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

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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 some 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. The 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 analyzed 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.

***Keywords*:** Intellectual capital components, innovation, Universities, Saudi Arabia.

INTRODUCTION

Research objectives:

To investigate the contributory factors that lead to support the intellectual capital toward innovation level among Faculty in the Saudi Arabian universities.

Research Questions

1-Which is the main factor of intellectual capital components that has the dominating influential on the innovation level support among faculty members?
2- Does Government Intellectual Capital policies of the intellectual capital (as moderate) impact on innovation level among faculty?
3- Does financial support of the intellectual capital (as moderate) effect on innovation level among faculty?
4- Does the level of intellectual capital affect the innovation level among faculty?

RESEARCH HYPOTHESES

H_1 Human Capital is the major factor affecting the intellectual capital toward innovation level among faculty.
H_2 Structural Capital is the major factor affecting the intellectual capital toward innovation level among faculty.
H_3 Relational Capital is the major factor affecting the intellectual capital toward innovation level among faculty.
H_4 Government Intellectual Capital policies affect the innovation level among faculty.
H_5 Government Intellectual Capital policies affect the outcome of Human capital towards innovation level among faculty.
H_6 Government Intellectual Capital policies affect the outcome of Structural capital towards innovation level among faculty.
H_7 Government Intellectual Capital policies affect the outcome of Relational capital towards innovation level among faculty.
H_8 Financial support of Intellectual capital affects the innovation level among faculty.
H_9 Financial Support affects the outcome of Human capital towards innovation level among faculty.
H_{10} Financial Support affects the outcome of Structural capital towards innovation level among faculty.
H_{11} Financial Support affects the outcome of Relational capital towards innovation level among faculty
H_{12} intellectual capital level is affecting by the Innovation level among faculty

Literature review

This study 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 (Fig. 1).

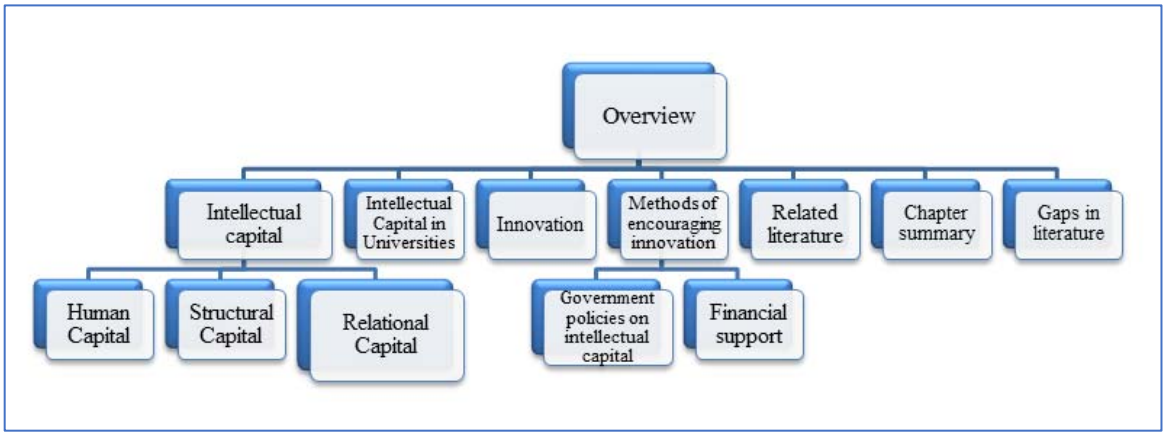

Fig. 1. The main areas covered in studying previous studies.

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The previous studies reveal that there was increased interest in IC application and management in the Higher education institutions setting [(1)]. Since the start of the IC movement, this research topic has gained interest in university settings. Some studies have focused on IC reporting [(2)] and IC practice inside the universities [(3, 4, 5)]

Scholars have categorized IC components differently. Nonetheless, there is a widely accepted classification proposed by [(1,2,5,6,7)]. 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 [(3,4,5)]. In the higher education setting the content of each IC-subcategory is provided by [(1)].

Indeed, the relationship between IC and innovation has been widely studied [(8,9,10)]. To be specific, human capital is universally seen as the most basic knowledge asset for enterprises [(10)]. Researchers have also identified a significant positive correlation between the organization's overall level of IC and performance outcomes, including new product development [(10, 11, 12)] innovation performance [(13, 14, 15, 16, 17)].

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 [(18)] in Indonesian universities [(19)], in the Taiwanese universities and investigation by [(20)] in Iraqi universities are revealed in the intellectual capital research literature. Generally IC significantly affects universities' performance [(18)].

Few studies are measuring the relationship between IC and innovation in developing countries [(13)]. 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, some studies [(19, 20)] showed that intellectual capital had a significant impact on universities, especially innovation. As such, this topic requires further exploration.

METHODOLOGY

Research Design

Research design included procedures for gathering, analysing, reporting and interpreting data gathered from primary respondents [(21)]. 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 [(22)].

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.

Theoretical framework (Fig. 2)

This 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 each 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.

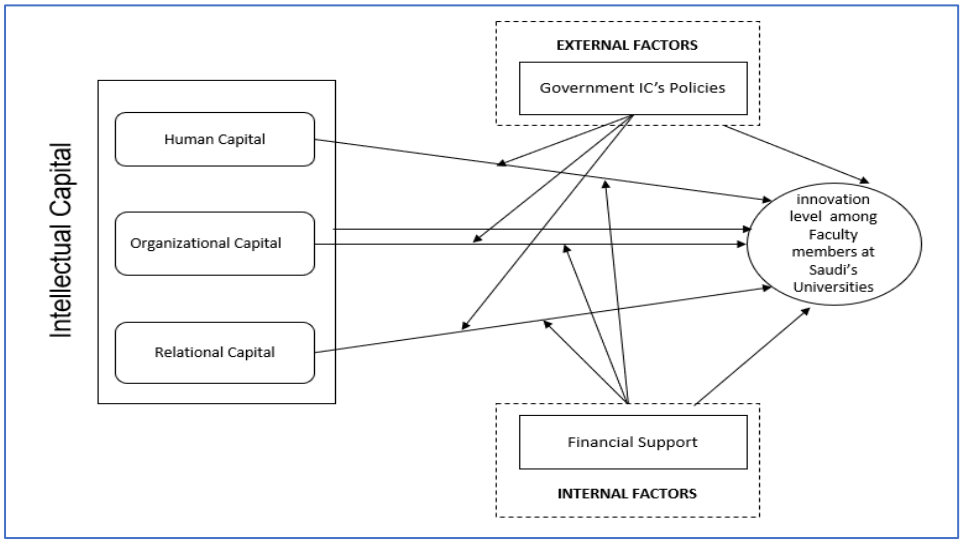

Fig. 2. Proposed Conceptual Framework for measuring IC in Saudi's University adapted from [23].

Sampling design

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. 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.

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 [24]. 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.

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Fig. 3. Administrative Region in the Kingdom of Saudi Arabia

Measurement of Intellectual capital

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

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 by [26, 27,28,29,30,31].

Interview

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 he asks all respondents similar questions. Researchers must follow standard procedures when conducting structured interviews as this practice increases reliability [22]. 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.

Analysis and reporting of Intellectual capital

Statistical Package for Social Scientists (SPSS) and Stata were used to analyze the data collected. Data analysis techniques adopted was used to perform descriptive and correlation analysis. The analysis considered 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.

DATA ANALYSES

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 Figure (4).

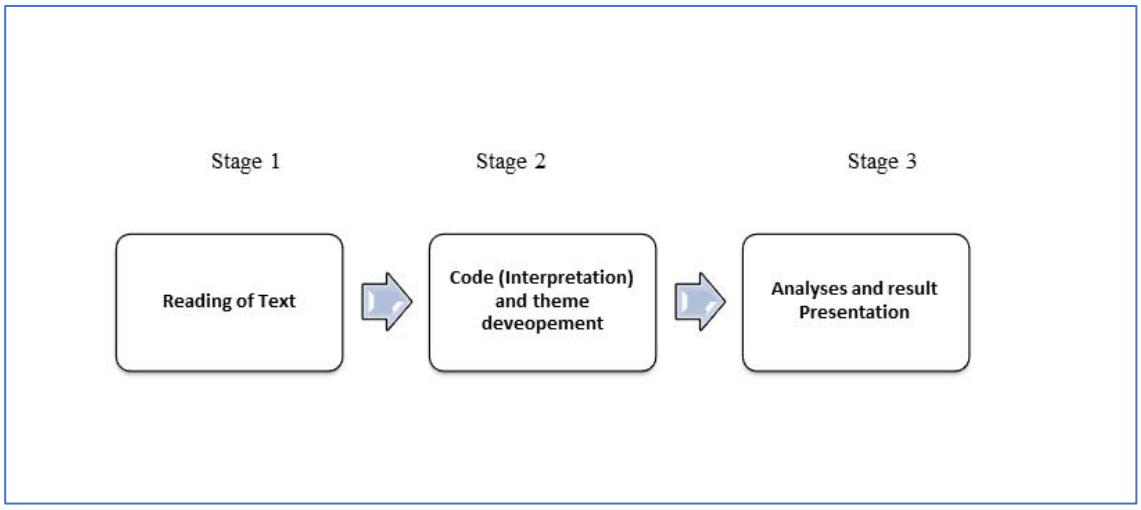

Fig. 4. Stages of qualitative analyses used in this study.

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, which 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.

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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 (No. 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

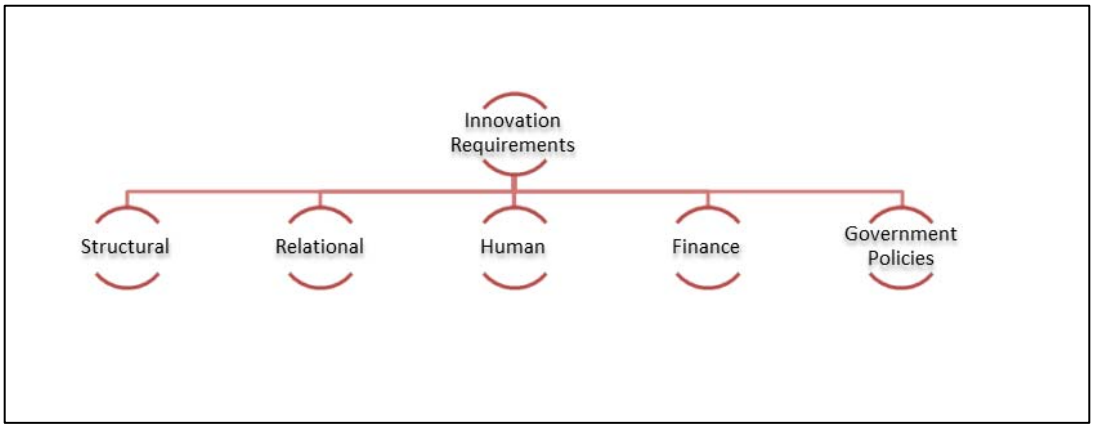
Stage 3

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 analyzed data revealed intellectual capital has an impact on the innovation level at 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 (Fig. 5).



Fig, 5. 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.

RESULTS AND DISCUSSION

The study showed 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. Among the three IC factors, the main factor was relational capital, while the least factor was structural capital [(32)]. HC, RC and leadership capital had a more significant impact compared to structural capital [(33)]. 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 indicated that among the three IC types, customer capital had the greatest impact, followed by employee capital then structural capital [(17)]. Human capital is the most significant component of IC in terms of higher education institution performance [(34)]. In the study, SC comes in the second place and RC the last position.

The study of [(35)] 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. The components of IC used in the analysis are different, hence the difference in the results.

The study indicated that there is a significant association between IC and innovation level. However, [33] 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 results of [9] support the mediating role of IC and the moderating roles of entrepreneurial orientation and social capital on innovation. Also, their

The current study showed the moderating role of government intellectual capital policies toward relational capital. Contrary to this finding, [9] 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 present study revealed a significant relationship between Innovation and all other variables. Several aspects of IC and their interrelationships, by accumulating and mediating innovation differently, enable universities to draw upon innovation in distinct ways. Previous study[9] revealed that firms that have higher levels of social capital and entrepreneurial orientation tend to amplify the effects of intellectual capital on innovation.

The findings in the study suggest that government intellectual capital policies toward relational capital affect the innovation level among faculty. On the other hand, [34] found that relational capital has 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 a more positive influence on the performance of universities. Since the data collected is based on different sources, the findings differ.

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 analyze the new IC initiatives and innovation behavior 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 behavior 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 analyzed.

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.

Conclusions and recommendations

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) Does 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?

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 are 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, it is recommended that the Government needs to make 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.

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أكثر مكونات رأس المال الفكري تأثيراً على مستوى الابتكار لدى أعضاء هيئة التدريس في جامعات المملكة العربية السعودية

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المستخلص

تعد موارد رأس المال الفكري (IC) مثل رأس المال العلائقي ورأس المال الهيكلي ورأس المال البشري عوامل مهمة للنجاح في المؤسسات. تشير الدلائل إلى أن IC مهم في الحصول على ميزة تنافسية. إن الجامعات الحالية بطيئة في تعزيز وتشجيع الابتكار على الرغم من موارد تكنولوجيا المعلومات المتاحة لها. في المملكة العربية السعودية، لم تقم أي دراسة بالتحقيق في تأثير تكنولوجيا المعلومات على مستوى الابتكار في سياق التعليم. هدفت هذه الدراسة إلى التعرف على العامل المؤثر الرئيسي لرأس المال الفكري الذي يؤدي إلى المزيد من الابتكار بين أعضاء هيئة التدريس في الجامعات العاملة في المملكة العربية السعودية. استخدمت الدراسة تصميم البحث الوصفي. تم اعتماد المنهج المختلط في البحث. وشمل ذلك الأساليب النوعية والكمية. تكون مجتمع الدراسة من أعضاء هيئة التدريس في بعض جامعات المملكة العربية السعودية. تم جمع البيانات الأولية عن طريق استبيانات المسح والمقابلات شبه المنظمة. تم استخدام بيانات البحث الكمية لقياس الآراء في الردود المقدمة من المشاركين في الاستطلاع. وكانت المتغيرات المستقلة هي رأس المال البشري ورأس المال الهيكلي ورأس المال الاجتماعي/العلائقي. وكانت المتغيرات المعتدلة هي سياسات رأس المال الفكري الحكومية والدعم المالي. وكان المتغير التابع هو مستوى الابتكار. وقد تم تحليل الردود من المقابلات بشكل نوعي للمساعدة في استخلاص الأنماط والمواضيع الرئيسية المتعلقة بالتكنولوجيا المعلوماتية والابتكار. تم تحليل البيانات الكمية التي تم جمعها باستخدام برنامج Stata. وكانت الأساليب الإحصائية المستخدمة في التحليل هي الإحصاء الوصفي وتحليل الانحدار. وتم تحليل البيانات النوعية باستخدام برنامج Nvivo 12. وبناء على التحليل الكمي، وجدت الدراسة أن مستوى رأس المال الفكري يؤثر على مستوى الابتكار لدى أعضاء هيئة التدريس. تعد السياسات الحكومية تجاه رأس المال العلائقي والسياسات الحكومية تجاه رأس المال الهيكلي هي المكونات الأكثر تأثيرًا. بالإضافة إلى ذلك، أظهرت نتائج التحليل النوعي أن رأس المال الهيكلي هو العامل الرئيسي لمكونات رأس المال الفكري الذي له تأثير مهيمن في دعم رأس المال الفكري. تساهم هذه الدراسة في أدبيات تكنولوجيا المعلومات، وتأسيس علاقة واضحة بين تكنولوجيا المعلومات ومستوى الابتكار في الجامعة. وستساعد النتائج في تقديم توصيات لصناع القرار وأصحاب المصلحة في مجال الأبحاث لدعم جهود رأس المال الفكري في الجامعات.

الكلمات المفتاحية: مكونات رأس المال الفكري، الابتكار، الجامعات، المملكة العربية السعودية.