KBV) (Crook et al., 2011; Larson & Morling, 2015; Newbert, 2007; Nienhuser, 2008; Pfeffer & Salancik, 2003).

The RBV theory postulates that firms with resources that are valuable, rare, inimitable, and non-substitutable (VRIN) have critical competitive advantages over others as regards enhancing performance (Al-Musali & Ku Ismail, 2014; Barney, 1991; Ghaffar & Khan, 2014; Grant, 1996a, 1996b; Han & Li, 2015; Liao & Wu, 2009; Wernerfelt, 1984; Zack, 1999; Zollo & Winter, 2002). As an extension of RBV, KBV posits that firms create, acquire, and distribute knowledge as a strategic asset to gain competitive advantage and achieve superior performance (Kianto et al., 2014; Kogut & Zander, 1992; McEvily & Chakravarthy, 2002; Miller, 2002; Narasimha, 2001; Spender, 1996; Zack et al., 2009). Based on these theoretical views of the firm, Crook et al. (2011), Newbert (2007), Nienhuser (2008), and Pfeffer and Salancik (2003) believed that knowledge resources, especially human capital, are vital resources that enable enterprises to create more firm values that ultimately leads to higher market values, as found with the findings in this study.

Unlike the hypotheses related to HCE, all the hypotheses involving SCE (H4, H5, and H6) were not supported. Among them, H4 and H6 showed that the influence of SCE on ROA (profitability) and MC (market value) was insignificant whereas H5 indicated a significant negative effect of SCE on ATO (productivity).

The two industries – information technologies and pharmaceutical, biotechnologies, and life sciences – are knowledge intensive, and they have been considered among the most attractive industries for start-ups (Martin, 2016). The start-ups are normally small firms that are very competitive and contribute "significantly to aggregate productivity growth" of the whole economy (OECD, 1997, p. 9). In other words, these small firms have very high levels of productivity (OECD, 1997) whereas their investments in the

structural process, i.e. structural capital, are very limited, if any. For example, so focusing on rapid growth, start-up firms normally spend very little time, or not at all, on documenting their processes, a major part of structural capital, even though it has been recognized as a mistake (Harroch & Frasch, 2013). The firms included in the sample for this study were randomly selected. It was likely that start-up companies that had gone public were chosen and included in the sample. Their existence might contribute to the negative relationship between SCE and firm productivity, indicated by ATO.

Among the hypotheses related to CEE, the hypotheses H7 and H8 were supported while H9 was not. In other words, CEE significantly and positively impacted ROA (profitability) and ATO (productivity) while its influence on market value was insignificant. The significant, positive relationship between CEE and profitability as well that between CEE and productivity obtained in the present study was consistent with the traditional role of physical and financial capital in business environment (Clarke et al., 2011; Shiu, 2006; Ting & Lean, 2006).

For the hypotheses on RDE, the hypothesis H10 was supported while H11 and H12 were not. In other words, RDE significantly and positively impacted firm profitability. However, the effects on productivity and market value were found insignificant. The significant, positive relationship between RDE and corporate profitability could be explained with the resource-based view (RBV) of the firm (Ghaffar & Khan, 2014; Mithas et al., 2012; Wang, 2011).

The theory postulates that firms with resources that are valuable, rare, inimitable, and non-substitutable (VRIN) have critical advantages over others as regards enhancing performance, especially in terms of increasing profits (Al-Musali & Ku Ismail, 2014;

Barney, 1991; Ghaffar & Khan, 2014; Grant, 1996a, 1996b; Han & Li, 2015; Liao & Wu, 2009; Wernerfelt, 1984; Zack, 1999; Zollo & Winter, 2002). Based on this view, Ghaffar and Khan (2014), Vishnu and Gupta (2014), and Wang (2011) suggested that corporate investment in research and development (R&D) takes the central role in determining how companies can gain these competitive advantages and achieve superior performance, which ultimately leads to more innovation and a higher level of profitability. As a result, these authors' study found that firms which invest more in R&D likely earn more profits than those that do not. The findings of the present study were consistent with theirs.

With the hypotheses related to RCE, H14 was supported while H13 and H15 were not. In other words, RCE significantly and positively impacted firm productivity (ATO). However, the influence of RCE on profitability and market value was insignificant. The significant, positive relationship between RCE (advertising and marketing expenses) and productivity could be explained with the theoretical informative view of advertising (Bagwell, 2005; Belleflamme & Peitz, 2009) and empirical evidence of a link between competition and firm productivity (Aghion, Braun, & Fedderke, 2008; Blundell, Griffith, & Reenen, 1999; Clerides, 2012; CMA, 2015, Holme, 2010; Nickell, 1996).

As one among the three fundamental theories related to the role of advertising regarding firm operation and performance – the persuasive view, the informative view, and the complementary view (Bagwell, 2005; Belleflamme & Peitz, 2009), the informative view became popular in the 1960s thanks to the work of a group of "Chicago School" economists (Bagwell, 2005; Belleflamme & Peitz, 2009). This theory of advertising suggests that the information about some product is normally not available for consumers, which leads to the imperfection of the market (Bagwell, 2005; Belleflamme

& Peitz, 2009; Ozga, 1960; Stigler, 1961). When a firm advertises the product, consumers can receive the missing information about it (Bagwell, 2005; Belleflamme & Peitz, 2009; Ozga, 1960; Stigler, 1961). As a result, the demand for the product becomes elastic. Most importantly, advertising enables a company to be more competitive and promotes competition among the established firms (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964). Also, advertising activities in an industry reduce the entry barriers and allow new entrants to join the market via publicizing their existence, products and prices, which leads to even more competition among the firms in an industry (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964). In short, the more advertising and marketing expenses – the marker of RCE, the higher level of competitiveness for an enterprise, and the more competition among firms in an industry (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964).

For the link between competition and firm productivity, in the latest official report of the United Kingdom (UK) government on competition and markets, it is confirmed that "there is a strong body of empirical evidence showing that competition can drive greater productivity." (CMA, 2015, p. 2). The positive influence of competition on productivity could be found not only in companies, but also within industries, and even the whole national economy (CMA, 2015). The findings of the report were consistent with the earlier studies in the field (Aghion et al., 2005; Aghion et al., 2008; Blundell et al., 1999; Clerides, 2012; CMA, 2015, Holme, 2010; Nickell, 1996). Holme (2010) observed that nearly all the related studies found that increases in competition resulted in improvement of productivity. Nickell (1996) presented empirical evidence of a positive relationship

between larger numbers of competitors, i.e. more competition, and significantly increased productivity in an industry.

Briefly, the more advertising and marketing expenses, i.e. the more investments in relational capital (RC), the more competition among firms in the same industry, which leads to increased productivity in companies and the whole industry. Therefore, the association starting with more advertising and marketing expenses, i.e. higher level of RC, and ending with increased productivity explained the significant, positive relationship between RCE (advertising and marketing expenses) and corporate productivity.

Summary of Conclusions

In summary, each of the two new efficiency elements added to the modified VAIC model influenced only one indicator of business performance (profitability for RDE and productivity for RCE). By contrast, HCE significantly and positively impacted all three indicators of firm performance (profitability, productivity, and market value). CEE also significantly and positively affected two (profitability and productivity) of the three indicators of corporate performance. Therefore, the results of testing the two models and all the related hypotheses indicated that the impact of IC on corporate performance mostly came from the traditional IC efficiency elements HCE and CEE.

The results of the chi-square difference test showed that there was no statistically significant difference between the two models – the classic VAIC and the modified version that included two new efficiency elements, RCE and RDE. Consequently, the hypothesis H16 was not supported. The insignificant difference could be explained with

the above interpretation of the findings obtained in this study: the two traditional IC efficiency elements HCE and CEE were the main sources of the impact of IC on business performance of firms. The absence of a statistically significant difference between the models leads to the conclusion that the classic VAIC model is adequate. It can be used effectively to measure IC in assessing the impact of IC on organizational performance.

Limitations

This study had some limitations. The primary limitation was that only publicly listed companies that have reported their annual revenue and R&D expenses in their annual report were included in the research sample. According to Sydler, Haefliger, and Pruksa (2014), in 2009, less than 50% of publicly traded companies reported R&D expenses. Although the limitation was necessary because it ensured that the companies included in the research sample had been able to employ their IC in developing real products or services and selling them (Chang & Chuang, 2009; Tubigi et al., 2013), the obtained sample may have been skewed somewhat from that of the entire population. As a way to mitigate the issue, a large sample for the study (more than 400 firms) was used in the study, and the company screening feature of the online service of financial analytics S&P Capital IQ Platform was employed to select firms included in the research sample.

Another potential limitation of this study was the choices of only two industries, the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences, of which firms were randomly selected for the sample. Although the focus on these industries was necessary because they were considered among the most knowledge-intensive and innovative ones (Pal & Soriya, 2012; Vishnu & Gupta, 2014),

the selection may have had some impact on the generalizability of the study. The limitation was alleviated by the number of prior studies that have validated the choices (Bramhandkar et al., 2007; Chang & Lee, 2012; Chouldhury, 201; Jasour et al., 2013; Libo et al., 2011; Rahman & Ahmed, 2012; Sharabati et al., 2010; Shil et al., 2010; Vishnu & Gupta, 2014; Wu et al., 2012).

The geographical regions limited to North America and Western Europe, where companies included in the sample were domiciled, was also a potential limitation. The participant companies, belonging to the two selected industries, were the corporations having headquarters in the U.S, Canada, and the developed countries in Western Europe such as the United Kingdom (UK), France, Germany, Belgium, Italy, Norway, Denmark, and Switzerland. The selection was necessary because, in these countries, both the industries – the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences – were mature and strong, contributing significantly to the national economies and the advancement of the industries as a whole (U.S. Department of Commerce, 2016, 2010). However, the choice may have had some effect on the generalizability of the study.

Implications and Recommendations

This section discusses the implications of the present study for the fields of knowledge management and intellectual capital, impacts on firm management and business practitioners' management decisions, and influences on economic policymakers. The section also presents recommendations to business leaders, entrepreneurs, and

policymakers regarding options they can take to improve their organizations' performance. Finally, potential future research is discussed.

Contributions to the KM and IC Literature

Drucker (1999) opined that one of the most important metrics of corporate success in the 21st century would be how much the productivity of knowledge workers is increased. Not only do firms now recognize that knowledge is one of, if not the most crucial resources, they also try to manage organizational knowledge more effectively and efficiently (Salmaninezhad & Daneshvar, 2012). Therefore, it is critical for companies to have the capability to manage knowledge, and KM has been considered as a key determinant for firm success (Chen et al., 2009). According to Tan and Wong (2014) and Chen et al. (2009), the need to be able to measure KM performance – to understand how well KM initiatives have been implemented – becomes vital. However, it is enormously difficult to measure the value added to organizations as the outcomes of implementing KM initiatives (Ibrahim & Reid, 2010; Harlow, 2012; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014). As a result, it is very challenging to evaluate KM impact on organizational performance (Carrillo et al., 2003; Chen et al., 2009; Harlow, 2012; Ibrahim & Reid, 2010; Kankanhalli & Tan, 2008; Liebowitz, 2005; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014).

This study found that it is appropriate for IC to be used as a proxy for KM performance, and the present study employed the VAIC model to measure IC. A preliminary review of the KM literature suggests a gap in KM research that explores how to apply the model in attempts to evaluate the impact of knowledge management. This

study closed this gap. It contributed to the KM literature and the IC literature by providing an empirical study that related the application of the VAIC model to the assessment of KM impact on organizational performance.

Additionally, in the KM literature, there was a lack of empirical studies demonstrating the connection between KM and organizational performance (Andreeva & Kianto, 2012; Feng, Chen, & Liou, 2004; Holsapple & Wu, 2011; Massignham, 2014; Rasula et al., 2012; Tanriverdi, 2005; Tubigi et al., 2013; Zack et al., 2009). Therefore, it was still unclear how KM impacts corporate business performance (Andreeva & Kianto, 2012; Holsapple & Wu, 2011; Ibrahim & Reid, 2010; Tanriverdi, 2005). Such a lack of empirical studies might be attributed to the daunting task of assessing the impact of KM implementation as discussed above (Ibrahim & Reid, 2010; Harlow, 2012; Ragab & Arisha, 2013; Shakina & Bykova, 2011; Tan & Wong, 2014). As another significant contribution to the KM literature, this study provided KM researchers with an approach that facilitates the assessment of KM effects. Using IC measurement as a proxy for KM performance effectively helps them while they work on empirical analyses that would contribute to accumulative efforts of illuminating the impact of KM on organizational performance.

In the present study, employing the quantitative causal modeling research was also a significant contribution to the KM literature. As pointed out by Wong and Aspinwall (2004) and Zack et al. (2009), case-based research has been popular in studies on KM. With the use of causal modeling approach, this study helped to strengthen the empirical trend in KM research and provided a model for future research on the impact of KM initiatives.

As pointed out by Joshi et al. (2013) and Maditinos et al. (2011), while trying to use the VAIC method for IC measurement, researchers were challenged by the question of whether the classic model is good enough to be used, or should it be modified by including R&D expenses and RCE? Additionally, there was a lack of clear guidelines that are supported by empirical evidence or best practices for researchers to follow (Svanadze & Kowalewska, 2015; Maditinos et al., 2011).

This study made another significant contribution to both the KM and IC literature by providing a clear answer to the above question: The classic VAIC model is adequate. For IC measurement, the answer can be used as an empirically supported guideline that helps researchers confidently select the approach they would like to take. The present study provided empirical evidence that the classic VAIC model can be used effectively to measure IC in assessing the impact of IC on business performance. Researchers may include RCE and RDE as additional efficiency elements in the model to address the limitations of the VAIC method. However, it was found that these new elements did not provide any significant benefit.

Furthermore, the results of testing the models and hypotheses in this study provided strong empirical support for the theoretical views of the firm: RBV (resource-based view), KBV (knowledge-based view), and ICBV (IC-based view). With these findings, the present study made significant contributions to all the KM literature, the IC literature, and the management literature. In the study, it was found that almost all IC indicators – HCE, CEE, RCE, RDE – significantly and positively impacted either all (HCE's impact), or several (CEE's impact), or at least one (RCE's and RDE's impact) indicator of firm performance. In other words, IC had a significant influence on corporate business

outcomes. The results of the study strengthened the recognition of knowledge resources as valuable strategic assets that can help companies gain competitive advantages and achieve superior performance. Also, the findings in the present study contributed to the accumulated empirical evidence that knowledge management – capabilities and processes to manage these valuable resources – has a crucial role in organizations (Bogner & Bansal, 2007; Chien, 2015; Chen et al., 2009; Liao & Wu, 2009; Rowe & Widener, 2011; Rusly et al., 2014; Salmaninezhad & Daneshvar, 2012; Singh & Gupta, 2014; Tan & Wong, 2014).

Impacts on Professional Business Organizations

The present study also had practical implications for management in enterprises. An effective choice of a model used for measuring IC would help firms improve their capability of measuring IC (Molodchik et al., 2014). According to Marr et al. (2014), the capability of measuring IC helps companies formulate their business strategy and then evaluate their execution of the plan. More importantly, the capability of measuring IC facilitates the assessment of the KM impact on corporate performance, which in turn helps business leaders fine-tune their execution of business plans related to implementing KM initiatives (Andone, 2009). Being able to evaluate the outcome of KM implementation, firm managers can make judgment regarding what to continue, what to improve, and what to discard (Tan & Wong, 2014), which ultimately leads to organizational improvements (Chen et al., 2009).

The results of testing the models and the related hypotheses in this study showed that human capital had a significant, positive impact on all the indicators of organizational

performance – profitability, productivity, and market value. The findings provided empirical evidence to support the theoretical views of the firm such as the resource-based view (RBV), the knowledge-based view (KBV), the IC-based view (ICBV), and various theories about the role of human capital regarding firm competitiveness and performance. Not only did these findings contribute to the field of enterprise management, but they also made another significant contribution to the fields of KM and IC. The findings provided strong empirical evidence of the critical role of IC in the business environment. More importantly, the findings validated the view that knowledge resources are companies' strategic assets, and KM capabilities and processes that manage these valuable resources are crucial for firm success in a knowledge-based economy.

As per the findings, it is recommended that business leaders and entrepreneurs should heavily invest in their employees via training and staff development. They also should offer better compensation and benefits, promote creativity and innovation, and create a flexible working environment. By doing so, an organization can retain talents and strongly compete for the most skillful employees. As a result, the enterprise would become more innovative, competitive, and ultimately successful.

One of the main goals for most companies is to gain competitive advantage and achieve superior performance so that they can capture market share, sell the products or services, and generate revenues in excess of costs and expenses, i.e. earn profits (Mahoney & Pandian, 1992). The results of testing the hypothesis H1, H7, and H10 revealed that human capital, capital employed, and research and development (R&D) expenses all had a significant, positive impact on firm profitability.

As per the findings, if a company aims to make more profits, it is recommended that the corporate executive officers should pay more attention to three areas. First, as normal, the firm should increase the capital employed, i.e. enhancing the capital employed efficiency (CEE). Second, the firm should invest more in their employees, i.e. improving the human capital efficiency (HCE). Finally, the firm should focus on strengthening and expanding in-house research and development activities, i.e. boosting the R&D efficiency (RDE). By doing that, as shown with the results of the present study, the firm would have a good chance of raising its profitability.

According to AWPA (2013), productivity is "the key to long-run economic growth" (p. 4). Improvement in productivity enables firms, or even an entire economy, "to produce more output with the same quantity of inputs" (p. 4). The results of testing the hypotheses H2, H8, and H14 indicated that human capital, capital employed, and advertising and marketing expenses all had a significant and positive influence on firm productivity.

Based on the findings, if a company tries to improve its productivity, it is recommended that the business leaders should consider more investment in the following areas. As above, first, the firm should increase the capital employed, i.e. enhancing the capital employed efficiency (CEE). Second, the firm should invest more in their employees, i.e. improving the human capital efficiency (HCE). Finally, the firm should have a better marketing strategy and spend more on advertising its products and services, i.e. enhancing the relational capital efficiency (RCE). By doing that, as found in this study, there would be good prospects for the company to boost its productivity.

Influences on Economic Policymakers

Introduced by a group of "Chicago School" economists, the informative view of advertising posits that when a firm advertises its products, consumers can receive the missing information about them (Bagwell, 2005; Belleflamme & Peitz, 2009; Ozga, 1960; Stigler, 1961). Also, advertising enables a company to be more competitive and promotes competition among the established firms (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964). Moreover, advertising activities in an industry reduce the entry barriers and allow new entrants to join the market via publicizing their existence, products and prices, which leads to even more competition among the firm members of the industry (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964).

In short, the more advertising and marketing expenses – the marker of RCE, the higher level of competitiveness for an enterprise, and the more competition among firms in the same industry (Bagwell, 2005; Belleflamme & Peitz, 2009; Telser, 1964). For a company that tries to gain and sustain competitive advantage, it is recommended that while considering options, the board of directors should not overlook the impact of a sound marketing strategy and the effects of increasing expenses on advertising its products and services.

Wysokinska (2003) suggested that enhanced competitiveness leads to a firm's capability to stimulate growth and development, boost productivity, expand its markets even facing fierce competition, achieve superior performance, and ultimately succeed in its business. Also, the extant literature provides ample empirical evidence of a link between competition and productivity (Aghion et al., 2005; Aghion et al., 2008; Blundell et al., 1999; Clerides, 2012; CMA, 2015, Holme, 2010; Nickell, 1996). It is well-known

that productivity has a significant, positive effect on the growth of firms, the expansion of industries, and even the strength of an entire national economy (AWPA, 2013).

For economic policymakers of industries or a national economy, if the goals are to boost competition in some industry or to strengthen the entire economy in the prospect of a more and more competitive global market, it is recommended that one of the options the policymakers should take is to encourage firms to improve relational capital efficiency (RCE) by increasing expenses on advertising and marketing. By doing that, as postulated by the above informative view of advertising, each company may enhance its competitiveness and productivity. Moreover, competition among all the firms in the same industry would be increased, which presents a good chance of leading to a higher level of competitiveness and productivity of the entire economy.

Not only did these findings contribute to the fields of economics and marketing, but once again they also made significant contributions to the fields of KM and IC. The findings provided strong empirical evidence of the central role of KM and IC in a knowledge-based economy. More importantly, the findings confirmed the view that knowledge resources are firms' strategic assets, and knowledge management – capabilities and processes that manage these valuable resources – has a far-reaching influence on various aspects of an economy in the new era.

Future Research

Future research may try to collect data for a sample that better represents a diverse population of companies. First, in this study, only the publicly listed firms belonging to two industries – the sector of information technology and the sector of pharmaceutical,

biotechnology, and life sciences – were randomly selected for the sample. In the future, researchers may consider choosing companies in other industries. By doing this, the sample will likely better mirror the entire population of publicly listed firms.

Second, future research may expand the geographical regions where the headquarters of the firms selected for the sample are located. Instead of only choosing companies domiciled in the North America continent (USA and Canada) and the developed European countries (mostly in Western Europe), researchers may try to include enterprises in Asia, South America, and Africa in the sample. As a result, the sample will better represent a diverse population that reflects the effects of economic globalization.

Besides, in the present study, the data were extracted from the annual reports of randomly selected publicly listed companies for only one fiscal year. However, a longer period, e.g. five or ten consecutive fiscal years, is certainly worth considering in data collection for future research.

Summary

Evaluation of KM performance has been a crucial part of implementing KM initiatives. However, it is a daunting task to measure KM performance directly. One of the solutions is to measure IC using the VAIC model and then use the IC measurement to study the KM impact. Although being criticized due to its limitations, the VAIC model has been used widely in the literature to examine the relationship between IC and corporate performance. Researchers who plan to use the model have to be faced with the challenging question of whether the classic version is good enough or should it be modified by including R&D expenses and RCE? Besides, there was a lack of clear

guidelines supported by empirical evidence or best practices for researchers to consider if they plan to use the VAIC method. To provide a clear answer to the question and an empirically supported guideline for IC measurement, this study tried to answer two research questions:

1. How appropriate is IC as a proxy for KM performance in evaluating the influence of KM implementation on organizational performance?
2. Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance?

To address the first question, a literature review of 116 articles in two fields, KM and IC, was performed. It identified eight themes that indicated the tight relationship between KM and IC and the potential usage of IC measurement as a proxy for KM performance. Then, a content analysis was conducted on the same 116 articles. The study identified 209 references under eight categories that were associated with only one concept – IC as a proxy for KM performance. The results of the literature review and the content analysis indicated that it is appropriate for IC to be used as a proxy for KM performance in evaluating the impact of KM implementation on organizational performance.

Next, the data collecting, the data screening, the structural equation modeling analysis, and the chi-square difference test were performed to address the second research question: Which version – the classic VAIC model or the modified version that includes R&D expenses and RCE – better describes the impact of IC on organizational performance? As part of answering this question, a sample of 425 firms belonging to two knowledge-intensive industries – information technology and pharmaceutical,

biotechnologies, and life sciences – was selected randomly from a population of 61320 publicly listed companies.

Then the data were screened for missing data, outliers, normality, and multicollinearity. After records with missing data or outliers were removed, the final sample of 416 firms was analyzed using the structural equation modeling technique. The results of the analysis found that both the models – the classic VAIC and the modified version – fit the data pretty well.

The results also showed that the hypotheses H1 (HCE has a significant positive impact on ROA), H2 (HCE has a significant positive impact on ATO), H3 (HCE has a significant positive impact on market value), H7 (CEE has a significant positive impact on ROA), H8 (CEE has a significant positive impact on ATO), H10 (RDE has a significant positive impact on ROA), and H14 (RCE has a significant positive impact on ATO) were supported. Besides, the results indicated that the hypotheses H4 (SCE has a significant positive impact on ROA), H5 (SCE has a significant positive impact on ATO), H6 (SCE has a significant positive impact on market value), H9 (CEE has a significant positive impact on market value), H11 (RDE has a significant positive impact on ATO), H12 (RDE has a significant positive impact on market value), H13 (RCE has a significant positive impact on ROA), and H15 (RCE has a significant positive impact on market value) were rejected.

Finally, a chi-square difference test was conducted to determine whether there was a statistically significant difference between the two models. The results showed that the difference between them was not significant, and the hypothesis 16 was not supported.

Therefore, it was concluded that the classic VAIC model is adequate, and adding RCE and RDE as two new efficiency elements in the model does not provide benefit.

The present study made various significant contributions to the KM and IC literature. This study showed that it is appropriate for IC to be used as a proxy for KM performance, and the present study employed the VAIC model to measure IC. The findings facilitated how to measure KM performance and evaluate KM impacts. Employing the quantitative causal modeling research was also a significant contribution to the KM literature. More importantly, the results of testing the two VAIC models and related hypotheses found that the classic VAIC model can be used effectively to measure IC.

The present study also had practical implications for enterprise management. Using IC measurement as a proxy for KM performance facilitates the assessment of the impact of KM on corporate performance, which in turn helps business leaders fine-tune their execution of business plans related to implementing KM initiatives (Andone, 2009, Tan & Wong, 2014), and ultimately leads to organizational improvements (Chen et al., 2009). Not only did these findings contribute to the field of enterprise management, but they also made another significant contribution to the fields of KM and IC. The findings validated the view that knowledge resources are companies' strategic assets, and KM capabilities and processes that manage these valuable resources are crucial for firm success.

Additionally, this study made various recommendations to professional organizations as well as entrepreneurs and business leaders. As per the findings, it is recommended that business leaders and entrepreneurs should heavily invest in their employees via training and staff development. If a company aims to make more profits, the corporate executive

officers should pay more attention to the following activities: increasing the capital employed (CEE), investing more in their employees (HCE), and focusing more on research and development (RDE). If a company tries to improve productivity, the business leaders should consider more investments in three areas: the capital employed (CEE), their employees (HCE), and advertising and marketing (RCE). It is also recommended that if an enterprise seeks to gain competitive advantage, the board of directors should not overlook the impact of increasing advertising expenses (RCE).

Furthermore, the present study had implications and recommendations to economic policymakers of industries or a national economy. If the goals are to boost competition in some industry or to strengthen the entire economy, it is recommended that policymakers should consider encouraging firms to improve their relational capital efficiency (RCE) by increasing expenses on advertising and marketing. Not only did these findings contribute to the fields of economics and marketing, but they also supported the view that KM has a far-reaching influence on various aspects of a knowledge-based economy, another significant contribution to the KM and IC literature.

The study had several limitations. One limitation was that only publicly listed companies that had reported their annual revenue and R&D expenses in their annual reports were chosen for the sample. Another limitation of this study was related to the choices of only two industries, the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences, of which firms were randomly selected for the sample. The geographical regions limited to North America and Western Europe, where companies included in the sample were domiciled, was also a potential limitation.

Finally, this study provided various implications for future research. In the future, researchers may consider choosing companies in industries other than the sector of information technology and the sector of pharmaceutical, biotechnology, and life sciences. Researchers may also try to include enterprises domiciled in other regions such as Asia, South America, and Africa, in their studies. Besides, a longer period, e.g. five or ten consecutive fiscal years, is certainly worth considering in data collection for future research.

Appendix A

Literature Review Matrix

The following acronyms are used in Appendix A:

- T1 → Theme 1: Knowledge resources have the central role in both KM and IC.
- T2 → Theme 2: KM and IC have a tight relationship.
- T3 → Theme 3: Human resources are critical to both KM and IC.
- T4 → Theme 4: Structural capabilities, or structural capital, are critical to both KM and IC.
- T5 → Theme 5: Relational capabilities are critical to both KM and IC.
- T6 → Theme 6: KM and IC have a significant positive impact on organizational performance and firm success.
- T7 → Theme 7: Firms implement KM initiatives with the goals to create and accumulate IC.
- T8 → Theme 8: IC measurement can be used as a means to assess KM performance.

Citations	T1	T2	T3	T4	T5	T6	T7	T8
Agbim et al. (2013), p. 64			1	1		1		
Agoston & Dima (2013)								
Al-Musali and Ku Ismail (2014)	1					1		
Al-Shubiri (2003), p.463			1		1	1		
Andone (2009), p.25						1		
Antosova and Csikosova, (2011), p.114	1	1	1			1		1
Ashouri et al. (2015)								
Abdullah et al. (2013)								
Benscik (2013)								
Bogner and Bansal (2007), p.166	1	1						
Borin & Donato (2015)								
Bramhandkar et al. (2007), p.358			1	1	1			
Brock et al. (2001)								
Bruning (2011)								
Carlluci et al. (2004), p.582	1	1				1		
Carrillo et al. (2003)								
Chaghalvand et al. (2014)								
Chan (2009), p.4	1		1			1		
Chang and Chuang (2009), P.182			1	1		1		
Chang and Hsieh (2011), p.8	1					1		
Chen et al. (2009)	1	1				**1**		1
Chuang (2004), p.460	1			1				
Chung et al. (2013)								
CIDA (Canadian Int. De. Agency) (2000)								
Deep and Narwal (2014), p.44	1		1	1	1			
Dixon (2006)								
Djamil et al. (2013), p. 182	1					1		
Ghaffar et al. (2011)								
Ghaffar et al. (2012)								
Harlow (2008), p.150	1	1				1		
Harlow (2013), p.322								
Hashemnia et al. (2014), p.50						1		
Henry (2011)								
Hsu and Subherwal (2012), p.489	1	1				1		
Huang (2011), p.1	1	1				1		
Huang and Hsueh (2010), p.265	1	1				1		
Huang and Wu (2010), p.581		1				1		
Hudgins (2014), p.2	1	1						
Hui et al. (2013), p.150						1		
Hung & Lee (2007)								
Ibrahim and Reid (2010), p.567	1	1				1		1
Jennex and Olfman (2004), p.6	1			1		1		
Joshi et al. (2013), p.266	1		1			1		
Kalkan et al. (2014), p.701	1							
Kankanhalli and Tan (2008), p.3	1	1				1		1
Kehelwalatenna and Premaratne (2012)	1							
Khalique and Bontis (2014), p.225	1					1		
Khanghahi (2014)								
Khanhossini et al. (2013), p.2		1	1	1	1	1		
Kharal et al. (2014), p.239		1	1			1		
Kianto et al. (2013), p.112	1	1	1	1	1	1		1
Kianto et al. (2014), p.362	1	1	1	1	1	1		1
Kiessling et al. (2009), p.421	1	1	1			1		
Knoco (2000)								
Kumari et al. (2015)								
Lee and Choi (2003), p.188	1		1	1				
Liao and Wu, 2009, p.64						1		
Majeed et al. (2013), p.46				1		1		
Marr et al. (2003), p.771		1				1	1	1
Mention and Bontis (2013), p.288		1	1			1		
Metcalfe (2008)								
Minonne and Turner, (2009), p.583	1		1					
Morariu (2014), p. 394	1							
Mura et al. (2012)								

Naidenova et al. (2015)								
Nemati et al. (2013), p.380			1	1	1	1		
OECD (2007)								
Pal and Soriya (2012), p.122			1			1		
Papula and Volna (2011), p.501	1	1	1	1	1	1		1
Petty et al. (2008)								
Piri et al. (2014), p.985			1	1		1		
Porter, M. (2008)								
Ragab and Arisha (2013). p.12	1	1	1	1	1	1	1	1
Razaghi et al. (2013)								
Razaghi et al. (2013)								
Rehman et al. (2011), p.9			1	1	1			
Reise et al. (2013)								
Riahi-Belkaoui, (2003), p.217			1	1	1			
Richter & Vogel (2010)								
Roberts, J., & Armitage, J. (2008)								
Rosca (2010)								
Salkhi et al. (2014)								
Sanchez et al. (2008), p.1	1	1					1	1
Sapsed et al. (2002)								
Sarmadi et al. (2013), p.3	1		1			1		
Schenk & Parent (2014)								
Schenk (2015)								
Schumaker, Solieman, & Chen (2009)								
Sefidgar et al. (2015), p.770			1	1	1	1		
Seleim and Khalil, (2011)	1	1	1	1	1	1	1	1
Selke (2006)								
Shahpasand et al. (2013), p.321		1	1	1	1			
Shakina and Bykova (2011), p.917	1	1						1
Sharabati et al. (2013), p.33	1		1	1	1	1		
Shil et al. (2011), p.3						1		
SIDA (2012)								
Slakovic and Babic (2013), p.85						1		
Stadler et al. (2014)								
Standing and Benson (2000)								
Starzynska (2006)								
Stevens & Campion (1994)								
Tan et al. (2007), p.358			1	1	1			
Tanriverdi (2005), p.311	1		1	1	1	1		
Theriou et al. (2011), p.97			1	1	1	1		
Trisnowati and Fadah (2014), p.2						1		
Uadiale and Uwygbe (2011), p.49	1					1		
Vera and Crossan (2012), p.9	1	1						
Wiig (1997), p.399	1	1				1		
Yeganeh et al. (2014), p.704			1	1	1	1		
Zaired et al. (2012), p. 27	1	1	1	1		1		1
Zarraga & Bonache (2002)								
Zerenler et al. (2008), p.31	1					1		
Zhou and Fink (2003), p.34	1	1	1	1	1		1	1

Appendix B

Content Analysis Coding Sheet

Code Index	Description	Citation	Study Type	Field	Category	Concept
1	**KM and IC are believed to be closely coupled.** When KM activities are used to develop and maintain IC, it becomes a resource of sustainable competitive advantage (Seleim and Khalil, 2007). On the other hand, when IC is properly utilized and exploited, it increases the absorptive capacity of the organization, which, in turn, facilitates its KM processes. In addition, Cortini and Benevene (2010) assert that knowledge can add value to organizations through intangible assets (i.e. IC).	Seleim and Khalil, (2011), p.590	Quantitative	KM	KM-IC-TR	IC as a proxy for KM performance
2	Conceptually, **KM and IC are related**, as they include the whole range of intellectual activities from knowledge creation to knowledge leverage (Huang and Wu, 2010; Zhou and Fink, 2003; Nonaka et al., 2000).	Seleim and Khalil, (2011), p.587	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
3	**KM and IC are vital sources of competitive advantage and organizational performance** (Nonaka et al., 2000; Marr et al., 2004; Curado, 2008; Shih et al., 2010).	Seleim and Khalil, (2011), p.587	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
4	It is imperative for organizations to **use KM to accumulate IC** in order to cope with their increasingly challenging environments (Shih et al., 2010).	Seleim and Khalil, (2011), p.587	Quantitative	KM	CICGKMI MICAKMP KM-IC-OP-FS	IC as a Proxy for KM Performance
5	In the **complex assessment of knowledge management**, there is **appropriate to use the model of Intellectual Capital**, which evaluates the structure of knowledge assets from the point of view of value creation.	Papula and Volna (2011), p.501	Quantitative	KM	MICAKMP KM-IC-KR	IC as a Proxy for KM Performance
6	More recently, a number of contemporary classifications, the distinctions, is adjusted particular, by dividing the spheres of *intellectual capital* to **external capital (customers), internal capital (structural) and human capital** among which can be referred by Sveiby (1997) and Ross et al. (1997).	Nemati et al. (2013), p.380	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
7	Organizational **intellectual capital**, indicate technologies, and other mechanisms that will help staff to **generate revenue** for the company (Isaac et al, 2010). So in order to **improve product performance** and new products is important intellectual capital in the organization.	Nemati et al. (2013), p.380	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
8	In this age with the rapid development of global economy, **intellectual capital**, which be represents the company's core assets (such as structures, processes, systems, culture, brand, competencies and communication with customers) **has become a vital stimulus to sustain a**	Nemati et al. (2013), p.380	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance

	business in today's competitive environment and the role of physical resources is limited to support those assets.					
9	The results showed that **intellectual capital (human, structural and relational) only with performance of company (nonfinancial and market) has a significant relationship**.	Nemati et al. (2013), p.384	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
10	In contrast, later evolution understands the employees explicitly **in the context of other elements of intellectual capital and the knowledge management** is **understood as measurement, reporting and analyzing of intellectual capital.**	Papula and Volna (2011), p. 499	Quantitative	KM	MICAKMP	IC as a Proxy for KM Performance
11	There are several views at the breakdown **structure of intellectual capital** model presented in literature, usually consisting of three main components: **human capital, organizational capital and relational capital**.	Papula and Volna (2011), p. 501	Quantitative	KM	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
12	**Both knowledge management and intellectual capital** tend to **manage knowledge assets** towards **creating values for better achieving of strategic goals of organization**.	Papula and Volna (2011), p. 501	Quantitative	KM	KM-IC-KR KM-IC-TR KM-IC-OP_FS	IC as a Proxy for KM Performance
13	**Knowledge management (KM) and intellectual capital (IC)** are believed to **influence each other**, and **the relationship between the two constructs** is of **vital importance** to organizational effectiveness.	Seleim and Khalil (2011), p.586	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
14	Through a successful **knowledge management (KM)** organizations **improve their effectiveness and gain competitive advantage**.	Theriou et al. (2011), p.97	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
15	Arthur Anderson Business Consulting (1999) believed that **people, corporate culture and information technology** are the **biggest enablers of knowledge management implementation**.	Theriou et al. (2011), p.101	Quantitative	KM	KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
16	This study showed that **three types of intellectual capital –employee capital, structural capital, and customer capital– had a significantly positive relationship with innovation performance**.	Zerenler et al. (2008), p.31	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-RCM KM-IC-OP-FS	IC as a Proxy for KM Performance
17	Generally the components forming **the intellectual capital may be listed as employee, structural, and customer capital**.	Zerenler et al. (2008), p.32	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
18	Intellectual capital in this study was defined as **the total stocks of all kinds of intangible assets, knowledge, capabilities, and relationships**, etc, at employee level and organization level, within a company.	Zerenler et al. (2008), p.34	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance
19	Intellectual capital is **positively associated with innovation performance** in automotive supplier industry.	Zerenler et al. (2008), p.34	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
20	Often regarded as a fourth factor of production in addition to land, labour and financial capital, **intellectual capital (IC)** is	Chan (2009), p.4	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for

	said to epitomize **the intangible value drivers of companies and play an increasing role in their corporate performance as well as having an impact on their financial achievements such as market valuation** (Bozbura, 2004; Quantitative Brennan, 2001; Petty and Guthrie, 2000).					KM Performance
21	From an epistemological perspective, **IC is said to be knowledge about knowledge**, and the understanding of IC appears to require an assessment of the language used in its definition and application (Jørgensen and Boje, 2006).	Chan (2009), p.4	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance
22	The point-of-view presented here is that **the word "intellectual" actually refers to the employees** who encapsulate the company's knowledge.	Chan (2009), p.6	Quantitative	IC	KM-IC-HRM	IC as a Proxy for KM Performance
23	The conceptualization of IC may be broadened to include **all value creation activities performed by humans**; that is, the intelligent living organism: employees, directors and stakeholders relating to the company.	Chan (2009), p.6	Quantitative	IC	KM-IC-HRM	IC as a Proxy for KM Performance
24	The empirical results reveal that **VAIC is positively associated with profitability**.	Chan (2009), p.31	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
25	**KM and IC are distinct, but conceptually interrelated concepts** (cf. Nahapiet & Ghoshal, 1998; Easterby-Smith & Prieto, 2008).	Hsu and Subherwal (2012), p.489	Quantitative	KM	KM-IC-KR KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
26	The current knowledge-based economy has led to the literature emphasizing **knowledge management (KM) and intellectual capital (IC) as major sources of competitive advantage**.	Hsu and Subherwal (2012), p.489	Quantitative	KM	KM-IC-KR KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
27	**KM and IC share their representation of knowledge as a firm resource** that can lead to sustainable competitive advantage.	Vera and Crossan (2012), p.9	Quantitative	KM	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
28	**KM and IC share a more static view of knowledge**, while OL is primarily interested in the changes in knowledge.	Vera and Crossan (2012), p.9	Quantitative	KM	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
29	**KM and IC share a more static view of knowledge**, while OL is primarily interested in the changes in knowledge.	Vera and Crossan (2012), p.9	Quantitative	KM	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
30	The **evaluation of knowledge management (KM) performance** has become **increasingly important** since it provides the reference for directing the organizations to enhance their performance and competitiveness.	Zaired et al. (2012), p. 27	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
31	The results show that **all elements of knowledge management capabilities have a positive significant relationship with all measures of the performance** at 1% level of significant; it means that there is a great correlation between knowledge management capabilities and organizational performance.	Zaired et al. (2012), p. 27	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
32	The **knowledge management processes** is defined as the degree to which the **firm creates, shares, and utilizes knowledge resources** across functional boundaries [5].	Zaired et al. (2012), p. 28	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance

33	When **knowledge is examined from a value creation perspective, it is understood as intellectual capital (IC)**. IC comprises the **valuable knowledge-based resources** and the **management activities related to them**.	Kianto et al. (2013), p.112	Quantitative	KM	MICAKMP KM-IC - TR KM-IC-KR	IC as a Proxy for KM Performance
34	The main intangible value drivers are typically seen in terms of **human resources, structural resources, and relationship networks**, and **the management activities span strategy formulation and implementation** used for better leveraging these resources (e.g., Bontis, 2001; Guthrie, 2001; Edvinsson & Malone, 1997).	Kianto et al. (2013), p.112	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
35	Based on this extensive evidence, it seems that the possession of **intangible assets leads to superior organizational performance**, that is, **a high level of IC is correlated with high performance** (Menor et al, 2007; Hsu & Sabherwal, 2011).	Kianto et al. (2013), p.113	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
36	One definition of **IC** is that it is the **possession of the knowledge**, **applied experience**, **organizational technology**, **customer relationships**, **and professional skills** that provide a company with a **superior competitive position** (Edvinsson & Malone, 1997).	Kianto et al. (2013), p.113	Quantitative	KM	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
37	According to another definition, **IC consists of the knowledge-based resources** that contribute to the sustained competitive advantage of the firm, or simply knowledge that can be converted to profits (Sullivan, 1998).	Kianto et al. (2013), p.113	Quantitative	KM	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
38	The results in Table 1 showed that **KM capabilities are related to organizational performance**.	Agbim et al. (2013), p. 64	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
39	The results of this study are similar to the findings of previous studies. Rasula et al. (2012) found that **KM practices that are measured by IT, organization and knowledge affects organizational performance positively**.	Agbim et al. (2013), p. 64	Quantitative	KM	KM-IC-OP_FS KM-IC-SCM	IC as a Proxy for KM Performance
40	**Structural, cultural and human KM resources** are positively related to **competitive advantage**.	Agbim et al. (2013), p. 64	Quantitative	KM	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
41	The findings also present **a positive significant relationship between KM and OP** (Mills & Smith, 2011).	Hui et al. (2013), p.150	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
42	The **knowledge management has a strong effect on the organizational performance**. It can be done in the production sector as well in future.	Majeed et al. (2013), p.46	Quantitative	KM	KM-IC-OP-FS KM-IC-SCM	IC as a Proxy for KM Performance
43	**Organizations, therefore, implement KM processes** to capture and disseminate knowledge flows **with the object of accumulating IC** (Ahmed and Omar, 2011).	Ragab and Arisha (2013). p.12	Quantitative	KM	CICGKMI MICAKMP KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance

44	In the traditional conceptualization where organizational knowledge is envisaged as a series of ‘‘stocks and flows’’, **Intellectual Capital (IC)** can be viewed as **an organization’s stock of knowledge** at any particular time (Bontis, 2004). **It comprises knowledge** that has been acquired and formalized to be used **to create value and so gain competitive advantage** (Chatzkel, 1998).	Ragab and Arisha (2013). p.12	Quantitative	KM	MICAKMP KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
45	The regression results show that **knowledge management generally has a positive effect on organizational performance**. Also, the results show that knowledge management is positively related to the different dimensions of organizational innovation (process innovation and administrative innovation).	Slakovic and Babic (2013), p.85	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
46	However, drawing from the dynamic interpretation of IC (Kianto, 2007) **one can argue that IC, or more generally organizational knowledge**, is **not only about what the organization possesses or has, it is also about what the organization does**.	Kianto et al. (2013), p.113	Quantitative	IC	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
47	The literature is rich with various **definitions of KM**, but one of the most simple and comprehensive definitions is “[a] **conscious strategy of getting the right knowledge to the right people at the right time** and helping people share and put information into action in ways that strive **to improve organizational performance**” (O'Dell et al., 1998).	Ragab and Arisha (2013), p.6	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
48	**KM is vital not only for the success of organizations**, but also for the development of societies. The societal role of KM grows from the fact that **knowledge is the foundation of economic progress and growth of communities** in the current era (Romer, 1986).	Ragab and Arisha (2013), p.6	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
49	To meet the demands of a globalized economy, today’s nations have to **leverage the knowledge of their citizens** and provide knowledge-related infrastructures such as education, apprenticeships, research programs, and ICT, **all of which would be managed by KM** (Wiig, 2007).	Ragab and Arisha (2013), p.6	Quantitative	KM	KM-IC-KR KM-IC-SCM	IC as a Proxy for KM Performance
50	Based on the fact that **‘people’ are the main drivers of KM** (Yahya and Goh, 2002), research in this area studies **HRM functions from a KM perspective**.	Ragab and Arisha (2013), p.6	Quantitative	KM	KM-IC-HRM	IC as a Proxy for KM Performance
51	**IC** is undoubtedly amongst the **most critical resources for knowledge-intensive firms**.	Mention and Bontis (2013), p.288	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance
52	Recognized as **the central component of IC, HC comprises the knowledge, skills, experiences and abilities of the members of the organization** (Edvinsson and Malone, 1997; Roslender and Fincham, 2004). Given its nature, HC is inseparable from its bearer (Ferna´ndez et al., 2000) and is neither owned nor fully controlled by the firm (Edvinsson and Sullivan, 1996).	Mention and Bontis (2013), p.288	Quantitative	KM	KM-IC-HRM KM-IC-OP-FS	IC as a Proxy for KM Performance
53	**Individual knowledge, expertise and skills represent valuable resources and a source of sustainable competitive**	Mention and Bontis (2013), p.288	Quantitative	KM	KM-IC-HRM KM-IC-TR	IC as a Proxy for

	advantage, provided that organizations are able to effectively manage and leverage this knowledge and expertise embedded in individuals (Collins and Clark, 2003; Lado and Wilson, 1994).					KM Performance
54	**Organizational structure has also been studied as being as important as culture in relation to KM success**, and flat organizational structures with few hierarchal levels are generally found to promote more knowledge sharing since they enhance interaction and communication between employees (Claver-Cortes et al., 2007).	Ragab and Arisha (2013), p.6	Quantitative	IC	KM-IC-SCM	IC as a Proxy for KM Performance
55	When classifying IC, most authors agree with the tripartite classification proposed by Stewart (1998), in which **IC is broken down into Human Capital (HC), Structural Capital (SC) and Relational Capital (RC)** (Kwee Keong, 2008).	Ragab and Arisha (2013), p.16	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
56	The CEOs agreed that "**knowledge is our most important asset**." They also agree that knowledge-based assets will be the foundation of success in the 21st century. As a result of such convictions**, efforts to manage knowledge and intellectual capital**, are now pursued with considerable success by many leading organizations.	Wiig (1997), p.399	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP_FS	IC as a Proxy for KM Performance
57	The **organizational structure** within an organization may encourage or inhibit knowledge management.	Lee and Choi (2003), p.188	Quantitative	KM	KM-IC-SCM	IC as a Proxy for KM Performance
58	It is **people** who **create and share knowledge**. Therefore, managing people who are willing to create and share knowledge is important.	Lee and Choi (2003), p.188	Quantitative	KM	KM-IC-HRM	IC as a Proxy for KM Performance
59	**Technology contributes to knowledge management**. This technology infrastructure includes IT and its capabilities	Lee and Choi (2003), p.188	Quantitative	KM	KM-IC-SCM	IC as a Proxy for KM Performance
60	A number of studies have addressed **knowledge management processes**; they divide knowledge management into several processes. For example, Alavi and Leidner [2] considered four processes such as **creation, storage, transfer, and application**.	Lee and Choi (2003), p.189	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance
61	**Intellectual capital (IC) is a key driver of innovation and competitive advantage** in today's knowledge based economy.	Marr et al. (2003), p.771	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
62	At the same time, **knowledge management (KM) is recognized as the fundamental activity for obtaining, growing and sustaining IC** in organizations.	Marr et al. (2003), p.771	Quantitative	KM	KM-IC-TR CICGKMI MICAKMP	IC as a Proxy for KM Performance
63	This means that the **successful management of IC is closely linked to the KM processes** an organization has in place; which in turn implies that the **successful implementation and usage of KM** ensures the **acquisition and growth of IC**.	Marr et al. (2003), p.772	Quantitative	KM	KM-IC-TR CICGKMI MICAKMP	IC as a Proxy for KM Performance
64	Today **IC** is recognized as **a key strategic asset for organizational performance** and **its management** is **critical for the competitiveness of organizations.**	Marr et al. (2003), p.772	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance

65	The paper shows that a clear understanding of epistemological issues is at the center of **choosing a successful KM approach within an IC framework**.	Marr et al. (2003), p.772	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
66	SkICandia (2000) defines it as "**the possession of knowledge**, **applied experience, organizational technology, customer relationships and professional skills** that provide Skandia with a competitive edge in the market."	Deep and Narwal (2014), p.44	Quantitative	KM	KM-IC-KR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
67	Marr and Schiuma (2001) **defined intellectual capital as the group of knowledge assets** that are attributed to an organization and most significantly contribute to an improved competitive position of the organization by adding value to defined key stakeholders."	Deep and Narwal (2014), p.44	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance
68	The exploratory study done by Bontis (1998) about the relationship among corporative investment in intellectual capital and their performance indicated the **significant and substantial cause- and-effect relationship among intellectual capital dimensions and organizational performance**.	Hashe,mnia et al. (2014), p.50	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
69	The twenty-first century knowledge driven economy has seen increasing importance being placed on maximizing the **organization's intellectual capital (IC)**. At the same time **knowledge management (KM)** systems are being developed. The paper establishes **similarities between the two** and proceeds to **develop a systematic approach to linking them** through the **intellectual capital web** (ICW).	Zhou and Fink (2003), p.34	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
70	The integration of IC and KM requires **alignment of KM processes with IC assets** to meet the organization's strategic needs.	Zhou and Fink (2003), p.35	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
71	Across the activities presented in Figure 1, **some significant IC-related KM activities** can be identified. These range from **managing intellectual assets** in the "governance functions" to selling products with high knowledge content in the "realize its value" function. Especially, the "operational" function and "realize its value" function aim to **create and leverage knowledge assets** effectively, hence enable organizations to concentrate on **developing and exploiting their IC**.	Zhou and Fink (2003), p.35	Quantitative	KM	KM-IC-TR KM-IC-KR CICGKMI MICAKMP	IC as a Proxy for KM Performance
72	Finally, **IC can be described as its intangible asset; knowledge** that can be used to **create value**; it is an important for each and every organization to be able to survive and continue its activity, and human capital is the core of IC.	Sharabati et al. (2013), p.33	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
73	Sundac and Krmpotic (2009) concluded: Only **the synergy of HC, SC and RC can result in strong IC** that **becomes the source of the company's competitive advantage and value added**.	Sharabati et al. (2013), p.34	Quantitative	KM	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance

					KM-IC-RCM	
74	The paper draws on IC and KM literatures to build a theoretical model on **how intellectual asset assets and their management practices interact in producing organizational performance**. Several conceptual models and related discussion on the interaction of IC and KM practices are put forth.	Kianto et al. (2014), p.362	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
75	By **addressing both the "static" asset aspect of IC as well as the "dynamic" perspective of how leveraging IC assets** can be enabled by systematic managerial activities, the paper **combines the key issues in IC and KM literatures** and demonstrates how intangible resources should be managed to produce value.	Kianto et al. (2014), p.362	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
76	The **two key academic discussions addressing knowledge in organizations** are the literatures of intellectual capital (IC) and knowledge management (KM).	Kianto et al. (2014), p.362	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
77	As Gold et al. (2001) notes that the **technological KM resource** is the **KM infrastructure** that determines the business degrees of freedom a firm enjoys in its business plans. Therefore, the **assistance of technical KM resource** is essential for initiating and carrying out **knowledge management**.	Chuang (2004), p.460	Quantitative	KM	KM-IC-SCM	IC as a Proxy for KM Performance
78	**Structural KM resource** is operationalized based on Gold et al. (2001), assessing the extent to which an organization depends on interactions among employees, the importance of **knowledge sharing**, and creation of new knowledge. Thus, this measure **reflects the capability of structural knowledge managements of organizations**.	Chuang (2004), p.461	Quantitative	KM	KM-IC-SCM KM-IC-KR	IC as a Proxy for KM Performance
79	The operationalization of the **human KM resource** faced by an organization is adopted from Lee and Choi (2003) to assess **knowledge domains of employees** and their various applications in particular products.	Chuang (2004), p.461	Quantitative	KM	KM-IC-HRM KM-IC-KR	IC as a Proxy for KM Performance
80	The model defines **KM effectiveness** in terms of two main constructs: **Knowledge Infrastructure Capability and Knowledge Process Capability**, with the Knowledge Process Capability construct being influenced by a Knowledge Task.	Jennex and Olfman (2004), p.6	Quantitative	KM	KM-IC-SCM KM-IC-KR	IC as a Proxy for KM Performance
81	In summary, **KM is managing organizational processes** to **create, store and reuse organizational knowledge** (Huang et al., 1999), while, on the other hand, developing a knowledge culture to facilitate these processes, with an **ultimate aim to create and maximize IC** to make a more intelligent organization.	Zhou and Fink (2003), p.35	Quantitative	KM	KM-IC-TR KM-IC-KR CICGKMI	IC as a Proxy for KM Performance
82	From the forgoing discussion, the **relationship between IC and KM is of vital importance** to an organization.	Zhou and Fink (2003), p.39	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
83	**KM** focuses on facilitating and managing **knowledge-related activities** and strives to **create a knowledge friendly environment in which IC will grow**.	Zhou and Fink (2003), p.39	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance

84	The systematic **KM approach** has to transcend the traditional boundaries of management domain and must take into account various factors that have **impact on IC identification and KM implementation activities**. This requires the integration of **technologies, people and systems, with a people focus**.	Zhou and Fink (2003), p.39	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
85	In the remainder of this section, we will **illustrate how IC can be managed and how the individual IC elements are linked to KM activities**.	Zhou and Fink (2003), p.39	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
86	As previously asserted, the **integration of IC and KM requires aligning KM processes with individual IC elements** to meet an organization's strategic needs. Figure 4 provides an example of this linkage.	Zhou and Fink (2003), p.39	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
87	**Intellectual capitals** are sum of human and structural capitals. Moreover, they **include organizational experiences and technologies, relationships with customers and professional relationships** that provide competitive advantage. (Edvinsson, 1997).	Sefidgar et al. (2015), p.700	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
88	**Human factor** plays an important role in the process **of knowledge management and knowledge-based organizations** and is also considered to be **the most important competitive advantage** of any organization and the **scarcest resource** in **knowledge-based economy** of the century.	Sefidgar et al. (2015), p.704	Quantitative	IC	KM-IC-HRM KM-IC-OP-FS	IC as a Proxy for KM Performance
89	According to the findings of statistical methods, we can conclude that when the **human capital, customer (relational) capital, and structural capital variables** are studied independently, they have **positive relationship with performance** but when the simultaneous effects of these three variables are studied, only human and structural capitals are the effective factor of performance.	Sefidgar et al. (2015), p.704	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
90	This definition has manifold implications. First, **intellectual capital contains intangible resources that encompass knowledge and information** that can be used by an organization to **capitalize on its profits**. Second, it is the combination of intangible assets that is used to create and establish value for a firm (Chaminade and Roberts, 2003).	Khalique and Bontis (2014), p.225	Quantitative	IC	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
91	It is important to note that **the pursuit of IC and its associated KM processes** must be driven by the strategic need of the organization.	Zhou and Fink (2003), p.42	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
92	The purpose to link IC with organizational strategic objective is to ensure that the **firm gets competitive advantages from its IC and KM development.**	Zhou and Fink (2003), p.42	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
93	In the **center of the ICW is the people component** that is referred to as "**knowledge workers**" in Figure 5. The **roles of knowledge workers** are to interpret organizational tactics into	Zhou and Fink (2003), p.43	Quantitative	KM	KM-IC-TR KM-IC-HRM	IC as a Proxy for KM Performance

	guidelines and detailed activities, and to improve business and operating practices by **providing their managers with insights into the advantage of KM implementation** (Wiig, 1995).					
94	**Managers of knowledge workers** must go beyond the traditional **human resource management** by not only recruiting and attracting talented people, but also **nurturing and promoting knowledge focused behaviors and a knowledge-sharing environment**.	Zhou and Fink (2003), p.43	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-KR	IC as a Proxy for KM Performance
95	Thus, the overall cross-unit KM capability of a multi-business firm is specified as a higher-order construct that comprises **three first-order KM capabilities**: (1) **product KM capability**, (2) **customer KM capability**, and (3) **managerial KM capability**.	Tanriverdi (2005), p.311	Quantitative	KM	KM-IC-HRM KM-IC-SCM KM_IC-RCM	IC as a Proxy for KM Performance
96	**Customer KM capability** enables the firm to exploit related **customer knowledge** across multiple business units.	Tanriverdi (2005), p.311	Quantitative	KM	KM-IC-RCM KM-IC-KR	IC as a Proxy for KM Performance
97	**KM** is a support function to **improve knowledge-intensive business processes**.	Jennex et al. (2008), p.1	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
98	**KM** involves the basic processes of **creating, storing and retrieving, transferring and applying knowledge**.	Kankanhalli and Tan (2008), p.3	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance
99	The **ultimate aim of KM** is to avoid reinventing the wheel and **leverage cumulative organizational knowledge** for **more informed decision-making** (Alavi and Leidner 2001).	Kankanhalli and Tan (2008), p.3	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
100	In a **knowledge economy**, the successful **management of these activities** has been identified as likely to **provide a company with a competitive advantage** (Prahalad and Hamel, 1998; Drucker, 1999).	Joshi et al. (2013), p.266	Quantitative	IC	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
101	The similarity of all of these definitions is introducing **intellectual capital as a knowledge, skill, and ability** that can lead to **wealth making valuable output for the company**.	Sarmadi et al. (2013), p.3	Quantitative	IC	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
102	Therefore **intellectual capital is considered as an intellectual resource, knowledge, information and intellectual properties** that concluded to value **making and profitability for the company**.	Sarmadi et al. (2013), p.3	Quantitative	IC	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
103	**Product KM capability** enables the firm to **exploit related R&D and operations knowledge** across multiple business units and to **reduce the overall R&D and operations costs** of the firm	Tanriverdi (2005), p.315	Quantitative	IC	KM-IC-OP-FS KM-IC-KR KM-IC-SCM	IC as a Proxy for KM Performance
104	Firms can pursue two different aspects of **intellectual capital: the resource of knowledge and the process of knowing.**	Bogner and Bansal (2007), p.166	Quantitative	IC	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
105	**KM** is **a strategic process**, the desired goal of which is to **harness the value of information** by integrating it with processes that govern the manipulation of **intellectual assets**.	Harlow (2008), p.150	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
106	These firms are able to **use the tacit knowledge component of KM to create**	Harlow (2008), p.150	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for

	hard-to-duplicate core competence in managing, identifying, capturing, systemizing, and applying tacit knowledge to create customer value as measured by innovation and economic outcomes.				KM-IC-OP-FS MICAKMP	KM Performance
107	**Most practice metrics of KM initiatives** focus on **measuring knowledge assets or intellectual capital (IC) of a firm**, assuming the outcome of a KM initiative being its impact on IC.	Kankanhalli and Tan (2008), p.5	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
108	Three **other metrics specific to KM** are the **Skandia Navigator, IC index, and Intangible Assets Monitor**.	Kankanhalli and Tan (2008), p.5	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
109	Many practitioners and scholars have identified **three basic components of IC i.e. human capital, structural capital and relational capital** (Holton and Yamkovenko, 2008; Yang and Lin, 2009; Mavridis and Kyrmizoglou, 2005; Tayles et al., 2007).	Rehman et al. (2011), p.9	Quantitative	KM	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
110	The Proposed model (M3) for (ROE) and (M3) for (EPS) show that **HCE, SCE and CEE has significant relation with financial performance** of modaraba companies at (P>0.05) and (P> 0.10) respectively.	Rehman et al. (2011), p.9	Quantitative	KM	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
111	Previous studies (Bontis, 1998; Bontis et al., 2000; Cabrita & Bontis, 2008) identified the **positive relationship between IC and business performance**.	Shil et al. (2011), p.3	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
112	Results found that **intellectual capital had positive effect on the economic and financial performance**.	Pal and Soriya (2012), p.122	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
113	Ahangar (2011) carried out the study to analyze the intellectual capital performance and the relationship between profitability, employee productivity and growth in sales. Results implied **that intellectual capital efficiency was significantly related with profitability and productivity** and among different components; **human capital was significantly associated with company's performance**.	Pal and Soriya (2012), p.122	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM	IC as a Proxy for KM Performance
114	Shiu found **a significant and positive relationship among financial performance and intellectual capital** model. Royal and O'Donnell (2008) found that **human resource capital is part of intellectual capital and is a very important element of value creation**.	Al-Shubiri (2003), p.463	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM	IC as a Proxy for KM Performance
115	Bannany (2008), Kamath (2008) pointed to the **use of value-added customer relations intellectual capital** as a measure of capital, after all, customer loyalty, customer satisfaction and this reflect to corporate firm performance.	Al-Shubiri (2003), p.463	Quantitative	IC	KM-IC-OP-FS KM-IC-RCM	IC as a Proxy for KM Performance
116	We are going to adhere to the notion of **Knowledge Management** used by Nonaka and Tacheuchi (1995) and by Nonaka (2005) which they see as **a process in which explicit and tacit knowledge** held by individuals, teams and organizations interplay. If well managed, **the process allows the expansion and creation of more knowledge** (Nonaka, 1994).	Sanchez et al. (2008), p.1	Quantitative	KM	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance

117	McCann (2008) also deal with the two issues at the same time considering **KM as a set of practices and processes** designed to develop the **quality and quantity of IC**.	Sanchez et al. (2008), p.1	Quantitative	KM	KM-IC-TR CICGKMI MICAKMP	IC as a Proxy for KM Performance
118	Given that the **whole point of knowledge management** is to **improve the performance of the corporation** and to **help it to achieve its objectives**, the best and most logical approach is tie-in **measurement of knowledge management** with the corporate **overall performance measurement**	Andone (2009), p.25	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
119	Other **key determinants** include **human resources, information technology and competitive strategy** integrated to elicit the greatest efficiency.	Chang and Chuang (2009), P.182	Quantitative	KM	KM-IC-OP-FS KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
120	**Knowledge management must be a reflection of the competitive strategy in order to create customers' value, earn profit** for the organization and manage employees.	Chang and Chuang (2009), P.182	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
121	Therefore, **how to manage knowledge, becomes a critical issue, and KM becomes the key to success for an organization**. To **obtain effective knowledge management, it is necessary to be able to measure KM performance** (Ahn & Chang, 2004).	Chen et al. (2009)	Quantitative	KM	KM-IC-OP-FS KM-IC-KR	IC as a Proxy for KM Performance
122	**A KM performance evaluation** can be analyzed **from intellectual capital**, BSC, technology, and process **perspectives**. The primary objective is to estimate **the level of KM performance in the whole organization**.	Chen et al. (2009)	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
123	**Successful knowledge management** requires **more than individual employees** sharing a repository of experiences. Rather, **knowledge management requires an active systematic effort on the part of the organization** to recognize and capture new knowledge (Drucker, 1993).	Kiessling et al. (2009), p.421	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
124	Although an **effective knowledge management** system may be implemented, its **positive organizational level outcomes** are heightened when **individual employees' knowledge are evident**. In essence, **the greater the stock of individual employees' knowledge**, the **more successful firms** will be able to integrate and coordinate at the firm level.	Kiessling et al. (2009), p.421	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-HRM	IC as a Proxy for KM Performance
125	Firm **knowledge management refers to the knowledge management processes** in an organization that **develop and use knowledge** within the firm (Gold et al., 2001).	Kiessling et al. (2009), p.421	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
126	**Knowledge management (KM) and organizational performance** are believed to be essential of the success in business. The different results in literatures which declare **KM affects organizational performance positively**.	Kiessling et al. (2009), p.421	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
127	Since Handy (1996) suggested that **managing the knowledge and skills of its employees was a key organizational challenge**, each of the management	Minonne and Turner, (2009), p.583	Quantitative	KM	KM-IC-HRM KM-IC-KR	IC as a Proxy for KM Performance

	disciplines has contributed to the concept of Knowledge Management (KM) in a rather independent way.					
128	This paper attempts to answer this question, first examining the literature for approaches **to measuring KM from the perspective of Intellectual Capital (IC) theory**.	Ibrahim and Reid (2010), p.567	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
129	If the **knowledge** is deemed to be the **most important resource of organizations**, then clearly the need to secure that resource must be **of primary concern** and **demands good management**.	Ibrahim and Reid (2010), p.567	Quantitative	KM	KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
130	The **fundamental idea of KM**, as originally proposed, is dealing with **the management of knowledge** in related activities (Wiig, 1997). This includes **organizing, sharing and using knowledge** in order to **create value and achieve competitive advantage** for an organization.	Ibrahim and Reid (2010), p.567	Quantitative	KM	KM-IC-KR KM-IC-TR KM-IC-OP-FS MICAKMP	IC as a Proxy for KM Performance
131	The research has also led to a number of frameworks for classifying and measuring the concept. The classificatory models that have been developed include Petrash's (1996) Value Platform model. This **classifies IC as the sum of human capital, organizational capital and customer capital**.	Tan et al. (2007), p.358	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM_IC-RCM	IC as a Proxy for KM Performance
132	Theory and practice also deal with a different but **equally important division of IC into the categories of human capital, structural capital, and relational** (Bontis 1998; Edvinsson & Malone 1997, Stewart 1997).	Bramhandkar et al. (2007), p.358	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM_IC-RCM	IC as a Proxy for KM Performance
133	Knowledge is a close concern of engineering consulting firms, and **proper management of intellectual capital** might have **an immediate effect on the business operation and management**.	Huang and Hsueh (2010), p.265	Quantitative	IC	KM-IC-KR KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
134	On the other hand, **the interaction between innovation and knowledge management or intellectual capital** has also been studied (Darroch and McNaughton, 2002; McAdam, 2002; Gloet and Terziovski, 2004; Liu et al., 2005).	Huang and Wu (2010), p.581	Quantitative	IC	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
135	The results show that **intellectual capital has a positive and significant relationship with the performance of business organizations** in Nigeria. These results reinforce the accumulating body of empirical support for the **positive impact of intellectual capital on business performance**.	Uadiale and Uwygbe (2011), p.49	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
136	**Intellectual capital is recognized "as an aggregation of all knowledge and competences of employees** that can bring **competitive advantages** for the organizations (Stewart, 1997).	Uadiale and Uwygbe (2011), p.50	Quantitative	IC	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
137	Firms may find that **increasing their knowledge management capability** leads to **more trade secrets and process improvements** and less need for expensive and unproductive R&D where the chance of	Harlow (2013), p.322	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance

	success in the marketplace is often 10% or less.					
138	**IC** has been **linked to sustainable competitive advantage** of companies, **mainly via value outputs** being generated by the **company's human resources, capabilities and competence** (Bontis, 1998, 2001; Bontis et al., 2000; Wood, 2003; Lonnqvist, 2004).	Joshi et al. (2013), p.266	Quantitative	IC	KM-IC-OP-FS KM-IC-HRM	IC as a Proxy for KM Performance
139	Edvinsson, L., Malone M.S. (1997) define **intellectual capital as the knowledge oriented process** that **include applied experiences, organizational technologies, customer relationship and professional skills** which increase the **competitive capabilities and future profits** of the company.	Khanhossini et al. (2013), p.2	Quantitative	IC	KM-IC-OP-FS KM-IC-TR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
140	**Human capital is the main and potential ability of the organization** that is a combination of the employees' general and professional knowledge. Human capital is knowledge storage in the organization that is showed by the employees (Bonits 1998).	Sarmadi et al. (2013), p.3	Quantitative	IC	KM-IC-HRM	IC as a Proxy for KM Performance
141	Rising of new discipline – **knowledge management** is response to this demand, since it concentrates every trends of development in last time and moreover it is trying to **develop systematic way how to identify, obtain, maintain and use intellectual capital**.	Antosova and Csikosova, (2011), p.114	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
142	Mainly mutual exchange of **knowledge** support significantly acting of the subject in knowledge society that means transition to the knowledge firm. But there is necessary to **create such firm's atmosphere, where value of intellectual capital and managing of knowledge** is the highest priority.	Antosova and Csikosova, (2011), p.114	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
143	**Intellectual capital is presented by organization knowledge** using for creation of organization wealth. According Armstrong (2002) it can be stocks and flow of knowledge disposal in organization.	Antosova and Csikosova, (2011), p.115	Quantitative	KM	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
144	When **at the knowledge management level** there are working with concrete **knowledge and creating processes how to obtain, elaborate, and use such knowledge at organization level**, proper environment for their obtaining, sharing, development and using is basis.	Antosova and Csikosova, (2011), p.133	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
145	**Intellectual capital** looks through the main dynamics **which affect economic competition in knowledge economics** from different perspectives.	Antosova and Csikosova, (2011), p.135	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
146	**Spreading information in knowledge economics** focuses **its attention on knowledge management** in every organization, corporation or company.	Antosova and Csikosova, (2011), p.135	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance
147	**Talking about knowledge management**, or learning companies, **similarly about intellectual possession as a potential for ensuring competitive advantages** is nowadays inevitable in intensive academic and professional discussions and that is in an academic organization and also in practice, in all levels of organizations.	Antosova and Csikosova, (2011), p.135	Quantitative	KM	KM-IC-KR	IC as a Proxy for KM Performance

148	**Talking about knowledge management**, or learning companies, **similarly about intellectual possession as a potential for ensuring competitive advantages** is nowadays inevitable in intensive academic and professional discussions and that is in an academic organization and also in practice, in all levels of organizations.	Antosova and Csikosova, (2011), p.135	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
149	**Knowledge management expects** and at the same time use the ability of people to gain, share and develop the **knowledge**, this way **creating added value reflecting in performance** and qualitative characteristics, increasing the value of a final product for a customer.	Antosova and Csikosova, (2011), p.139	Quantitative	KM	KM-IC-TR KM_IC-KR KM-IC-HRM KM_IC-OP-FS	IC as a Proxy for KM Performance
150	The **two components of KM** in Integrated Circuit (IC) industry are **intangible assets and the knowledge creation mechanism**.	Huang (2011), p.1	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
151	A company wishing to **stay competitive** in a treacherous business environment, therefore, has to ensure **satisfying KM both inside and outside the organization** while **bolstering organizational performance by accumulating intellectual capital**.	Huang (2011), p.1	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
152	Chiao-Ven Huang (2009) said the structural models of national defense R&D institutes and R&D teams at private-run high-tech companies both registered **positive relationship between KM and intellectual capital, and intellectual capital and organizational performance**. Meanwhile, KM exerts an indirect influence on organizational performance through the causal relations among elements of intellectual capital.	Huang (2011), p.9	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
153	Shu-Fang Zhang (2010) indicated **positive correlations among all dimensions of KM, intellectual capital** and **organizational innovation**	Huang (2011), p.9	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
154	**Because knowledge was in human individuals** and it **could not be created without people**, the aim of the company was to develop and manage those people.	Paula and Volna (2011), p.498	Quantitative	KM	KM-IC-HRM KM-IC-KR	IC as a Proxy for KM Performance
155	**Human capital** became the center of **knowledge management** while the **distribution of knowledge** among organization's employees was considered as **its main activity**.	Paula and Volna (2011), p.498	Quantitative	KM	KM-IC-HRM KM-IC-KR	IC as a Proxy for KM Performance
156	**Human capital representing the knowledge source** of the company and the **object of knowledge management** has been later completed with **other components of intellectual capital,** namely with **organizational and relational capital**.	Paula and Volna (2011), p.499	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
157	Individual items of knowledge are always oriented towards something outside the person and therefore **the object of knowledge management has been broadened to all parts of intellectual capital** (Mouritsen & Larsen, 2005).	Paula and Volna (2011), p.499	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance

158	In contrast, later evolution understands the employees explicitly in the context of other elements of intellectual capital **and the knowledge management is understood as measurement, reporting and analyzing of intellectual capital**.	Paula and Volna (2011), p.499	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
159	The **importance of knowledge management** in company's development **lies mainly in maximal use of the entire intellectual property** of the company in main firm's value forming processes and its development for future needs.	Paula and Volna (2011), p.500	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
160	**Knowledge management processes** definitely need **not only knowledge from inside** the organization, but **as well from outside** the company, recognized by **the concept of intellectual capital as relational capital**.	Paula and Volna (2011), p.503	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-RCM	IC as a Proxy for KM Performance
161	**Both knowledge management and intellectual capital** tend to **manage knowledge assets** towards **creating values for better achieving of strategic goals** of organization.	Paula and Volna (2011), p.503	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
162	**While knowledge management brings theoretical and practical framework of setting and realizing knowledge initiatives** throughout all of defined areas of internal and external environment, **intellectual capital on the other hand gives the structure needed for proper evaluation and visualization of indicator** which will be **used for measurement of knowledge management initiatives** and **gained results**.	Paula and Volna (2011), p.503	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
163	The analysis revealed **three patterns of relationships between KM and IC**: **one-way influence from KM to IC** (e.g. knowledge application influences each of human capital, organizational capital, and relational capital; **one-way influence from IC to KM** (e.g. human capital influences knowledge acquisition and knowledge transfer); and **two-way influence between KM and IC** (e.g. between knowledge documentation and organizational capital, between knowledge transfer and relational capital).	Seleim & Khalil (2011), p.586	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-SCM KM-IC-RCM MICAKMP	IC as a Proxy for KM Performance
164	**Knowledge management (KM) and intellectual capital (IC) movement are rooted in the contemporary management schools of thought.** The essence of these schools of thought is that a **firm's ability to develop, use, and benefit from its knowledge** and intellect through learning is the **only source of sustainable competitive advantages**.	Seleim & Khalil (2011), p.587	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
165	In addition, **KM and IC are believed to influence each other**, and **the relationship between the two constructs** is of **vital importance to organizational effectiveness** (Shih et al., 2010; Rastogi, 2000; Zhou and Fink, 2003).	Seleim & Khalil (2011), p.587	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
166	Ramirez et al. (2007) view **IC management and KM as a set of managerial activities** aiming at **identifying and valuing the knowledge assets** of an organization as well as **leveraging these**	Seleim & Khalil (2011), p.590	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance

	assets through the creation and sharing of new knowledge.					
167	When **KM activities are used to develop and maintain IC**, it becomes a **resource of sustainable competitive advantage** (Seleim and Khalil, 2007). On the other hand, when **IC is properly utilized and exploited**, it increases the absorptive capacity of the organization, which, in turn, **facilitates its KM processes**.	Seleim & Khalil (2011), p.590	Quantitative	KM	KM-IC-TR KM-IC-OP-FS MICAKMP	IC as a Proxy for KM Performance
168	Conceivably, the socialization, externalization, combination, and internalization **(SECI) model** (Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998) is a **more fitting theoretical foundation for understanding the KM-IC relationship**.	Seleim & Khalil (2011), p.590	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
169	Huss (2004) explains that the **IC components (e.g. HC, OC and RC)** represent the **input for the knowledge creation process in the SECI model**, and its **main output takes the form of commercially exploitable intangibles**.	Seleim & Khalil (2011), p.590	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
170	The literature provides further support to the **SECI-based argument for a KM-IC relationship**. Marr et al. (2003) argue that **KM is a fundamental activity for growing and sustaining IC** in organizations.	Seleim & Khalil (2011), p.591	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
171	Bontis (1999) posits that **managing organizational knowledge** encompasses two related issues: **organizational learning flows and intellectual capital stocks**. O**rganizational learning, as a part of KM** (Rastogi, 2000), reflects the management's effort to **managing knowledge and ensures that IC is continually developed, accumulated, and exploited**.	Seleim & Khalil (2011), p.591	Quantitative	KM	KM-IC-TR CICGKMI MICAKMP	IC as a Proxy for KM Performance
172	KM encompasses dynamic means of organizational learning, innovation, competencies, expertise, and capability, which evolve toward the development of an organization's IC (Rastogi, 2000). As such, **the goal of KM is to build and exploit IC effectively**.	Seleim & Khalil (2011), p.591	Quantitative	KM	KM-IC-TR CICGKMI MICAKMP	IC as a Proxy for KM Performance
173	Huss (2004) adds that **IC is accumulated from the daily decisions and experiences** that took place in work processes, instructions, and forms, **which all constitute different KM mechanisms**. On the other hand, **HC, OC, and RC enable organizations to form, develop, and manage knowledge** (Van Buren, 1999; Wu and Tsai, 2005).	Seleim & Khalil (2011), p.591	Quantitative	KM	KM-IC-TR MICAKMP KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
174	In this context organizations are **recognizing the importance of managing all of their resources particularly their human resource** which is considered key driver of the innovation of any organization.	Kianto et al. (2014), p.364	Quantitative	KM	KM-IC-TR KM-IC-OP-FS KM-IC-HRM	IC as a Proxy for KM Performance
175	While the first focuses on **intangible resources that contribute to value creation** (e.g. Edvinsson and Malone, 1997; Sullivan, 1998; Spender et al., 2013), typically **in terms of human, structural and relational capital assets** governed by an organization (e.g. Bontis, 2001; Guthrie, 2001), the latter concentrates on the	Kianto et al. (2014), p.364	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance

	knowledge-related processes and management activities in firms (e.g. Gold et al., 2001; Lee and Choi, 2003; Heisig, 2010).					
176	In this paper, it is suggested that **IC could be examined from static perspective** – i.e. as a raw material for organizational value creation, especially when **simultaneously coupled with the analysis of the organizational processes** that help to **create that value**. Here, these processes are **called KM practices**.	Kianto et al. (2014), p.364	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
177	**KM practices refer to the aspects of the organization** that can be manipulated and controlled by conscious and intentional management activities (Foss and Michailova, 2009; Andreeva and Kianto, 2012). Accordingly, they are c**onceptualized in this study as the set of management activities that enable the firm to deliver value from its IC**.	Kianto et al. (2014), p.365	Quantitative	KM	KM-IC-TR KM-IC-OP-FS MICAKMP	IC as a Proxy for KM Performance
178	In this study a conceptual and theoretical suggestion that **IC and KM practices** could be **coupled** in the same analysis was put forward, **combining both static and dynamic aspects of knowledge-based value creation**. This means **treating IC assets as static** (in one point of time) and **KM practices as processes that provide the dynamism over time**.	Kianto et al. (2014), p.365	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-OP-FS MICAKMP	IC as a Proxy for KM Performance
179	To conceptually **analyze organizational value creation with both static and dynamic perspectives**, several possibilities concerning **the nature of interaction between IC assets and KM practices** are overviewed.	Kianto et al. (2014), p.365	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
180	TKogut and Zander (1992) propose that **value creation through innovation** takes place when **various types of existing knowledge is KMcombined to generate new applications**, and thereby it is the **capabilities for combining knowledge** that **produce and replenish the IC** assets of a firm. This can be – and has been – **interpreted** in various ways **in terms of the nature of interaction between IC assets and KM practices**.	Kianto et al. (2014), p.366	Quantitative	KM	KM-IC-TR KM-IC-KR MICAKMP	IC as a Proxy for KM Performance
181	The **intellectual capital identification and evaluation**, as well as **company's performance measurement** in terms of **value-added of the intellectual capital** is one of the **principal issues in the knowledge management**.	Shakina and Bykova (2011), p.917	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for KM Performance
182	Several researches, **analyzing the intellectual capital in terms of knowledge management implementation**, are trying to catch a connection between indirect characteristics of intellectual capital and performance of a company.	Shakina and Bykova (2011), p.918	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
183	The **ability to enhance effectiveness of others resources including tangible assets** is the **key feature** of **intellectual capital. Knowledge management provides the whole range of tools for the effective use of intangibles**.	Shakina and Bykova (2011), p.918	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
184	**A validity of intellectual capital proxy indicators use was proved**. Specifically, we could **obtain the information on** some	Shakina and Bykova (2011), p.918	Quantitative	KM	KM-IC-TR MICAKMP	IC as a Proxy for

	company's **internal factors of knowledge management** using **publicly available data**. Many of the selected indicators showed high significance in the specified models and are obviously interpreted in terms of theory and practice of knowledge management.					KM Performance
185	In addition, at the same year Ruggles (in Mathi, 2004) pointed out that **factors such as people, process and technology** should be taken under consideration **in knowledge management implementation**, **focusing mainly in people** and then **following process and technology**.	Theriou e6t al. (2011), p.101	Quantitative	KM	KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
186	In short, **in a knowledge-based economy**, if an enterprise **has adept knowledge management**, an **increasing accumulation of intellectual capital**, and is **able to improve organizational performance**, **it can master competition** of the future.	Chien (2015), p.50	Quantitative	KM	KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
187	The **operational definition of** this study concerning **knowledge management** is drawn from the **four modes of the spiral of knowledge theory** of Nonaka and Takeuchi (1995): (1) Socialization; (2) Externalization; (3) Combination and (4) Internalization.	Chien (2015), p.51	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
188	**KM and IC share a more static view of knowledge**, while OL is primarily interested in the changes in knowledge.	Vera and Crossan (2012), p.9	Quantitative	KM	KM-IC-TR KM-IC-KR	IC as a Proxy for KM Performance
189	The **knowledge management infrastructures** are the mechanism for the organization to **develop its knowledge** and also **stimulate the creation of knowledge** within the organization as well as **the sharing and protection of it**.	Zaired et al. (2012), p.28	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-SCM MICAKMP	IC as a Proxy for KM Performance
190	Many researchers discussed the **knowledge management infrastructure capabilities** through the following elements: **technology; structure**; culture and **human resources** as shown in Table 1.	Zaired et al. (2012), p.32	Quantitative	KM	KM-IC-TR KM-IC-KR KM-IC-HRM KM-IC-SCM	IC as a Proxy for KM Performance
191	Moreover, Results of correlation analysis showed that there is **a significant positive relationship between indicators of the IC (human, structural and relational) and KM**.	Shahpasand et al. (2013), p.321	Quantitative	KM	KM-IC-TR KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
192	**Intellectual capital** can be viewed as **a mix of human capital, structural capital and customer capital**.	Riahi-Belkaoui, (2003), p.217	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-RCM	IC as a Proxy for KM Performance
193	The **operational dimension of KM** includes **the set of organizational and managerial activities and projects** such as teamwork, meetings, benchmarking of best practices, community of practice, etc. These activities are **about the usage and development of intellectual capital**.	Carlluci et al. (2004), p.582	Quantitative	KM	KM-IC-TR	IC as a Proxy for KM Performance
194	Therefore, the **cognitive nature of organizational competencies** allows us to	Carlluci et al. (2004), p.587	Quantitative	KM	KM-IC-KR	IC as a Proxy for

	state that their improvement takes place through KM and that **KM is at the heart of business performance improvement and value creation**.				KM-IC-OP-FS	KM Performance
195	**Knowledge management (KM) and organizational performance** are believed to be essential of the success in business. The different results in literatures which declare **KM affects organizational performance positively**.	Liao and Wu, 2009, p.64	Quantitative	KM	KM-IC-OP-FS	IC as a Proxy for KM Performance
196	The current knowledge-based economy has led to the **literature emphasizing knowledge management** (KM) and **intellectual capital** (IC) as **major sources of competitive advantage**.	Hsu & Sabherwal, 2012, p. 489	Quantitative	KM-IC	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
197	**KM and IC** are distinct, but **conceptually interrelated, concepts**. Whereas KM in firms has been defined as doing what is needed to get the most out of knowledge resources, including both explicit and tacit knowledge, IC captures "the sum of all knowledge firms utilized for competitive advantage".	Hsu & Sabherwal, 2012, p. 489	Quantitative	KM-IC	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
198	The **literature on KM and IC share the same broad objective**: **understanding the role of knowledge and its management in firm success and competitiveness**. The literature on IC examines the nature of organizational knowledge and its different types, and also how they affect firm performance, whereas the KM literature deals with the processes and practices for managing IC.	Hsu & Sabherwal, 2012, p. 489	Quantitative	KM-IC	KM-IC-KR KM-IC-TR KM-IC-OP-FS	IC as a Proxy for KM Performance
199	Based on the IC-based theory developed by Reed et al. (2006) which consider the **IC as the sole strategic asset of firms** that play the crucial role in creating and maintaining firms` competitive advantage, we expect **IC as well as its components to be positively associated with banks' organizational financial performance**.	Al-Musali & Ku Ismail, 2014, p.202	Quantitative	IC	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
200	However**, the association between R&D expenditure efficiency (RDE) and the companies' operating, financial, and stock market performance is positively significant** in Taiwan semiconductor industry.	Chang & Hsieh, 2011, p.8	Quantitative	IC	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
201	Among the components of intellectual capital, **human capital efficiency (HCE) is the only factor that positively contributes to banking industry performance**. That could be related to the service-focused line of business that banking is in.	Djamil et al., 2013, p.182	Quantitative	IC	KM-IC-KR KM-IC-OP-FS	IC as a Proxy for KM Performance
202	Stewart (1997) defined **intellectual capital as the total stocks of the collective knowledge,** information, technologies, intellectual property rights, experience, organization learning and competence, team communication systems, customer relations, and brands that are able to create values for a firm.	Kalkan et al., 2014, p.701	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance
203	**Intellectual capital (IC) is recognized as a strategic asset which gives competitive advantages by driving organizations for superior performance** in the modern day knowledge-based economies.	Kehelwalatenna and Premaratne, 2012, p. 1	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance

204	Moreover the World Bank (2004) has highlighted that the Sri Lankan government's investments to maintain a skilled labor force and high literacy rate. **This again justifies the importance given to the human capital by the country whereas human capital is also a major component of IC**.	Kehelwalatenna and Premaratne, 2012, p. 2	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance
205	A proof demonstrating that **IC has positive impact on market value, productivity and profitability** is given by approximately 67 per cent of the reviewed studies (Table I).	Morariu, 2014, p.394	Quantitative	IC	KM-IC-KR	IC as a Proxy for KM Performance
206	**Intellectual capital** is the **most significant organizational asset in the knowledge-based economy** and **organizational success** will be **based on the strategic management of knowledge** rather than the strategic allocation of physical and financial resources.	Hudgins (2014), p.2	Quantitative	IC	KM-IC-KR KM-IC-TR	IC as a Proxy for KM Performance
207	**Intellectual capital and its components** including human capital and structural capital **plays essential role in corporate performance and influences on the economic performance** (Murthy & Mouritsen, 2011).	Piri et al. (2014), p.985	Quantitative	IC	KM-IC-HRM KM-IC-SCM KM-IC-OP-FS	IC as a Proxy for KM Performance
208	**Intellectual Capital** is a **unique resource that not all companies can emulate**. This is what makes the **Intellectual Capital as a key resource for the company to create value added** that will be achieved **competitive advantage** that companies are able to compete and survive in the business environment.	Trisnowati and Fadah (2014), p.2	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance
209	Najibullah (2005) conducted a study on the relationship between intellectual capital and the company's financial performance on bank listed on the Dhaka Stock Exchange in Bangladesh. The study showed that **there was a strong relationship between intellectual capital and company performance and market value** of the company.	Trisnowati and Fadah (2014), p.4	Quantitative	IC	KM-IC-OP-FS	IC as a Proxy for KM Performance

References

Agbim, K. C., Orarewo, G. O., & Owutuamor, Z. B. (2013). The Impact of knowledge management capabilities on organizational performance: A survey of the service sector. *Journal of Business Management and Social Sciences Research, 2*(9), 61 – 67.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and innovation: An inverted-U relationship. *Quarterly Journal of Economics, 120*(2), 701 – 728.

Aghion, P., Braun, M., & Fedderke, J. (2008). Competition and productivity growth in South Africa. *Economics of Transition, 16*(4), 741 – 768.

Ahmed, A.S.S. and Omar, E.M.K. (2011). Understanding the knowledge management-intellectual capital relationship: a two-way analysis. *Journal of Intellectual Capital, 12*(4), 586 – 614.

Ahonen, G., & Hussi, T. (2002). Managing intangible assets – a question of integration and delicate balance. *Journal of Intellectual Capital, 3*(3), 277-286.

Ahuvia, A. (2001). Traditional, interpretive, and reception based content analyses: Improving the ability of content analysis to address issues of pragmatic and theoretical Concern. *Social Indicators Research, 54*(2), 139 – 172.

Akhavan, P., Hosnavi, R., Ramezan, M., & Zahedi, M. R. (2014). Examining the business performance model based on the intellectual capital approach in an Iranian industrial town. *International Journal of Current Life Sciences, 4*(11), 10404 – 10412.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly, 25*(1), 107-136.

Al-Musali, M., & Ku Ismail, K. (2014). Intellectual capital and its effect on financial performance of banks: Evidence from Saudi Arabia. *Procedia - Social and Behavioral Sciences, 164*(2014), 201 – 207.

Al-Shubiri, F. N. (2013). The Impact of Value Added Intellectual Coefficient Components on Financial Health. *Review of International Comparative Management, 14*(3), 459 – 472.

Andone, I. (2009). Measuring the Performance of Corporate Knowledge Management Systems. *Informatica Economica, 13*(4), 24 – 31.

Andreeva, T., & Kianto, A. (2012). Does knowledge management really matter? Linking knowledge management practices, competitiveness and economic performance. *Journal of Knowledge Management, 16*(4), 617 – 636.

Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science, 22*(5), 1123-1137.

AWPA (Australian Workforce and Productivity Agency) (2013). Human capital and productivity: Literature review. Retrieved from https://docs.education.gov.au/system/files/doc/other/human-capital-and-productivity-literature-review-march-2013.pdf.

Bagwell, K. (2005). *The economic analysis of advertising*. Retrieved from https://ideas.repec.org/h/eee/indchp/3-28.html.

Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management, 17*(1), 99-120.

Baskerville, R., & Dulipovici, A. (2006). The theoretical foundations of knowledge management. *Knowledge Management Research and Practice, 2006*(4), 83 – 105.

Becker, G.S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. New York, NY: Columbia University Press.

Belleflamme, P. & Peitz, M. (2009). *Advertising and marketing strategies*. Cambridge, UK: Cambridge University Press.

Berawi, M. A. (2004). Quality revolution: Leading the innovation and competitive advantages. *International Journal of Quality & Reliability Management, 21*(4), 425 – 438.

Berge, B. L. (2001). *Qualitative research methods for the social sciences* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Berzkalnea, I., & Zelgalve, E. (2014). Intellectual capital and company value. *Procedia - Social and Behavioral Sciences, 110*(2014), 887 – 896.

Blundell, R., Griffith, R., & Reenen, J. V. (1999). Market share, market value and innovation in a panel of British manufacturing firms. *Review of Economic Studies, 66*, 529 – 554.

Bogner, W., & Bansal, P. (2007). Knowledge Management as the Basis of Sustained High Performance. *Journal of Management Studies, 44*(1). 165 – 188.

Bollen, K. A. (1989). *Structural equations with latent variables*. New York, NY: John Wiley & Sons

Bontis, N. (1996). There is a price on your head: managing intellectual capital strategically. *Business Quarterly, 60*(4), 40-7.

Bontis, N. (1998). Intellectual capital: an exploratory study that develops measures and models. *Management Decision, 36*(2), 63-76.

Bontis, N. (1999). Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field. International Journal of Technology Management, 18(5/6/7/8) 433-462.

Bontis, N. (2001). Assessing knowledge assets: a review of the models used to measure intellectual capital. *International Journal of Management Review, 3*(1), 41-60.

Bontis, N. (2002). *World congress of intellectual capital readings*. Boston, MA: Butterworth-Heinemann-KMCI Press.

Bontis, N. (2004). *IC what you see: Canada's intellectual capital performance, working slides*. Retrieved from http://www.business.mcmaster.ca/mktg/nbontis//ic/publications/CanadaIC.ppt.

Bontis, N., Chua, W., & Richardson, S. (2000). Intellectual capital and the nature of business in Malaysia. *Journal of Intellectual Capital, 1*(1), 85-100.

Bontis, N., & Serenko, A. (2009). A follow-up ranking of academic journals. *Journal of Knowledge Management, 13*(1), 16-26.

Braganza, A., Edwards, C., & Lambert, R. (1999). A taxonomy of knowledge projects to underpin organizational innovation and competitiveness. *Knowledge and Process Management, 6*(2), 83 – 90.

Bramhandkar, A., Erickson, S. and Applebee, I. (2007). Intellectual capital and organizational performance: an empirical study of the pharmaceutical industry. *The Electronic Journal of Knowledge Management, 5*(4), 357-362. Retrieved from www.ejkm.com.

Brooking, A. (1996). Intellectual Capital. London: Cengage Learning EMEA,

Carrillo, P., Robinson, H., Anumba, C., & Al-Ghassani, A. (2003). IMPaKT: A framework for linking knowledge management to business performance. *Electronic Journal of Knowledge Management, 1*(1), 1 – 12.

Chan, K.H. (2009a). Impact of intellectual capital on organizational performance: an empirical study of companies in the Hang Seng Index (Part 1). *The Learning Organization, 16*(1), 4-21.

Chan, K.H. (2009b). Impact of intellectual capital on organizational performance: an empirical study of companies in the Hang Seng Index (Part 2). *The Learning Organization, 16*(1), 22-39.

Chang, C., & Chuang, S. H. (2009). Performance effects of knowledge management: Corporate management characteristics and competitive strategy enablers. *Asian Journal of Management and Humanity Sciences, 4*(4), 181 – 199.

Chang, W.S., & Hsieh, J.J. (2011a). Intellectual capital and value creation – is innovation capital a missing link? *International Journal of Business and Management, 6*(2), 1-12.

Chang, W.S. and Hsieh, J.J. (2011b). The dynamics of intellectual capital in organizational development. *African Journal of Business Management, 5*(6), 2345-2355.

Chang, C.M., & Lee, Y.J. (2012). Verification of the Influences of Intellectual Capital upon Organizational Performance of Taiwan-listed Info-Electronics Companies with Capital Structure as the Moderator. *Journal of International Management Studies, 7*(1), 80-92.

Chen, M. Y., & Chen, A. P. (2006). Knowledge management performance evaluation: A decade review from 1995 to 2004. *Journal of Information Science, 32*(1), 15–36.

Chen, M.C., Cheng, S. and Hwang, Y. (2005). An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *Journal of Intellectual Capital, 6*(2), 159-176.

Chen, M.Y., Huang, M.J., & Cheng, Y.C. (2009). Measuring knowledge management performance using a competitive perspective: An empirical study. *Science Direct – Experts Systems with Applications, 36*(4), 8449 – 8459.

Chien, Y.C. (2015). The influences of knowledge management on organizational performance of Taiwan-Listed IC design houses: Using intellectual capital as the mediator. *The Journal of International Management Studies, 10*(1).

Chiucchi, M.S. (2013). Measuring and reporting IC: lessons learned from an interventionist research project. *Journal of Intellectual Capital, 14*(3), 395 – 413.

Choi, B., Poon, S. K., & Davis, J. G. (2008). Effects of knowledge management strategy on organizational performance: a complementarity theory-based approach. *Omega, 36*, 235 – 251.

Chong, C. W., Holden, T., Wilhelmij, P., & Schmidt, R. A. (2000). Where does knowledge management add value? *Journal of Intellectual Capital, 1*(4), 366 – 380.

Choudhury, J. (2010). Performance impact of intellectual capital: a study of Indian IT sector. *International Journal of Business and Management, 5*(9), 72-80.

Chuang, S. (2004). A resource based perspective on knowledge management capability and competitive advantage: An empirical investigation. *Expert Systems with Application, 27*(3), 459 – 465.

Clarke, M., Seng, D. and Whiting, R.H. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital, 12*(4), 505-30.

Clerides, S. (2012). Competition, Productivity and Competitiveness: Theory, Evidence, and an Agenda for Cyprus. *Cyprus Economic Policy Review, 6*(2), 81 – 88.

CMA (Competition and Markets Authority) (2015). *Productivity and competition: A summary of evidence*. Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/443448/Productivity_and_competition_report.pdf.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20*(1), 37 – 46.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd Ed.) Thousand Oaks, CA: Sage Publications, Inc.

Crook, R., Todd, S., Combs, J., Woehr, D., & Ketchen, D. (2011). Does human capital matter? A meta-analysis of the relationship between human capital and firm performance. *Journal of Applied Psychology, 96*(3), 443 – 456.

Daou, A., Karuranga, E., & Su, Z. (2014). Towards a better understanding of intellectual capital in Mexican SMEs. Journal of Intellectual Capital, 15(2), 316-332.

Deep, R., & Narwal, K. P. (2014). Intellectual capital and its association with financial performance: A study of Indian textile sector. *International Journal of Management & Business Research, 4*(1), 43 – 54.

Djamil, A. B., Razafindrambinina, D., & Tandeans, C. (2013). The impact of intellectual capital on a firm's stock return: Evidence from Indonesia. *Journal of Business Studies Quarterly, 5*(2), 176 – 183.

Drucker, P.F. (1959). Challenges to management science. *Long Range Planning, 5*(2), 238-249.

Drucker, P.F. (1993). The rise of the knowledge society. *Wilson Quarterly, 17*(2), 52-70.

Drucker, P.F. (1999). Knowledge-worker productivity: the biggest challenge. *California Management Review, 41(*2), 79-94.

Dumay, J., & Garanina, T. (2013). Intellectual capital research: a critical examination of the third stage. Journal of Intellectual Capital, 14(1), 10 – 25.

Edvinsson, L. (1997). Developing intellectual capital at Skandia. *Long range planning, 30*(3), 366-373.

Edvinsson, L., & Malone, M.S. (1997). *Intellectual Capital – Realizing Your Company's True Value by Finding its Hidden Roots*. New York, NY: Harper Business.

Egger, M., Smith, G. D., Phillips, A. N. (1997). Meta-Analysis: Principles and Procedures. *BMJ: British Mediacla Journal, 315*(7121), 1533 – 1537.

Fathi, S., Farafmand, S., & Khorasani, M. (2013). Impact of intellectual capital on financial performance. *International Journal of Academic Research in Economics and Management Sciences, 2*(1), 6 – 17.

Fazlagic, A. (2010). Measuring the intellectual capital of a university. In *Proceedings of the Conference on Trends in the management of human resources in higher education, 2010*. Retrieved from http://www.oecd.org/edu/imhe/35322785.pdf.

Feng, K., Chen, E., & Liou, W. (2004). Implementation of knowledge management systems and firm performance: an empirical investigation. *The Journal of Computer Information Systems, 45*(2) 92 – 104.

Field, A. P, & Gillett, R. (2010). How to do a meta-analysis. *British Journal of Mathematical and Statistical Psychology, 63*(3), 665 – 694.

FijalKowska, J. (2008). Management and communication of the companies' knowledge - guidelines for intellectual capital statement. *Journal of Systems, Cybernetics, and Informatics, 6*(2), 42 – 47.

Filieri, R., & Alguezaui, S. (2014). Structural social capital and innovation. Is knowledge transfer the missing link? *Journal of Knowledge Management, 18*(4).

Fink, A. (2005). *Conducting research literature reviews: From the Internet to paper* (2nd ed.). Thousand Oaks, CA: Sage.

Firer, S., & Williams, S. M. (2003). Intellectual capital and traditional measures of corporate performance. *Journal of Intellectual Capital, 4*(3), 348-360.

Firer, S. and Stainbank, L. (2003). Testing the relationship between intellectual capital and a company's performance: evidence from South Africa. *Meditari Accountancy Research, 11*(1), 25-44.

Fitz-enz, J. (2000). *The ROI of Human Capital*. New York, NY: Amacom.

Gamerschlag, R. (2013). Value relevance of human capital information. *Journal of Intellectual Capital, 14*(2), 325-345.

Ghaffar, A. & Khan, W. A. (2014). Impact of research and development on firm performance. *International Journal of Accounting and Financial Reporting, 4*(1), 357 – 367.

Ghosh, S. and Mondal, A. (2009). Indian software and pharmaceutical sector intellectual capital and financial performance. *Journal of Intellectual Capital, 10*(3), 369-388.

Gigante, G., & Previati, D. (2011). A Knowledge Oriented Approach to the Investigation of Italian Banks Performances. *International Journal of Economics and Finance, 3*(5), 12 – 23.

Goh, P.K. (2005). Intellectual capital performance of commercial banks in Malaysia. *Journal of Intellectual Capital, 6*(3), 385-396.

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185-214.

Grant, R. M. (1996a). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science, 7*(4), 375-387.

Grant, R. M. (1996b). Towards A knowledge-based theory of the firm. *Strategic Management Journal, 17*(winter special issue), 109-122.

Grant, R.M., & Baden-Fuller, C. (2004). A knowledge-accessing theory of strategic alliances. *Journal of Management Studies, 41*(1), 61-84.

Green, S. (1991). How many subjects does it take to do a regression analysis? *Multivariate Behavioral Research, 26*(3), 499 – 510.

Gruian, C.M. (2011). The Influence of Intellectual Capital on Romanian Companies' Financial Performance. *Annales Universitatis Apulensis Series Oeconomica, 13*(2), 260 – 272.

Hair, J., Hult, G., Ringle, C., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Los Angeles, CA: Sage.

Han, Y., & Li. D. (2015). Effects of intellectual capital on innovative performance: The role of knowledge-based dynamic capability. *Journal of Knowledge Management, 53*(1), 40 – 56.

Handy, C.B. (1989). *The Age of Unreason*. London, GB: Arrow Books.

Harlow, H. (2012). Fifty-plus years on and the question remains: Why do we still not have a theory of tacit knowledge? In *Proceedings of the 13th European Conference on Knowledge Management*, Universidad Politécnica de Cartagena, Spain, 6-7 September 2012.

Hashemnia, S., Naseri, S., & Mozdabadi, S. (2014). A strategic review the impact of intellectual capital components on organizational performance in sepah bank branches throughout Tehran province. *Journal of Educational and Management Studies, 3*(4), 46 – 56.

Heisig, P. (2009). Harmonisation of knowledge management – comparing 160 KM frameworks around the globe. *Journal of Knowledge Management, 13*(4), 4 – 31.

Holsapple, C. W., & Singh, M. (2001). The knowledge chain model: Activities for competitiveness. *Expert Systems with Applications, 20*(1), 77 – 98.

Holsapple, C. W., & K. D. Joshi., K. D. (2004). A formal knowledge management ontology: Conduct, activities, resources, and influences. *Journal of American Society of Information Science Technology 55*(7), 593 – 612.

Holsapple, C. W., & Jones, K. (2005). Exploring secondary activities of the knowledge chain. *Knowledge and Process Management, 12*(1), 3 – 31.

Holsapple, C. W. and Wu, J. (2011). An elusive antecedent of superior firm performance: The knowledge management factor. *Decision Support Systems, 52*(1), 271 – 283.

Holsapple, C. W., & Wu, J. (2013). Does Knowledge Management Matter? The Empirical Evidence from Market-Based Valuation. *ACM Transactions on Management Information Systems, 4*(2), 1 – 23.

Holme, T. J. (2010). Competition and productivity: A review of evidence. Retrieved from https://mobile.minneapolisfed.org/research/sr/sr439.pdf.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6*(1), 53 – 60.

Hox, J., & Bechger, T. M. (1998). Introduction to structural equation modeling. *Family Science Review, 11*, 354 – 373.

Huang, C. (2009). Knowledge sharing and group cohesiveness on performance: An empirical study of technology R&D teams in Taiwan. *Technovation, 29*(11), 786-797.

Huang, C.L. (2011). The influence of knowledge management implementation on organizational performance at Taiwan-listed integrated circuit companies: Using intellectual capital as the mediator. *Journal of Business Management, 7*(2), 1 – 17.

Huang, C. F., & Hsueh, S. L. (2010). A study on the relationship between intellectual capital and business performance in the engineering consulting industry: A path analysis. *Journal of Civil Engineering and Management, XIII*(4), 265 – 171.

Hudgins, M. R. (2014). The Impact of Intellectual Capital on the Performance of U.S. Property-Casualty Insurance Companies. *Business and Economics Journals, 5*(4), 1 – 6.

Hui, H., Radzi, C., Kheirollahpour, H., & Radu, S. (2013). Impact of Knowledge Management and Organizational Learning on Different Dimensions of Organizational Performance: A Case Study of Asian Food Industry. *Interdisciplinary Journal of Contemporary Research in Business, 5*(3), 148 – 154.

Ibrahim, F., & Reid, V. (2010). What is the value of knowledge management practices? *The Electronic Journal of Knowledge Management, 7*(5), 576 – 574.

Idre, UCLA (2015). How can I perform the likelihood ratio, Wald, and Lagrange multiplier (score) test in Stata? Retrieved from http://www.ats.ucla.edu/stat/stata/faq/nested_tests.htm.

Jardon, C., & Martos, M. (2013). Intellectual capital as competitive advantage in emerging clusters in Latin America. *Journal of Intellectual Capital, 14*(3), 462 – 481.

Jasour, J., Shagagi, F., & Rezazadeh, S. (2013). Impact of intellectual capital on financial performance in the pharmaceutical industry in Iran. *International Journal of Accounting and Economics Studies, 1*(1), 1-8.

Jenatabadi, H. S. (2012). An overview of path analysis: Mediation analysis concept in structural equation modeling. Retrieved from https://arxiv.org/ftp/arxiv/papers/1504/1504.03441.pdf.

Joshi, M., Cahill, D., Sidhu, J., & Kansal, M. (2013). Intellectual capital and financial performance: an evaluation of the Australian financial sector. *Journal of Intellectual Capital, 14*(2), 264 – 285.

Kalkan, A., Bozkurt, O., & Arman, M. (2014). The impacts of intellectual capital, innovation and organizational strategy on firm performance. In *Proceedings of the 10th International Strategic Management Conference*. doi: 10.1016/j.sbspro.2014.09.025.

Kamath, G.B. (2008). Intellectual capital and corporate performance in Indian pharmaceutical industry. Journal of Intellectual Capital, 9(4), 684-704.

Kankanhalli, A., & Tan, B. (2008). Knowledge management metrics: A review and directions for future research. In *Knowledge Management: Concepts, Methodologies, Tools, and Applications* (pp. 3409 – 3420). doi: 10.4018/978-1-59904-933-5.ch282. Retrieved from http://www.igi-global.com/chapter/knowledge-management-metrics/25353#abstract.

Kapyla, J., Kujansivu, P., & Lonnqvist, A. (2012). National intellectual capital performance: a strategic approach. *Journal of Intellectual Capital, 13*(3), 343 – 362.

Kase, R., Paauwe, J., & Zupan, N. (2009). HR practices, interpersonal relations, and intrafirm knowledge transfer in knowledge-intensive firms: A social network perspective. *Human Resource Management, 48*(4), 615-639.

Kaufmann, L., & Schneider, Y. (2004). Intangibles: a synthesis of current research. *Journal of Intellectual Capital, 5*(3), 366-388.

Kaya, F., Sahin, G., & Gurson, P. (2010). Intellectual capital in organizations. *Problems and Perspectives in Management, 8*(1), 153 – 160.

Kehelwalatenna, S., & Premaratne, G. (2012). *An Empirical Investigation on Intellectual Capital Performance: Evidence from Banking Sector*. Retrieved from http://ssrn.com/abstract=2157813.

Khalifa, M., Yu, A., & Shen, K. (2008). Knowledge management systems success: a contingency perspective. *Journal of Knowledge Management, 12*(1), 119 – 133.

Khalique, M., Bontis, N., Shaari, J., & Isa, A. (2015). Intellectual capital in small and medium enterprises in Pakistan. *Journal of Intellectual Capital, 16*(1), 224 – 238.

Khanhossini, D., Nikoonesbati, M., KHeire, H., & Moazez, E. (2013). *Investigating of relationship between intellectual capital and financial performance in MAPNA group companies*. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2216638.

Kharal, M., Zia-ur-Rehman, M., Abrar, M., Khan, M., Kharal, M. (2014). Intellectual Capital & Firm Performance: An Empirical Study on the Oil & Gas Sector of Pakistan. *International Journal of Accounting and Financial Reporting, 4*(1), 238 – 261.

Kianto, A., Andreeva, T., & Pavlov, Y. (2013). The impact of intellectual capital management on company competitiveness and financial performance. *Knowledge Management Research and Practice, 11*(2013), 112 – 122.

Kianto, A., Ritala, P., Spender, J., & Vanhala, M. (2014). The interaction of intellectual capital assets and knowledge management practices in organizational value creation. *Journal of Intellectual capital, 15*(3), 362 – 375.

Kiessling, T., Richey, R. G., Meng, J., & Dabic, M. (2009). Exploring knowledge management to organizational performance outcomes in a transitional economy. *Journal of world business, 44*(4), 421 – 433.

Kline, R. B. (2011). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: The Guilford Press.

Klock, M., & Megna, P. (2000). Measuring and valuing intangible capital in the wireless communications industry. The Quarterly Review of Economics and Finance, 40(4), 519–532.

Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science, 3*(3), 383-397.

Komnenic, B., & Pokrajcic, D. (2012). Intellectual capital and corporate performance of MNCs in Serbia. *Journal of Intellectual Capital, 13*(1), 106-119.

Krippendorff, K. (1989). *Content analysis*. Retrieved from http://repository.upenn.edu/asc_papers/226

Kujansivu, P. and Lonnqvist, A. (2007). Investigating the value and efficiency of intellectual capital. *Journal of Intellectual Capital, 8*(2), 272-287.

Kweh, Q., Chan, Y., & Ting, I (2013). Measuring intellectual capital efficiency in the Malaysian software sector. *Journal of Intellectual Capital, 14*(2), 310-324.

Labra, R., & Sánchez, P. (2013). National intellectual capital assessment models: a literature review. *Journal of Intellectual Capital, 14*(4), 582 – 607.

Larson, D. & Morling, A. (2015). The Causal Relationship between Human Capital & Stock Performance - A quantitative study on the Stockholm Stock Exchange. Retrieved from http://www.diva-portal.org/smash/get/diva2:827710/FULLTEXT01.pdf.

Lee, H., & Choi, B. (2003). Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination. *Journal of Management Information Systems, 20*(1), 179 – 228.

Lentjushenkovaa, O., & Lapinab, I. (2014). The classification of the intellectual capital investments of an enterprise. In *Proceedings of the 19th International Scientific Conference; Economics and Management 2014, ICEM 2014*, 23-25 April 2014, Riga, Latvia.

Lev, B. (2001). *Intangibles: Management, Measurement, and Reporting*. Washington, DC: Brookings Institution Press.

Levy, Y. & Ellis, T.J. (2006). A Systems approach to conduct an effective literature review in support of information systems research. *Informing Science Journal, 9*, 181-212.

Liao, S.H., & Wu, C.C. (2009). The Relationship among knowledge management, organizational learning, and organizational performance. *International Journal of Business and Management, 4*(4), 64 – 76.

Libo, F., Xin, Y., & Su, W. (2011).*Research on the relationship between intellectual capital and company performance - An empirical analysis based on panel data*. Retrieved from http://www.seiofbluemountain.com/upload/product/201108/2011gszlhy04a8.pdf.

Liebowitz, J. (2005). Developing metrics for determining knowledge management success: A fuzzy logic approach. *Issues in Information Systems, 6*(2), 36 – 42.

Lin, C, Y., & Edvinsson, L. (2010). What National Intellectual Capital Indices Can Tell About the Global Economic Crisis of 2007-2009? *Electronic Journal of Knowledge Management, 8*(2), 253 – 266.

Loehlin, J. C. (1992). Latent variable models: An introduction to factor, path and structural analysis (2nd Ed.). New Jersey: Hillsadale.

Lostumbo, N. & Sengupta, A. (2013). *The long-term effects of advertising expenditures: Examining the evidence*. Retrieved from http://www.pwc.com/us/en/tax-services/publications/advertising-expenditures-impact-transfer-pricing.html.

Maditinos, D., Chatzoudes, D., Tsairidis, C. and Theriou, G. (2011). The impact of intellectual capital on firms' market value and financial performance. *Journal of Intellectual Capital, 12*(1), 132-151.

Mahapa, M. (2013). Impact of Knowledge Management Strategies on Organizational Performance in the Hospitality Industry of Zimbabwe. *Public Administration Research, 2*(1), 76 – 83.

Mahoney, J. & Pandian, R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal, 13*(5), 363 – 380.

Majeed, Y., Khalid, Z., Irfan, M., & Khan, M. A. (2013). The impact of knowledge management on organizational performance. *Far East Journal of Psychology and Business, 11*(2), 37 – 47.

Maltz, A. C., Shenhar, A. J., & Reilly, R. R. (2003). Beyond the balanced scorecard: Refining the search for organizational success measures. *Long Range Planning, 36*(2), 187- 20.

Mankiw, N.G., Romer, D., & Weil, D.N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics, 107*(2), 407 – 437.

Marr, B., Gray, D., & Schiuma, G. (2004). Measuring intellectual capital – what, why, and how. In Bourne, M. (Ed.), *Handbook of Performance Measurement* (pp. 369-411). London, England: Gee.

Martin, J. A. (2016). *The 10 biggest startup opportunities in 2016*. Retrieved from http://www.cio.com/article/3019718/startups/the-10-biggest-startup-opportunities-in-2016.html.

Massingham, P. (2014a). An evaluation of knowledge management tools: Part 1 – Managing knowledge management. *Journal of Knowledge Management, 18*(6), 1075 – 1100.

Mayo, A. (2001). *The Value of the Enterprise: Valuing People as Assets – Monitoring, Measuring, Managing*. London, GB: Nicholas Brealey Publishing.

McEvily, S. K., & Chakravarthy. (2002). The persistence of knowledge-based advantage: An empirical test for product performance and technological knowledge. *Strategic Management Journal, 23*(4), 285 – 305.

Meek, G., & Gray, S. (1988). The value added statement: an innovation for US companies? *Accounting Horizons, 2*(2), 73 – 81.

Mehralian, G., Rajabzadeh, A., Sadeh, M.R. and Rasekh, H.R. (2012). Intellectual capital and corporate performance in Iranian pharmaceutical industry. *Journal of Intellectual Capital, 13*(1), 138-158.

Mehri, M., Umar, M.S., Saeidi, P., Hekmat, R.K., & Naslmosavi, S. (2013). Intellectual Capital and Firm Performance of High Intangible Intensive Industries: Malaysia Evidence. *Asian Social Science, 9*(9), 146 – 154.

Mention, A. L. (2012). Intellectual Capital, Innovation and Performance: a Systematic Review of the Literature. *Business and Economic Research, 2*(1), 1 – 37.

Mention, A., & Bontis, N. (2013). Intellectual capital and performance within the banking sector of Luxembourg and Belgium. *Journal of Intellectual Capital, 14*(2), 286 – 309.

Mertler, C., & Vannatta, R. (2013). *Advanced and multivariate statistical methods*. Glendale, CA: Pyrczak Publishing.

Miller, D. (2002). Knowledge inventories and managerial myopia. *Strategic Management Journal, 23*(8), 689 – 706.

Mills, A. M., & Smith, T. A. (2011). Knowledge management and organizational performance: a decomposed view. *Journal of Knowledge Management, 15*(1), 156 – 171.

Mincer, J. (1958). Investment in human capital and personal income distribution. *Journal of Political Economy, 66*(4), 281 – 302.

Mithas, S., Tafti, A., Bardhan, I, & Goh, J. M. (2012). Information technology and firm profitability: Mechanism and empirical evidence. *MIS Quaterly, 36*(1), 205 – 224.

Moballeghi, M., & Moghaddam, G. G. (2011). Knowledge management and measuring its impact on organizational performance. In *Proceedings of the 2011 International Conference on Financial Management and Economics*, 2011, Singapore.

Molodchik, M., Shakina, E., & Barajas, A. (2014). Metrics for the Elements of Intellectual Capital in an Economy driven by Knowledge. *Journal of Intellectual Capital, 15*(2), 206-226.

Mondal, A., & Ghosh, S. (2012). Intellectual capital and financial performance of Indian banks. *Journal of Intellectual Capital, 13*(4), 515 – 530.

Morariu, C. (2014). Intellectual capital performance in the case of Romanian public companies. *Journal of Intellectual Capital, 15*(3), 392 – 410.

Mosteller, F. & Wallace, D. (1963). Inference in an authorship problem. *Journal of the American Statistical Association, 58*(302), 275 – 309.

Mosavi, S. A., Nekoueizadeh, S. & Ghaedi, M. (2012). A study of relations between intellectual capital components, market value and finance performance. *African Journal of Business Management, 6*(4), 1396 – 1403.

Muhammad, N., & Ismail, A. (2009). Intellectual capital efficiency and firms' performance: study on Malaysian financial sectors. *International Journal of Economics and Finance, 1*(2), 206-12.

Myung, I. J. (2003). Tutorial on maximum likelihood estimation. *Journal of Mathematical Psychology, 47*(2003), 90 – 100.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital and the organizational advantage. *Academy of Management Review, 23*(2), 242-266.

Narasimha, S. (2001). Salience of knowledge in a strategic theory of the firm. *Journal of Intellectual Capital, 2*(3), 215 – 224.

Nelson, R.R. (1991). How do firms differ and how does it matter? *Strategic Management Journal 12*(Special Issue), 61 – 74.

Nemati, S., Jalilian, H. R., & Akbari, P. (2013). Investigate the relationship between intellectual capital and company performance (Dairy Industry of Kermanshah Province). *Scientific Journal of Pure and Applied Sciences, 2*(12), 379 – 385.

Neuendorf, K.A. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage Publications Ltd.

Newbert, S. (2007). Empirical research on the resource-based view of the firm: An assessment and suggestions for future research. *Strategic Management Journal, 28*(2), 121 – 146.

Newsom (2015). Nested Models, Model Modifications, and Correlated Errors. Retrieved from http://www.upa.pdx.edu/IOA/newsom/semclass/ho_nested.pdf.

Ngah, R., & Ibrahim, A. R. (2010). *The effect of knowledge sharing on organizational performance in small and medium enterprises.* Paper presented at the Proceedings of the 5th International Conference on Knowledge Management: Theory, Research & Practice.

Nickell, S. (1996). Competition and Corporate Performance. *Journal of Political Economy, 104*(4), 724 – 746.

Nickerson, J.A., & Zenger, T.R. (2004). A knowledge-based theory of the firm - the problem- solving perspective. *Organisation Science, 15(6)*, 1-16.

Nienhüser, W. (2008). Resource dependence theory - How well does it explain behavior of organizations? *Management Revue*, 9 – 32.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14-37.

Nour, A. N. I., Sharabati, A. A. A., & Shamari, N. S. (2013). The impact of intellectual capital on Jordanian telecommunication companies' business performance. *American Academic & Scholarly Research Journal, 5*(3), 32 – 46.

OECD (1997). *Small business, job creation and growth: Facts, obstacles, and best practices*. Retrieved from https://www.oecd.org/cfe/smes/2090740.pdf.

O' Leary, D. (2002). Technologies of knowledge storage and assimilation. In Holsapple, C.W, (Eds). *Handbook on Knowledge Management: Knowledge Directions* (pp. 29 – 46). Heidelberg, Germany: Springler-Verlag.

Ozga, S. A. (1960). Imperfect Markets Through Lack of Knowledge. *Quarterly Journal of Economics*, 74, 29 - 52.

Pal, K., and Soriya, S. (2012). IC performance of Indian pharmaceutical and textile industry. *Journal of Intellectual Capital, 12*(1), 120-137.

Palich, L.E., Carini, G.R., & Seaman, S.L. (2000). The impact of internationalization on the diversification-performance relationship: A replication and extension of prior research. *Journal of Business Research, 48*(1), 43 – 54.

Pastuszak, Z., Chuacharoen, S., Tong-In, D., Anussornnitisarn, P., Meeanpol, S., & Shyu, S. H. P. (2013). Performance of intellectual capital among Thailand's publicly listed companies. *International Journal of Innovation and Learning, 14*, 241 – 253. http://dx.doi.org/10.1504/IJIL.2013.055526.

Patton, J. R. (2007). Metrics for knowledge-based project organizations. *S. A. M. Advanced Management Journal, 72*(1), 33 – 43.

Penrose, E.T. (1959). *The Theory of the Growth of the Firm*. New York, NY: John Wiley & Sons.

Pension, K., Nyasha, M., Sheiller, M. & Vhuramai, C. (2013). Impact of knowledge management on organizational performance: A case study of Grain Marketing Board (GMB). *Greener Journal of Business and management Studies, 3*(6), 270 – 278.

Peteraf, M.A. (1993). The cornerstone of competitive advantage: a resource-based view. *Strategic Management Journal, 14*(3), 179-191.

Petrash, G. (1996). Dow's journey to a knowledge value management culture. *European Management Journal, 14*(4), 365 – 373.

Piri, P., Alghyanib, M. Y., Sadaghianic, S. B., & Nejad, S. A. H. (2014). A study on the effects of intellectual capital efficiency on economic performance. *Management Science Letters, 4*(2014) 985 – 992.

Porter, M. (1985). *Competitive Advantage*. New York: NY: Free Press.

Pong, C., & Mitchell, F. (2005). Accounting for a disappearance: a contribution to the history of the value added statement in the UK. *The Accounting Historians Journal, 32*(2), 173 – 199.

Pouraghajan, A., Ramezani, A. & Mohammadzadeh, S. (2013). Impact of Intellectual Capital on Market Value and Firms' Financial Performance: Evidences from Tehran Stock Exchange. *Engineers Press, 12*(1), 197 – 208.

Pucar, S. (2012). The influence of intellectual capital on export performance. *Journal of Intellectual Capital, 13*(2), 248-261.

Pulic, A. (1998). *Measuring the performance of intellectual potential in knowledge economy*. Retrieved from http://www.vaic-on.net/download/Papers/Measuring%20the%20Performance%20of%20Intellectual%20Potential.pdf.

Pulic, A. (2000). *An accounting tool for IC management*. Retrieved from http://www.vaicon.net

Pulic, A. (2000), *MVA and VAIC™, Analysis of Randomly Selected Companies from FTSE 250*. Austrian IC Research Center, Graz and London.

Pulic, A. (2008). *The principles of intellectual capital efficiency – A brief description*. Retrieved from http://www.cik-hr.com/data/principles_2008.pdf.

Ragab, M., & Arisha, A. (2013). Knowledge management and measurement: a critical review. *Journal of Knowledge Management, 17*(6), 873 – 901.

Ramirez, Y., & Gordillo, S. (2013). Recognition and measurement of intellectual capital in Spanish universities. *Journal of Intellectual Capital, 15*(1), 173 – 188.

Rasula, J., Vuksic, V. B., Stemberger, M. I. (2012). The impact of knowledge management on organizational performance. *Economic and Business Review, 14(*2), 147 – 168.

Reed, K. K., Lubatkin, M., & Srinivasan, N. (2006). Proposing and testing an intellectual capital-based view of the firm. *Journal of Management Studies, 43*(4), 867-893.

Rehman, W., Rheman, C. A., Rehman, H., & Zahid, A. (2011). Intellectual capital performance and its impact on corporate performance: An empirical evidence from Modaraba sector of Pakistan. *Australian Journal of Business and Management Research, 1*(5), 8 – 16.

Reinartz, W., Haenlein, M., & Henseler, J. (2009). An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in marketing, 26*, 332 – 344.

Riffe, D., Lacy, S., & Fico, F. (2005). *Analyze media messages: Using quantitative content analysis in research*. Mahwah, NJ: Taylor & Francis.

Rigdon, E. (1996). Model Comparison in SEM. Retrieved from http://www2.gsu.edu/~mkteer/nested.html.

Roos, G., & Roos, J. (1997). Measuring your company's intellectual performance. *Long Range Planning, 30*(3), 413-26.

Rose, S., Spinks. N. & Canhoto, A. I. (2015). *Management research: Applying the principles*. New York, NY: Routledge.

Rowe, B., & Widener, S. (2011). Where performance measurement and knowledge management meet: Evaluating and managing corporate knowledge. *Journal of Accounting and Finance, 11*(2), 91 – 106.

Rusly, F., Sun, P., & Corner, J. (2014). The impact of change readiness on the knowledge sharing process for professional service firms. *Journal of Knowledge Management, 18*(4).

Russo, M. W. (2007). How to Review a Meta-analysis? *Gastroenterol Hepatol, 3*(8), 637 – 642.

Salmaninezhad, R., & Daneshvar, M. (2012). Relationship Analysis between Intellectual Capital and Knowledge Management (Case study - Tehran Science & Technology Park). *Interdisciplinary Journal of Contemporary Research in Business, 3*(10), 135 – 143.

Sarmadi, S. (2013). Investigating of relationship between intellectual capital and financial performance of Petrochemical Companies listed in Tehran Stock Exchange. Social Science Research Network. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2251620.

Scarborough, H., Swan, J., & Preston, J., (1999). *Knowledge management: A literature review*. Institute of personnel and development: London, England.

Schultz, T.W. (1961). Investment in human capital. *The American Economic Review, 51*(1), 1 – 17.

Sekaran, U., & Bougie, R. (2009). *Research methods for business: A skill building approach* (5 ed.). West Sussex, UK: John Wiley & Sons Ltd.

Semdergaard, S., Kerr, M., & Clegg, C. (2007). Sharing knowledge: contextualizing socio-technical thinking and practice. *Learning Organization, 14*(5), 423-35.

Seleim, A., & Khalil, O (2011). Understanding the knowledge management-intellectual capital relationship: a two-way analysis. *Journal of Intellectual Capital, 12*(4), 596 – 614.

Senior, N. W. (1836). An outline of the science of political economy. London, England: Longman. In P. Quintas, P. Lefrere, G. Jones, *Knowledge management: A strategic agenda*. Long Range Planning, 30(3), 386.

Shakina, E., & Bykova, A. (2011). Intellectual capital evaluation: Relationship between knowledge management implementation and company's performance. In *Proceedings of the 12th European Conference on Knowledge Management*, University of Passau, Germany, 1-2 September 2011.

Shang, S. S. C., Lin, S. L., & Wu, Y. L. (2009). Service innovation through dynamic knowledge management. *Industrial Management & Data Systems, 109*(3), 322 – 337.

Sharabati, A., Jawad, S., & Bontis, N. (2010). Intellectual capital and business performance in the pharmaceutical sector of Jordan. *Management Decision, 48*(1), 105 – 131.

Shih, K., Chang, C., & Lin, B. (2010). Assessing knowledge creation and intellectual capital in banking industry. *Journal of Intellectual Capital, 11*(1), 74-89.

Shil, C., Chen, W., Morrison, M. (2010). The impact of intellectual capital on business performance in Taiwanese design industry. *Journal of Knowledge Management Practice, 11*(1), 1 – 19.

Shiu, H. (2006). Application of the VAIC method to measures of corporate performance: a quantile regression approach", Journal of American Academy of Business, Vol. 8 No. 2, pp. 156-160.

Singh, R., and Gupta, M., (2014). Knowledge management in teams: empirical integration and development of a scale. *Journal of Knowledge Management, 18*(4).

Slavkovic, M., & Bbic, V. (2013). Knowledge management, innovativeness, and organizational performance: Evidence from Serbia. *Economic Annals, LVIII*(199), 85 – 107.

Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. London, UK: Strahan and Cadell.

Smith, S. (2013). Determining sample size: How to ensure you get the correct sample size. Retrieved from https://www.qualtrics.com/blog/determining-sample-size/.

Spender, J.C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic Management Journal, 17*, 45 – 62.

Spender, J.C. and Grant, R.M. (1996). Knowledge and the firm: overview. *Strategic Management Journal, 17*(Winter), 5-9.

Stahle, P. (2014). *National Intellectual Capital as an Economic Driver – Perspectives on Identification and Measurement*. Retrieved from http://www.stahle.fi/National_Intellectual_Capital_as_an_Economic_Driver_200408_final.pdf

Stahle, P., Stahle, S., & Aho, S. (2011). Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital, 12*(4), 531-551.

Staples, D. S., & Webster, J. (2008). Exploring the effects of trust, task interdependence and virtualness on knowledge sharing in teams. *Information Systems Journal, 18*(6), 617-640.

Statistics and Scientific Computation, UT Austin (2001). *Structural equation modeling using AMOS: An introduction*. Retrieved from https://stat.utexas.edu/images/SSC/Site/AMOS_Tutorial.pdf.

Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation, 7*(17). Retrieved from http://pareonline.net/getvn.asp?v=7&n=17.

Stevens, J. (2001). *Applied multivariate statistics for the social sciences* (4th ed.). Hilldales, NJ: Laurence Erlbaum Associates.

Stewart, T. (1991). Brainpower: How intellectual capital is becoming America's most valuable asset. *Fortune*, June 3 1991, 44 – 60.

Stewart, T. (1994). Your company's most valuable asset: intellectual capital. *Fortune*, October 3 1994, 68 – 74.

Stewart, T. (1997). *Intellectual capital: The wealth of organizations*. New York, NY: Nicholas Brealey Publishing, Business Digest.

Stigler, G. J. (1961). The Economics of Information. *Journal of Political Economy*, 69, 213 – 225.

Suhr, D. (2010). Step your way through path analysis. Retrieved from http://www.wuss.org/proceedings08/08WUSS%20Proceedings/papers/pos/pos04.pdf.

Suraj, O., & Bontis, N. (2012). Managing intellectual capital in Nigerian telecommunications companies. *Journal of Intellectual Capital, 13*(2), 262 – 282.

Svanadze, S., & Kowalewska, M. (2015). The measurement of intellectual capital by VAIC method – example of WIG20. *Online Journal of Applied Knowledge Management, 3*(2), 36 – 44.

Sveiby, K. E. (2010). Methods for Measuring Intangible Assets. Retrieved from http://www.sveiby.com/articles/IntangibleMethods.htm.

Sydler, R., Haefliger, S. & Pruksa, R. (2014). Measuring intellectual capital with financial figures: can we predict firm profitability? *European Management Journal, 32*(2), 244-259.

Tabachnick, B.G. and Fidell, L.S. (2007). *Using Multivariate Statistics* (5th Ed.). Boston, MA: Allyn & Bacon.

Tan, H.P., Plowman, D. and Hancock, P. (2007). Intellectual capital and financial returns of companies. *Journal of Intellectual Capital, 8*(1), 76-95.

Tan, L. P., & Wong, K. Y. (2014). Development of Knowledge Management Measurement Metrics and Their Importance in Performance Measurement. In *Proceedings of the 11th International Conference on Intellectual Capital, Knowledge Management and Organizational Learning*, Sydney, Australia, 6-7 November 2014.

Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multi-business firms. *MIS Quarterly, 29*(2), 311 – 334.

Telser, L. G. (1964). Advertising and Competition. *Journal of Political Economy*, 72, 537 – 562.

The University of Texas at Austin (2012). *Structural equation modeling using AMOS – An introduction*. Retrieved from https://stat.utexas.edu/images/SSC/Site/AMOS_Tutorial.pdf.

Theriou, N., Maditinos, D., & Theriou, G (2011). Knowledge management enabler factors and firm performance: An empirical research of the Greek medium and large firms. *European Research Studies, 14*(20, 97 – 133.

Ting, I.W.K. and Lean, H.H. (2009). Intellectual capital performance of financial institutions in Malaysia. *Journal of Intellectual Capital, 10*(4), 588-599.

Trisnowati, Y., & Fadah, I. (2014). *The Impact of intellectual capital on bank's market value and financial performance in Indonesia Stock Exchange*. Retrieved from http://ssrn.com/abstract=2408325.

Tseng, C., & James, Y. (2005). Intellectual capital and corporate value in an emerging economy: empirical study of Taiwanese manufacturers. *R&D Management, 35*(2), 187-201.

Tubigi, M., Alshawi, S., & Alshawi, H. (2013). Impact of Knowledge Management Processes on Organisational Performance; a Preliminary Study. In *Proceedings of the European, Mediterranean & Middle Eastern Conference on Information Systems 2013* (EMCIS2013) October 17-18 2013, Windsor, United Kingdom

Uadiale, O. M., & Uwuigbe, U. (2011). Intellectual capital and business performance: Evidence from Nigeria. *Interdisciplinary Journal of Research in Business, 1*(10), 49 – 56.

UCDHSC (2006). *Structural equation modeling with AMOS 5.0*. Retrieved from http://www.ucdenver.edu/academics/colleges/nursing/Documents/PDF/HowToUseAMOS5.pdf.

Verona,G., & Ravasi, D. (2003). Unbundling dynamic capabilities: An exploratory study of continuous product innovation. *Industrial and Corporate Change, 12*(3), 577 – 606.

Viera, A. J., & Garrett, J. M. (2005). *Understanding inter-observer agreement: The kappa statistic*. Retrieved from http://www.stfm.org/Portals/49/Documents/FMPDF/FamilyMedicineVol37Issue5Viera360.pdf.

Vishnu, S., & Gupta, V. (2014). Intellectual capital and performance of pharmaceutical firms in India. *Journal of Intellectual Capital, 15*(1), 83 – 99.

Volkel, M., & Haller, H. (2009). Conceptual data structures for personal knowledge management. *Online Information Review, 33*(2), 298 – 315.

Vorhies, D. W., & Neil, A. M. (2005). Benchmarking marketing capabilities for sustainable competitive advantage. *Journal of Marketing, 69*(January), 80 – 94.

Wang, J. (2008). Investigating market value and intellectual capital for S&P 500. *Journal of Intellectual Capital, 9*(4), 546-63.

Wang, C. H. (2011). Clarifying the effects of R&D on performance: Evidence from the high technology industries. *Asia Pacific Management Review, 16*(1), 51 – 64.

Wang, M. (2011). Measuring intellectual capital and its effect on financial performance: evidence from the capital market in Taiwan. *Frontier of Business Research in China, 5*(2), 243-265.

Wang, Z., Wang, N., Liang, H. (2014). Knowledge sharing, intellectual capital and firm performance. *Management Decision, 52*(2), 230 – 258.

Weber, R. (1990). *Basic content analysis*. Thousand Oaks, CA: SAGE Publications Ltd.

Werner, C., & Schermelleh-Engel, K. (2010). *Deciding between competing models: Chi-Square difference tests*. Retrieved from http://www.psychologie.uzh.ch/dam/jcr:ffffffff-b371-2797-0000-00000fda8f29/chisquare_diff_en.pdf.

Wernerfelt, B. (1984). A resource-based view of the firm. Strategic Management Journal, 5(2), 171-180.

Weston, R., & Gore, P. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719 – 751.

Wiig, K.M. (1997). Integrating intellectual capital and knowledge management. *Long Range Planning, 30*(3), 399-405.

Witherspoon, C., Bergner, J., Cockrell, C.R., & Stone, D.N. (2013). Antecedents of Organizational Knowledge Sharing: A Meta-Analysis and Critique. Journal of Knowledge Management, 17(2), 7-7.

Wong, K. Y., & Aspinwall, E. (2004). Characterizing knowledge management in the small business environment. *Journal of Knowledge Management, 8*(3), 44-61.

WRDS (2016). *WRDS Compustat*. https://wrds-web.wharton.upenn.edu/wrds/index.cfm

Wu, M. F., Lee, Y. J., & Wang, G. L. (2012). To verify how intellectual capital affects organizational performance in listed Taiwan IC design companies with considering the moderator of corporate governance. *The journal of Global Business Management, 8*(1), 20 – 32.

Wuensch, K. L. (2016). Conducting a path analysis with SPSS/AMOS. Retrieved from http://core.ecu.edu/psyc/wuenschk/MV/SEM/Path-SPSS-AMOS.pdf.

Wyatt, A. (2008). What financial and non-financial Information on intangibles is value relevant? A review of the evidence. *Accounting and Business Research, 38*(3), 217 – 256.

Wysokinska, Z. (2003). Competitiveness and its relationship with productivity and sustainable development. *Fibers And Textiles In Eastern Europe, 11*(3), 11 – 14.

Xue, Q. L. (2007). *Statistics for psychosocial research II: Structural models*. Retrieved from http://ocw.jhsph.edu/courses/structuralmodels/PDFs/Lecture3.pdf.

Yasar, N. N., Isik, M., & Calisir, F. (2015). Intellectual capital efficiency: the case of football clubs. In *Proceedings of the 11th International Conference on Strategic Management*.

Yeganeh, M., Sharahi, B., Mohammadi, E., & Beigi, F. (2014). A Survey of the Relationship between Intellectual Capital and performance of the Private Insurance Companies of Iran. *Procedia – Social and Behavioral Sciences, 114*(February 21, 2104), 699 – 705.

Zack, M. (1999). Developing a knowledge strategy. *California Management Review, 41*(3), 125-145.

Zack, M., Mckeen, J., & Singh, S. (2009). Knowledge management and organizational performance: An exploratory analysis. *Journal of Knowledge Management, 13*(6), 392 – 409.

Zaied, A. N., Hussein, G. S., & Hassan, M. M. (2012). The Role of Knowledge Management in Enhancing Organizational Performance. *I.J. Information Engineering and Electronic Business, 5*(2012), 27 – 35.

Zeghal, D. and Maaloul, A. (2010). Analyzing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital, 11*(1), 39-60.

Zehri, C., Abdelbaki, A., & Bouabddellah, N. (2012). How intellectual capital affects firms' performance? *Australian Journal of Business and Management Research, 2*(8), 24 – 31.

Zhang, Y., & Wildemuth, B. M. (2008). *Qualitative analysis of content*. Retrieved from https://www.ischool.utexas.edu/~yanz/Content_analysis.pdf

Zingales, L. (2000). In search of new foundations. *The Journal of Finance, 55*(4), 1623 – 1653.

Zollo, M., & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science, 13*(3), 339 – 352.

Zurbriggen, E. (2009). Assessing fit. Retrieved from http://people.ucsc.edu/~zurbrigg/psy214b/09SEM5a.pdf.