6-2020

# The most influential component of intellectual capital components on the level of innovation among the faculty at Universities in Saudi Arabia

Reem Fihran A. ALSHEHRI

# THE MOST INFLUENTIAL COMPONENT OF INTELLECTUAL CAPITAL COMPONENTS ON THE LEVEL OF INNOVATION AMONG THE FACULTY AT UNIVERSITIES IN SAUDI ARABIA

ALSHEHRI, REEM FIHRAN A

SINGAPORE MNAGAMENT UNIVERSITY

2020

# The Most Influential Component of Intellectual Capital Components on The Level of Innovation Among the Faculty at Universities in Saudi Arabia

Alshehri, Reem Fihran A.

Submitted to Lee Kong Chian School of Business in partial fulfilment of the requirements for the Degree of Doctor of Innovation

Dissertation Committee:

Reddi KOTHA(Supervisor/Chair)
Associate Professor of Strategic Management
Singapore Management University

Shantanu BHATTACHARYA
Professor of Operations Management
Singapore Management University

CHEAH, Lai Yin Sarah
Associate Professor Management & Organisation
National University of Singapore

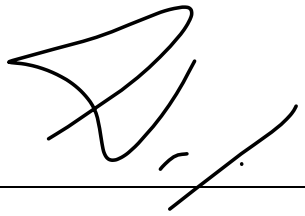
Singapore Management University

2020

I hereby declare that this Doctorate dissertation is my original work and it has been written by me in its entirety.

I have duly acknowledged all the sources of information which have been used in this dissertation.

This dissertation has also not been submitted for any degree in any university previously



Alshehri, Reem Fihran A. 12 June 2020

# THE MOST INFLUENTIAL COMPONENT OF INTELLECTUAL CAPITAL COMPONENTS ON THE LEVEL OF INNOVATION AMONG THE FACULTY AT UNIVERSITIES IN SAUDI ARABIA

Alshehri, Reem Fihran A

## Abstract

Intellectual Capital (IC) resources such as relational capital, structural capital and human capital are important factors for success in institutions. Evidence indicates that IC is significant in obtaining a competitive advantage. Current universities are slow to promote and encourage innovation despite the IC resources at their disposal. In Saudi Arabia, no study has investigated the impact of IC on the innovation level in the education context. The purpose of this study was to investigate the main influential factor of intellectual capital that leads to more innovation among faculty members in universities operating in Saudi Arabia. The study used a descriptive research design. A mixed method was adopted in the research. This included qualitative and quantitative methods. The study population comprised of the faculty members in Saudi Arabia universities. Primary data was collected via survey questionnaires and semi-structured interviews. Quantitative research data was used to measure the opinions in the responses provided by respondents surveyed. The independent variables were human capital, structural capital and social/relational capital. The moderator variables were government Intellectual Capital policies and financial support. The dependent variable was innovation level. Responses from interviews were analyzed qualitatively to help derive key patterns and themes regarding IC and innovation. The quantitative data collected was analyzed using Stata software. The statistical methods employed in the analysis were

descriptive statistics and regression analysis. Qualitative data was analysed using Nvivo 12. Based on the quantitative analysis, the study found that the level of intellectual capital affects the innovation level among faculty members. The government policies toward relational capital and the government policies toward structural capital are the most influential components. Additionally, the results from the qualitative analysis revealed that structural capital is the main factor of the Intellectual capital components that has a dominating influence in intellectual capital support. This study contributes to the IC literature, establishing a clear relationship between IC and university innovation level. The findings will help provide recommendations to decision-makers and research stakeholders to support intellectual capital efforts in universities.

## TABLE OF CONTENT

**ACKNOWLEDGEMENT**

I would like to acknowledge

My dear mother, and my deceased father, who died last June.

My husband (Mohammed) and My kids (Wesam & Sally)

My sisters, and brothers

My supportive supervisor (Prof. Reddi KOTHA)

My committee members (Prof. Shantanu BHATTACHARYA & Prof. Sarah CHEAH)

My government for the supporting

The former Saudi Arabian cultural attaché in Singapore (Dr Aimen Moumena)

The current Saudi Cultural attaché in Singapore (Dr Abdalaziz Alsaleh)

***

Thank you All for your Kind Hearts and Beautiful Minds.

***

Special thanks go to everyone in the ministry of education and Saudi universities who assisted me to access to collect the data.

# CHAPTER 1: INTRODUCTION

## 1.1 Overview of the research

The ability of humans to think separates them from other animal species in the world, given that humans can execute cognitive skills. Thinking is the trait where intellectual is used as part of the human evolutionary way to modernism. Maslow (1932) stipulates that human capacity to think results from emotional needs and wants. Furthermore, the author argues that through thinking, humans attempt to alleviate their fears.

To be an intelligent person, one needs to implement critical thinking, carry out many types of research to solve the problems that humans commonly face. And reflect on how intelligence impacts society (Jennings & Kemp-Welch, 1997). Research done by Auranen and Nieminen (2010) noted that many researchers define intellectual capital (IC) in several ways. Most of the scholars, however, agreed on the inclusion of intangible resources and activities in the definition. So, IC allows organisations to transform resources in their system and create investor value. According to the European Commission (2006) report, IC includes the organisation's human, organisational and relational activities and resources.

Figure 1.1 Relationship between Intellectual Capital, Information Technology and Organizational Culture (Manriquez, 2014).


Girard and Girard (2015) define knowledge management (KM) is as a pool of systematic methods organizations use to enhance the flow of knowledge and information for the right individuals at the suitable time. KM helps people in organizations act efficiently and effectively in producing organizational value. Worldwide, the innovation level has increased since the economic crisis witnessed in 2009. Innovation drives growth. Thus, most organizations make policy actions which promote efficient products in their research and development (R&D) departments.

It is generally known that due to the introduction of a modern economy based on knowledge, organizations often use tangible assets as the basis for competitive advantage (Chen & Chen, 2013). Thus, knowledge has helped some countries value their institution operations and maintain a competitive edge. This has, in turn, began to wear away the economic power of several states. Within the new economic era, IC resources such as customer relations, organization capital and human capital are essential factors for success in institutions. Furthermore, they are the essential components that are driving and sustaining competition, thereby creating more value.

In Saudi Arabia, the would-be of creating a competitive edge and long-term benefits rests on efficient management of IC as opposed to managing tangible assets. Saudi Arabia societies have undergone four socio-economic phases in history. The phases are a primitive society, an agricultural society, the industrial society and finally the information society. The country is presently undergoing the information society stage.

During the four eras, hierarchy and other factors of production (land, entrepreneurship, labour, natural resources and capital) have changed from a solitary enterprise to multi-enterprises. Before the information society era came into reality, more attention was placed on conventional factors such as labour, natural resources, entrepreneurship and capital. Presently, organizations pay consideration to other factors apart from the three mentioned factors. In this information society, organizations professionally process information: production, dissemination, use and adaptation (United Nations, 2016).

In the narrow viewpoint, Saudi Arabia citizens are more open to changes evident in the new economic model. In this new model, reliance on the oil-based economy is no longer considered as a sustainable method in maintaining the development drive of nations. The government has recognised that building its intellectual capacity (this has been a key government policy) is the best initiative to move away from an oil-based economy (Alghamdi, Wagih, Alzahrani, & Attia, 2016; Bakhsh, 2016). Capacity building, with regards to intellectual capacity, witnessed an upsurge in government funding, a pointer that the Saudi Arabia government is dedicated to establishing its intellectual capital as well as a talent pool. All these efforts relate to the two key economic aspects, survivability and sustainability.

Knowledge-based policies, including human and intellectual capital building, are built by creating various educational institutions and departments that meet the desires of the industrial and corporate sectors in Saudi Arabia. These policies now go beyond the talents of others to do routine tasks. This is apparent through the initiation of suitable policies, funding, and several incentives, both for individuals and organizations (Alghamdi et al., 2016).

Evidence shows that the Saudi Arabia government is dedicated to promoting an information society. For instance, Rasooldeen (2011), Minister of Commerce and Industry, Mr Abdullah Alireza, said that Saudi Arabia has to move away from being a gas station in the world to a refined laboratory of innovation, knowledge and excellence. He also added that the government's focus is on establishing intellectual capital, promote a knowledge-based economy and promote the continuation of the country's industrialization process.

Higher education institutions in Saudi Arabia play a crucial role in capacity building fixated on intellectual capital. Higher education institutions are there seeking to produce high quality and experts who can contribute their experience and knowledge in all fields (Pircher & Pausits, 2011). University education is therefore viewed as the body that is based on the direction and management of field experts in the specified areas, and later, refining students' talents and their knowledgeability (Chen & Chen, 2013).

Character building is in line with university education goals. Universities are responsible for building students' personalities, developing their abilities and helping them to justify and use all possibilities in rationalization, development and innovation efforts (Nashar, 1976). University

education in Saudi Arabia is considered as the highest education level (also called tertiary level). Students who complete the second stage of education eventually enroll for university education. At this level, most students often study for four to six years. The years extend in line with the type of specialization.

### 1.2 Problem Statement

With the responsibility of offering higher institutions of education, universities must have the best intellectual capital, exceeding the highest level of brilliance compared to other organizations (Fazlagic, 2005). Kok (2007) argue that they have to serve as knowledge-intensive organizations. The primary teaching and learning activities in these institutions signify knowledge transfer processes. Research is essential for knowledge generation. Disputatiously, taking into consideration these facts, the level of personal knowledge and intellectual capital should reach the maximum level.

Intellectual capital worth is derived from the current pool of developed academic minds, talents and research-oriented culture. In a Humboldt-style, research in universities plays an essential role in the creation of new knowledge (Fazlagic, 2005; Brătianu & Pînzaru, 2015; Leitner, 2011). Universities develop knowledge using a detailed system of values, philosophy and theory, which have substantial implications for the general public. What is more, through research, universities nurture the culture of creativity, progress and innovation to bring transformations to the community. This practice also relates to the context of higher education in Saudi Arabia (Alali, & Nikolaidis, 2015; Al-Musali & Ismail, 2014; Alalwany, Koshak, & Ibrahim, 2014; Bokhari, 2015;

Alghamdi, Wagih, Alzahrani, & Attia, 2015; Alghamdi, Wagih, Alzahrani, & Attia, 2016).

As stated earlier, universities are required to have a developed intellectual capital count. Up till now, the reality parodies this practice. Current universities are slow to promote and encourage innovation (Brătianu & Pînzaru, 2015; Fazlagic, 2005). Remarkably, business organizations such as consultancies and high-tech start-ups produce far greater knowledge with practical uses and innovation, up ahead of most universities (Fazlagic, 2005). Several universities are still gathering knowledge, storing it and passing it on because of lack of investment in modern research and innovation methods. Additionally, currently, generating new knowledge is not a part of the universities' mission. They solely focus on producing educated graduates without industry skills. Faculty, either in the position of professor or lecturer, only distribute knowledge or transfer skills to graduates. Research is not part of the duties given to the faculty members. Instead, it is an added alternative, where knowledge seems to be fixed.

In the prior economic eras, support toward creation of intellectual capital was sometimes repressed by university administrators and key policymakers because of lack of understanding in realizing the full prospective of the results generated from research activities and innovation-driven initiatives (Alsayadi & Algarni, 2017; Todericiu & Şerban, 2015; Hamdan, Buallay, & Alareeni, 2017). Nonetheless, with the commencement of the knowledge Economy (K-Economy), these philosophies have begun to change, though at a more sluggish pace than projected. Lack of administration support, especially in terms of financial and clear-cut innovation and research policy, has slowed down the

effort of building intellectual capital. This has accidentally affected the advancement towards a knowledge economy.

Unintentionally, universities' poor attitude to changes, adapting to the ever-progressing world of technology and quick expansion of knowledge has led to opacity in managing and administering core university functions (Fazlagic, 2005). For instance, instead of availing funding for research and development, universities channel the money meant for innovation other avenues. In most cases, funding for innovation is inadequate and thus cannot support a dynamic R&D and innovative environment.

Transparency with respect to resources spending, management and policy should be topmost priorities in current universities. Public institutions, such as those offering education, should be more transparent. In a knowledge-based society, citizens regularly demand continuous and comprehensive access to the information as soon as the government allocates public funds (Leitner, 2011; Alali, & Nikolaidis, 2015; Todericiu & Şerban, 2015). With suitable indicators and clear reporting techniques, universities can carry out transparent research (Fazlagic, 2015). Fazlagic also noted that universities could highlight mismanagement in universities with regards to the research findings given that there is a lack of intellectual capital policies.

Universities, especially in the context of Saudi Arabia, have the responsibility to accept the concerns about innovation policies fully. Since universities are deliberated as critical institutional actors in the national innovation systems (Zambon & Monciardini, 2015; Karchegani, Sofian, & Amin, 2006; Alalwany et al., 2014; Todericiu & Şerban, 2015), the government is trying to make them more similar, flexible, competitive and

transparent (Alghamdi et al., 2016; Alali, & Nikolaidis, 2015; Wagih, 2015). In a conventional understanding, today, the universities' image contradicts what the public expect them to be. Initially, the critical activities for most universities involved accumulating knowledge, safeguarding it and passing it forth for adoption by institutions and firms.

Intellectual capital is significant in obtaining a competitive advantage. Constantin (2009) reported that companies use IC to create value. Therefore, we are looking to explore and investigates what the most influential component of intellectual capital components on the level of innovation among faculty at universities in Saudi Arabia is. These components to be investigated as intellectual capital has been observed as a crucial aspect of intellectual capital. Intellectual capital measures serve as a competitive advantage to organisations in a world of scarce resources and increasing competition (Alali, & Nikolaidis, 2015; Al-Musali & Ismail, 2014; Todericiu & Şerban, 2015). Willpower, which the most prominent aspect of intellectual capital components, brings administrative, organisational and cultural changes and enables the planning and management of intangible resources to be consistent with the enterprise strategy adopted to create value (Todericiu & Şerban, 2015).

### 1.3 Research Objectives

This research proposes to examine the effect of intellectual capital on the innovation level in the education context. Specifically, the research investigates the main influence factor of intellectual capital that leads to more innovation among faculty members in universities operating Saudi Arabia. The findings will help provide recommendations to decision-makers to support intellectual capital efforts in universities, overcome the problems faced and

address their requirements to get the maximum amount of creativity and innovation which differentiate universities from other institutions and positively reflect on the revitalization of the knowledge status and how to raise its economy.

### 1.4 Research Question

Based on the objective highlighted, four research questions are formulated to better understand the relationship between intellectual capital and innovation in Saudi Arabia.

The research questions include:

a) Which is the main factor of intellectual capital components having the dominating influence on the innovation level support among faculty members?

b) Do Government Intellectual Capital policies of the intellectual capital (as moderate) impact on innovation level among faculty members?

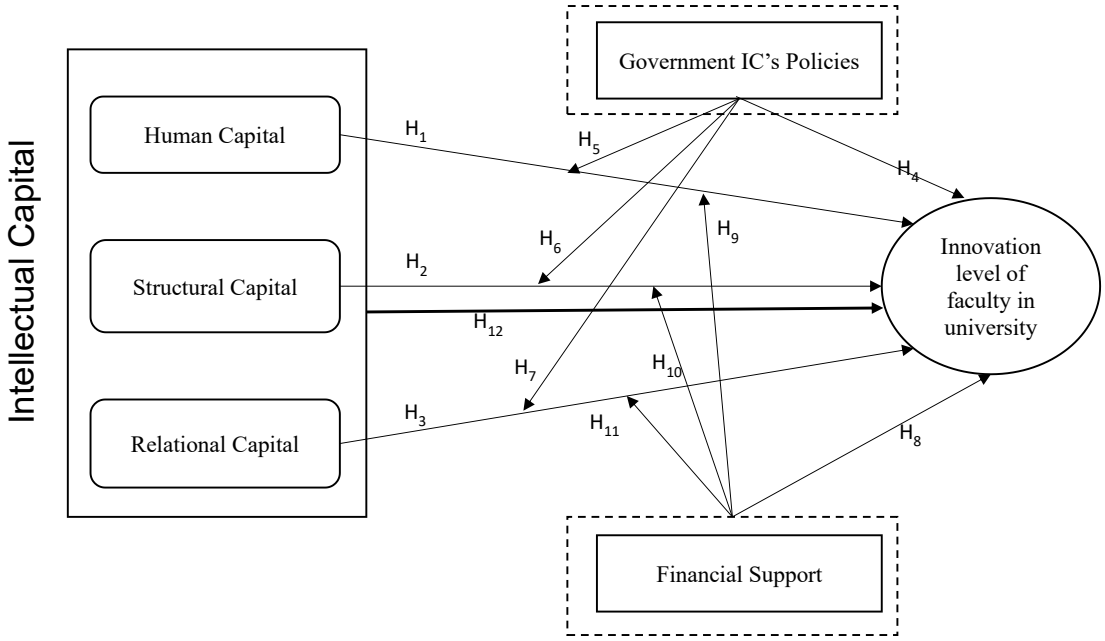
c) Does financial support of the intellectual capital (as moderate) impact on innovation level among faculty members?

d) Does the level of intellectual capital affect the innovation level among faculty members?

| RESEARCH OBJECTIVES | RESEARCH QUESTION | RESEARCH HYPOTHESES |
|---|---|---|
| To Investigate the contributory factor that leads to the support of intellectual capital toward innovation level among faculty in universities. | 1- Which is the main factor of intellectual capital components having the dominating influential on the innovation level support among faculty members? | $H_1$ Human Capital is the major factor affecting the intellectual capital toward innovation level among faculty.<br>$H_2$ Structural Capital is the major factor affecting the intellectual capital toward innovation level among faculty.<br>$H_3$ Relational Capital is the major factor affecting the intellectual capital toward innovation level among faculty. |
| | 2- Does Government Intellectual Capital policies of the intellectual capital (as moderate) impact on innovation level among faculty? | $H_4$ Government Intellectual Capital policies affect the innovation level among faculty.<br>$H_5$ Government Intellectual Capital policies affect the outcome of Human capital towards innovation level among faculty.<br>$H_6$ Government Intellectual Capital policies affect the outcome of Structural capital towards innovation level among faculty.<br>$H_7$ Government Intellectual Capital policies affects the outcome of Relational capital towards innovation level among faculty. |
| | 3- Does financial support of the intellectual capital (as moderate) impact on innovation level among faculty? | $H_8$ Financial support of Intellectual capital affects the innovation level among faculty.<br>$H_9$ Financial Support affects the outcome of Human capital towards innovation level among faculty.<br>$H_{10}$ Financial Support affects the outcome of Structural capital towards innovation level among faculty.<br>$H_{11}$ Financial Support affects the outcome of Relational capital towards innovation level among faculty |
| | 4- Does the level of intellectual capital affect the innovation level among faculty? | $H_{12}$ intellectual capital level is affecting by the Innovation level among faculty. |

Table 0.1 **Matrix of Objective, Research Questions and Hypotheses**

Figure 0.2 Proposed Conceptual Framework with Hypotheses




Conceptual Framework adapted from Wu & Sivaloganathan (2013), Cricelli, Greco, Grimaldi, & Dueñas (2018)

### 4.1.1 Importance of study

Currently, IC is significant and has top priority compared to other resources, particularly in the educational institutions. It stimulates competitive advantages, thus creating value for these institutions. IC concept was initially limited to for-profit enterprises. Nonetheless, public and non-profit organisations, including universities, started to pay attention to the idea given its significance in value creation. What is more, Ramírez, Tejada and Gordillo (2013) pointed out that universities have many objectives, comprising of production and distribution of knowledge, investment in industry research and human resources.

### 4.1.2 Novelty of the research

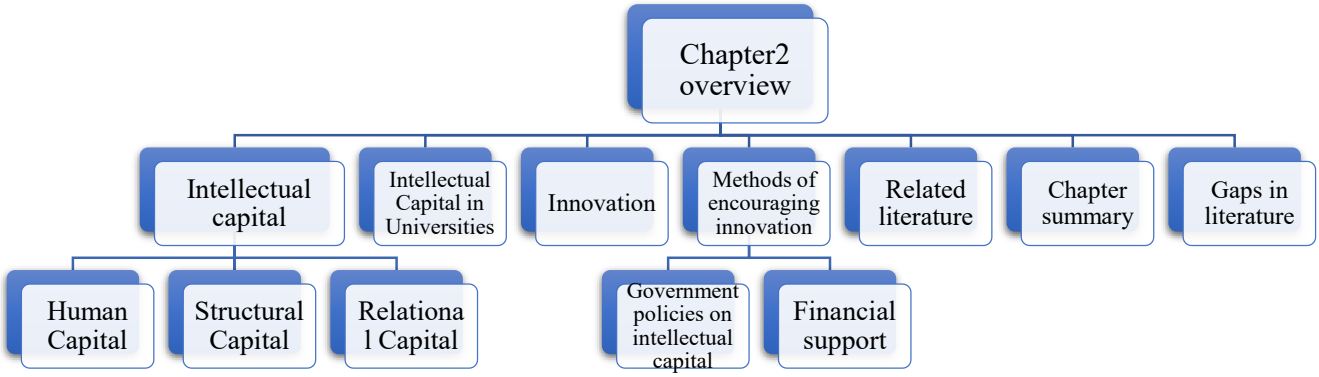
This study aimed to contribute to the IC literature in varied ways. First, the research gives insights into the findings of IC research in the Saudi Arabia context, which are scale, especially in tertiary education institutions. It measures IC effectiveness taking into account all sectors in the teaching and learning environment. Ultimately, it provides an accurate indication of the link between IC and university innovation level. Besides, the findings shown whether two moderating variables, financial support and government policies, moderate this relationship, a relationship that has not been sufficiently examined about this topic.

The study results can be generalised to other higher learning institutions within Saudi Arabia. The exploration techniques might be spread to other neighbouring countries. For instance, the result can demonstrate the state of oil-producing countries which have the same language, religion and a business landscape (e.g. Bahrain and Emarat and Kuwait). Finally, the study conclusions

will help university stakeholders, comprising of students, faculty members, decision-maker, policymakers and scholars to improve their attention of IC. And the implication of incorporating IC to grow their adaptation level. Moreover, it provide valuable discernment on how organisations can place their determinations and financial plans to ensure efficient and effective use of IC.

## CHAPTER 2: LITERATURE REVIEW

This chapter provides a discussion of the previous literature on intellectual capital and innovation in various sectors. The literature focuses on the dominant components of intellectual capital and the level of innovation among different participants. The main areas covered include intellectual capital, components of intellectual capital, innovation, intellectual capital and innovation and the related literature.



## 2.1 Intellectual capital

Recently, there is an increased interest of investigators in measuring human capital, whose effects on the results of organizations is not completely recognized in theoretical as well as empirical terms (Curado, Henriques & Bontis, 2011). Scholars have recognised intellectual capital (IC) as an increasingly vital source of value creation (Schiuma, Carlucci & Sole, 2012; Curado, 2011). Yitmen (2011) agrees that the organization's capacity to innovate is associated with its IC. Moreover, interest in investigating and understanding the intellectual capital practices of major universities is on the rise (Sangiorgi and Siboni, 2017; Secundo et al., 2010) as more top university managers have started discovering its benefits.

Several scholars have put forth various definitions of IC. María Díez et al. (2010) define IC as the combination of the organizational, relational and human resources and activities in organizations, including the skills, knowledge, competences and experiences of the employees. It also includes the organizational procedures, routines, systems and company databases. Additionally, IC comprises of all resources related to the external relationships the enterprise has, including customers, research and development (R&D) partners, suppliers among others.

Subramaniam & Youndt (2005) define IC as the set of knowledge assets a company owns, has access to and manages them for sustainable market competitive advantage. IC refers to the intangible asset represented by the organization's knowledge, patents, trademarks and brands (Agostini, Nosella & Filippini, 2017; Secundo & Elia, 2014; Secundo et al., 2010; Secudon et al., 2015). Clarke, Seng and Whiting (2011) consider IC as a value

in financial displays. Its value may be gauged in the accounting value and steady-state value. Edvinsson and Malone (1997a) define IC as "the possession of knowledge, applied experience, organizational technology, customer relationships and professional skills that provide a competitive edge in the market."

Scholars have argued that intellectual capital is vital in a university setting due to its contribution towards improved performance of the whole institution (Barbosa, Vale, Vale & Branco, 2016). Secundo et al (2010) suggest that the universities that develop a supportive organizational culture and encourage the capacity for the identification, management and reporting of IC are likely to realize a competitive advantage. Similarly, Chatterji & Kiran (2017) argue that the use of the IC concept helps universities deal with new managerial challenges.

## 2.2 Component of Intellectual Capital

There are distinct views about determining IC components (González-Loureiro & Teixeira, 2011; Zerenler, Hasiloglu & Sezgin, 2008; Agostini, Nosella & Filippini, 2017; Clarke, Seng & Whiting, 2011). Overall, the components that form intellectual capital can be listed as human, structural, and relational capital (Veltri, Mastroleo & Schaffhauser-Linzatti, 2012; Tai-Ning, Chen, Lin Shou-Yen & Lun, 2011; Zerenler, Hasiloglu & Sezgin, 2008; Sharabati, Jawad & Bontis, 2010). Although the components name is used extensively, the name might be different from one researcher to another.

In this study, three components of IC are considered, namely human capital, relational capital and structural capital. It is vital to note that IC components are not independent as shown by Barbosa, Vale, Vale and Branco

(2016). Instead, the effect of IC can be optimized when these three aspects interact and complement each other.

### 2.2.1 Human Capital

Yitmen (2011) defines human capital (HC) as an "organization's combined human capability for solving business problems." Alzuman (2015), in contrast, defines human capital as the value given to workers within a company by making them apply their expertise, skills and know-how. This definition implies that HC is the human capability meant for solving problems in the business as well as exploiting intellectual properties. HC includes the skills and abilities of the employees in an organization (Leitner, 2011). The success in most organizations depends more on the intangible assets such as HC instead of conventional factors (Secundo & Elia, 2014; Secundo et al., 2010; Secudon et al., 2015).

Human capital is deemed to be intrinsic to individuals and can never be owned by a company. For that matter, human capital can leave an organisation if a worker quits (Alzuman, 2015; González-Loureiro & Teixeira, 2011). Besides, when the management fails to offer a setting where others might pick up their expertise, then such a company would not likely grow (Bornay-Barrachina et al. 2012). On the same note, Wang, Yen, Tsai and Lin (2008) confirmed that skilfulness is one of the central characteristics for HC, in addition to proficiency in their tasks and responsibilities leading to success. Human capital entails how efficient a company uses its resources through innovation and creativity (Alzuman, 2015).

of corporate culture, internal communication, the capacity to transmit experiences, the management system (Clarke, Seng & Whiting, 2011) and the training and attitude of human resource (Jin, Hopkins, & Wittmer, 2010; González-Loureiro & Teixeira, 2011). Leitner (2011) points out that HC is a pertinent enhancer of innovation because it positions the organization to scan for any new knowledge and in turn, advance its knowledge frontiers. As such, organizations need to invest in people (Bornay-Barrachina et al. 2012).

The IC based-view proposed by Jin, Hopkins, & Wittmer (2010) suggests that HC is an essential source of competitive advantage. Bornay-Barrachina et al. (2012) research demonstrated that HC directly affects the innovation level. In this context, organizations that seek sustainable and competitive market advantage must recruit talented employees. Similarly, Crook et al. (2011) point out the significance of HC in enhancing firm performance. Moreover, Leitner (2011) argues that HC is a source of innovativeness. Most of the universities in Saudi Arabia have few tangible resources (Alatawi, Dwivedi, Williams, & Rana, 2012). Consequently, the creativity of faculty in generating competitive advantages is vital.

Human capital serves as intangible assets in organizations (Crook et al., 2011; Secundo & Elia, 2014; Secundo et al., 2010; Secudon et al., 2015; Bornay-Barrachina et al. 2012). These assets subsume training, education, intelligence, skills, punctuality and loyalty. Universities enhance the knowledge and skills of their employees to get investing benefits (González-Loureiro & Teixeira, 2011). During this fourth industrial revolution, universities in Saudi Arabia can strategically invest in their HC as a strategic measure (Abel & Deitz, 2012). Universities need HC to realize their objectives, develop innovative

capabilities and maintain them. Research illustrates that investments in HC translate to economic growth (Crook et al., 2011).

### 2.2.2 Structural Capital

Structural capital (SC) is sometimes referred to as organizational capital by some scholars. Rahim, Kamal and Mat (2011) define SC as organizational knowledge that is present in the company obtained through learning. The knowledge exists in the company's routines, culture, processes and strategy which organize and preserve memories. According to Agostini, Nosella and Filippini (2017), structural capital refers to the things owned by an organization. Khan (2016) asserts that organisational capital serves as a guideline in the routine work processes. What is more, it supports the enterprise's standard procedures. Kong (2010) noted that SC includes infrastructure development meant to facilitate innovation within enterprises.

Khan (2014) definition indicates that structural capital deals with the structure and system of an organization. SC includes supportive processes, non-physical infrastructure and databases which facilitate the functioning of human capital. Deeb and Merhej (2016) state that even if employees leave the enterprise, SC remains with the enterprise as it has the mandate to own it. Khavandkar, Theodorakopoulos, Hart & Preston (2016) state that SC comprises of methods, routines, capabilities, methodologies and procedures embedded in the organization. Khan (2014) indicates that organizations can hire or purchase structural capital. Moreover, they can share and duplicate it.

Structural capital is classified into three sub-categories, namely process capital, organizational capital and innovation capital (Khavandkar, Theodorakopoulos, Hart & Preston, 2016). Organizational capital comprises of

organizational systems and philosophy for leveraging the capabilities of the organization. Innovation organization comprises of intangible assets such as intellectual property (including trademarks, patents and copyrights). Process capital comprises of procedures, programs and methods that enhance goods and service delivery (Brenner & Coners, 2010; Secundo & Elia, 2014; Secundo et al., 2010; Secudon et al., 2015).

In the IC literature, it is widely acknowledged that employees become a non-substitutable and distinctive asset, in efforts to provide competitive differentiation (Khan, 2016). This is due to their specialized knowledge that contributes to the introduction and development of new ideas, products and services. Duplicating SC for other companies is difficult due to ownership rights (Agostini, Nosella & Filippini, 2017). Brenner & Coners (2010) study suggested that designing the right business processes allows organizations to recognize various target markets and consumer groups, address their diverse needs suitably, establish support processes essential for business model and manage the value-added processes which spark innovation.

Structural capital serves as a strategic asset for numerous organizations. It includes organizational structure, databases, hardware, software, information systems, trademarks, routines, system policies, procedures and company image workers usually use to support their business processes and activities (Hsu & Wang, 2012). According to Sharabati, Jawad, and Bontis, (2010), SC mainly avail as the environment which supports people to invest their HC in creating the innovation, technology, creativity, organisational culture and quality management as well as leverage its knowledge to improve organisational performance.

According to Kong (2010), organizations need SC for optimum innovation. Similarly, Agostini, Nosella & Filippini (2017) research found a direct link between the efficiency of SC and the enterprise's capacity to generate radical innovations (new markets, new distribution channels or new products) as well as incremental innovations (improved processes, improved products or improved level of service rendered to customers) and, thus, improve the company's performance. Moreover, Deeb and Merhej (2016) established that SC positively influences innovation in universities located in Syria.

### 2.2.3 Relational Capital

Relational capital incorporates capabilities, knowledge, systems and procedures developed from various relationships with different external agents (Subramaniam & Youndt, 2005). Some of the relationships include supplier relationships, customer relationship, trade name and trademarks, the franchise as well as licenses. Khavandkar, Theodorakopoulos, Hart and Preston (2016) state that RC is the value in-built in the enterprise's relationship with suppliers, vendors and customers. RC, in general, are stakeholder relationship, collaboration and partnership (Subramaniam & Youndt, 2005; Khavandkar, Theodorakopoulos, Hart & Preston, 2016).

Relational capital denotes embedded knowledge in client preferences, counting suppliers and associations with major partners (Yitmen, 2011). At its core, Hsu and Wang (2012) reveal that RC is concerned with the mobilization of knowledge and key relationship resources via social structure. Close, trusting relationships often arise from the prospective to make significant contributions to RC development. This practice enables enterprises to access and exploit cooperation partners' competencies and knowledge (Capello & Alessandra,

2005). Therefore, firms should invest in different relational assets and establish effective routines of cooperation, which facilitates knowledge transfer.

Given that relationships with key stakeholders necessitates greater transparency as well as accountability to enhance decision-making process, the university's capacity to establish and maintain these relationships affect its basic sources of reputation (Sangiorgi & Siboni, 2017). Secundo et al. (2010) argue that relations with the government, research centres and the industry are the major indicators of university RC. Moreover, relational capital is seen from cooperation with the industrial and the business world (Chatterji and Kiran, 2017). Industries and universities need each other; universities produce graduates required by the industry as labour.

To realize satisfactory innovation performance, an enterprise should make complete use of its internal resources and appropriately use information, capabilities and technologies obtained from the external stakeholders. Capello and Faggian (2005) note that this is essential to organizational success since not all knowledge essential for innovation can be found within the organization's boundaries, an argument supported by Chen, Lin and Chang (2006). RC, in this regard, provides organizations with prospects to interact with distinct stakeholders and integrate their organizational knowledge with that of other organizations (Capello & Faggian, 2005).

Clarke, Seng & Whiting (2011) study indicated that RC includes the relationships with third parties, most customers and suppliers. Universities must assess the density and level of trust, interactions, and cooperation, all being vital aspects of RC (Capello and Faggian, 2005). Sociocultural factors, including relational proximity, enable knowledge transfer between the industries.

Sometimes, industries join the similar social organisation to ease the sharing of batik techniques, marketing and processes.

Universities are responsible for creating RC (Sangiorgi & Siboni, 2017; Chatterji & Kiran, 2017; Secundo et al., 2010). Using Italian case studies in university setting, Paoloni, Cesaroni and Demartini (2019) relational capital permits universities to emphasize and promote the effectiveness of the third mission. In universities, the third mission seeks to produce knowledge outside the academic environments to champion social, economic and cultural development (Secundo & Elia, 2014; Secundo et al., 2010; Secudon et al., 2015).

## 2.3 Intellectual Capital in Universities

The approach to IC in universities begins with the identification of investigations proposing IC models, measurement frameworks and established findings (Alkhaffaf & Aljanabi, 2016; Anggraini, Ali, & Aza, 2016). Fazlagic (2005). Fazlagic (2005) suggests an IC framework for creating an IC framework considering the existing resources, the investments made, and the goals universities want to realize. The framework thus includes resources, activities and results for each of the three components of IC. The author asserts that the IC measurement matrix recommended for universities helps understand knowledge creation and innovation in universities.

Veltri, Mastroleo & Schaffhauser-Linzatti (2012) used fuzzy logic to measure IC for universities in Australia. The fuzzy expert system considers different IC groups and qualitative nature of the majority of IC indicators. The scholars adopted a logical approach to IC. Nonetheless; the study was limited as more tests can be done using comparable IC data.

Secundo, Margherita, Elia & Passiante (2010) proposed a conceptual framework to measure IC in higher education. The authors separated IC into organizational, relational and human capital. They used two components to measure HC, which are attractiveness and efficiency. Attractiveness was defined as the university's capacity to draw talent and retain it using a culture of openness and high-quality strategy. They defined efficiency as the link between production of value and human resources dedicated to this goal (Secundo et al., 2010).

The model emphasises the significance of creating the university infrastructure, traditional facilities including laboratories and libraries and information technology infrastructure available for research and teaching purposes. All these factors contribute to good results. Secundo et al. (2010) also considered two elements of RC. The first aspect is how the university controls its network relationships linked to R&D. The second aspect is the international scope-institution's readiness to engage with the industrial community as well as international scientific community.

Leitner and Curaj (2014) suggested a simple model of IC for universities. The model was supported by various best management practices. In the model, they showed that universities transform intangible resources to realise education activities and engage in research to generate distinctive outputs linked to specific and general goals of the entity. The authors, in this regard, stressed that there is need for a debate that establishes a framework for IC reporting at the national level to offer room for comparison and take into account diversity in European universities.

Sánchez, Elena and Castrillo (2009) presented a list including various indicators for consideration when evaluating IC in a university setting. They composed a model with three IC (supported by Barbosa, Vale, Vale & Branco, 2016) categories alongside 43 IC indicators. The first aspect of consideration was the ease of getting information from various universities. This component is useful for comparative purposes. The second aspect considered was financial resources as a means to get hints about the university's strategy; universities are reluctant to reveal financial details.

## 2.4 Innovation

Innovation includes factors that directly facilitate innovation, such as technological resources (Jin, Hopkins & Wittmer, 2010). The innovation capacity of human resources and organizational capabilities directly related to innovation, such as the information system. Innovation goes beyond the improvement of new products and processes; it also includes the capability to capacity absorb new technology and adopt new business models (Li & Yu, 2018; Khan, 2014; Khan, 2016). Creative capabilities and innovation with the associated skills and experience have become the basis for success and development. Also, eventually leading to the added value of a company's products as well as enhancing its competitive position (Curado et al., 2011).

The growing significance of innovation and knowledge production has created new roles for universities (Zomer & Benneworth, 2011). With R&D and innovation, universities have to contribute towards realization of the third mission (Piirainen, Andersen & Andersen, 2016). The third mission inspires universities to encourage three types of activities, namely: technological transfer and innovation; social engagement and continuous training (Secundo et

al., 2016; Sánchez, Elena-Pérez & Castrillo, 2009). It brings stakeholders' demand for increased transparency, greater competition among universities, companies and enterprises involved in research and teaching, the implementation of new management and performance systems which incorporate intellectual capital and intangible assets and pressure universities to promote autonomy (Zomer & Benneworth, 2011).

Several scholars have reported the significant contribution of universities and research institutions to the innovation systems in several countries (Lu, 2012; Sánchez, Elena-Pérez & Castrillo, 2009). In the university setting, Aichouni et al. (2015) reported innovations comprising of innovative curricula design and supportive notes. Similarly, Tierney and Lanford (2016) argue that administrators and academicians in universities are expected to direct and coordinate cross-institutional R&D projects and advocate for innovation.

High-class universities are interested in talents which break organizational and scientific boundaries, establishing opportunities for new ideas through R & D (Chen & Chen 2013; Tierney & Lanford, 2016). Poor interest in R&D, as shown in literature, leads to poor results for the whole nation (Khan, 2016). There is lack of attentiveness on innovation and creativity university students and faculty members; this observation was made by Iqbal (2011). As, such, universities in Saudi Arabia need to pay more attention to innovation.

Faculty's creative output in universities can be increased significantly by improving university's creative environment. Iqbal (2011) presented an outline of the status of creativity and innovation in Saudi Arabia universities. The author reported low level of creative outcomes revealed in the Innovative

Global Index. Therefore, to thrive in the global innovation challenge, universities are gradually expected to offer more opportunities which nurture student's creative and cognitive potential. From the educational perspective, Chell, Karata-Özkan & Nicolopoulou (2007) argue that social enterprise entrepreneurs and practitioners must nurture skills and competencies, such as leadership skill, managerial knowledge, business skills and entrepreneurial competencies to ensure effectiveness and sustainability.

Innovation is a major success factor for organizations to achieve as well as maintain competitive advantage (Baker, 2014). In universities, innovation is defined as the capacity to apply the existing knowledge from R & D in a new way, find new learning methods, identify new administrative procedures and apply the educational process to produce new beneficial results (Piirainen, Andersen & Andersen, 2016). These realizations help universities achieve added value (radical innovation), improve the present knowledge and develop the entire process by improving personnel training procedures (incremental innovation).

## 2.5 Methods of encouraging innovation

Knowledge-based economies are more sustainable, flexible in the long run (Khorsheed & Al-Fawzan, 2014). Aichouni et al. (2015) research indicates that the quantity and quality of innovation, creativity skills and knowledge produced and gained by human capital of a given country determine its prosperity. In modern universities, innovation is vital for long-term success. To enhance this initiative, Khorsheed and Al-Fawzan (2014) indicate that Saudi authorities-initiated collaborations with major stakeholders to move the country

from reliance on natural resources to knowledge-based industries in order to establish innovative society instead of a consumption society.

Scholars have proposed several approaches for institutions to foster innovation in spite of limited resources. Yusuf and Atassi (2016), for instance, proposed that to promote innovation, universities in Saudi Arabia need to offer entrepreneurship education, partner with non-academic institutions and provide support resources. In addition, the authors suggest that stakeholders in university education should address bureaucracies, strengthen the adoption of intellectual property rights and facilitate inclusive participation.

Various factors influence the level of innovation in universities. According to Aichouni et al. (2015), the education environment influences creativity and innovation in Saudi Arabia universities. The key components identified are school curriculum/environment, university opportunities, organization management and individual characteristics. In this study, we focus only on two moderating factors, which include government policies on intellectual property and financial support.

### 2.5.1 Government policies on intellectual capital

Universities in developing and developed countries are playing a noticeable role in the national innovation systems (Aichouni et al., 2015). Some universities have even managed to learn measures to interact with key industry actors. In any national innovation system, successful collaboration between the universities and the industry brings many benefits to industrial firms and universities thereby ensuring socio-economic development of the whole country (Khorsheed & Al-Fawzan, 2014). The goals and expectations of

universities and industrial organization still have considerable differences. As such, government policy guiding these collaborations become vital.

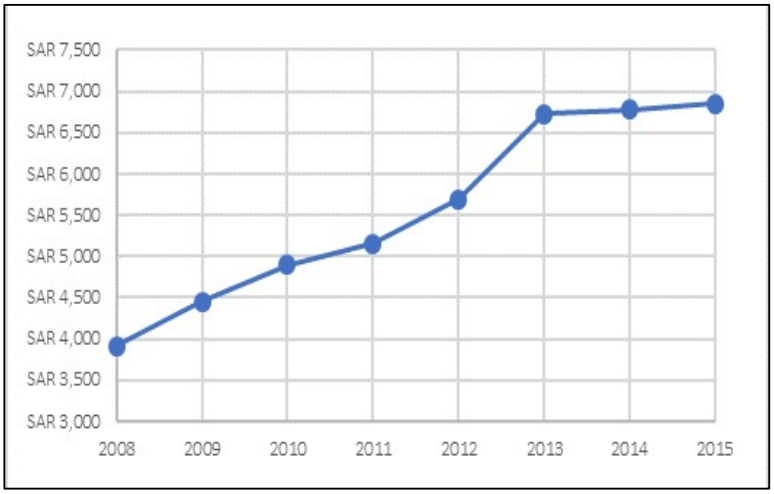
Governments encourage innovation differently. Government policy has a profound impact on the investments made by universities and other higher education institutions (Indiyati, 2018). This author argues that government policies can facilitate or hinder IC investment. A number of diverse government policies can intensify the motivation to innovate in universities, including: securing intellectual property rights, development of partnerships with enterprises, high schools, universities, governments, professional associates and government assistance to cater for research costs (Al-Sudairi & Bakry, 2014; Bakhsh, 2016; Khan, Al-Saud, Al-Khahtani & Al-Derham, 2014; Indiyati, 2018).

Gulf countries recently started new improvements in their educational systems, universities and research institutions to transform their economies from oil-based economies to knowledge-based economies (Leitner & Curaj, 2014; Bakhsh, 2016). The manifestation of these reforms in Saudi Arabia can is evident from the rearrangement of the existing educational system (the ministry of education was merged with the ministry of higher education, the formation of various technology valleys, innovation centres, research chairs, creativity and innovation programs and the inauguration of new universities alongside research institutes (Khorsheed & Al-Fawzan, 2014; Khan, Al-Saud, Al-Khahtani & Al-Derham, 2014).

Saudi Arabia has spent great attention to the development of human capital in all spending programs for decades. Government expenditure in 2008

reached 28 billion US dollars (104 billion Saudi Riyals), representing 3,911 Saudi Riyals per capita. The fund is used to support public schools offering public education, private schools and public universities, and education and training programs and the scholarship program launched by King Abdullah (Khorsheed & Al-Fawzan, 2014). Nevertheless, and as noted by Al-Sudairi and Bakry (2014), while Saudi Arabia spending on its education system surpasses that of the distinguished countries like Brazil and Malaysia, the status of knowledge delivery is still below the expectations compared to these two countries.

Figure: Expenditure for Human Capital development in Saudi Arabia per capita




Iqbal (2011) established that in Saudi Arabia, creative outcomes linked to innovation are low. For this reason, Aichouni et al. (2015) proposed a model to support creativity and promote innovation within higher learning institutions. The model was formulated considering government support, human skills, investment in R&D and the increasing knowledge via education to industry connections at the national level in which intellectual capital and R&D support are expected to increase innovation as well as enhance creativity. To continue

promoting university investment in IC, Alghamdi, Wagih, Alzahrani and Attia (2015) assert that the government needs to invest in RC, HC and SC.

Intellectual property, elements in measuring intellectual capital development, must be protected by the government by implementing some measures to protect, safeguard and market the available intellectual property (Khorsheed, M. & Al-Fawzan, 2014). Within universities, generating money is a key aspect for sustainability. The cycle of money versus project funding policy must be addressed to ensure that stakeholders get the opportunity to share the income generated from intellectual property. The policy need to be fair, inclusive and encourage further innovation and discoveries (Alali, & Nikolaidis, 2015; Alghamdi et al., 2015, 2016; Ramírez, et al., 2013).

### 2.5.2 Financial support

With the shortage of funds, universities must be resourceful in generating revenue for themselves. With the prevailing economic realities characterized by massive budget cuts and inefficient funding system, universities need to exploit alternatives was of generating income, otherwise called third money stream (Khorsheed, M. & Al-Fawzan, 2014). In the third money stream, income is generated from other sources apart from government and students fees (Kok, 2007). So, Saudi Arabia universities must invest in business models, strategies and leadership that can help them optimise opportunities for the third-stream activities as well as revenue.

The corporate and industry players in Saudi Arabia must realize that the product of innovation from tertiary education is no longer be available for free. Instead, they have to pay for it (Kok, 2007). This is due to the efforts geared

towards steering the economy away from reliance on natural resources to the development of modern knowledge-based industries (Bakhsh, 2016; Leitner & Curaj, 2014). In this sense, Khorsheed & Al-Fawzan (2014) found that strong cooperative relationships between research institutions, private industries and universities are central to attaining knowledge-based industries. Partnerships are key given that partners can provide financial incentives to help establish innovation centres.

Sufficient fund, especially in research and innovation, must be adequately provided. Scholars have established that lack of funding is a factor that slows down innovation level in most universities (Iqbal, 2011). Kok (2007) noted that universities should strike a balance between their responsibilities internally to their employee and student inventors, and externally to their potential commercial partners. The potential commercial partner here refers to any business organization, government agencies, semi-government agencies or statutory agencies. Providing financial support is part of the universities' responsibilities in relation to their function as employers to researchers. It has to be done fairly and reasonably (Zambon & Monciardini, 2015).

Given the low level of innovation reported by Iqbal (2011), Saudi Arabia universities need to create and optimize their financial resources competencies to support different strategy and innovation implementation initiatives. Research has established that financial support is important in championing innovative university initiatives (Subramaniam & Youndt, 2005; Curado et al., 2011). For instance, Clarke, Seng and Whiting (2011) made observations about IC and organization performance and concluded that financial capacity is a significant factor which improves performance. The study proposes that

financial resource capability positively contributes to the adoption of successful strategies. This, in turn, increases the strategic performance of Saudi Arabia universities.

## 2.6 Relating intellectual Capital and Innovation

Knowing the relationship between intellectual capital and innovation is important in evolution and development (Alalwany et al., 2014). Alalwany and colleagues implore that the knowledge economy concept, within the intellectual capital setting, shares some vital aspects with sustainable development concepts as well as the innovation concept. Specifically, sustainability requires innovation and innovative leads, which is a key distinguishing factor in determining the organizational performance (Todericiu & Şerban, 2015; Hamdan et al., 2017).

Alghamdi et al (2015) and Leitner and Curaj (2014) noted that IC is part of the growth factors in the knowledge-based economy. Some prior studies have addressed IC efficiency and its relationship with organisation's performance (Celenza & Rossi, 2014; Inkinen, 2015). The two studies showed that organisations still suffer from inefficient utilisation of IC.

## 2.7 Related literature

Prior literature illustrates that IC has a profound impact on innovation (Lu, 2012' Alkhaffaf & Aljanabi, 2016; Zerenler, Hasiloglu & Sezgin, 2008; Maboudi, Mobaraki, Khavandkar & Esfandabadi, 2015; Tafti & Yarmohammadian 2017; Subramaniam & Youndt, 2005; Meihami & Karimi, 2014; Najim, Alnaimi & Alnaji, 2012; Córcoles and Vanderdonckt, 2013). These researchers have revealed distinctive findings.

Zerenler, Hasiloglu and Sezgin (2008) study investigated the impact of IC on innovation performance of the Turkish automotive supplier industry. The study indicated that three types of IC (employee capital, customer capital and structural capital) had a significant positive relationship with innovation performance. What is more, the study found that the higher the rate of growth of the industry, the stronger were the relationships between three types of IC and innovation performance. Furthermore, among the three IC types, customer capital had the greatest impact, followed by employee capital and lastly structural capital.

Maboudi, Mobaraki, Khavandkar & Esfandabadi (2015) investigated the impact of IC on innovation using a sample from Zanjan University Science and Technology Park (STP) firms. The researchers used quality-correlation method in the investigation. Data was collected through questionnaire, targeting 220 participants. Data analysis was then performed using structural equation modelling. Hypotheses were tested through Pearson correlation coefficient. The correlation test and analysis indicated that IC had a significantly and positive impact on innovation. HC and SC are the two elements which did not reveal any significant link to innovation. Nonetheless, the study established that all three IC elements are key predictors of innovation.

Tafti & Yarmohammadian (2017) investigated the relationship between intellectual capital and organisational innovation among faculty members of the International University of Qeshm, Iran. And the results have shown that there was a positive relationship between intellectual capital and components of human capital, structural capital and customer with organisational innovation.

Furthermore, the results indicate that as intellectual capital is better, the organizational innovation will be more.

Subramaniam and Youndt (2005) investigated how various IC elements influence different kinds of innovative capabilities in enterprises. They used a longitudinal, multiple-informant study targeting 93 organizations. The results revealed that HC, organizational capital and RC and their interrelationships influenced radical and innovative incremental capabilities selectively. As expected, organizational capital influenced incremental innovative capability positively, while HC interacted with social capital to positively influence radical, innovative capability. Nevertheless, the study suggested that HC, by itself, is negatively related to radical innovative capability. Remarkably, social capital played a significant role in the two types of innovation; it positively influenced radical, and incremental innovative capabilities.

Lu (2012) screened the present status of the Taiwan public Universities. The author used a two-stage analysis to assess the impact of IC on operational efficiency. The results demonstrated that teaching and research efficiency plays a crucial role in IC performance estimations, giving a detailed report to policymakers for improved decision-making effectiveness. This study focused on the key factors affecting the intellectual productivity of faculty members in Universities.

Lu (2012) used two-stages structure, namely teaching research efficiency and cost efficiency to examine the effect of IC in Taiwan universities. Using truncated regression, the study also analysed how IC affects operational efficiency in Taiwan universities. The findings suggested that universities

handle cost efficiencies more appropriately compared to research efficiencies and teaching efficiencies. Moreover, the regression analysis performed suggested that IC plays a significant role in affecting research efficiency and teaching efficiency in universities.

Meihami and Karimi (2014) reported findings from a study about IC reporting and performance of universities. The study focused on three core factors, namely education performance, research function and financial performance. The study targeted responses from 112 professors from Islamic Azad University Qhorveh. Data gathering in this research was realized through questionnaires. The researchers then concluded that IC, education performance, research function and financial performance have positive effect.

Córcoles and Vanderdonckt (2013) sought the opinion of university stakeholders about the emphasis they give to the completion of the information from the university financial statements relating to their IC. The researchers designed and sent a questionnaire to every member belonging to the Social Councils of Spanish public universities. These participants provided a good illustration of the attitudes and opinions of university stakeholders since because they represent different social groups linked to the Spanish universities. The results showed that the information that is most valued by different stakeholder groups is related to RC, followed by HC and lastly SC.

In the investigation, data collection was done through an online survey. Members of the social councils of Spanish public universities were targeted in this study. The sample size was 247. The results of this empirical study permit us to criticize the recent accounting information model used by Spanish higher

education institutions to recommend measures to extend the annual account's limits and include significant information on IC demanded by different stakeholders. This empirical study also identifies which of IC components (human, structural and relation) has the most influencing factor.

Zhang & Cao (2014) investigated the impact of IC on technology innovation performance. The participants targeted were from 64 universities approved by the ministry of education. The researchers formulated and tested six hypotheses. Structured equation modeling was used to analyse the data, taking into account 19 indicators for the three IC components. The findings showed that relationship capital and human capital positively and directly influence technology innovation. The study also established that SC fully mediate this relationship.

Chen & Chen (2013) investigated the positioning of five types of universities in Taiwan, considering IC perspective and innovative development as key measures. The goal was to use the results to offer future research suggestions. The study focused on fundamental development trends in the five Taiwanese universities. To forecast development trends and Taiwanese birth trends, the authors used Grey model. They then ranked the universities using Vlse Kriterijumska Optimizacija Kompromisno Resenje (VIKOR) with regards to opinions provided by twenty IC experts. The findings demonstrated that IC enhances innovative capability in universities as it facilitates competitive advantage.

Najim, Alnaimi and Alnaji (2012) investigated the effects of IC on innovation (realization of university goals), taking into account private

universities and public universities in Jordan. The four IC components considered were relational capital, HC, SC, leadership and strategy. Realizing university goals (innovation) was measuring using variables such as improving community relationships, academic goals, realizing the university's programs and plans, attracting new students and maintaining/developing the staff. The authors sampled participants from three universities namely Middle East University, University of Jordan and Al Zaytoonah University of Jordan.

The study considered views from both public universities and private universities. The researchers developed and tested five hypotheses. Data analysis was done using multiple regression investigation (multicollinearity test for the hypotheses formulated). The sample populace consisted of university staff members. The analysis found that IC significantly affects the university's capacity to achieve innovation goals. What is more, HC, RC and leadership capital had a more significant impact compared to structural capital (Najim, Alnaimi & Alnaji, 2012).

## 2.8 Chapter summary

This literature reveals that recently, scholars have shown increased interest in IC application and management in the Higher education institutions setting (Veltri, Mastroleo & Schaffhauser-Linzatti, 2012; Sánchez, Elena-Pérez & Castrillo, 2009). Since the start of the IC movement, this research topic has gained interest in university settings. Some studies have focused on IC reporting (Sánchez, Elena-Pérez & Castrillo, 2009) and IC practice inside the universities (Secundo et al., 2015; Secundo & Elia, 2014; Secundo et al., 2010).

Scholars have categorized IC components differently. Nonetheless, there is a widely accepted classification proposed by Leitner (2011), Sánchez, Elena and Castrillo (2009), (Clarke, Seng & Whiting (2011), Veltri, Mastroleo & Schaffhauser-Linzatti, 2012 and Secundo, Margherita, Elia and Passiante (2010). According to most researchers, IC could be organized in three blocks, namely human capital, relational capital and structural capital, all useful for the higher education sector (Secundo et al., 2010; Secundo et al., 2015; Secundo & Elia, 2014). In the higher education setting the content of each IC-subcategory is provided by (Veltri, Mastroleo & Schaffhauser-Linzatti, 2012).

Indeed, the relationship between IC and innovation has been widely studied (e.g. Subramaniam and Youndt 2005; Wu et al. 2008; Leitner 2011; Bornay-Barrachina et al. 2012). To be specific, human capital is universally seen as the most basic knowledge asset for enterprises (Bornay-Barrachina et al. 2012). Researchers have also identified a significant positive correlation between the organization's overall level of IC and performance outcomes, including new product development (Chen, Lin & Chang, 2006; Chen, Lin & Chang, 2009; Bornay-Barrachina et al., 2012) and innovation performance (Zhang & Cao, 2014; Agostini, Nosella, & Filippini, 2017; Yitmen, 2011; Hsu & Wang, 2012; Leitner, 2011; Wu, Chang & Chen, 2008; Zerenler, Hasiloglu & Sezgin, 2008; Subramanian & Youndt, 2005).

## 2.9 Gaps in The literature

Although many studies have been carried explanation regarding intellectual capital and innovation in organizations, specific studies that pay attention to the relationships between intellectual capital variables and innovation in university setting is rare. At this time, only studies carried out

by Anggraini, Ali, & Aza, (2016) in Indonesian universities, Lu (2012) in the Taiwanese universities and investigation by Meihami and Karimi (2014) in Iraqi universities are revealed in the intellectual capital research literature. Anggraini, Ali, & Aza, (2016), for instance, mentioned that IC significantly affects universities' performance.

Few studies are measuring the relationship between IC and innovation in developing countries (Zhang & Cao, 2014). However, these studies did not test if the relationship between IC and innovation are moderated by some other variables (e.g. government policy and financial support). There lacks literature which supports the impact of intellectual capital on innovation in the education sector. However, studies reported by Lu (2012), and Meihami and Karami (2014) showed that intellectual capital had a significant impact on universities, especially innovation. As such, this topic requires further exploration.

# CHAPTER 3: METHODOLOGY

## 3.1 Research Design

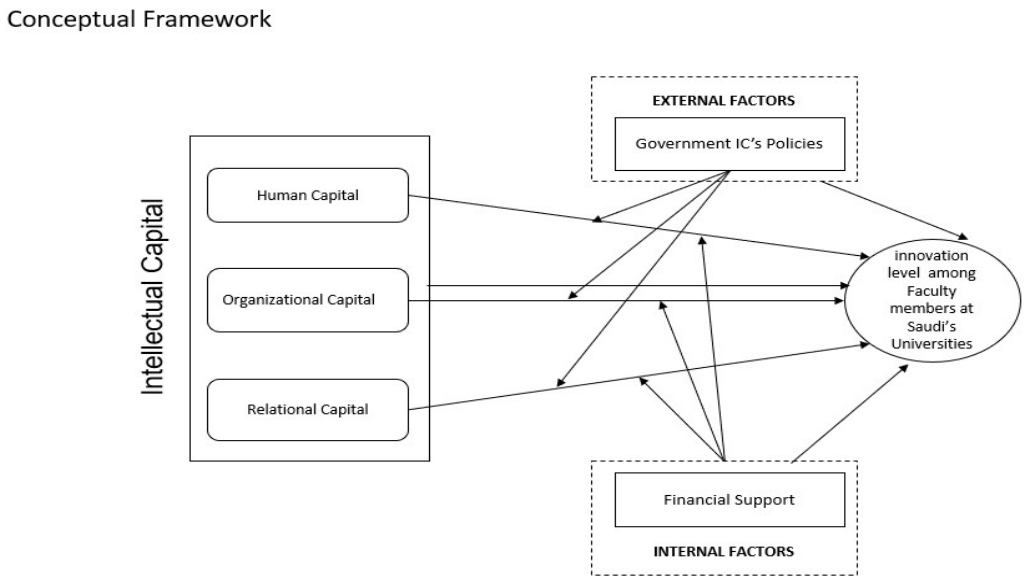
Research design included procedures for gathering, analysing, reporting and interpreting data gathered from primary respondents (Creswell, 2013). The research study adopted a mixed research technique involving qualitative and quantitative approaches. The research design adopted helps comprehend the behaviours and individuals' concepts within their natural settings. The mixed method is appropriate as the study involved collection and analysis of quantitative and qualitative data. In addition, quantitative research is widely known as a better technique for in-depth data collection and advanced analysis (Neuman & Robson, 2012).

Quantitative research data was used to measure the opinions in the responses provided by respondents surveyed while the correlation between the independent and dependent variables was quantitatively measured through descriptive statistics. Conversely, qualitative research was used to analyse qualitative data, including attitudes and opinions regarding the effects of intellectual capital towards innovation level among university's faculty in Saudi Arabia.

## 3.2 Theoretical framework

A theoretical framework mainly included the beliefs, attitudes and the personalities of the principal researcher. It provides the methodological design assumed by the research. Scholars use distinct research paradigms to understand the beliefs, perceptions, attitudes and the true nature of the assumptions made in a given study. These entail the adoption of positivism and interpretivism models. This study used positivism theoretical framework. The framework is suitable as it guided the entire research process.

Figure: Proposed Conceptual Framework for measuring IC in Saudi's University




Conceptual Framework adapted from (Wu & Sivalogathasan, 2013) and (Cricelli, et al., 2018)

## 3.3 Sampling design

The study population comprised of the faculty members in Saudi Arabia universities. The study sampled respondents from all universities to provide empirical data for analysis. This data assisted the researcher in establishing the effects of IC towards innovation level among the university's faculty in Saudi Arabia. Currently, more than 42 universities are operating in Saudi Arabia. Since there are many faculty members in these universities, a small sample was used for analysis purposes.

Due to the lack of time and cost, stratified random sampling was used as the basis of the sampling design. In this method, the researcher divided the study populate into smaller sub-categories called strata (Carl-Erik, Bengt & Jan, 2003). Faculty strata were formed based on the members' shared characteristics, including academic ranking. This sampling method, being a probability sampling approach, is suitable as all faculty members have an equal opportunity of being included in the research. Moreover, the researcher can represent sub-categories of the university faculty in the final study sample.

Figure: Administrative Region in the Kingdom of Saudi Arabia


The researcher sent invitation letters to all universities in Saudi Arabia for more than three times, requesting for permission to conduct the investigation. However, responded universities were nine of the whole numbers which are (Taif University (public), King Abdelaziz University (public), King Fahad University of Petroleum and Minerals (public), King Saud University (public), King Faisal University (public), Umm Al Qura University (public), Majmaah University (public), Riyadh Elm University (private) and Prince Fahad bin Sultan University (private), most of these universities are the top universities in Saudi according to Time Higher Education Services, published in 2017 (Bhardwa, 2017). The sampling framework for this study is all faculty members who holder PhD at Saudi universities.

## 3.4 Measurement of Intellectual capital

For the purposes of this research, questionnaire and semi-structured interview questions were used to collect primary data.

### 3.4.1 Questionnaires

The questionnaires were distributed to different respondents from the selected universities identified to take in the study. The questions designed

were used in recognizing the relation between IC and innovation level among faculty members at Saudi Arabia universities. Besides, the questionnaires were created to highlight the precise study objectives.

i. Section 1: Demographics (Gender, age, academic qualification)
ii. Section 2: Human Capital (Hiring policy, social network and Self-learning)
iii. Section 3: Structural Capital (IT, Researchers and infrastructure)
iv. Section 4: Relational Capital (Equality of gender and communication with senior management)
v. Section 5: Government's IC (policies (Government existing policies and faculty workload)
vi. Section 6: Financial Support (funding to the R&D and salary)
vii. Section 7: Innovation Level (Scientific Research, Patent Registered)

The item for the questionnaire was based on the instrument used in Alzuman (2015), Patterson, West, Shackleton, Dawson, Lawthom, Maitlis, & Wallace (2005) Rashied & Alzaidi (2014) Deeb& Merhej (2016) Sharabati, Naji Jawad & Bontism(2010) Siegel & Kaemmerer (1978).

### 3.4.2 Interview

In order to validate the findings obtained through a questionnaire, a series of structured interviews were carried out semi-structured interviews, the interviewer usually asks predetermined questions. The interviewer creates and plan interview questions in advance, and then ask all respondents similar questions. Researchers must follow standard procedures when conducting structured interviews as this practice increases reliability (Neuman & Robson, 2012). The researcher read out the interview questions and record the responses provided by the interviewees. In this study, semi-structured interviews were preferred because

the researcher can easily compare the responses provided. The researcher had addressed the reliability and validation of the instrument items accordingly.

### 3.5 Reliability of Instruments

The researcher was checked and tested the internal consistency of each item before actually distributing the questionnaire. Testing for reliability was determined using a pilot test. The investigator normally collects data from a minimum of 30 subjects (Sekaran & Bougie, 2010). The sample used for the pilot test could not be included in the final sample, as the data would no longer valid. The questionnaire used in the pilot study and the actual study differed due to some modifications made after conducting the pilot study.

Data collected from the pilot was analysed using Statistical Package for Social Scientists (SPSS). The data analysis software generated two essential pieces of information which are the 'correlation matrix' and 'view alpha if item deleted' columns. Cronbach alpha (α) is the most generally used measure of internal consistency reliability (Bonett, 2010). It shows that closely related items are related as a category. Thus, this instrument was used in this investigation to assess the survey's internal consistency.

According to Bolarinwa (2015), conditions that could affect Cronbach values include:

- The numbers of survey items; the scale of <10 variables could cause Cronbach alpha to be low.
- Score distribution; normality increases Cronbach's alpha value while skewed data reduces it.

- Timing; Cronbach alpha does not indicate the stability or consistency of the test over time.
- The wording of the items; negative-worded questionnaire should be reversed before scoring.
- Items with 0, 1 and negative scores: Ensure that items/statements that have 0 s, 1 s and negatives are eliminated.

The reliability coefficient (alpha) can range from 0 to 1, with 0 representing a questionnaire that is not reliable and 1 representing absolutely reliable questionnaire. A reliability coefficient (alpha) of at least 0.70 or higher is considered acceptable reliability in SPSS (Sekaran & Bougie, 2010). Therefore, such coefficients can be used as an item in the survey instrument (Cohen, Manion, & Morrison, 2011).

### 3.6 Validity of Instruments

Bolarinwa (2015) explains that there are four types of validity that can be assessed in questionnaires. They include face, content, construct and criterion validity.

- Face validity: Experts and sample participants evaluate whether the questionnaire measures what it intends to measure.
- Content validity: experts perform this assessment. They evaluate whether the questionnaire content accurately assesses all the fundamental aspects of the topic. The experts must be specialists in the specified field.

- Construct validity: It should be evaluated if specific criteria cannot be identified to adequately define the construct being measured. Expert determination of content validity or factor analysis can substantiate that key constructs underpinning the content are included.
- Criterion validity: In this kind of assessment, the replies to the survey items are compared to a "gold standard," which is a predetermined benchmark.

For the purposes of this study, content validity was used for validity purposes by referring to an expert in the area of intellectual capital. Face validity and construct validity were employed as a validity assessing method. Expert's opinion was sought in order to determine the validity of the survey construct and the measurement instrument. In order to do this, the questionnaire that has been checked for reliability was sent to experts, an academician with professorship status to validate it.

## 3.7 Pilot test

To carry out a pilot test, the researcher sought to interview three professors who confirmed that the interview questions are valid, using convenience sampling. The data were tested for reliability and sent for validation. The items which did not meet the minimum criteria set for this research were dropped from the questionnaire.

## 3.8 Analysis and reporting of Intellectual capital

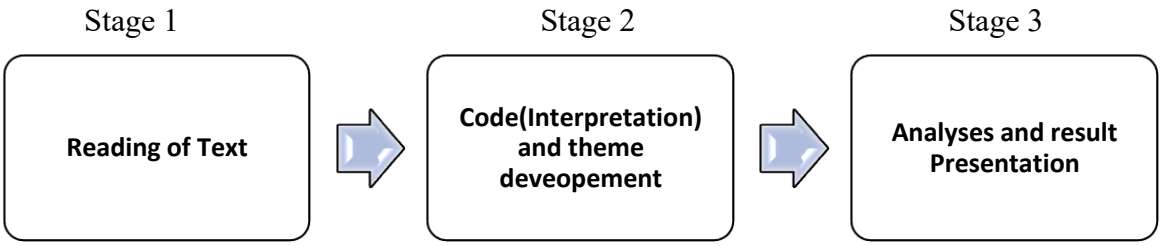
Statistical Package for Social Scientists (SPSS) and Stata were used to analyse the data collected. Data analysis techniques adopted was used to perform descriptive and correlation analysis. The analysis took into account the independent and dependent variable. The independent variables are human capital, structural capital and social/relational capital. The dependent variable is innovation. Descriptive statistics were used to reveal the nature of the relation between IC and innovation level among faculty members in Saudi Arabia Universities.

Qualitative analysis was carried out with the intention of analysing the data collected during the whole process of the study. The data were analysed to provide some understanding, interpretation and explanation of concepts that characterise intellectual capital in relation to innovation. The researcher's focus was on how the qualitative data obtained relates to faculty members as a specific group in Saudi Arabia universities. The analysis revealed core patterns and themes related to intellectual capital.

# CHAPTER 4: DATA ANALYSES AND RESULTS

## 4.1 QUALITATIVE ANALYSIS

The analysis was conducted using Nvivo 12, a qualitative powerful qualitative analysis software developed and owned by QSR international, this section will follow a 3-stage process as displayed in the figure below;




**Stage 1**

The transcribed interview was read severally to get a complete overview of what the data entails, care was given to identify the most used words, this was done as a form of feasibility test, to ensure the collected data is addressing the subject of the research before commencing analysis. Upon completion of the text reading, a word cloud was used to depict the most used words in the collected data, this was done in a bid to ascertain what the given data entails.


Words such as research, university, support, scientific, students, financial etc. were among the most occurring words, indicating that the collected data contains some of the research keywords.

**Stage 2**

Interpretation in form of codes was assigned to the text in this stage, the developed codes were combined based on the existing uniformity within them to form codes. The codes were created to capture amongst some other details the impact of intellectual capital on innovation at the university. Initial theme and code development using deductive approach revealed the following themes and codes as shown below;

| Name | References (Number of occurrence) |
|---|---|
| **Innovation requirements** | 74 |
| **Structural Capital** | 35 |
| Task specification is of high importance | 2 |
| Creation of a general publication platform | 1 |
| provision of laboratory assistants and teaching assistants | 1 |
| Provision of a centralized work Centre | 1 |
| Proper infrastructure and materials | 3 |
| Excessive Administrative procedure (Bureaucracy) | 6 |
| Presence of a good atmosphere | 2 |
| Material motivation | 2 |
| Inter-university cooperation | 5 |
| Allocate extra time for research | 8 |
| IP right | 2 |
| Library | 2 |
| **Relational Capital** | 14 |
| Proper communication and teamwork amongst research stakeholders | 1 |
| Equality of gender the about grab opportunities to promote research | 3 |
| Need appreciation | 4 |
| Need ease of communication with senior management | 1 |
| Help from colleagues | 5 |
| **Human Capital** | 11 |
| Self-learning is crucial | 4 |
| Clarity of mind | 3 |
| Improve social network to enhance research cooperation | 4 |

| | |
|---|---|
| **Finance Capital** | 8 |
| Research can be improved with financial support | 7 |
| Private company partnership | |
| Financial Support must be given to respondents | 1 |
| **Government IC Policies** | 6 |
| Salary increase would boost innovation | 1 |
| Government provision for innovators | 1 |
| Evaluating and adjusting government procedures | 2 |
| Load | 2 |

**Stage 3**

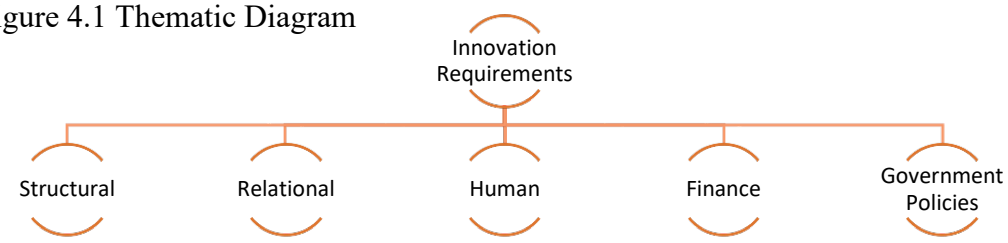
**Demography**

The data was collected from 23 respondents, 15 males and 8 females. 4 professors, 12 assistant professors, 1 co-professor and 6 associate professors.

The analysed data revealed intellectual capital has an impact on the innovation level at the higher education institutions. All respondents reiterated the need for intellectual capital on innovation as revealed in the following themes and their respective codes.

In other go ascertain the effect of the respective IC on innovation, the themes were subdivided into the 3 branches of IC.

Figure 4.1 Thematic Diagram




This analysis is focused on understanding the effect on IC on innovation in Saudi Universities. Therefore, some of the earlier created codes will be exempted from this analysis, mainly because the data did not reveal any relationship between them and innovation.

**Innovation requirements**

This theme is exploring the requirements for innovation given by the respondents with respect to IC.

**Structural Capital**

a. **Task specification is of high importance:** Respondents believe innovation is greatly limited in an environment where tasks are not specified, they believe an environment where everyone knows their role and function will be more innovative than one that is not.

*"Giving time and stress, identifying the tasks of the present, means that we have laboratory technicians and scientific researchers. All of them are busy and attend together. There is no difference between them. The scientific researcher needs to have different tasks, because the person has transparency and clarity and has written tasks that are more creative."*

"*Designing a research plan and determining the role of departments in each role. Each department can participate in this research plan and then allocate appropriate time for all faculty members to participate in research. This may help to develop and improve research in the university.*"

b. **Creation of a general publication platform:** respondents believe the university can improve research and innovation by creation a publication platform that is open to both members of the university and non-members, this is stemmed from the common publication challenge faced by researchers.

*"We can improve the University's work on the work of a special scientific journal that helps researchers to write research, as well as researchers from outside the university to publish these researches in that magazine at the university."*

c. **provision of laboratory assistants:** Respondents believe innovation in university is affected by the presence or absence of adequate laboratory assistants who can help in scientific research, these assistants must be knowledgeable on the intricacies of conducting scientific research, responses under this node include;

*"providing laboratories and research assistants who are scientifically distinguished to support faculty members in research and then scientific publishing."*

d. **Provision of a centralized work Centre:** Respondents believe the presence of a centralized working/research Centre will have an indirect impact on innovation. Having all expert in a field working in the same facility would boost cooperation and would also reduce infrastructural cost, respondents noted that this would aid the achievement of expected results in the research.

*"Research Centres We do not have research centres, each one works alone. For example, a doctor works for himself. And another doctor comes the same specialization works the same thing there will be repetition. I hope to establish a centre and all members work with each other to reduce waste in effort and financial waste and be the best achievement."*

e. **Proper infrastructure and materials:** Innovation can be improved if the university has the proper infrastructure, in terms of devices, tools, and materials needed for research.

*"The infrastructure needs improve for administrative and development process in terms of training and books used in research and use in the process of extraction of research there are several ways in the process of extraction of research and manufacturing, or manufacturing reports required of students and students would prefer to be developed."*

*"The difficulty of obtaining certain materials is always the hindrance to research."*

*"Limited laboratory equipment, financial support, and communication with other large universities are all major obstacles. The lack of research priorities for the region to directly serve this area is also an obstacle. We must have a serious management based on improving those obstacles and treating them. It becomes a kind of open communication between universities and the flexibility of communication, providing tools, and providing financial support for research is always the main motivation. If the tools you mentioned are available, the university has standards, tools, and plans, but nothing tangible"*

f. **Excessive Administrative Procedure (Bureaucracy):** Excessive procedure when seeking to get approval for research sometimes slows down

innovation as indicated by the respondent. Research is needed to innovated, and late or none approval of research means late or nil innovation

*"Of course, bureaucracy in general is required and is very useful with the sequence of functions, especially the transfer of requests from one department to another administrative level of another is therefore very required and arranged work. But possible to challenge the innovation of the member if the organizational structure is simplified rather than conical is less in the bureaucratic sequence"*

"*Any transaction must go through the usual steps even if it is clear, the head of the department then the administrator and the agent sometimes reach the manager and return the same line almost*"

*"Reducing bureaucracy, we are in a competitive stage with international universities. We do not always regard the university as local but international. We need to be dynamic with effective change. With Vision 2030, based on the new plan, for the year 2030 we are still in bureaucracy and delay in making decisions and delay in appointments and regulations. And consideration of this is possible if it changed that it is embarking on the process of change and development."*

"*The distribution of powers at different levels in the sense must give specific powers and clear to the head of the department as well as the Dean because now everything is up to the senior management and take time, what the powers of the head of the Department of the special and the Dean because the head of the department is close to the members of the faculty and touch their need more than others It has authority. For example, it adopts certain projects or adopts certain conferences or purchases some devices and has a great authority in the work*"

"*The university suffers from centralization. I think that this is in all universities.*"

"*Innovation through transparency in the administration of the university to introduce all the criteria in their choices in the priorities of attendance and departure and tools and all regulations and tools and implementation and implementation of all the departments because unfortunately we have a kind of central management of the university all things that create fog*"

g. **Presence of a good atmosphere:** Respondents believe the sole driver of innovation is the general atmosphere of the university, they believe researchers cannot be innovative in a tense environment.

*“I believe that it is the first thing in the innovation. The faculty member, if he feels a comfortable atmosphere, all this drives him to walk in the path of innovation and be innovative.”*

**"***Fair policy helps to have a comfortable atmosphere for the faculty members and I think it is the number one innovation in the faculty member if he felt a comfortable atmosphere all this drives him to walk in the way of innovation and be innovative.***"**

h. **Material and moral motivation:** Motivation (moral and material/finance) was pointed was highlighted to have a significant impact on innovation, they believe this factor is crucial for innovation to thrive in their respective university.

*“Yes, for everyone, so I believe that the material motivation is productive, do work and I’ll support you”*

**"***The sense of continuous motivation and positive will be creative in the work because when he does an excellent job and good must give him moral support sometimes be moral support word or letter of thanks***"**

i. **Inter-university cooperation:** This is another factor mentioned by one of the respondents, they believe cooperation and exchange of resources (human and material) amongst university can significantly boost innovation.

"*Cooperation between the other universities is important because they have experiences and laboratories we need to benefit from them and of course cooperation with industry as well as we know the problems and our research products are in the interest of society and the problems that exist in the industry these are the most important things for excellence."*

*"The lack of linkage and cooperation with the powerful forces greatly weaken everything within the universities at the end of the work, whether military, health, educational or industrial work, there must be knowledge and participation in information and constructive criticism between the university and these government agencies."*

*"There should be some sort of open communication between the universities and the flexibility of communication"*

*"Cooperation between the other universities is important because they have experiences and laboratories we need to benefit from them and of course cooperation with industry as well as we know the problems and our research products are in the interest of society"*

*"Innovation through scientific and external communication means visiting other universities and competing with them on scientific research to support the cause of innovation, but this university is almost closed."*

j. **Allocate extra time for research:** majority of the respondents decry the unavailability of time for research, this unavailability is as result of the administrative positions held by the respondents. They believe allocating a special time for them in the school curriculum for research alone, would significantly increase their innovativeness.

*"I sit on the computer more than my sleep, more than I sit quiet, and read books. I love to read the books of my library so much. I love to read them, but all the time I'm sitting on the computer to work."*

*"Most of the time is directed to teaching and the work of quality and time is short for scientific research, and may be the number of faculty members few Each specialization may be only one doctor then the research field is a little narrower"*

*"Reducing the teaching burden of research activists Not all teachers are research activists. I say that in a place in the world we distinguish activists and reduce the burden of teaching to have more hours for scientific research and this is done in other universities."*

*"To encourage research, a faculty member should give two full-time days each week for scientific research and end-of-term assessment of your research work"*

*"I think innovation has to be a full-time person to create, it is necessary to allow more time for the faculty member"*

*"I am an administrator at the university and not the subject of teaching only. The factor of time is very difficult, and this can be the majority here. The management of the time factor needs a strong management. It affects greatly the performance of the individual."*

*"I'm a researcher who does not need any support, other than time. Time is very important. Time is the biggest obstacle. I mean, I have dozens of wonderful research, but I do not have time."*

*"Our problem is that 24 hours are divided between our administrative work at college, Teaching, parenting, family, traveling between house and work, all of which affect the field of research explicitly"*

**k. IP right:** Some respondents complained about the process of adopting property rights, as some suffered from university involvement or the supporting companies for innovation

*"We have intellectual rights openly violated in University or in the external bodies, we find the research and messages and initiatives, projects and programs and work on them for very long periods, but unfortunately rights are not preserved"*

*"We have material support and a company, which was a private sector within the university. it is company private sector follow the university if anyone has a project presented to them as they study and resolve something similar business After what they teach, they say this is a promising product that we will support if We will be partners with you."*

L. **Library:** Respondents requested that the library of the university be open 24 hours or at least to the end of the night so that they can benefit from it as much as possible

*"I want the university open 24 hours, so I do mean at least until 11 pm "*

*"It is possible to extend the school day to late hours. This is possible given the opportunity for students to be in the university campus. For example, the establishment of centers inside or outside the colleges, which means a physical environment that encourages innovation in terms of communication with the outside world, A unified university can be more effective."*

**Relational capital**

a. **Proper communication and teamwork amongst research stakeholders:** Innovation can be improved through proper communication amongst research stakeholders (researcher(s), colleagues, professors, research assistants etc.). Proper communication birth the hasty and timely development of new ideas that would form the bedrock for innovation.

*"First of all, team work as one hand, shared ideas, workshops and help with other sections open up a wider field of research, whenever the opportunities are greater, new ideas, strong researches, honest intention and a common goal all these pour in the benefit of the research success."*

b. **Equality of gender the about grab opportunities to promote research**: respondents noted that women have results yielded a significant positive impact on innovation, therefore, this helps innovation.

*" I expect the role of women is effective at this time, very great cooperation between male and female colleagues, all the cooperation is effective, constructive, we recently discovered that women despite their multiple concerns, Allah Almighty enabled them to do several things at the same time, for example, I cannot talk on the phone and write in the paper, I mean that If we leave the field for women to*

*cooperate with men there will be a very large productivity and Allah knows what is the best."*

*"The male section is more able to seize opportunities because the departments are managed by men, the support goes to men."*

*"When we see the researches of the university and the research of our college specifically, the man section is in the sky and we are low."*

c. **Need appreciation:** Respondents emphasized their strong need for appreciation and moral support from management

*"The appreciation, the appreciation, the appreciation, and put under it 10 lines, the financial is necessary. but I mean the professor is like someone at the end who says thank you I swear you were doing an effort I mean the appreciation is very important not talking about the financial estimate I mean the financial estimate is nice no one hates money but Also the moral appreciation is very important."*

*"To be innovative that when you find support and appreciation"*

*"The number one most important thing estimates, the estimate to feel that in the estimated place"*

*"We may not give them money, but give him the appreciation for the faculty such as what is your opinion and discuss them and meet them every semester and feel that his/her ideas are estimated"*

**d. Need ease of communication with top leadership:**

*"Yes, we need windows to be open between the faculty and the top leadership directly. The channels of communication are available. The site of the administration of communication and messages come to almost hundreds of messages a week but do not read it impossible. We need to be filtered and categorized at the end of the day or week and show ideas and suggestions and a meeting with the owner of the idea or suggestion."*

**e. Help from colleagues:** Help from colleagues is crucial for innovation as pointed out by the respondents, they believe their success in research was as a result of the assistance they got from their colleagues.

*"is the help of my colleagues as well as some graduate students each one has a role to play and the benefit, we all benefited from each other."*

"*Sharing information with colleagues is very useful, even if a person has a doctorate, every individual is successful in his field of specialization. We still learn from anyone in any specialty*"

"*If you have good information you need to publish it with help, by facilitating obstacles, cooperating with colleagues, leaving disputes and harassment*"

"*All the members here are cooperating but we need more"*

"*Team work, one hand, shared ideas, workshops and assistance with the rest of the sections open up a wider field of research, all the opportunities were greater, the ideas were new and the research was stronger, the sincere intention and the single goal all contribute to the success of the research.*"

**Human Capital**

a. **Self-learning is crucial:** Innovation is only possible if the researcher as a personal motivation to keep learning.

*"Focus on the same researcher, what did you do to elevate yourself? Everything provided by universities if not the same person has the enthusiasm and motivation will not benefit."*

*"The process of innovation belongs to the person himself and is convinced that this is a message of his mission to research and develop new areas with his specialization always be interested and this interest to his creative"*

*" The human is a self-serving and says I exist and market for himself must have experience and interpersonal skills patience and endurance and the skill of problem solving, meaning in personality traits and be a neutral person"*

*"Continue the process of self-motivation to be more productive and related to things in the university"*

*b.* **Clarity of mind:** This is also seen as an essential tool for innovation, respondents believe any scholar looking to innovate must engulf himself/herself with the task and not occupy his/her mind with other things.

*" Clarity of mind, constant search, constant reading"*

*" some social conditions, including family conditions and frequent travel time, it occupies time and occupies space in mind"*

*"Time , because at the end he has 24 hours I wish he has 48 hours and the real requirements is very many that he works in the communities and he serves the student and he is perfect as a university professor, the truth is very difficult, I have flexibility because my kids are already in the university stage but before that I was suffering before that I see professors of the university who have the requirements of a house and such is very hard for them."*

c. **Improve social network to enhance research cooperation:** The researcher must be willing to improve social relationship with colleagues and professors for the purpose of intellectual cooperation.

*"One is sure to benefit from his colleagues and develop himself either from colleagues or self-help, both in the presence of courses or reading"*

*"My colleagues advised me to participate in a Master's and PhD thesis for some students so that the faculty member is involved in the academic and research process. It depends on the person to be interacting with those who are experienced to adapt to the research work"*

*"I consult my colleagues when I teach a new subject as well as in supervising some master's letters I ask experienced people to benefit from them"*

*"We work together and cooperate with each other and each one share his experience and educational level with others and benefit from each other"*

**Finance Capital**

**A. Research can be improved with financial support**

**B. financial Support must be given to respondents**

Majority of the respondents complained about funding, and they complained that this has a negative impact on innovation. It is worthy to note that there are some existing differences in their complaints on finance. Some researchers do not get any form of funding while some get funding, however, very inadequate. Some also complained that the bureaucracy involved in applying for research grants is discouraging and complex. Generally, all respondents agree that finance has a huge impact on their innovativeness. Generally, funding affects the structural capital of getting the needed resources necessary for research.

*"Certainly, there are financial difficulties, most of the research I have done was at a personal cost and not with financial support from the university. There is, of course, the act that the University is allocating a certain amount for research, but I have not had the opportunity to get it and benefit from it."*

*"Yes, there is funding but after you publish. How you will publish when you don't have work? And how you will work when you don't have funds?"*

*"Honestly, the University has begun a great development and very much to encourage innovation, but for scientific research, we face the poverty of some devices, and will be provided in the near future."*

*"is very little, and very little is not very frank, and this is a problem. Especially now, all the research we are working on is ISI means in the areas of excellence, which do not accept any magazine even if the court is global, "*

*"lack of financial support for research"*

*" financial support is greater for research, means more financial support and less routine, meaning if you go on a search and wait for a year, after the year responds to you positively or exile. It is possible that he will not be able to take his age. If we walked through this path, he would be the killer of innovation."*

*"The university needs some kind of transparency and financial support to achieve the goals of the university"*

**C. Private company partnership**

*"I want to reach large companies or big banks and we do joint research to serve them to a great extent and serve the community also through the research in the sense of integration between companies and universities I am a researcher invented something and you as a company you have a problem, what you propose on your problem and we study and research and develop solutions through scientific research"*

**Government IC Policies**

**A. Salary increase would boost innovation**

*"The basic salary in higher education is very low compared to other sectors, and the bulk of our salaries are the allowances. However, these allowances are not paid during retirement, and this affects very significantly after the retirement of the faculty member. The basic salary is weak"*

**B. Government provision for innovators:** Generally, there is not item interest to innovator by MOE

*"The ministry's instruction on education has no clause on whether a person has invented something, next year will reduce the teaching burden to half. There is no scientific limit to be precise. You do not find a specific item interested in the innovator."*

**C. Evaluating and adjusting government procedures:** Generally, the impact of government on innovation is directly stated in the data. However, a respondent pointed out that the complexity of obtaining

research approval and research grants is a result of the policies created by the government (ministry), this university is mandated to follow this procedure, therefore slowing down innovation as earlier stated.

*"Some government procedures may affect the speed of taking the procedures. The research process does not facilitate the research, it is not because of the university but because of some actions taken outside the university."*

*"We sometimes expect that the one who does not ask for a program or research tools and needs it within a month or two we get the subject takes longer because of the government procedures known."*

**D. Load:** Faculty members suffer from high teaching load in private Saudi universities, which hinders them from finding time for scientific research and then innovation

*"We have worked to stimulate scientific research. For example, we pay for prof incentives if he participates in a conference and receives incentives if he does a translation. So, the scientific research organization has become encouraged to research. Especially that the load in universities is high. So, we are motivating the prof to find time for scientific research."*

*"The Ministry of Education defined that assistant professor has 14 hours and 16 hours. Consequently, this number is very high, I think that this load is very high. "*

## IC FOR INNOVATION AND UNIVERSITY CLASSIFICATION

As earlier stated, 7 universities were represented in this analysis, the 7 universities were grouped together with respect to similarity between them and the difference in their responses with respect to IC for innovation was assessed.

| University | Classification |
|---|---|
| King Saud University<br>King Abdulaziz University<br>King Fahd University | Leading Universities |
| Um Al Qura University<br>Taif University | Emerging Universities |
| Prince Fahad Bin Sultan University<br>Riyadh Elm University | Private Universities |

The preceding sections have explored the meaning of the nodes and what they represent,

**1. Structural Capital Requirement for Innovation and University Classification**

| Name | University Classification |
|---|---|
| Task specification is of high importance | Leading and private |
| Creation of a general publication platform | Private |
| provision of laboratory assistants and teaching assistants | Leading and private |
| Provision of a centralized work Centre | Emerging |
| Proper infrastructure and materials | Emerging |
| Excessive Administrative procedure (Bureaucracy) | Leading and emerging |
| Presence of a good atmosphere | Private |
| Material motivation | Leading and Emerging |
| Inter-university cooperation | Emerging |
| Allocate extra time for research | Leading, Emerging and Private |
| IP right | Leading and emerging |
| Library | Leading |

Interestingly, the structural capital needed for innovation is divided among all three categories as shown in the above table.

**2. Relational Capital Requirement for Innovation and University Classification**

| Name | University Classification |
|---|---|
| Proper communication and teamwork amongst research stakeholders | Leading and emerging |
| Equality of gender the about grab opportunities to promote research | Leading |
| Need appreciation | Leading and emerging |
| Need ease of communication with senior management | Emerging |
| Help from colleagues | Leading and emerging |

Only the leading and emerging universities are represented in this capital, the data reveals the private universities have no problem with innovation at the relational capital level.

### 3. Human Capital Requirement for Innovation and University Classification

| Name | University Classification |
|---|---|
| Self-learning is crucial | Leading and emerging |
| Clarity of mind | Leading and Private |
| Improve social network to enhance research cooperation | Leading and emerging |

### 4. Finance Capital Requirement for Innovation and University Classification

| Name | University Classification |
|---|---|
| Research can be improved with financial support | Leading, emerging and private |
| Private company partnership | Leading and emerging |
| Financial Support must be given to respondents | Leading, emerging and private |

### 5. Government Policies Capital Requirement for Innovation and University Classification

| Name | University Classification |
|---|---|
| Salary increase would boost innovation | Emerging |
| Government provision for innovators | Leading, emerging and private |
| Evaluating and adjusting government procedures | Leading, emerging |
| Load | private |

## 4.1.1 What is the new?

### 1- Student preoccupation (private & leading universities)

*"The thing that I do not like is student preoccupation. Most students at Prince Fahd University are employees. The students are preoccupied with them, including the people of the army. Therefore, we do not know how to solve the equation between the student's comfort and the problem of their preoccupation with the job. This affects their lack of attendance and lack of scientific material, which makes me a sad faculty member on these students"*

*"We have here most Students are linked to other jobs. They do not care about scientific research."*

**2- Publishing in ISI journal (Leading universities)**

*"There are more catalysts that need to build and support the scientific publishing in international journals and participate in conferences in ISI journal and this condition is very difficult to prevent from participating in conferences, which is very important and must be used, but this condition prevents us from benefiting from conferences."*

*"I think that you should take into account the ratio available for each specialty, for example field (a) where the number of instances of journals that do not take time in research and publication opportunity is a large faculty members request that there be a fair equation between the requirements of (a) (B) In support and acceptance of opportunities and even in publishing, those who are now published in regular journals if supported will be published in the ISI journal"*

*"The issue of scientific research that the publication in ISI journal is not the main factor for research."*

*"The university has recently sought to stipulate that the research is published in the ISI journals and referees for research, which would raise the value of research submitted for the purpose of promotion." +*

*"Publication in ISI journals, which have helped to improve the level of research. The University has gone a long way in terms of innovation." +*

*"All the research we are working on is ISI means in the areas of excellence, which do not accept any journal even if the court and global."*

**3- Facilities (private& emerging universities)**

*"I would love to have a whole unified area. it does not relevant with academic work. Including sports, cafeteria and other entertainment. And be unified and not distributed."*

*"Students need clubs, we are waiting to move to the new building, which is one of the largest universities, and all these things will be resolved."*

**4- Publishing Effortlessly: (Leading universities)**

*"The culture spread is normal. They write your name without effort. I tell them how to write my name. I do not know anything about the research, but I strongly reject it. I have to practice research and write the percentage of my work in research. 10%, 20%, 70%."*

### 4.1.2 What is not relevant?

#### 1- Reputation (leading universities)

*“King Saud University is a distinguished university in the Kingdom with a history of more than fifty years.”*

*"University is distinguished and its reputation in general and the extent of its impact on society and that all people speak about it can be the biggest motivation within the university in the system and infrastructure is distinct in everything, whether teaching or research"*

*"King Saud University is one of the first universities that started with King Fahd University and King Abdelaziz University is the highest rated universities in the Kingdom"*

*"The system is clear according to the effort of the person gets the return, whether moral or physical according to his effort and work and projects implemented by the system the most important thing of the system and the application of equality and justice and to the extent that the system is clear and study from the first day to the last day What in the vacations and absences can be the most beautiful thing in the university system clear and strict"*

#### 2- The effects of the Psychological side (leading & private universities)

*"clarity of mind each one should not occupy his mind in other things"*

*" I want to do in this research is that you deal very much with the process that is concerned with mental, intellectual and cognitive issues and during your continuation in the research process because it is considered the basic rule or the basic roots of every tree.."*

*“The psychological and personal side is to continue the process of self-motivation to be more productive and related to things in the university, as well as some social conditions, including family conditions and frequent travel time”*

#### 3- Level of enrolled students (leading, emerging& private)

*“Only the level of students, the level of students or general education, can be a problem, so I see it as a point that the emerging universities may face”*

*“The university in country side, it has accepted the student low rates I mean everyone in Jeddah is coming to Rabigh because Jeddah rate is high but the rate of rabigh is low so the level of physics department we accepted many girls want to enter the physics section because they have low rate.”*

*“Reduce the number of admissions there are a large number now is Great burden on university and society”*

*"One of the things that helps innovation is to change the quality of the student, not the student himself, and by focusing on the schools through the quality of the*

*study in the schools before the university stage at the university level. The more the student input and education are improved, the better the education in terms of education."*

4- **Number of students in postgraduate studies (leading & private universities)**

*"The lack of the number of students in postgraduate studies can affect the research process in the case of students but their number is insufficient"*

*"The number of postgraduate students helps greatly as the number increases and their participation in master's and doctoral research if they exist"*

*"The thing that improves research in this university is students. Especially Masters students. Two years ago, we opened four new master's programs. I hope this helps the professors".*

*"The presence of students and the increase is too important, whenever, The higher the number of graduate students, whenever the greater the results."*

5- **Retirement System: (leading universities)**

*"If the person does not want to retire let him continue because the prof knows advanced things and abroad continues for 80- and 90-years' experience and research capacity are useful for beginners and graduate students should benefit from previous experiences"*

6- **Promotions system: (leading& emerging universities)**

*"The promotion system is linked to the number of years of experience, whether in other organizations or universities the human has the ability to search and the nature of his work attracts him to search Applied research may be different from academic research, and even when you get the support that supports for scientific research, but may not find the result of this research unless applied to help them to address the work."*

*"The Higher Education Regulation for promotions in order to increase from the lecturer to the assistant and from the lecturer to the associate professor and the associate professor to the doctor there are laws that must pass 4 years of the same degree and require a certain number of researches. I am involved in research with 3 scientists at the world level, but they do not give me any point if I am a participant, in contrast, I am writing one research without any benefits and I am one scholar and well known how the one researcher is doing his work, these are laws, but they lack credibility and is illogical and is not true,"*

*"Produce research you get promoted, but in fact, is a purely routine process in the university has no impact on the community".*

## 4.2 : QUANTITATIVE ANALYSIS

The analysis is focused on investigating the components of intellectual capital that influence innovation.

The following hypotheses will be tested in this section;

**Hypothesis 1**

$H_0$ – Human Capital is the major factor affecting the intellectual capital toward innovation level among faculty.

$H_1$ – Human Capital is not the major factor affecting the intellectual capital toward innovation level among faculty.

**Hypothesis 2**

$H_0$ – Structural Capital is the major factor affecting the intellectual capital toward innovation level among faculty.

$H_1$ – Structural Capital is not the major factor affecting the intellectual capital toward innovation level among faculty.

**Hypothesis 3**

$H_0$ –Relational Capital is the major factor affecting the intellectual capital toward innovation level among faculty.

$H_1$ –Relational Capital is not the major factor affecting the intellectual capital toward innovation level among faculty.

**Hypothesis 4**

$H_0$ – Government Intellectual Capital policies do not affect the innovation level among faculty.

$H_1$ – Government Intellectual Capital policies affect the innovation level among faculty.

**Hypothesis 5**

$H_0$ ¬ Government Intellectual Capital policies do not affect the outcome of Human capital towards innovation levels among faculty.

$H_1$ ¬ Government Intellectual Capital policies affect the outcome of Human capital towards innovation levels among faculty.

**Hypothesis 6**

$H_0$ - Government Intellectual Capital policies do not affect the outcome of Structural capital towards innovation level among faculty.

$H_1$ - Government Intellectual Capital policies affect the outcome of Structural capital towards innovation level among faculty.

**Hypothesis 7**

$H_0$- Government Intellectual Capital policies do not affect the outcome of Relational capital towards innovation level among faculty.

$H_1$- Government Intellectual Capital policies affect the outcome of Relational capital towards innovation level among faculty.

**Hypothesis 8**

$H_0$- Financial support does not affect the innovation level among faculty.

$H_1$- Financial support affects the innovation level among faculty.

**Hypothesis 9**

$H_0$- Financial Support does not affect the outcome of Human capital towards innovation level among faculty.

$H_1$- Financial Support affects the outcome of Human capital towards innovation level among faculty.

**Hypothesis 10**

$H_0$- Financial Support does not affect the outcome of Structural capital towards innovation level among faculty.

$H_1$- Financial Support affects the outcome of Structural capital towards innovation level among faculty.

**Hypothesis 11**

$H_0$ - Financial Support does not affect the outcome of Relational capital towards innovation level among faculty.

$H_1$ - Financial Support affects the outcome of Relational capital towards innovation level among faculty.

**Hypothesis 12**

$H_0$ - The intellectual capital level is not affected by the Innovation level among faculty.

$H_1$ - The intellectual capital level is affected by the Innovation level among faculty.

**Data Presentation**

162 respondents successfully completed the survey questionnaire throughout the dissertation. A Likert scale questionnaire design was used to capture the perspective of the respondents on the 12 variables of interest, namely; Innovation, human capital, structural capital, relational capital, Government IC Policies to innovation, Government IC Policies to human capital, Government IC Policies to structural capital, Government IC Policies to relational capital, Financial support to innovation, Financial support to human capital, Financial support to structural capital and Financial support to relational capital.

Interval data on some of the characteristics of the universities was included as part of the control variables; Age of institution, Deanship college, Patents awarded, Admission rate, Number of publications since 2012 and Number of administrative staff.

The ordinal variable was measured on 1-7 scale; Very strongly disagree, Strongly Disagree, Disagree, neither disagree nor agree, Agree, Strongly Agree, very strongly agree.

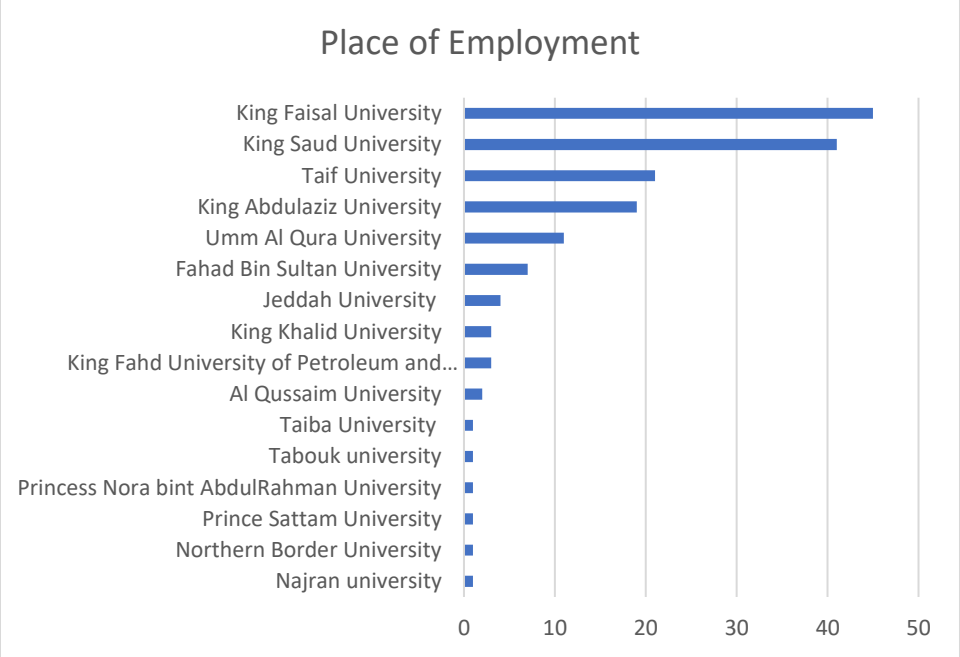
## Data Presentation

Data was gathered with the use of an online survey, 162 completed the questionnaire.

## Demographic Information

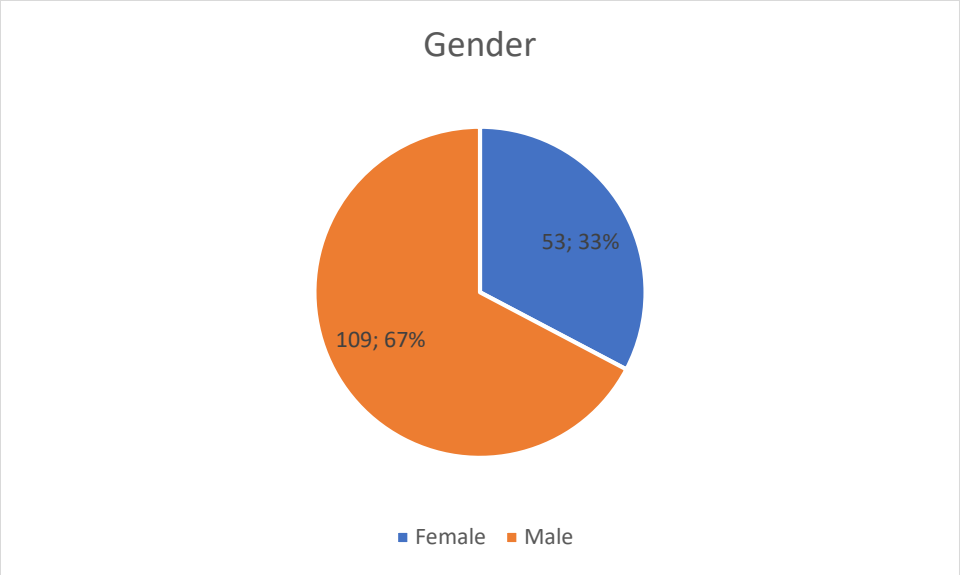
### Institution distribution

Majority of the respondents are employees of King Faisal University as shown in the chart below;



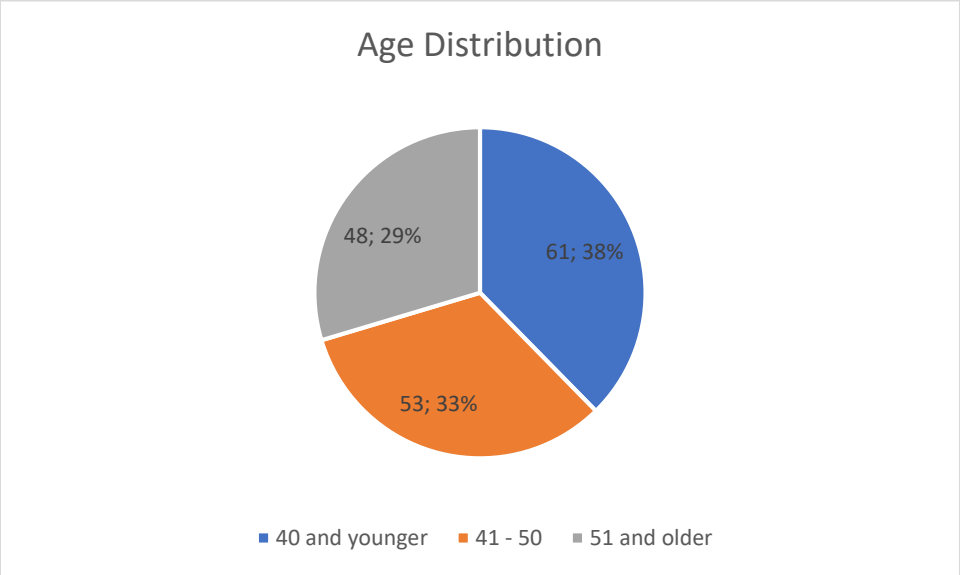

### Gender Distribution

67% of the total respondents are males while the rest are females.




Age Distribution

38% of the respondents are between the ages of 0 to 40, 33% are 41-50 years old while 29% are above 50 years old.




**Academic Rank**

1. All respondents are Professors with 57% of them holding the associate professor rank.

| Academic Rank | Frequency | Percentage |
|---|---|---|
| Assistant Professor | 93 | 57% |
| Associate Professor | 34 | 21% |
| Professor | 35 | 22% |
| Total | 162 | 100% |

**Citizenship**

2. 62% of the respondents are Saudi citizens, this is followed by Arab citizens that hold 31% of the respondents.

| Race | Frequency | Percentage |
|---|---|---|
| Arab | 50 | 31% |
| Asian | 6 | 4% |
| Other | 5 | 3% |
| Saudi | 100 | 62% |
| Westerner | 1 | 1% |
| Grand Total | 162 | 100% |

**Place of Academic Qualification**

2. 46% of the respondents earned their academic degree from a western institution.

| Origin of earned academic degree | Frequency | Percentage |
|---|---|---|
| Asian | 14 | 9% |
| Middle Eastern | 30 | 19% |
| Other | 14 | 9% |
| Saudi | 30 | 19% |
| Westerner | 74 | 46% |
| Grand Total | 162 | 100% |

**Language Proficiency**

4. 62% of the respondents have proficiency in Arabic.

**Language Proficiency**

| Foreign language Proficiency | Frequency | Percentage |
|---|---|---|
| Arabic | 101 | 62% |
| English | 40 | 25% |
| French | 2 | 1% |
| None | 10 | 6% |
| Other | 9 | 6% |
| Grand Total | 162 | 100% |

**Reading Habit**

5. 43% of the respondents spend below 10hrs on academic reading and writing daily, while 33% spend 10-20 hours.

| Average Number of Hours Spent on academic reading and writing | Frequency | Percentage |
|---|---|---|
| 10-20hrs | 52 | 32% |
| 21-30hrs | 19 | 12% |
| 31hrs and above | 14 | 9% |
| None | 8 | 5% |
| Under 10hrs | 69 | 43% |
| Grand Total | 162 | 100% |

**Years of Experience**

**6.** Majority (33%) of the respondents have over 20 years' experience in Academia

| Number of years spent in Academia | Frequency | Percentage |
|---|---|---|
| 11-20years | 44 | 27% |
| 1-5 years | 27 | 17% |
| 6-10years | 30 | 19% |
| Less than a year | 8 | 5% |
| Over 20 years | 53 | 33% |
| Grand Total | 162 | 100% |

**Scientific Conference**

**7.** 52% of Respondents attend an average of 1-2 conference(s) annually, while 17% never attend scientific conferences.

| Average Number of Scientific conferences Attended per year | Frequency | Percentage |
|---|---|---|
| 1-2 times | 88 | 54% |

| | | |
|---|---|---|
| 3-4 times | 30 | 19% |
| 5-6 times | 7 | 4% |
| More than 7 times | 11 | 7% |
| Never attend | 26 | 16% |
| Grand Total | 162 | 100% |

## Data Analysis

### Data Sources

Primary and secondary data sources were used for this analysis, the primary data was collected through the use of a survey questionnaire whilst the secondary data was gathered from external sources.

**The primary data variables in this study include;**

1. Human capital
2. Structural capital
3. Relational capital
4. Government innovation
5. Government human capital
6. Government structural capital
7. Government relational capital
8. Financial innovation
9. Financial human capital
10. Financial structural capital
11. Financial relational capital

12. Innovation

**Secondary data variables include;**

1. Number of students
2. Administrative staff
3. Publications
4. Admission rate
5. Patents
6. Age of institution
7. Deanship/college

**Reliability Test for Primary Data**

**Steps Taken to Validate the Reliability of the Survey**

1. Third-party validity check: Upon developing the questionnaire, I consulted a group of colleagues and experts that are familiar with the topic of my research to review the questionnaire and give their assessment and recommendations with regards to whether or not the questionnaire capture the focus of the research.
2. Pilot Test: A pilot test was conducted with 30 participants to use the results of the pilot test to check the relevance of some of the research questions.
3. Data cleaning: As earlier, the questionnaire has an initial of 600 respondents, but the data cleaning process reveals 162 valid questionnaires.
4. Internal consistency check and revising: This was done with the aid of Cronbach's alpha. Details are given below;

Data on the factors under study were collected and measured using a Likert scale; a reliability test was conducted on the scale of measurement of each factor to check its level of internal consistency.

NB: The acceptable Cronbach alpha level is ≥0.70, therefore any scale with a Cronbach alpha of 0.7 is regarded as consistent. SPSS was used test for Cronbach's alpha value of all variables

The results of the reliability test statistics reveal that all scales have a Cronbach's alpha that is greater than 0.700 except Government Intellectual Capital Policies with respect to Structural Capital, Government Intellectual Capital Policies with respect to Relational Capital and Financial support of Intellectual capital with respect to Relational Capital. This was addressed by deleting an item in each scale to attain the 0.700 benchmark.

| S/n | Scale name | Cronbach's Alpha | Number of items in scale |
|---|---|---|---|
| **1** | Human Capital | 0.862 | 5 |
| **2** | Structural Capital | 0.929 | 9 |
| **3** | Relational Capital | 0.931 | 10 |
| **4** | Government Intellectual Capital Policies toward Innovation | 0.980 | 4 |
| **5** | Government Intellectual Capital Policies toward Human Capital | 0.845 | 5 |
| **6** | Government Intellectual Capital Policies toward Structural Capital | 0.803 | 3 (when item 3 was deleted) |
| **7** | Government Intellectual Capital Policies toward Relational Capital | 0.904 | 3 (when item 4 was deleted) |
| **8** | Financial support of Intellectual capital toward Innovation | 0.877 | 4 |

| | | | |
|---|---|---|---|
| **9** | Financial support of Intellectual capital toward Human Capital | 0.616 | 4 |
| **10** | Financial support of Intellectual capital toward Structural Capital | 0.877 | 4 |
| **11** | Financial support of Intellectual capital toward Relational Capital | 0.785 | 2 (when item 2 was deleted) |
| **12** | Innovation | 0.891 | 5 |

**Summary Table**

The mean value of all ordinary variables was calculated, and the summary statistics was formulated;

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Number of students** | 162 | 80840.12 | 44329.54 | 5000 | 180212 |
| **Administrative staff** | 162 | 3635.556 | 1224.402 | 300 | 5000 |
| **Publications** | 162 | 3459.833 | 3823.208 | 36 | 9746 |
| **Admission rate** | 162 | 70.24691 | 19.33524 | 25 | 85 |
| **Patents** | 162 | 38.08642 | 55.60234 | 0 | 392 |
| **Age of institution** | 162 | 45.06173 | 18.95522 | 6 | 71 |
| **Deanship/College** | 162 | 30.73457 | 11.2773 | 7 | 60 |
| **Human Capital** | 162 | 4.820988 | 1.260505 | 2 | 7 |
| **Structural Capital** | 162 | 4.814815 | 1.121347 | 2 | 7 |
| **Relational capital** | 162 | 4.808642 | 1.07792 | 2 | 7 |
| **Government IC Policies toward Innovation** | 162 | 4.58642 | 1.372512 | 1 | 7 |
| **Government IC Policies toward Human Capital** | 162 | 4.240741 | 1.230086 | 1 | 7 |
| **Government IC Policies toward Structural Capital** | 162 | 4.333333 | 1.309307 | 1 | 7 |
| **Government IC Policies toward Relational Capital** | 162 | 4.679012 | 1.288527 | 1 | 7 |
| **Financial Support toward Innovation** | 162 | 4.234568 | 1.27831 | 1 | 7 |
| **Financial Support toward Human Capital** | 162 | 4.567901 | 1.113868 | 1 | 7 |
| **Financial Support toward Structural Capital** | 162 | 4.259259 | 1.203285 | 1 | 7 |
| **Financial Support toward Relational Capital** | 162 | 4.049383 | 1.225011 | 1 | 7 |
| **Innovation** | 162 | 4.777778 | 1.152906 | 1 | 7 |

**Number of students**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 80840.12 This is the statistical mean of the datasets; it is the average of all the number of students.

Std. Dev = 44329.54 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the number of students.

Min = 5000 This is the minimum value, the lowest number of students in the dataset.

Max = 180212 This the maximum, highest number or value in the number of students.

**Administrative staff**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 3635.556 This is the statistical mean of the datasets; it is the average of all the administrative staff.

Std. Dev = 1224.403 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the administrative staff.

Min = 300 This is the minimum value, the lowest number of administrative staff.

Max = 5000 This the maximum, highest number or value in the administrative staff.

**Publications**

The total number of observations = 162 This means the total number of respondents that completed the survey.

Mean = 3459.833 This is the statistical mean of the datasets; it is the average of all the publications since 2012.

Std. Dev = 3823.208 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the publications

Min = 36 This is the minimum value, the lowest number of publications

Max = 9746 This the maximum, highest number or value in the number of publications

**Admission Rate**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 70.2469 This is the statistical mean of the datasets; it is the average of all the admission rate.

Std. Dev = 19.3352 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the admission rate.

Min = 25 This is the minimum value, the lowest number in the admission rate.

Max = 85 This the maximum, highest number or value in the admission rate.

**Patents**

The total number of observations = 162 This means the total number of respondents that completed the survey.

Mean = 38.08642 This is the statistical mean of the datasets, it is the average of all the number of patents awarded.

Std. Dev = 55.60234This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of patents awarded.

Min = 0 This is the minimum value, the lowest number of patents awarded.

Max = 392 This the maximum, highest number, or value in the number of patents awarded.

**Age of Institution**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 45.06173 This is the statistical mean of the datasets; it is the average of all the age of institution.

Std. Dev = 18.95522 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the age of institution.

Min = 6 This is the minimum value, the lowest number in the age of institution.

Max = 71 This the maximum, highest number or value in the age of institution.

**Deanship/College**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 30.73457 This is the statistical mean of the datasets; it is the average of all the number of Deanship/College.

Std. Dev = 11.2773 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the number of Deanship/College.

Min = 7 This is the minimum value, the lowest number in the Deanship/College.

Max = 60 This the maximum, highest number or value in the Deanship/College.

**Human Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.820988 This is the statistical mean of the datasets; it is the average of all the sum of Human capital.

Std. Dev = 1.2605 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Human capital.

Min = 2 This is the minimum value, the lowest number in the Human capital.

Max = 7 This the maximum, highest number or value of the Human capital

**Structural Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.8148 This is the statistical mean of the datasets; it is the average of all the structural capital.

Std. Dev = 1.1213 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the structural capital.

Min = 2 This is the minimum value, the lowest number of structural capital.

Max = 7 This the maximum, highest number or value in the structural capital.

**Relational Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.8084 This is the statistical mean of the datasets; it is the average of all the relational capital.

Std. Dev = 1.0779 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the relational capital.

Min = 2 This is the minimum value, the lowest number of relational capital.

Max = 7 This the maximum, highest number or value in the relational capital.

**Government IC Policies to Innovation**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.5864 This is the statistical mean of the datasets, it is the average of all the Government IC Policies to innovation.

Std. Dev = 1.3725 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Government IC Policies to innovation.

Min = 1 This is the minimum value, the lowest number of Government IC Policies to innovation.

Max = 7 This the maximum, highest number or value in the Government IC Policies to innovation.

**Government IC Policies to Human Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.2407 This is the statistical mean of the datasets; it is the average of all the Government IC Policies to human capital.

Std. Dev = 1.23001 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Government IC Policies to human capital.

Min = 1 This is the minimum value, the lowest number of Government IC Policies to human capital.

Max = 7 This the maximum, highest number or value in the Government IC Policies to human capital.

**Government IC Policies to Structural Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.3333 This is the statistical mean of the datasets; it is the average of all the Government IC Policies to structural capital.

Std. Dev = 1.3093 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Government IC Policies to structural capital.

Min = 1 This is the minimum value, the lowest number of Government IC Policies to structural capital.

Max = 7 This the maximum, highest number or value in the Government IC Policies to structural capital.

**Government IC Policies to Relational Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.6790 This is the statistical mean of the datasets; it is the average of all the Government IC Policies to relational capital.

Std. Dev = 1.2885 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Government IC Policies to relational capital.

Min = 1 This is the minimum value, the lowest number of Government IC Policies to relational capital.

Max = 7 This the maximum, highest number or value in the Government IC Policies to relational capital.

**Financial support to Innovation**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.2346 This is the statistical mean of the datasets; it is the average of all the Financial support to innovation.

Std. Dev = 1.27831 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Financial support to innovation.

Min = 1 This is the minimum value, the lowest number of Financial support to innovation.

Max = 7 This the maximum, highest number or value in the Financial support to innovation.

**Financial support to Human Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.5679 This is the statistical mean of the datasets; it is the average of all the Financial support to human capital.

Std. Dev = 1.1139 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Financial support to human capital.

Min = 1 This is the minimum value, the lowest number of Financial support to human capital.

Max = 7 This the maximum, highest number or value in the Financial support to human capital.

**Financial support to Structural Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.2593 This is the statistical mean of the datasets; it is the average of all the Financial support to structural capital.

Std. Dev = 1.2033 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Financial support to structural capital.

Min = 1 This is the minimum value, the lowest number of Financial support to structural capital.

Max = 7 This the maximum, highest number or value in the Financial support to structural capital.

**Financial support to Relational Capital**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.0494 This is the statistical mean of the datasets; it is the average of all the Financial support to relational capital.

Std. Dev = 1.2250 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the Financial support to relational capital.

Min = 1 This is the minimum value, the lowest number of Financial support to relational capital.

Max = 7 This the maximum, highest number or value in the Financial support to relational capital.

**Innovation**

Total number of observations = 162 This means the total number of respondents that successfully completed the survey.

Mean = 4.77778 This is the statistical mean of the datasets; it is the average of all the number of innovations.

Std. Dev = 1.1529 This means the deviation from the mean, the higher the standard deviation, wider the values of the mean are spread across the range of the number of innovations.

Min = 1 This is the minimum value, the lowest number of innovations.

Max = 7 This the maximum, highest number or value in the number of innovations.

**Hypotheses Testing**

A correlation test was used to validate the existence of an association between the variables, thereby providing a base to measure the level association between the variables. The correlation was used to validate the degree of association between the variables. This means correlations is validating the strength of linear association between the variables. Regression seeks to explain the relationship between independent variables and dependent variables. In this study, the dependent variable is innovation while the independent variables are; Number of students, Administrative staff, Publications since 2012, Admission rate, Patents awarded, Age of an institution, deanship/college, human capital, structural capital, relational capital, Government IC Policies to innovation, Government IC Policies to human capital, Government IC Policies to structural capital, Government IC Policies to relational capital, Financial support to innovation, Financial support to human capital, Financial support to structural capital, Financial support to relational capital.

## Correlation Coefficient

| Variables | Number of students | Administrative staff | Publications since 2012 | Admission rate | Patents awarded | Age of institution | deanship/college | human_capital | structural_capital | relational_capital | govt_innovation | govt_human_capital | govt_structural_capital | govt_relational_capital | financial_innovation | financial_human_capital | financial_structural_capital | financial_relational_capital | innovation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of students** | 1.000 | | | | | | | | | | | | | | | | | | |
| **Administrative staff** | 0.292 | 1.000 | | | | | | | | | | | | | | | | | |
| **Publications since 2012** | -0.172 | 0.674 | 1.000 | | | | | | | | | | | | | | | | |
| **Admission rate** | -0.748 | -0.387 | 0.182 | 1.000 | | | | | | | | | | | | | | | |
| **Patents awarded** | -0.036 | -0.059 | 0.020 | 0.416 | 1.000 | | | | | | | | | | | | | | |
| **Age of institution** | 0.447 | 0.805 | 0.625 | -0.329 | 0.179 | 1.000 | | | | | | | | | | | | | |
| **deanship/college** | 0.321 | 0.426 | 0.381 | 0.159 | 0.458 | 0.579 | 1.000 | | | | | | | | | | | | |
| **human_capital** | 0.023 | 0.034 | 0.090 | 0.064 | 0.198 | 0.134 | 0.123 | 1.000 | | | | | | | | | | | |
| **structural_capital** | 0.013 | 0.116 | 0.222 | 0.112 | 0.284 | 0.239 | 0.245 | 0.653 | 1.000 | | | | | | | | | | |
| **relational_capital** | 0.078 | 0.125 | 0.168 | 0.104 | 0.241 | 0.219 | 0.303 | 0.651 | 0.813 | 1.000 | | | | | | | | | |
| **govt_innovation** | -0.084 | -0.010 | 0.121 | 0.194 | 0.115 | 0.039 | 0.123 | 0.671 | 0.664 | 0.681 | 1.000 | | | | | | | | |
| **govt_human_capital** | -0.058 | -0.014 | 0.135 | 0.149 | 0.103 | 0.065 | 0.116 | 0.661 | 0.686 | 0.696 | 0.791 | 1.000 | | | | | | | |
| **govt_structural_capital** | -0.078 | -0.056 | 0.109 | 0.132 | 0.105 | 0.040 | 0.051 | 0.654 | 0.673 | 0.684 | 0.724 | 0.760 | 1.000 | | | | | | |
| **govt_relational_capital** | -0.024 | -0.001 | 0.089 | 0.137 | 0.166 | 0.074 | 0.169 | 0.653 | 0.724 | 0.756 | 0.757 | 0.794 | 0.789 | 1.000 | | | | | |
| **financial_innovation** | -0.030 | 0.051 | 0.171 | 0.180 | 0.219 | 0.157 | 0.207 | 0.589 | 0.607 | 0.668 | 0.615 | 0.651 | 0.743 | 0.680 | 1.000 | | | | |
| **financial_human_capital** | -0.015 | 0.045 | 0.113 | 0.064 | 0.010 | 0.118 | 0.099 | 0.290 | 0.398 | 0.365 | 0.232 | 0.394 | 0.300 | 0.288 | 0.386 | 1.000 | | | |
| **financial_structural_capital** | -0.077 | 0.028 | 0.185 | 0.196 | 0.209 | 0.106 | 0.142 | 0.637 | 0.597 | 0.642 | 0.663 | 0.667 | 0.714 | 0.723 | 0.723 | 0.399 | 1.000 | | |
| **financial_relational_capital** | -0.091 | -0.030 | 0.076 | 0.175 | 0.173 | 0.049 | 0.117 | 0.593 | 0.617 | 0.638 | 0.714 | 0.755 | 0.776 | 0.770 | 0.746 | 0.403 | 0.779 | 1.000 | |
| **innovation** | -0.062 | 0.069 | 0.124 | 0.160 | 0.258 | 0.090 | 0.171 | 0.631 | 0.689 | 0.705 | 0.676 | 0.669 | 0.720 | 0.763 | 0.655 | 0.312 | 0.651 | 0.694 | 1.000 |

From the correlation table, it is evident that the values highlighted in yellow have positive and correlations with their corresponding variables.

- Admission rate has a strong negative correlation with number of students. Which implies that as the admission rate goes up, the number of students reduces.
- Age of institution has a strong positive correlation with administrative staff and publications since 2012. Which implies that the higher the age of institution, the higher the number of administrative staff and publications.
- Government IC Policies to innovation has a positive correlation with Human capital, structural capital and relational capital. This implies that as the number of Government IC Policies to innovation increases, so does the human capital, structural and relational capital.
- Government IC Policies to Human capital has a positive correlation with Human capital, Structural capital and Relational capital while maintaining a strong positive correlation with Government IC Policies to innovation. This implies that as the Government IC Policies to human capital increases, the human, structural, and relational capital increases and so does the number of Government IC Policies to innovations.
- Government IC Policies to structural capital has a positive correlation with Human capital, Structural capital and Relational capital while maintaining a strong positive correlation with Government IC Policies to innovation and Government IC Policies to human capital. Which means that as the number

of Government IC Policies to structural capital increases so does the human, structural, relational capital. Also, the Government IC Policies to innovations and Government IC Policies to human capital increases.

- Financial support to innovation has a positive correlation with Human capital, Structural capital, Relational capital, Government IC Policies to innovation, Government IC Policies to human capital, and Government IC Policies to relational capital while also having a strong positive correlation with Government IC Policies to structural capital. This means that as the number of Financial support to innovation increases, so does human capital, structural capital, relational capital, Government IC Policies to innovation, Government IC Policies to human capital and Government IC Policies to relational and structural capitals increases too.

- Financial support to structural capital has a positive correlation with Human capital, Structural capital, Relational capital, Government IC Policies to innovation, and Government IC Policies to human capital with strong positive correlations with Government IC Policies to structural capital, Government IC Policies to relational capital, and Financial support to innovation. This implies that as the number of Financial support to structural capital increases, the human capital, structural capital, relational capital, number of Government IC Policies to innovations, and Government IC Policies to human capital increases while Government IC Policies to structural and relational capital, and Financial support to innovations increases more.

- Financial support to relational capital has a positive correlation with Structural capital and Relational capital with strong correlations with Government IC Policies to innovation, Government IC Policies to human capital, Government IC Policies to structural capital, Government IC Policies to relational capital, Financial support to innovation, and Financial support to structural capital. This means as the Financial support to relational capital gets increased, the structural and relational capital tend s to get increased, while the Government IC Policies to innovation, Government IC Policies to human capital, Government IC Policies to structural capital, Government IC Policies to relational capital, Financial support to innovation and Financial support to structural capital gets increased.

- Innovation has a positive correlation with Human capital, Structural capital, Government IC Policies to innovation, Government IC Policies to human capital, Financial support to innovation, Financial support to structural capital, and Financial support to relational capital while having a strong positive with Relational capital, Government IC Policies to structural capital and Government IC Policies to relational capital. This implies that as the number innovations gets increased, there is an approximate increase in the level of Human capital, Structural capital, Government IC Policies to policy on innovation, Government IC Policies to policy on human capital, Financial support to innovation, Financial support to structural capital, and Financial support to policy on relational capital, Relational

capital, Government IC Policies to policy on structural capital and Government IC Policies to relational capital.

But for the model estimation, we'll proceed with the regression analysis.

**Regression Analysis Result**

Hypothesis 1

H0 – Human Capital is not the major factor in the intellectual capital toward innovation level among faculty.

H1 – Human Capital is the major factor in the intellectual capital toward innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 15.16 |
| Prob > F | 0 |
| R-squared | 0.4422 |
| Adj R-squared | 0.4131 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Human capital. The model summary reveals a significant model for F (8, 153) = 15.16 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 41.31% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| human capital | 0.557421 | 0.056945 | 9.79 | 0.000 |
| number of students | 4.64E-06 | 4.43E-06 | 1.05 | 0.297 |
| administrative staff | 0.000193 | 0.000137 | 1.41 | 0.16 |
| admission rate | 0.015982 | 0.010389 | 1.54 | 0.126 |
| age | -0.01118 | 0.007975 | -1.4 | 0.163 |
| deanship college | 0.002301 | 0.012733 | 0.18 | 0.857 |
| patents | 0.003313 | 0.001771 | 1.87 | 0.063 |
| publications | -1.9E-05 | 3.03E-05 | -0.64 | 0.523 |

| | | | | |
|---|---|---|---|---|
| cons | 0.266524 | 1.026041 | 0.26 | 0.795 |

The model show a significant coefficient for human capital, indicating that the null hypothesis would be rejected.

Hypothesis 2

H0 – Structural Capital is not the major factor in the intellectual capital toward innovation level among faculty.

H1 – Structural Capital is the major factor in the intellectual capital toward innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 19.48 |
| Prob > F | 0 |
| R-squared | 0.5046 |
| Adj R-squared | 0.4787 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Structural capital. The model summary reveals a significant model for F (8, 153) = 19.48 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 47.87% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| structural capital | 0.716192 | 0.063514 | 11.28 | 0.000 |
| number of students | 4.20E-06 | 4.17E-06 | 1.01 | 0.316 |
| administrative staff | 0.000272 | 0.000129 | 2.1 | 0.037 |
| admission rate | 0.014718 | 0.009795 | 1.5 | 0.135 |
| age | -0.01288 | 0.007526 | -1.71 | 0.089 |
| deanship college | -0.00608 | 0.01201 | -0.51 | 0.613 |
| patents | 0.001628 | 0.001692 | 0.96 | 0.337 |
| publications | -0.00004 | 2.86E-05 | -1.4 | 0.164 |

| | | | | |
|---|---|---|---|---|
| cons | -0.18926 | 0.972181 | -0.19 | 0.846 |

The model shows a significant coefficient for structural capital, indicating that the null hypothesis would be rejected. Without using fixed effect, the coefficient of administrative staff is also significant.

Hypothesis 3

H0 –Relational Capital is not the major factor in the intellectual capital toward innovation level among faculty.

H1 –Relational Capital is the major factor in the intellectual capital toward innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 21.58 |
| Prob > F | 0 |
| R-squared | 0.5301 |
| Adj R-squared | 0.5056 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Relational capital. The model summary reveals a significant model for F (8, 153) = 21.58 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 50.56% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| structural capital | 0.754633 | 0.063244 | 11.93 | 0 |
| number of students | 2.70E-06 | 4.07E-06 | 0.66 | 0.509 |
| administrative staff | 0.000116 | 0.000125 | 0.93 | 0.356 |
| admission rate | 0.010748 | 0.009571 | 1.12 | 0.263 |
| age | -0.00778 | 0.007291 | -1.07 | 0.288 |
| deanship college | -0.00763 | 0.011702 | -0.65 | 0.515 |

| | | | | |
|---|---|---|---|---|
| patents | 0.003527 | 0.001621 | 2.18 | 0.031 |
| publications | -2.2E-05 | 2.78E-05 | -0.8 | 0.427 |
| cons | 0.282639 | 0.938263 | 0.3 | 0.764 |

The models show a significant coefficient for relational capital, indicating that the null hypothesis would be rejected. In addition, the coefficient of deanship is also significant.

Hypothesis 4

H0 – Government Intellectual Capital policies do not affect the innovation level among faculty.

H1 – Government Intellectual Capital policies affect the innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 19.32 |
| Prob > F | 0 |
| R-squared | 0.5025 |
| Adj R-squared | 0.4765 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Government Intellectual Capital. The model summary reveals a significant model for F (8, 153) = 19.32 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 47.65% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| Government Intellectual Capital | 0.553307 | 0.049296 | 11.22 | 0 |
| number of students | 5.08E-06 | 4.18E-06 | 1.22 | 0.226 |
| administrative staff | 0.000105 | 0.000129 | 0.82 | 0.414 |
| admission rate | 0.011283 | 0.009847 | 1.15 | 0.254 |

| | | | | |
|---|---|---|---|---|
| age | -0.00519 | 0.007494 | -0.69 | 0.49 |
| deanship college | 0.001332 | 0.012024 | 0.11 | 0.912 |
| patents | 0.005099 | 0.001658 | 3.08 | 0.002 |
| publications | -3.3E-05 | 2.87E-05 | -1.16 | 0.246 |
| cons | 0.768305 | 0.959916 | 0.8 | 0.425 |

The model shows a significant coefficient for Government Intellectual Capital, indicating that the null hypothesis would be rejected. In addition, the coefficient of Patents is also significant.

Hypothesis 5

H0 ¬ Government Intellectual Capital policies do not affect the outcome of Human capital towards innovation levels among faculty.

H1 ¬ Government Intellectual Capital policies affect the outcome of Human capital towards innovation levels among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 19.87 |
| Prob > F | 0 |
| R-squared | 0.5095 |
| Adj R-squared | 0.4839 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Government human Capital. The model summary reveals a significant model for F (8, 153) = 19.32 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 47.65% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| govt human capital | 0.622005 | 0.054561 | 11.4 | 0 |
| number of students | 7.47E-06 | 4.14E-06 | 1.8 | 0.073 |
| administrative staff | 0.000242 | 0.000128 | 1.88 | 0.062 |
| admission rate | 0.0197 | 0.009718 | 2.03 | 0.044 |
| age | -0.00844 | 0.007453 | -1.13 | 0.259 |
| deanship college | -0.00483 | 0.011946 | -0.4 | 0.687 |
| patents | 0.005272 | 0.001646 | 3.2 | 0.002 |
| publications | -5.40E-05 | 2.86E-05 | -1.89 | 0.061 |
| cons | -0.21162 | 0.967494 | -0.22 | 0.827 |

The model shows a significant coefficient of govt human capital, indicating that the null hypothesis would be rejected. The coefficients of deanship and admission rate is also significant.

Hypothesis 6

H0 - Government Intellectual Capital policies do not affect the outcome of Structural capital towards innovation level among faculty.

H1 - Government Intellectual Capital policies affect the outcome of Structural capital towards innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 27.52 |
| Prob > F | 0 |
| R-squared | 0.59 |
| Adj R-squared | 0.5685 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Government structural Capital. The model summary reveals

a significant model for F (8, 153) = 27.52 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 56.85% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| govt structural capital | 0.640662 | 0.04704 | 13.62 | 0 |
| number of students | 7.99E-06 | 3.78E-06 | 2.11 | 0.036 |
| administrative staff | 0.000356 | 0.000118 | 3 | 0.003 |
| admission rate | 0.022331 | 0.008879 | 2.51 | 0.013 |
| age | -0.01136 | 0.006828 | -1.66 | 0.098 |
| deanship college | -0.00343 | 0.010918 | -0.31 | 0.754 |
| patents | 0.004137 | 0.001509 | 2.74 | 0.007 |
| publications | -6.1E-05 | 2.62E-05 | -2.35 | 0.02 |
| cons | -0.83317 | 0.891376 | -0.93 | 0.351 |

The model shows a significant coefficient of govt structural capital, indicating that the null hypothesis would be rejected. The coefficients of number of students, administrative staff, patents, publication and admission rate are also significant.

Hypothesis 7

H0- Government Intellectual Capital policies do not affect the outcome of Relational capital towards innovation level among faculty.

H1- Government Intellectual Capital policies affect the outcome of Relational capital towards innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 30.74 |
| Prob > F | 0 |
| R-squared | 0.6164 |
| Adj R-squared | 0.5964 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Government Relational Capital. The model summary reveals a significant model for F (8, 153) = 30.74 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 59.64% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| govt relational capital | 0.666163 | 0.046097 | 14.45 | 0 |
| number of students | 6.13E-06 | 3.66E-06 | 1.67 | 0.096 |
| administrative staff | 0.00021 | 0.000113 | 1.86 | 0.065 |
| admission rate | 0.01793 | 0.008598 | 2.09 | 0.039 |
| age | -0.00611 | 0.006582 | -0.93 | 0.355 |
| deanship college | -0.01021 | 0.010581 | -0.96 | 0.336 |
| patents | 0.003743 | 0.001461 | 2.56 | 0.011 |
| publications | -3.1E-05 | 2.52E-05 | -1.21 | 0.227 |
| cons | -0.30656 | 0.85292 | -0.36 | 0.72 |

The model shows a significant coefficient for govt relational capital, indicating that the null hypothesis would be rejected. Also, admission rate and patents are significant.

Hypothesis 8

H0- Financial support for Intellectual capital does not affect the innovation level among faculty.

H1- Financial support for Intellectual capital does affect the innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 16.18 |
| Prob > F | 0 |

| | |
|---|---|
| R-squared | 0.4583 |
| Adj R-squared | 0.43 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Financial innovation. The model summary reveals a significant model for F (8, 153) = 16.18 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 43% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| financial innovation | 0.576743 | 0.056774 | 10.16 | 0 |
| number of students | 3.55E-06 | 4.37E-06 | 0.81 | 0.418 |
| administrative staff | 0.000158 | 0.000134 | 1.18 | 0.242 |
| admission rate | 0.008701 | 0.010319 | 0.84 | 0.4 |
| age | -0.01123 | 0.007858 | -1.43 | 0.155 |
| deanship college | 0.001943 | 0.012548 | 0.15 | 0.877 |
| patents | 0.003678 | 0.00174 | 2.11 | 0.036 |
| publications | -2.6E-05 | 2.99E-05 | -0.87 | 0.384 |
| cons | 1.259903 | 0.997374 | 1.26 | 0.208 |

The model shows a significant coefficient of financial support towards innovation, indicating that the null hypothesis would be rejected. Also, the coefficient of patents is also significant.

Hypothesis 9

H0- Financial Support does not affect the outcome of Human capital towards innovation level among faculty.

H1- Financial Support affect the outcome of Human capital towards innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 4.39 |
| Prob > F | 0.0001 |
| R-squared | 0.1868 |
| Adj R-squared | 0.1443 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Financial human Capital. The model summary reveals a significant model for F (8, 153) = 4.39 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 14.43% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| financial human capital | 0.32343 | 0.076944 | 4.2 | 0 |
| number of students | 9.28E-06 | 5.34E-06 | 1.74 | 0.084 |
| administrative staff | 0.000126 | 0.000165 | 0.76 | 0.446 |
| admission rate | 0.024695 | 0.012504 | 1.98 | 0.05 |
| age | -0.00873 | 0.00967 | -0.9 | 0.368 |
| deanship college | -0.00139 | 0.015375 | -0.09 | 0.928 |
| patents | 0.006439 | 0.002127 | 3.03 | 0.003 |
| publications | -2.4E-05 | 3.66E-05 | -0.64 | 0.521 |
| cons | 0.630705 | 1.268202 | 0.5 | 0.62 |

The model shows a significant coefficient of financial human capital, indicating that the null hypothesis would be rejected. Admission rate and patents are also significant.

Hypothesis 10

H0- Financial Support does not affect the outcome of Structural capital towards innovation level among faculty.

H1- Financial Support affect the outcome of Structural capital towards innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 16.05 |
| Prob > F | 0 |
| R-squared | 0.4563 |
| Adj R-squared | 0.4278 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with financial structural capital. The model summary reveals a significant model for F (8, 153) = 16.05 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 42.78% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| financial structural capital | 0.606512 | 0.059979 | 10.11 | 0 |
| number of students | 3.12E-06 | 4.38E-06 | 0.71 | 0.477 |
| administrative staff | 0.000143 | 0.000135 | 1.07 | 0.288 |
| admission rate | 0.007534 | 0.010357 | 0.73 | 0.468 |
| age | -0.0081 | 0.007848 | -1.03 | 0.303 |
| deanship college | 0.006005 | 0.012584 | 0.48 | 0.634 |
| patents | 0.003668 | 0.001744 | 2.1 | 0.037 |

| | | | | |
|---|---|---|---|---|
| publications | -3.9E-05 | 0.00003 | -1.3 | 0.195 |
| cons | 1.067661 | 1.001038 | 1.07 | 0.288 |

The model shows a significant coefficient of financial structural capital, indicating that the null hypothesis would be rejected. Also, the coefficient of patents is also significant.

Hypothesis 11

H0 - Financial Support does not affect the outcome of Relational capital towards innovation level among faculty.

H1 - Financial Support affect the outcome of Relational capital towards innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 20.59 |
| Prob > F | 0 |
| R-squared | 0.5184 |
| Adj R-squared | 0.4932 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with financial relational capital. The model summary reveals a significant model for F (8, 153) = 20.59 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent variables can account/explain for 49.32% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| financial relational capital | 0.633047 | 0.054446 | 11.63 | 0 |

| | | | | |
|---|---|---|---|---|
| number of students | 7.24E-06 | 4.10E-06 | 1.76 | 0.08 |
| administrative staff | 0.000196 | 0.000127 | 1.54 | 0.125 |
| admission rate | 0.01688 | 0.009643 | 1.75 | 0.082 |
| age | -0.00986 | 0.007394 | -1.33 | 0.184 |
| deanship college | -0.00364 | 0.011834 | -0.31 | 0.759 |
| patents | 0.00381 | 0.001638 | 2.33 | 0.021 |
| publications | -1.5E-05 | 2.82E-05 | -0.54 | 0.588 |
| cons | 0.196305 | 0.951508 | 0.21 | 0.837 |

The model shows a significant coefficient of financial relational capital, indicating that the null hypothesis would be rejected. Also, the coefficient of number of students and patents is also significant.

Hypothesis 12

H0 - The intellectual capital level is not affected by the Innovation level among faculty.

H1 - The intellectual capital level is affected by the Innovation level among faculty.

| | |
|---|---|
| Number of obs | 162 |
| F(8, 153) | 24.74 |
| Prob > F | 0 |
| R-squared | 0.564 |
| Adj R-squared | 0.5412 |

The overall model summary reveal that the level of innovation in institutions Saudi can be predicted with Intellectual capital. The model summary reveals a significant model for F (8, 153) = 24.74 at 0.00 level of significance. In addition, the adjusted R squared values reveal that when positive bias is corrected, the independent

variables can account/explain for 54.12% of the variation in Innovation in Saudi tertiary institutions.

| innovation | Coeff | Std. Err. | t | P>t |
|---|---|---|---|---|
| Intellectual capital | 0.776212 | 0.060372 | 12.86 | 0 |
| number of students | 4.00E-06 | 3.91E-06 | 1.02 | 0.309 |
| administrative staff | 0.000174 | 0.000121 | 1.44 | 0.151 |
| admission rate | 0.012722 | 0.009199 | 1.38 | 0.169 |
| age | -0.01113 | 0.007041 | -1.58 | 0.116 |
| deanship college | -0.00642 | 0.011267 | -0.57 | 0.57 |
| patents | 0.002289 | 0.001574 | 1.45 | 0.148 |
| publications | -1.5E-05 | 2.68E-05 | -0.56 | 0.574 |
| cons | -0.14058 | 0.90875 | -0.15 | 0.877 |

The model shows a significant coefficient of Intellectual capital, indicating that the null hypothesis would be rejected.

**Comparison of Regression Models**

**1. Full regression with and without a fixed effect**

**Regression Summary**

| Without fixed effect | | With fixed effect | |
|---|---|---|---|
| Number of obs | 162 | Number of obs | 162 |
| F | 17.04 | F(27, 134) | 12.87 |
| Prob > F | 0.000 | Prob > F | 0.000 |
| R-squared | 0.6951 | R-squared | 0.7218 |
| Adj R-squared | 0.6543 | Adj R-squared | 0.6657 |

Without using the university as fixed effects; the model summary reveals a significant model for F (19, 142) = 17.04 at 0.00 level of significance. Also, the adjusted R squared values reveal that when a positive bias is corrected, the

independent variables can account/explain for 65.43% of the variation in Innovation in Saudi tertiary institutions

Using universities as fixed effects; the model summary reveals a significant model for F (27, 134) = 12.87 at 0.00 level of significance. Also, the adjusted R squared values reveal that when a positive bias is corrected, the independent variables can account/explain for 66.57% of the variation in Innovation in Saudi tertiary institutions.

| Innovation Coef. | Without fixed effect | | | | With fixed effect | | | |
|---|---|---|---|---|---|---|---|---|
| | Coeff | Std. Err. | t | P>t | Coeff | Std. Err. | t | P>t |
| number of students | 5.18E-06 | 3.52E-06 | 1.47 | 0.143 | -1.2E-05 | 1.59E-05 | -0.73 | 0.465 |
| administrative staff | 0.000267 | 0.000111 | 2.41 | 0.017 | 0.003116 | 0.001993 | 1.56 | 0.12 |
| admission rate | 0.014342 | 0.008345 | 1.72 | 0.088 | 0.096131 | 0.05247 | 1.83 | 0.069 |
| age | -0.01159 | 0.006242 | -1.86 | 0.065 | -0.01526 | 0.015042 | -1.01 | 0.312 |
| deanship college | -0.00669 | 0.009967 | -0.67 | 0.503 | 0.1173 | 0.089285 | 1.31 | 0.191 |
| human capital | 0.071944 | 0.104166 | 0.69 | 0.491 | 0.088603 | 0.103588 | 0.86 | 0.394 |
| structural capital | 0.09507 | 0.124473 | 0.76 | 0.446 | 0.079931 | 0.124093 | 0.64 | 0.521 |
| relational capital | 0.102081 | 0.12095 | 0.84 | 0.4 | 0.073776 | 0.12077 | 0.61 | 0.542 |
| govt innovation | 0.056143 | 0.07568 | 0.74 | 0.459 | 0.004951 | 0.078446 | 0.06 | 0.95 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| govt human capital | -0.04984 | 0.09103 | -0.55 | 0.585 | -0.04304 | 0.091386 | -0.47 | 0.638 |
| govt structural capital | 0.180743 | 0.086314 | 2.09 | 0.038 | 0.14372 | 0.087188 | 1.65 | 0.102 |
| govt relational capital | 0.256096 | 0.09068 | 2.82 | 0.005 | 0.292159 | 0.090858 | 3.22 | 0.002 |
| financial innovation | 0.043325 | 0.075594 | 0.57 | 0.567 | 0.086916 | 0.076804 | 1.13 | 0.26 |
| financial human capital | 0.044686 | 0.059231 | 0.75 | 0.452 | 0.038642 | 0.059162 | 0.65 | 0.515 |
| financial structural capital | -0.01639 | 0.08324 | -0.2 | 0.844 | -0.04329 | 0.084369 | -0.51 | 0.609 |
| financial relational capital | 0.077228 | 0.092866 | 0.83 | 0.407 | 0.10295 | 0.093004 | 1.11 | 0.27 |
| patents | 0.003051 | 0.001451 | 2.1 | 0.037 | -0.35015 | 0.247845 | -1.41 | 0.16 |
| publications | -3.7E-05 | 2.46E-05 | -1.51 | 0.132 | 0.001714 | 0.001226 | 1.4 | 0.164 |
| ic | 0.01827 | 0.217084 | 0.08 | 0.933 | 0.048778 | 0.215113 | 0.23 | 0.821 |
| cons | -0.92134 | 0.846156 | -1.09 | 0.278 | -14.6157 | 8.807298 | -1.66 | 0.099 |

The F is higher Without a fixed effect and although the adjusted r square value is indicating that the explanatory variables can account for more variables when the effect is used, the difference is very low.

Comparing the regression models, the analysis reveals that only the coefficient of government relational capital is significant in both models. The coefficient of administrative staff, the number of patents, government relational capital, and government structural capital is significant when the university is used as a fixed effect, indicating that the null hypothesis of hypothesis 6 and 7 would be rejected if the university is not used as a fixed effect and only hypothesis 7 would be rejected if the university is used as a fixed effect (with no other significant explanatory variables).

**A full regression model with publication as a dependent variable**

**Regression Summary**

| Without fixed effect | | With fixed effect | |
|---|---|---|---|
| Number of obs | 162 | Number of obs | 162 |
| F(17, 144) | 17.71 | F(28, 133) | 99999 |
| Prob > F | 0 | Prob > F | 0 |
| R-squared | 0.6765 | R-squared | 1 |
| Adj R-squared | 0.6383 | Adj R-squared | 1 |

The F is higher Without a fixed effect and although the adjusted r square value is indicating that the explanatory variables can account for more variables when the effect is used, the difference is very low.

| innovation | Without fixed effect | | | | With fixed effect | | | |
|---|---|---|---|---|---|---|---|---|
| | Coeff | Std. Err. | t | P>t | Coeff | Std. Err. | t | P>t |
| human capital | 200.542 | 352.2295 | 0.57 | 0.57 | -1.29E-10 | 0.000257 | 0 | 1 |
| structural capital | 761.9733 | 407.6406 | 1.87 | 0.064 | 5.31E-10 | 0.000308 | 0 | 1 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| relational capital | -0.42372 | 409.9332 | 0 | 0.999 | 2.52E-10 | 0.0003 | 0 | 1 |
| govt innovation | -97.9411 | 254.3164 | -0.39 | 0.701 | 2.94E-10 | 0.000194 | 0 | 1 |
| govt human capital | 475.3878 | 305.4117 | 1.56 | 0.122 | 4.49E-11 | 0.000227 | 0 | 1 |
| govt structural capital | 625.6488 | 287.2342 | 2.18 | 0.031 | 1.30E-10 | 0.000218 | 0 | 1 |
| govt relational capital | -239.602 | 306.8034 | -0.78 | 0.436 | -4.64E-11 | 0.000234 | 0 | 1 |
| financial innovation | -158.148 | 255.5486 | -0.62 | 0.537 | 2.91E-11 | 0.000191 | 0 | 1 |
| financial human capital | -4.84372 | 196.2514 | -0.02 | 0.98 | -4.20E-11 | 0.000147 | 0 | 1 |
| financial structural capital | 384.5064 | 279.9153 | 1.37 | 0.172 | 9.88E-11 | 0.000209 | 0 | 1 |
| financial relational capital | -590.134 | 310.0281 | -1.9 | 0.059 | -4.91E-10 | 0.000231 | 0 | 1 |
| ic | -1265.6 | 728.6522 | -1.74 | 0.085 | -8.96E-10 | 0.000533 | 0 | 1 |
| number of students | 0.002042 | 0.010657 | 0.19 | 0.848 | 0.124878 | 1.54E-08 | 8.10E+06 | 0 |
| administrative staff | 2.293884 | 0.320642 | 7.15 | 0 | 16.35731 | 1.17E-06 | 1.40E+07 | 0 |
| admission rate | 74.87194 | 26.6023 | 2.81 | 0.006 | 223.0571 | 4.69E-05 | 4.80E+06 | 0 |
| age | 63.56777 | 19.99597 | 3.18 | 0.002 | -983.508 | 0.000109 | 9.10E+06 | 0 |
| deanship college | -84.5088 | 32.96224 | -2.56 | 0.011 | 266.7374 | 0.000123 | 2.20E+06 | 0 |
| cons | -10832.2 | 2654.504 | -4.08 | 0 | -44528.4 | 0.003582 | 1.20E+07 | 0 |

Comparing the regression models, the analysis reveals that only the coefficient of administrative staff, admission rate, age, and deanship college are significant in

both models. The coefficient of the number of students is significant when the university is used as a fixed effect. The coefficient of government structural capital is significant when the fixed effect is applied.

## CHAPTER 5: DISCUSSION

The study shows that structural capital, government intellectual capital policies toward relational capital, and government intellectual capital policies toward structural capital are the most influential components of IC which influences innovation. This finding is inconsistent with other prior investigations indicating that relational capital is the main factors leading to innovation. For instance, Córcoles and Vanderdonckt (2013) found that among the three IC factors, the main factor was relational capital, while the least factor was structural capital. What is more, Najim, Alnaimi and Alnaji (2012) found that HC, RC and leadership capital had a more significant impact compared to structural capital. The application and contextualization of IC at the university level of analysis represents another significant cause of the disparity in the findings.

While this study shows that structural capital has a dominating influence, other previous study suggest that human capital is the main factor leading to innovation. In investigating the link between IC and innovation, Zerenler, Hasiloglu and Sezgin (2008) found that among the three IC types, customer capital had the greatest impact, followed by employee capital and lastly structural capital. At the same time, Shehzad et al (2014) study found that human capital is the most

significant component of IC in terms of higher education institution performance. In the study, SC comes in the second place and RC the last position.

The study of Sundac and Krmpotic (2009) suggested that human capital is most important among all three components but despite of this importance, a strong intellectual capital can be created with the combination of all these three components. The discrepancy in the findings can be attributed to the differences in organizational structure of universities, such as the number and composition of students and personnel. Universities use different IC languages. It is clear that the components of IC used in the analysis are different, hence the difference in the results.

The study indicates that there is a significant association between IC and innovation level. However, Najim, Alnaimi and Alnaji (2012) did not establish a positive significant link between IC and innovation. It is evident that the organization's intellectual assets are specific to each organization and their value and relevance depend on their potential contribution to the institution's key objectives. This premise can explain the difference in the findings. Additionally, the rate of penetration of intellectual capital in universities and the framework of the implementation of complex projects differ, demonstrating the discrepancy in the results.

The study shows the moderating role of government intellectual capital policies toward relational capital. Contrary to this finding, Wu et al (2008) explored how a firm's operational mode can reinforce the advantages of intellectual capital on innovation. Their results support the mediating role of IC and the moderating

roles of entrepreneurial orientation and social capital on innovation. The different measures used in assessing the research objectives explain the discrepancies in their findings. Moreover, the authors subdivided Intellectual Capital into different major components.

The study reveals a significant relationship between Innovation and all other variables. At the heart of this basis is the principle that the several aspects of IC and their interrelationships, by accumulating and mediating innovation differently, enable universities to draw upon innovation in distinct ways. Wu et al (2008) revealed that firms that have higher levels of social capital and entrepreneurial orientation tend to amplify the effects of intellectual capital on innovation.

Contrary to the finding, Subramaniam and Youndt (2005) demonstrated that human, organizational, and social capital and their interrelationships selectively influenced incremental and radical innovative capabilities. In their findings, organizational capital positively influenced incremental innovative capability, while human capital interacted with social capital to positively influence radical innovative capability. The complexities in universities (they use different metrics to assess and compare IC) might explain the discrepancy in the findings.

The findings in the study suggest that government intellectual capital policies toward relational capital affects the innovation level among faculty. On the contrary, Shahzad et al (2014) found that relational capital has a little effect on institution performance. An institution's relation with other institutions and with outsiders has no strong impact on universities performance as compared to human and structural capital. Accordingly, human and structural capital has more positive

influence on the performance of universities. Since the data collected is based on different sources, the findings differ.

| Literature findings | Study findings | The similarities or differences | Explanation |
|---|---|---|---|
| There is a significant link between HC and innovation in universities (Alawamleh et al., 2019) | Testing all 12 hypotheses individually against the dependent variable reveals a significant relationship with the independent variables. Therefore, HC is significantly related to innovation levels | There is a significant relationship between innovation and human capital. | Alawamleh et al (2019) focused on finding and investigating the relationship between HC and innovation as well as exploring the factors that affect that relationship. My study did not investigate factors that affect the relationship between HC element and innovation. Instead, moderating variables were included. |
| Structural capital and innovation level have a significant positive relationship (Merhej & Deeb, 2016) | Structural capital significantly and positively affects innovation levels | SC does contribute to innovation – but only to a limited extent. This conclusion is consistent with the findings of Subramaniam and Youndt (2005) and Merhej and Deeb (2016) who found a weak significant relationship between | Merhej and Deeb (2016) only focused on SC component of IC and incremental and radical innovation while the current study investigated all three IC components together, in |

| | | | |
|---|---|---|---|
| | | SC and innovation. My study does not reveal whether the relationship is weak or strong. | relation to overall innovation. The results are also different due to sample size (360 vs 162), different study settings, methodical approaches (questionnaire and field study versus questionnaire and interviews) |
| Relational capital and innovation have a significant relationship (Casanueva & Gallego, 2010) | Testing all 12 hypotheses individually against the dependent variable reveals a significant relationship with the independent variables. Therefore, relational capital and innovation in universities are significantly related. | Casanueva and Gallego (2010) study shown that social capital which arises from the internal relations of an intra-organisational network is associated with both the capacity of individuals in the network to generate new knowledge and improve their innovativeness. Shahzad et al (2014) found that relational capital has a little effect on institution performance. | Casanueva and Gallego (2010) investigated how the three components of social capital (resource, relational and structural) influence innovation, using one department chosen from a single university. |

| | | | |
|---|---|---|---|
| There is a significant positive relationship between intellectual capital and innovation (Maboudi et al., 2015; Shehzad et al., 2014; Alserhan, 2017; Wu, Chen & Chen, 2012; Najim, Alnaimi & Alnaji, 2012; Subramaniam & Youndt, 2005; Lu, 2012; Zhang & Cao, 2014) | Regression test without fixed effects indicated that government Intellectual Capital policies to structural capital, and government Intellectual Capital policies to relational capital have an impact on the level of innovation. | Maboudi used the qualitative correlation method, and data obtained from 139 university employees. Alserhan (2017) included other dimensions apart from innovation, namely quality, responsiveness and efficiency. Wu, Chen and Chen (2012) showed that to enhance innovation in higher education, institutions must know different methods for improving IC. Najim, Alnaimi and Alnaji (2012) study investigated the direct effect of intellectual capital elements ( ship and strategy, human capital, structural capital, and relational capital) on achieving university objectives (academic goals, maintaining and developing staff, improving community relationships, achieving the universities' plans and programs, and attracting the new students) Lu (2012) used two stage analysis to screen the present position of Taiwan public universities to demonstrate the vital role of teaching and research efficiency in intellectual capital | Overall, most of the studies proposed measurement scales which capture the particularities of innovation. Using different measurement scales is the main contributor to disparity in findings between studies. Additionally, most studies have investigated the impact of IC on a university's innovative capabilities, but they do not consider the moderating effect of other variables, such as financial factors and government policies. Maboudi et al (2015) revealed a significant positive relationship between IC and innovation; and the effect of IC on |

| | | | |
|---|---|---|---|
| | | performance estimations. On the contrary, my study used empirical data obtained from interviews and survey as well as secondary data from published sources. Zhang and Cao (2014) study is a theoretical analysis between HC, relationship capital and SC of university intellectual capital and its role on the performance of technology innovation. | innovation was identified after analysis of the collected data. Additional dependent variables included by Alserhan (2017) might explain the slight disparity in the findings. Wu, Chen and Chen (2012) used different methodological approaches, and population characteristics in comparison with my studies. This could be the major factors responsible for the differences in results. Najim, Alnaimi and Alnaji (2012) study was based on statistical analysis of the empirical data obtained on the activities of three major Jordanian universities. On the other hand, my study was based on several Saudi Arabia |

| | | | |
|---|---|---|---|
| | | | universities. This methodical disparity may explain the difference in the findings. Subramaniam and Youndt (2005) study examined how 3 IC components impact radical and incremental innovative capabilities. My study did not focus on different types of innovations, hence disparities in the results. By investigating the relationship between IC and technology innovation performance (an empirical study which is based on the universities affiliated with the ministry of education), Zhang and Cao (2014) findings have some disparities with my study. |

| | | | |
|---|---|---|---|
| Among the components of intellectual capital, the most influential factor is human capital (Shahzad et al., 2014; Sukmawati, 2019; Anggraini, Abdul-Hamid & Kassim, 2018; Alserhan, 2017) | Among the components of intellectual capital, the most influential component is structural capital. | Shahzad et al (2014) found that among the three IC components, human capital is the most influential factor, followed by structural capital and lastly relational capital. Alserhan (2017) ranked the impact of IC components as HC, RC and SC in the first, second and third position respectively. Anggraini, Abdul-Hamid & Kassim (2018) found that the most influential factor of IC is human capital, followed by SC and lastly RC.<br><br>Sukmawati (2019) found that the most influential component of IC is HC, followed by SC and lastly RC. In the Taiwanese universities, Wu, Chen and Chen (2012) study established that innovation capital was the most significant IC element. | Shehzad et al (2014) focused on the relationship between social and IC and staff performance and also between IC indices and staff performance. However, the authors did not explore which component of human, structural capital influence more on university performance compared with others. While my study used 3 IC components, Shahzad et al (2014) used 4 components, the addition being institutional capital. Anggraini, Abdul-Hamid and Kassim (2018) focused on online surveys targeted university leaders and faculty lectures. |

| | | | |
|---|---|---|---|
| | | | Sukmawati (2019) used a single data collection method (survey of 108) employees from one university. My study was a mixed study and it combined surveys with interview responses. The difference in data collection approaches may explain the disparity in the results. Wu, Chen and Chen (2012) focused on used a different criterion for IC evaluation in relation to innovation performance. This difference explains the disparity of the findings. |

### 5.1 Limitations and Recommendations

There are various limitations to this research. First, the study was restricted to faculty members with Ph.D. working in public and private universities. So, the findings are generalization to Saudi Arabia universities only. The universities included were from Saudi Arabia, limiting the generalization of the results

obtained. The findings, thus, cannot be extended beyond this country considering differences in population characteristics across countries and regions. So, there is a need for more evidence on IC determinants before making generalization to other countries.

This study was cross-sectional in nature, providing a description of current IC and innovation capabilities. As such, it cannot be utilized to analyse the new IC initiatives and innovation behaviour in universities over time. The cause and effect relationship between IC and innovation is not determined. What is more, the timing of this research is not definite to be representative. future studies work with longitudinal data on faculty innovation. Longitudinal studies will be more effective in identifying variable patterns and behaviour over a specified time. Exploring the variance in faculty members' innovation level across disciplines would provide useful information about the innovation capability in certain disciplines (for example, Science, Technology, Engineering and Mathematics) at Saudi public and private universities.

The web-based questionnaire was designed using Qualtrics, which is a well-developed tool for conducting online surveys. Nonetheless, universities which have spam blockers aimed at maintaining high security might have blocked some emails send to the websites used by the faculty members to receive emails. This might explain the reduced response rate-some participants targeted in the survey might not have received the survey link sent via email, leading to non-response bias.

Common method bias is a key limitation in this study. In the study, data on both the independent and dependent variables was collected from the same

respondents at one point in time, raising possible common method variance. Thus, false internal consistency may be present in the data. The data collection instrument caused variation in responses. The survey introduced a bias, leading to variances in the data analysed.

### 5.2 Contribution of the study

The study has some contributions to academia. The findings help advance the current literature on IC resources and its relationship with innovation in higher education settings. Drawing on the findings of sector-specific empirical data, research literature and interview testimony, this study assesses the qualitative and quantitative impact of IC on innovation. The research thus calls for action for universities to advance the academic literature on the subject.

The research has several contributions to university administration. University administrators play a key role in developing theories which identify the association between IC resources, problems, appropriate interventions and solutions. The findings may help transfer knowledge from the university to industry setting in efforts to ensure improved use of IC resources. Systematic data collection and analysis on the various pathways for universities' contribution to innovation through IC resources should be supported by the university staff.

The study informs government policy. The findings generated in the study may help make sense of complex relationships which underlie government practice and give insights into the improvements required for effective innovation. To improve the contribution of universities to innovation-based growth founded on IC resources, government policy should take a long-term perspective for developing

an industry-science eco-system, avoiding the temptation of quick solutions. Government policy makers should be more innovative in their search for effective IC policy interventions, venturing beyond the research and development efforts.

### 5.3 Conclusion

This chapter summarizes the whole research and state the key findings obtained. The conclusions and recommendations for research in future are included. IC is vital in business organizations and higher learning institutions. As such, studying the link between IC and innovation capacity in universities is important. The study sought to investigate the main influential factor of intellectual capital that leads to more innovation among faculty members in private and public universities located in Saudi Arabia. The relationship between IC and innovation was examined and discussed from the IC innovation perspective to answer the following four research questions:

a) Which factor of the Intellectual capital components has a dominating influence in intellectual capital support?
b) Do government intellectual capital policies (as a moderating factor) impact innovation level among the university faculty?
c) Do financial support (as a moderating variable) in scientific research impact innovation level among the university faculty?
d) Does the level of intellectual capital affect the innovation level among faculty members?

The study population included faculty members with PhD qualifications in Saudi Arabia universities. The universities include Taif University, King Abdelaziz

University, King Fahad University of Petroleum and Minerals, King Saud University, Umm Al Qura University, Riyadh Elm University and Prince Fahad bin Sultan University.

This study used a combination of survey technique and an in-depth interview method, providing valuable information and deeper understanding of IC as factors impacting the level of faculty innovation level in a larger sample of Saudi public universities. To collect the data from the faculty members who work in these universities, survey and exploratory research designs were used. The participants were recruited through invitation letters sent to them through their institutions. Some were invited for interview sessions and others completed an online questionnaire.

Several regression models were developed for the quantitative analysis, testing all 12 hypotheses individually against the independent variable reveals a significant relationship with the independent variables. However, when all variables are combined in the model, the results reveal that hypotheses 6 and 7 are significant when the fixed effect is not used and only hypothesis 7 is significant when universities are used as a fixed effect. This means government structural capital and government relational capital has an impact on the level of innovation among universities when variations caused by sample universities is not accounted for. However, if the variation is considered, only government relational capital has a significant relationship with innovation.

Relating this with the results of the qualitative analysis, the Government needs to makes structural policies that; encourage the publication and this can be

achieved by allocating time for research, provide materials and infrastructure needed for quality research work and establish policies that promote inter-university cooperation.

Lastly, one of the factors that depict the level of innovation in an institution is the number of publications. When the fixed effect is not used; administrative staff, admission rate, age, deanship, college, and government structural capital are significant while administrative staff, admission rate, age, deanship, college, and the number of students have a significant relationship with the publication when fixed effect is used.

# REFERENCES


Abel, J. & Deitz, R. (2012). Do Colleges and Universities Increase Their Region's Human Capital?" *Journal of Economic Geography*, 12 (3), 667-680.

Agostini, L., Nosella, A. & Filippini, R. (2017). Does intellectual capital allow improving innovation performance? A quantitative analysis in the SME context. *Journal of Intellectual Capital*, 18 (2), 1-12.

Aichouni, M., Touahmia, M., Al-Ghamdi, A., Ait-Messaoudene, N., Al-Hamali, R., Al-Ghonamy, A., & Al-Badawi, E. (2015). Creativity and Innovation among Gifted Saudi Students-An Empirical Study. *Procedia - Social And Behavioral Sciences,* 195, 1371-1379.

ALALI, A. S., & NIKOLAIDIS, P. (2015). Preliminary study of intellectual productivity in Public Universities of Saudi Arabia. Recent Advances in Computer Science. ISBN, 978-1.

Alalwany, H., Koshak, N. A., & Ibrahim, M. K. (2014). Developing Intellectual Capital to Advance Innovation and Entrepreneurial Capacity and Sustain Knowledge Economy. *International Journal of Industrial and Manufacturing Engineering*, *8*(8), 2433–2437.

Alatawi, F. M. H., Dwivedi, Y. K., Williams, M. D., & Rana, N. P. (2012). Conceptual model for examining knowledge management system (KMS) adoption in public sector organinzations in Saudi Arabia. *tGov Workshop*, *2*, 1–22.

Alawamleh, M., Bani Ismail, L., Aqeel, D. & Alawamleh, K. (2019). The bilateral relationship between human capital investment and innovation in Jordan. *Journal of Innovation and Entrepreneurship,* 8(6), 1-17. https://doi.org/10.1186/s13731-019-0101-3

Alghamdi, S. S., Wagih, M. E., Alzahrani, A. S., & Attia, M. A. (2015). Investing in Intellectual Capital for Enhancing the Management Systems in Saudi Arabia â€™ s Higher Education : Albaha ... *Canada International Conference on Education (CICE-June 22-25, 2015*, (November).

Alghamdi, S. S., Wagih, M. E., Alzahrani, A. S., & Attia, M. A. (2016). Investing in the Intellectual Capital of Albaha University , Saudi Arabia : The Concept and Mechanisms. *International Journal for Cross-Disciplinary Subjects in Education*, *7*(1), 2717–2725.

Alkhaffaf, H. & Aljanabi, A. (2016). Imperatives of intellectual capital and technical skills for innovation: Perspective on higher education. *AIP Conference Proceedings,* 1761(1), 12=25.

Al-Musali, M. A. K., & Ismail, K. N. I. K. (2014). Intellectual Capital and its Effect on Financial Performance of Banks: Evidence from Saudi Arabia. *Procedia - Social and Behavioral Sciences*, *164*(August), 201–207.

ALSAYADI, S. A., & ALGARNI, A. O. (2017). Utilizing Employee Intellectual Capital through Enterprise Social Network: A Case Study on Saudi Airlines Aviation Company. American Academic & Scholarly Research Journal, 9(1).

Alserhan, H. (2017). The Role of Intellectual Capital in Achieving a Competitive Advantage: A Field Study on Jordanian Private Universities in the Northern Region. *Global Journal of Management and Business Research: Administration and Management*, 17(5), 1-6.

Al-Sudairi, M. & Bakry, S. H. (2014). Knowledge Issues in Global Innovation Index: Assessment Of The State Of Saudi Arabia Versus Countries With Distinct Development, Innovation: Management. *Policy & Practice*, 16, (2), 176-183.

Alzuman, A. (2015). Faculty Research Productivity in Saudi Arabian Public Universities: A Human Capital Investment Perspective. Virginia Commonwealth University.

Anggraini, F., Abdul-Hamid, M. & Kassim, A. (2018). The Role of Intellectual Capital on Public Universities Performance in Indonesia. *Pertanika Journal of Social Science and Humanities,* 26(4), 2453-2472.

Anggraini, F., Abdul-Hamid, M. A., & Azlina, M. K. A. (2018). The Role of Intellectual Capital on Public Universities Performance in Indonesia. PERTANIKA JOURNAL OF SOCIAL SCIENCE AND HUMANITIES, 26(4), 2453-2472.

Auranen, O., & Nieminen, M. (2010). University research funding and publication performance-An international comparison. *Research Policy*, *39*(6), 822–834.

Baker, D. R (2014). Innovation and Value Creation: A Cross-Industry Effects Study of Patent Generation. Unpublished doctoral dissertation. Capella University.

Bakhsh, A. (2016, October 11). Saudi Investment in Human Capital Development...How did We Do Since 2008? A Clear Disappointment. Retrieved January 25, 2018, from https://www.linkedin.com/pulse/saudi-investment-human-capital-developmenthow-did-we-do-ammar-bakhsh/

Barbosa, S., Vale, J., Vale, V. & Branco, M. (2016). Intellectual Capital and Performance in Higher Education Organizations. *Theory and Applications in the Knowledge Economy*, 1, 670-681.

Bhardwa, %. (2017, May 16). Best universities in the Arab World 2017. Retrieved January 25, 2018, from https://www.timeshighereducation.com/student/best-universities/best-universities-arab-world-2017

Bokhari, A. (2015). The Gap of Knowledge-based Economy between The Developing Countries and Advanced Economies ( Applied on the Kingdom ..., (July 2017).

Bolarinwa OA. Principles and methods of validity and reliability testing of questionnaires used in social and health science researchers. Niger Postgrad Med J [serial online] 2015 [cited 2018 Feb 20]; 22:195-201. Available from: http://www.npmj.org/text.asp?2015/22/4/195/173959

Bonett, D. (2010). Varying coefficient meta-analytic methods for alpha reliability. *Psychological Methods*, 15 (4), 368–385.

Bornay-Barrachina, M., De la Rosa-Navarro, D., Cabrales, A. & Valle-Cabrera, R. (2012). Employment Relationships and Firm Innovation: The Double Role of Human Capital. *British Journal of Management*, 23(2), 223-240.

BRĂTIANU, C., & PÎNZARU, F. (2015). Challenges for the University Intellectual Capital in the Knowledge Economy. *Management Dynamics in the Knowledge Economy*, *3*(4), 609–627.

Brenner, M. & Coners, A. (2010). Process Capital as Strategic Success Factor: The Lufthansa Example. In: vom Brocke J., Rosemann M. (eds) *Handbook on Business Process Management 2*. International Handbooks on Information Systems. Berlin: Springer. 57-72.

Capello, R., & Faggian, A. (2005). Collective learning and relational capital in local innovation processes. Regional studies, 39(1), 75-87.

Carl-Erik, S., Bengt, S. & Jan, W. (2003). "Stratified Sampling". *Model Assisted Survey Sampling*. New York: Springer. pp. 100–109.

Casanueva, C. & Gallego, A. (2010). Social capital and individual innovativeness in university research networks. *Innovation: Management, Policy & Practice,* 12(1), 105-17.

Celenza, D., & Rossi, F. (2014). Intellectual capital and performance of listed companies: empirical evidence from Italy. Measuring Business Excellence, 18(1), 22-35.

Chatterji, N. & Kiran, R. (2017). Role of human and relational capital of universities as underpinnings of a knowledge economy: A structural

modelling perspective from north Indian universities. *International Journal of Educational Development,* 56(1), 52-61.

Chell, E., Karata-Özkan, M. & Nicolopoulou, K. (2007). Social Entrepreneurship Education: Policy, Core Themes and Developmental Competencies. International Journal of Entrepreneurship Education, 5, 143-162.

Chen, I. S., & Chen, J. K. (2013). Present and future: A trend forecasting and ranking of university types for innovative development from an intellectual capital perspective. *Quality and Quantity,* 47(1), 335-352

Chen, Y., Lin, M. & Chang, C. (2009). The positive effects of relationship learning and absorptive capacity on innovation performance and competitive advantage in industrial markets. *Industrial Marketing Management*, 38(2), 152-158.

Chen, Y., Lin, M., & Chang, C. (2006). The Influence of Intellectual Capital on New Product Development Performance – The Manufacturing Companies of Taiwan as an Example. *Total Quality Management & Business Excellence,* 17(10), 1323-1339.

Clarke, M., Seng, D. & Whiting, R. (2011). Intellectual capital and firm performance in Australia. *Journal of Intellectual Capital*, 12(4), 505-530.

Cohen, L., Manion, L., & Morrison, K. (2011). *Research Method in Education* (7th Editio). Routledge

Córcoles, Y. & Vanderdonckt, J. (2013). Empirical Evidence for the Increasing Importance of Intellectual Capital Reporting in Higher Education Institutions. *International Journal of Humanities and Social Science,* 3(8), 39-51.

Creswell, J. (2013). *Research design: Qualitative, quantitative, and mixed methods approach.* Thousand Oaks, California: Oxford University Press.

Cricelli, L., Greco, M., Grimaldi, M., & Dueñas, L. P. L. (2018). Intellectual Capital and University Performances in Emerging Countries - Evidence from Colombian public universities. *Journal of Intellectual Capital*, *19*(1), 71–95. https://doi.org/10.1108/JIC-02-2017-0037

Crook, T. R., Todd, S. Y., Combs, J. G., Woehr, D. J., & Ketchen, D. J. (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.

Curado, C., Henriques, P. & Bontis, N. (2011). Intellectual capital disclosure payback. *Management Decision,* 49(7), 1080-1098.

Deeb, K. A., & Merhej, M. M. (2016). The impact of structural capital on the innovation performance in Syrian Universities: A field study in Tishreen University. European Online Journal of Natural and Social Sciences, 5(3), 664

Edvinsson, L., & Malone, M. (1997). Intellectual capital. New York: Harper Business. Fogarty, T. J. (2000). Socialization and organizational outcomes in large public accounting firms. Journal of Managerial Issues, 12, 13-33.

Fazlagic, A. (2005). Measuring the intellectual capital of a university. Conference on Trends in the Management of Human Resources in Higher Education, OECD Headquarters in Paris Paris, 25 / 26 August 2005.

Gadhouma, Y. & Karam, Y. (2016). THE DETERMINANTS OF RESEARCH PRODUCTIVITY IN PUBLIC VERSUS PRIVATE SAUDI UNIVERSITIES, First International Conference on Advanced Business and Social Sciences. Asia Pacific Institute of Advanced Research (APIAR), 86-530-561

Girard, J., & Girard, J. (2015). Defining knowledge management: Toward an applied compendium. Online Journal of Applied Knowledge Management, 3(1), 1-20.

González-Loureiro, M. & Teixeira, A. (2011). Intellectual capital in public universities: a performance-oriented approach to manage intangible. International Journal of Engieenering and Industrial Management, 3(1), 95-125.

Hamdan, A. M., Buallay, A. M., & Alareeni, B. A. (2017). The Moderating Role of Corporate Governance on the Relationship between Intellectual Capital Efficiency and Firm. *International Journal of Learning and Intellectual Capital*, *1*(1), 1.

Hsu, L. & Wang, C. (2012). Clarifying the Effect of Intellectual Capital on Performance: The Mediating Role of Dynamic Capability. *British Journal of Management,* 23(2), 1-12.

Indiyati, D. (2018). The role of organisational culture, intellectual capital and competitive advantage in supporting the government policies in education. *International Journal of Economic Policy in Emerging Economies,* 11(1/2), 68-82.

Inkinen, H. (2015). Review of empirical research on intellectual capital and firm performance. Journal of Intellectual Capital, 16(3), 518-565.

Iqbal, A. (2011). Creativity and innovation in Saudi Arabia: An overview. *Organization and Management*, 13(3), 376-390.

Jafari, M., Aghaei Chadegani, A., and Biglari, V. (2011). Effective Risk Management and Company's Performance: Investment in Innovations and Intellectual Capital using Behavioral and Practical Approach. *International Research Journal of Finance and Economics*, 9(5), 18-26

Jin, Y., Hopkins, M., & Wittmer, J. (2010). Linking human capital to competitive advantages: Flexibility in a manufacturing firm's supply chain. *Human Resource Management,* 49(5), 1-10.

Karchegani, M.R., Sofian, S. & Amin, S.M. (2013). The relationship between intellectual capital and innovation: A review. International journal of business and management studies, 2(1), 561-581.

Khan, M. (2014). Identifying the Components and Importance of Intellectual Capital in Knowledge-Intensive Organizations. *Business and Economic Research*, 4(2), 297-307.

Khan, M. K., Al-Saud, T., Alkhathlani, H. & Al-Derham, H. (2014). New reforms of research, innovation and entrepreneurship in the GCC countries, Innovation: Management. *Policy & Practice*, 16(2), 174-175.

Khan, Y. (2016). Impact of Structural Capital on Innovation in the Australian SMEs. Conference paper. BE-ci 2016 International Conference on Business and Economics.

Khavandkar, E., Theodorakopoulos, N., Hart, M. & Preston, J. (2016). Leading the Diffusion of Intellectual Capital Management Practices in Science Parks. In H. Shipton, P. Budhwar, P. Sparrow, & A. Brown (Eds.), *Human Resource Management, Innovation and Performance (pp. 213–231).* London: Palgrave Macmillan UK.

Khorsheed, M. & Al-Fawzan, M. (2014). Fostering university–industry collaboration in Saudi Arabia through technology innovation centers. *Innovation*, 16(2), 224-237

Kok, A. (2007). Intellectual Capital Management as Part of Knowledge Management Initiatives at Institutions of Higher Learning. *Electronic Journal of Knowledge Management Volume*, *5*(2), 181–192.

Kong, E. (2010). Innovation Processes in Social Enterprises: An IC Perspective. *Journal of Intellectual Capital,* 11(2), 158-178.

Leitner, K. & Curaj, A. (2014) (Eds.). *A Strategic Approach for Intellectual Capital Management in European Universities. Guidelines for Implementation.* Bucharest: UEFISCDI.

Leitner, K., (2004). Intellectual Capital Reporting for Universities: Conceptual Background and Application for Austrian Universities. Research Evaluation, Vol. 13, Nº 2, págs. 129-140.

Leitner, K.H. (2011). The Effect of Intellectual Capital on Product Innovativeness in SMEs. *International Journal of Technology Management*, 53(1), 1-17.

Li, J. & Yu, D. (2018). The Path to Innovation: The Antecedent Perspective of Intellectual Capital and Organizational Character. *The Path to Frontier Psychology*, 9(2445), 1-18.

Lu, W. M. (2012). Intellectual capital and university performance in Taiwan. Economic Modelling, 29(4), 1081-1089.

Maboudi, M., Mobaraki, M., Khavandkar, J. & Esfandabadi, H. (2015). The Effect of Intellectual Capital on Innovation: A Case Study of an Institute for Advanced Studies in Basic Sciences Located in the Science and Technology Park of Zanjan. *Journal of Entrepreneurship and Organizational Management,* 4(3), 1-5.

Manriquez, V. D. (2014, September 29). The Importance of Integrating Knowledge Management with Maintenance. Retrieved January 25, 2018, from http://www.machinerylubrication.com/Read/29896/maintenance-knowledge-management.

María Díez, J., Lizet Ochoa, M., Begoña Prieto, M. & Santidrián, A. (2010). Intellectual capital and value creation in Spanish firms. *Journal of Intellectual Capital,* 11(3), 348-367.

Meihami, B & Karimi, J. (2014). The relationship between intellectual capital reporting and universities performance. *MAGNT Research Report*, 2 (5), 748-754.

Merhej, M. & Deeb, K. (2016). The impact of structural capital on the innovation performance in Syrian universities: A field study in Tishreen University. *European Online Journal of Natural and Social Sciences*, 5(3), 664-673.

Najim, A., Mohamed, A. & Alnaji, L. (2012). Impact of Intellectual Capital on Realizing University Goals in a Sample of Jordanian Universities. *European Journal of Business and Management,* 4 (14), 153-162

Nashar, Mohamed: University Administration, Development and Prospects, Assout University, Egypt, 1976.

Neuman, W. & Robson, K. (2012). *Basics of social research: Qualitative and quantitative approaches*. Toronto: Pearson A and B.

Paoloni, P. Cesaroni, M. & Demartini, P. (2019). Relational capital and knowledge transfer in universities. *Business Process Management Journal*, 25(1), 185-201

Patterson, M. G., West, M. A., Shackleton, V. J., Dawson, J. F., Lawthom, R., Maitlis, S., ... & Wallace, A. M. (2005). Validating the organizational

climate measure: Links to managerial practices, productivity and innovation. Journal of organizational behavior, 26(4), 379-408.

Piirainen, K., Andersen, A. & Andersen, P. (2016). Foresight and the third mission of universities: the case for innovation system foresight. *Foresight*, 18(1), 24-40

Pircher, R., & Pausits, A. (2011). Information and Knowledge Management at Higher Education Institutions. *Management Information Systems*, *6*(2), 008–016.

Rahim, N., Kamal, M. & Mat, R. (2011). Structural capital and its effect on organizational performance: A case study of Telekom Malaysia Berhad (TM) headquarters. Conference paper. 2011 IEEE Colloquium on Humanities, Science and Engineering Research (CHUSER 2011), Dec 5-6 2011, Penang.

Ramírez, Y., Tejada, A. & Gordillo, S. (2013). Recognition of intellectual capital importance in the university sector. *International Journal of Business and Social Research*, *3*(4), 27–41. Retrieved from http://thejournalofbusiness.org/index.php/site/article/view/27

Rashied, A. S.,& Alzaidi, H. S.(2014) The role of intellectual capital in achieving Superior university performance: An analytical study. AL-Qadisiyah Journal For Administrative and Economic sciences, 16(3), 6-35.

Rasooldeen, MD. (2011). Building Intellectual Capital, Knowledge Economy – Alireza". Saudi-US Relations Information Service.

Sánchez, M., Elena-Pérez, S. & Castrillo, R. (2009). Intellectual capital dynamics in universities: A reporting model. *Journal of Intellectual Capital*, 10(2), 307-324.

Sangiorgi, D. & Siboni, B. (2017). The disclosure of intellectual capital in Italian universities. *Journal of Intellectual Capital*, 18(2), 354-372.

Schiuma, G., Carlucci, D. & Sole, F. (2012). Applying a systems thinking framework to assess knowledge assets dynamics for business performance improvement. *Expert Systems with Applications,* 39(9), 8044–8050.

Secundo, G. & Elia, G. (2014). A performance measurement systems for academic entrepreneurship. *Measuring Business Excellence*, 18(3), 23-37.

Secundo, G., Elena- Perez, S., Martinaitis, Ž. & Leitner, K. (2015). An intellectual capital maturity model (ICMM), to improve strategic management in European universities: A dynamic approach. *Journal of Intellectual Capital,* 16(2), 419-442.

Secundo, G., Margherita, A., Elia, G. & Passiante, G. (2010). Intangible assets in higher education and research: Mission, performance or both? *Journal of Intellectual Capital*, 11(2), 140-157.

Secundo, G., Passiante, G., Gianfreda & Passabì, S. (2014). Managing intellectual capital in entrepreneurial university: a collective intelligence approach. Proceedings of the 6th European Conference on Intellectual Capital ECIC 2014, Slovak University of Technology (STU), Trnava, 10-11 April.

Sekaran, U., & Bougie, R. (2010). *Reasearch Method For Bussiness - A skill building Approach* (5th Editio). West Sussex: John Wiley & Sons, Inc.

Shahzad, U., Fareed, Z., Zulfiqar, B., Shahzad, F., Hafiz, S. & Latif, S. (2014). The Impact of Intellectual Capital on the Performance of Universities. *European Journal of Contemporary Education*, 10, 273-280. 10.13187/ejced.2014.10.273

Sharabati, A., Jawad, S. & Bontis, N. (2010). Intellectual capital and business performance in the pharmaceutical sector of Jordan. *Management Decision,* 48 (1), 105-131.

Siegel, S. M., & Kaemmerer, W. F. (1978). Measuring the perceived support for innovation in organizations. *Journal of Applied Psychology*, *63*(5), 553

Sivalogathasan, V., & Wu, X. (2013). Intellectual capital for innovation capability: a conceptual model for innovation.

Subramaniam, M. & Youndt, M.A. (2005). The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal,* 48(3), 450-463.

Sukmawati, A. (2019). The Evaluation of Lecturer's Performance and Sekolah Tinggi Perikanan's Performance Through Intellectual Capital. *Journal of Management,* 23(1), 19-39.

Sundac, D., & Krmpotic, I. F. (2009). Measurement and management of intellectual capital. *Tourism and Hospitality Management,* 15(2), 279-290.

Tafti, M. F., & Yarmohammadian, M. H. (2017). The Relationship between Intellectual Capital and Organizational Innovation among Faculty Members of International University of Yazd, Iran 2015-2016. International Journal of Humanities and Cultural Studies (IJHCS) ISSN 2356-5926, 2691-2702

Tai-Ning,Y., Chen, C.H, Lin Shou-Yen, L.S., & Lun, T.C. (2011). Knowledge creation and intellectual capital on securities investment services. *African Journal of Business Management,* 5(3), 924-933.

Todericiu, R., & Şerban, A. (2015). Intellectual Capital and its Relationship with Universities. *Procedia Economics and Finance*, *27*(15), 713–717.

United Nations, 2016. Regional Profile of the Information Society in the Arab Region, 2003-2015 [EN/AR]. Retrieved from https://reliefweb.int/report/yemen/regional-profile-information-society-arab-region-2003-2015-enar

Veltri, S., Mastroleo, G. & Schaffhauser-Linzatti, M. (2012). Measuring Intellectual Capital in the University Sector Using a Fuzzy Logic Expert System. *Knowledge Management Research and Practice*, 12(2), 175-192.

Wang, H. K., Yen, Y. F., Tsai, C. F., & Lin, Y. C. (2008). An empirical research on the relationship between human capital and innovative capability: A study on Taiwan's commercial banks. Total Quality Management, 19(11), 1189-1205.

Wu, H., Chen, J. & Chen, I. (2012). Ways to promote valuable innovation: Intellectual capital assessment for higher education system. *Quality and Quantity*, 46(5), 1-15

Wu, W.Y., Chang, M.L. & Chen, C.W. (2008). Promoting innovation through the accumulation of intellectual capital, social capital, and entrepreneurial orientation. *Research and Development Management*, 38(3), 265-277.

Yitmen, I. (2011). Intellectual Capital: A Competitive Asset for Driving Innovation in Engineering Design Firms. *Engineering Management Journal,* 23(2), 3-19.

Yusuf, N. & Atassi, H. (2016). Promoting a culture of innovation & entrepreneurship in Saudi Arabia: Role of the Universities. *International Journal of Higher Education Management,* 2(2), 26-33.

Zambon, S., & Monciardini, D. (2015). Intellectual capital and innovation. A guideline for future research. *Journal of Innovation Economics*, *17*(2), 13.

Zerenler, M., Hasiloglu, S. B. & Sezgin, M. (2008). Intellectual Capital and Innovation Performance: Empirical Evidence in the Turkish Automotive Supplier. *Journal of Technology Management and Innovation,* 3(4), 10-20.

Zhang, Y. & Cao, H. (2014). The Intellectual Capital and Technology Innovation Performance—Empirical Study Based on Universities Affiliated with Ministry of Education. *International Business and Management,* 9(2), 62-69.

Zomer, A., & Benneworth, P. (2011). The rise of the university's third mission. In Reform of higher education in Europe (pp. 81-101). Brill Sense.