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Modeling The Readiness Of Saudi Universities To Enhance The Efficiency Of Innovation Performance Imam Abdulrahman Bin Faisal University (A Case Study)

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Abstract-

Since the educational institution is one of the most important entities that affect innovation capabilities of the countries' economies; this study suggests the best model of the innovation performance of Saudi`s Universities as a first phase of further future researches in order to enhance the efficiency of the innovative performance in compliance with the new Saudi universities system. The current study contributes to the literature by being among the first to identify the best innovative model for Saudi universities according to their current innovation readiness. The study is applied to Imam Abdulrahman bin Faisal University (IAU) which is one of the largest Saudi Universities. The proposed model relies on two sub-groups of indicators: the indicator of the innovation inputs and the indicator of innovation outputs, considering the environmental factors. The findings of this study offer valuable insights for Saudi universities, enabling them to enhance their innovation capabilities and improve the efficiency of their innovative performance. The identification of the proposed innovation model and the assessment of current innovation readiness serve as a guide for decision-makers and stakeholders in the education sector, fostering the development and implementation of effective innovation practices within Saudi Arabian universities.

Keywords *- University innovation readiness, efficient innovative performance, innovative readiness, quantitative innovation indicators, innovation, IAU.*

1. Introduction

Since the research and innovation has the potential to drive economic growth, create diverse range of jobs and bring them together to local communities and businesses, Kingdom of Saudi Arabia's government announced some programs to reduce the amount of bureaucracy in research and innovation through the supervision of the ministry of higher education in order to concentrate on the delivery of high quality of teaching and research which the economy and society need. Therefore, the new administrative regulations of the higher education intensify the mutual relations with both the private sector and governmental sector besides stimulating university-based innovation and entrepreneurship in order to move from passive interdependence into active stakeholder engagement.

As reported by the Global Innovation Index (GII) 2021, which ranks world economies according to their innovation capabilities, it was obvious that over the past four years, the statistical confidence i[1]nterval for the ranking of Saudi Arabia was defined between 64 and 69[2]. In contrast, during 2022 Saudi Arabia jumped to achieve the 51th. The kingdom was

Imam Abdulrahman bin Faisal University, Saudi Arabia.

[2]Global Innovation Index2021
https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021/sa.pdf

able to reach advanced ranks in several indexes including the index of venture capital investment in emerging technological companies, the accessibility to ICT infrastructure, organizational environment for doing business and the use of ICT infrastructure[3]. Kingdom of Saudi Arabia's priorities for research, development and innovation to transform into an innovation based economy was one of the results of this progress[2]. On 2023, although Saudi Arabia ranked the 48th GII position[4] it was observed that it performed worse in innovation output than innovation inputs. Regarding the effectiveness translation of innovation investments into innovation outputs indicator, relative to the GDP, it was obvious that Saudi Arabia's performance is below the expectations for its level of development. The GII clarified that while Saudi Arabia ranks highest in the market sophistication, human capital and research, institutions, business sophistication and infrastructure, it shows lowest ranks in knowledge and technology outputs, creative outputs.

In accordance with the foregoing briefed assessment of Saudi Arabia innovation capabilities, the present study defines the allocation of some of the crucial entities of the innovation inputs at Saudi universities in comparison to some of the needed entities of the innovation outputs within the external environmental factors and the Kingdom commitment to the innovation progress.

According to the new Saudi universities system, only three universities among 29 public universities have started working under it. Imam Abdulrahman bin Faisal University (IAU) was one of the chosen universities. The new system will be gradually phased at the other universities, according to the defined standards by the Ministry of Higher Education, which is the official higher-education regulator in the kingdom.[5] The new change comes in line with the kingdom's Vision 2030, with the aim of reducing dependence on oil in order to diversify the economy[6]. The nomination of the chosen universities should be followed by a strategic plan for the transition to complete financial independence by each university. Therefore, IAU undertakes a strategic planning of innovation to accomplish revenue generation in order to maintain its sustainability.

The needed transformation raises the controversy of the previous studies which referred to the strong resistance to change in education especially in teaching process besides the main challenge to innovate in order to conclude the efficient productivity, where efficiency refers to the balance between the invested resources and the outcomes in terms of students' performance and equity[7] . (OECD, 2016).

Accordingly, moving into an innovation learning environment (ILE) requires not only individual mindsets shifts, but also shifts in the culture of the organization attempting to implement them and facing the most challenging ends of the change spectrum.[8](Mark,2016) . It is suggested that leading the staff through the process of

[3] Global Innovation Index2022
http://www.wipo.int/edocs/pubdocs/wipo-pub-2000-2022section1-en-gii-2022-at-aglance-global-innovation-index-2022-15th-edition.pdf

[4] Global Innovation Index2023
https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2003/sa.pdf

[5]https://www.ju.edu.sa/fileadmin/documents

[7]Innovating Education and Educating for Innovation THE POWER OF DIGITAL TECHNOLOGIES AND SKILLS
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https://www.researchgate.net/publication/336303484_Change_leadership_and_the_transition_to_innovative_learning_environments#read

transition into an innovative education can be done through preparing for change, implementing change; and sustaining change. These three phases should be implemented in conjunction with a clear understanding of how to lead change in teaching practices[9] (Mark Osborne,2019). In addition, Arab Universities precisely should have to draw students and innovative teaching who will come up with creative and innovative production through which the economic, social, and health affairs of community may flourish and develop[10]. (Al-youbi et al.,2021) . However, these studies didn't refer to the institutional polices and techniques that regulate the educational transition to innovation which should be tailored in accordance with the needs and the capabilities of each educational institution. Earlier studies also show that the university is an important part of the scientific innovation and technological advances in many sectors of the economy and production. Consequently, expenditure in scientific research and technological development provide a set of indicators that reflect the increased economic progress besides the advanced technological structure at national level[11] (Athanasios and Thomais,2016). In the meantime, (Abitia and G. Correa,2021) indicated that during the digital transformation, universities encounter another challenge related to prioritizing quick results and postpone the needed plans for building capabilities that are time-consuming .This problem can be solved through defining a plan for digital investments as a framework that can guide the systematic transformation of the organization in a sequential manner (Alenezi,2021) .(Guillermo and Bribiesca,2021) concluded in their study that assessing digital transformation of universities should be treated the same as any industry with an organizational structure, dynamic market, human resource and talent management, culture, processes, and the rest of the elements of a value chain .

According to Halász (2021) some of the teachers show a significant level of innovation activity with more traits of innovative work behavior than others who conduct their work by routines, standard methods and techniques. Therefore, innovation activities and individual innovation behavior are interdependent.

Consequently, the suggested model of this study defined that the university's organizational structure, as one of the elements of the innovation input indicator, has a direct impact on the efficiency of the innovation activities which is determined as one of the entities of the output innovation indicator.

In order to carry out the university's activities in research and innovation and to gain independence from the state budget fund, the university should maintain a diversity of its funding through charitable institutions, commercial companies, income from services and tuition fees. (Elena ; Tatiana, Alexander and etc ,2019) .

Accordingly, this study assures that entrepreneurship activities should be considered as a crucial entity in the suggested innovation model. The university's financial independence must be in conjunction with the entrepreneurial activities which should be introduced in all types of activities including teaching and research activity and supporting its own effective functionality.

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9 Mark Osborne (2019).Change leadership and the transition to innovative learning environments.
ResaerchGate.https://www.researchgate.net/publication/336303484_Change_leadership_and_the_transition_to_innovative_learning_environments

10 Al-youbi et al.(2021), How Arab Unniversties
https://www.researchgate.net/publication/348873516_How_Arab_Universities_Can_Be_Innovative

11 Athanasios and Thomais (2016). Research and Development. The Role of Universities for the Knowledge-based Society and Technological Innovations. Expenditure in Scientic Research and Applications as Crucial Factors for Economic Growth and the New Technological Frontiers. Research
Gate.https://www.researchgate.net/publication/310708656_Research_and_Development_The_Role_of_Universities_for_the_Knowledge-based_Society_and_Technological_Innovations_Expenditure_in_Scientic_Research_and_Applications_as_Crucial_Factors_for_Economic_Growth

In addition to N.M. Bunyak (2016) opinion which substantiates two types of entrepreneurial university models: entrepreneurial by result where teachers and graduates establish innovative companies and entrepreneurial by the type of activity, our study intensifies the importance of concluding entrepreneurial activities through the collaborations with the external stakeholders such as the industrial sector.
Furthermore, universities as subjects of market relations through transition of the knowledge into real innovative products should respond to the challenges of the surrounding environment and market factors. (Elena ; Tatiana, Alexander and etc ,2019) .
Consequently, the paper investigates the best innovation model that enables the efficient innovative performance of Saudi Universities.

2. Innovation Readiness of Imam Abdulrahman bin Faisal University (IAU)

2.1. **IAU's Strategic Plan**

IAU formulated a clear and appropriate vision and mission and derived its strategic plan, which was then updated on 2023 as a first preliminary phase towards the new transition of an independent innovation university. The higher administration is committed to the Vision 2030 of the Kingdom and ensures the alignment of vision with the national and international trends. Further, transparent systems and mechanisms are established for the timely follow-up to evaluate the extent to which the strategic plan is implemented and generate periodic reports on the progress made on different projects and initiatives.

The university received full institutional accreditation from the National Center for Academic Accreditation and evaluation on 2015 and aims to continuously renewing the accreditation of its colleges, institutions, labs and hospitals.

IAU has got variety of policies, guidelines, rules, regulations, user manuals and information management systems that are related to research and innovation and thereby IAU faculty members and students are constantly motivated to progress in their research productivity.

2.2. Assessing the effectiveness of IAU strategy

The university's mission expresses its role, which was defined through three pillars that constitute the IAU mission. The first element is "providing knowledge", The second one is "promoting research" which reflects the strategic objectives of concluding high standards of institutional research and the third element of the mission statement is to "Provide creative knowledge, research, and professional services with effective community partnerships". Therefore, the strategic plan was driven to reflect the three pillars of the university's mission. Consequently, A group of different key performance indicators were defined for monitoring and achieving the university's strategy which was modified on 2023 for the purpose of financial independency transformation.

Although the university strategy defines the technology transfer of its academic outputs besides intensifying its collaborations with both the private and industrial sectors to increase its opportunities for investments, the universty still facing different obstacles to achieve the strategic goals of the financial independency.

2.3. University research and innovation performance

The university has initiated and implemented a policy of rewarding creativity and innovation to faculty and students who publish in journals with specified impact factors. The policy requires, wherever relevant, the inclusion of undergraduate and postgraduate students in the research projects funded by and conducted at IAU.

Figure 1 shows the growth of Scopus publications in various fields. It indicates that since 2018, Natural Sciences publications have significantly grown and dominated the Medical Sciences publications. Based on the productivity during 2016 – 2021 in the three main

fields, IAU has a higher rank in the Medical Sciences field. Specifically, IAU is ranked 4th nationally based on Web of Science publications and 5th based on Scopus publications.

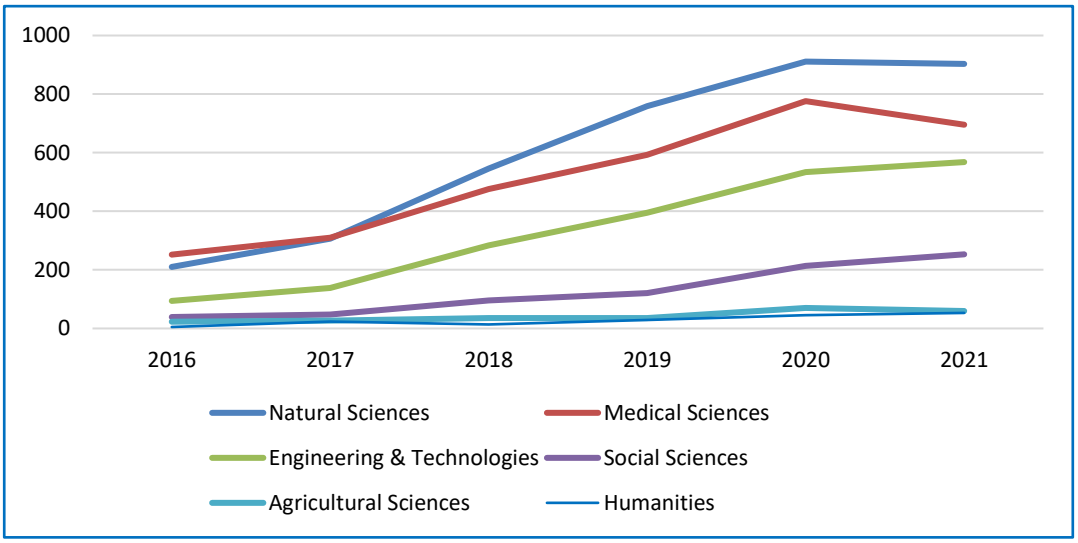

Figure 1. Trend of IAU Scopus publications in various fields - SciVal Data

Accordingly, the increased number of university innovation researches enables IAU colleges, centers, and institutes to grant patents with different disciplines through the existence of the university patent office.

2.4. Partnerships and Collaboration mechanism in the field of research and innovation at local and international levels

IAU strategic plan reflects the importance of sharing knowledge through different types of partnerships which offer a natural route to maximize the use of the academic research and innovation that should contribute to value creation and impact in society through several innovation channels. The most important channels were defined through direct research collaboration with industry & specialized companies – national and international – besides transferring knowledge and technical solutions within its research centers.

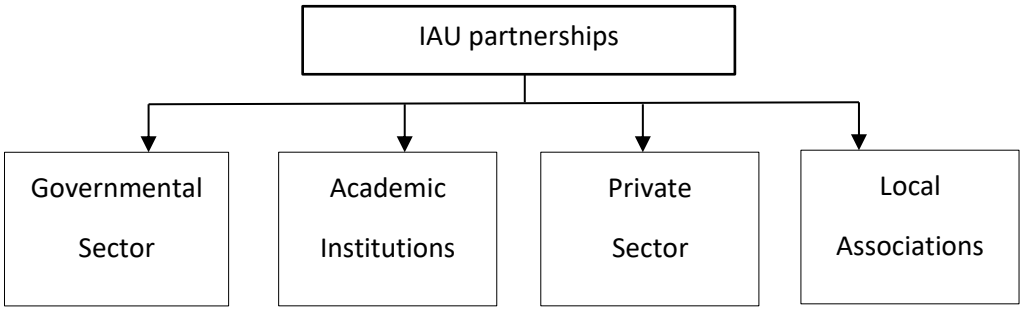

Figure-2: Types of IAU partnerships

The graph in figure-3 illustrates the progress of the total number of the signed agreements with regional and international collaborations during the past 10 years.

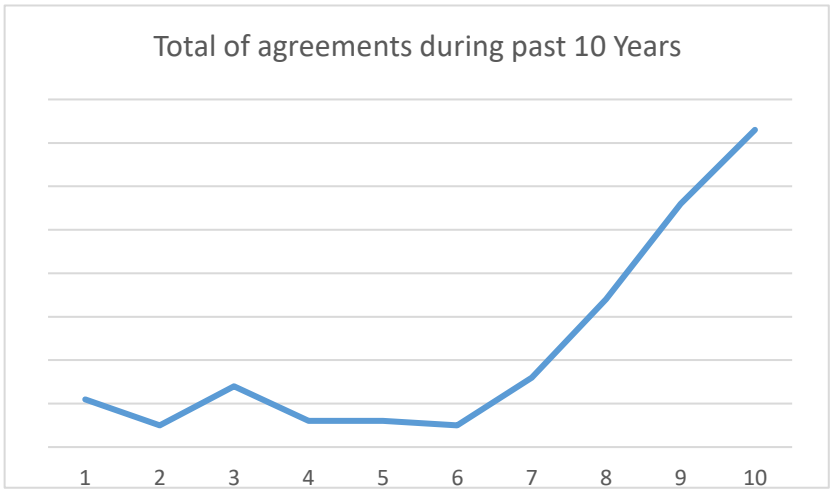

Figure-3: the progress of the total number of agreements during last 10 years

The following graph in figure 4 summarizes the percentage of the total partnerships for each discipline

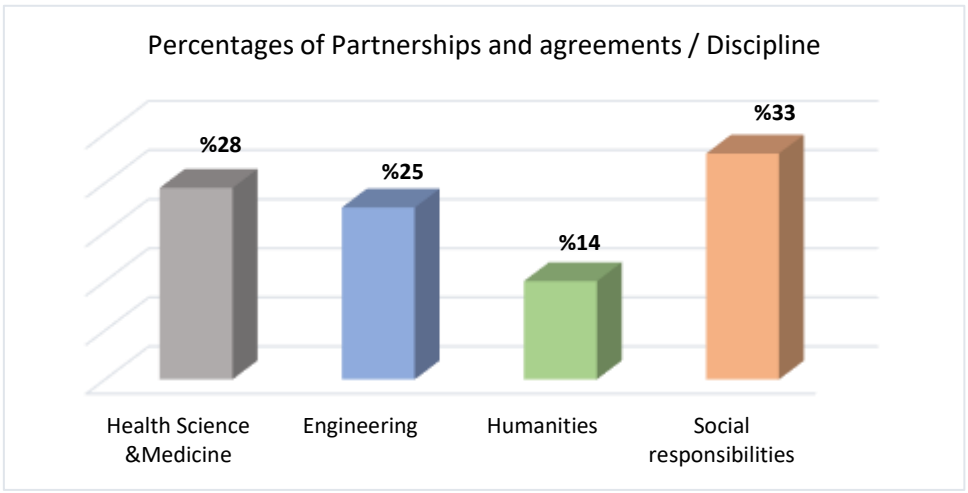

Figure-4: The percentages of the partnership and agreements per discipline

The analysis of the previous results demonstrated that the concluded agreements and partnership are not related to the purpose of technology transfer or collaborations for investments purposes. Furthermore, the concluded partnership highlighted the needs for increasing collaborations with the governmental sector to support the linkage with the business/industrial sectors. This type of cooperation should help produce high-value-added technologies.

3. Proposed Innovation model

The proposed innovation model of the current research is based on defining the present innovation readiness of Saudi universities and to detect the points of weakness, considering the concluded result of (Khayati & Selim, 2019)[12] study which indicated that innovation in Saudi universities does not match the potential of the country in comparison to the increased development of higher education in Saudi Arabia. The present study also depends on the concept of open innovation which tends to address the 'network' that defines the external engagements between the university and its partners which include the industry, the private sector, the governmental sector and other educational institutions. This means that the university shouldn't only depend on its own resources and knowledge but also depend on the external sorts of knowledge and facilities within other associated factors. Usually, such engagements should be supported by the establishment of stronger network ties. The model considered (Perkmann and Walsh, 2007) study which categorized the university-firm engagement according to the degree of required relational involvement and the range of institutional characteristics and factors that tend to either promote or limit the engagement of universities in open innovation practices which was emphasized by (Huggins,Prokop &Thompson ,2020).

It is noticeable that most of the literature tried to conclude a major model to be applied with the universities. Such literature didn't consider that the existent conditions may vary across regions according to the priorities and rules implemented by the managing authorities of the related operational programs. In addition, the internal factors inside universities are not identical. Accordingly, the study defined the most critical elements that constitute the innovation input index and the innovation output index that directly affect the Saudi universities taking in consideration the sensitivity of some of the external factors in the surrounded environment. These elements of evaluation were then defined in the suggested model. Figure 4 reflects the proposed innovation model.

[12]Khayati & Selim, (2019), the status of innovation in Saudi Arabia, Cognet education. https://www.researchgate.net/publication/335650548_The_Status_of_Innovation_in_Saudi_Universities

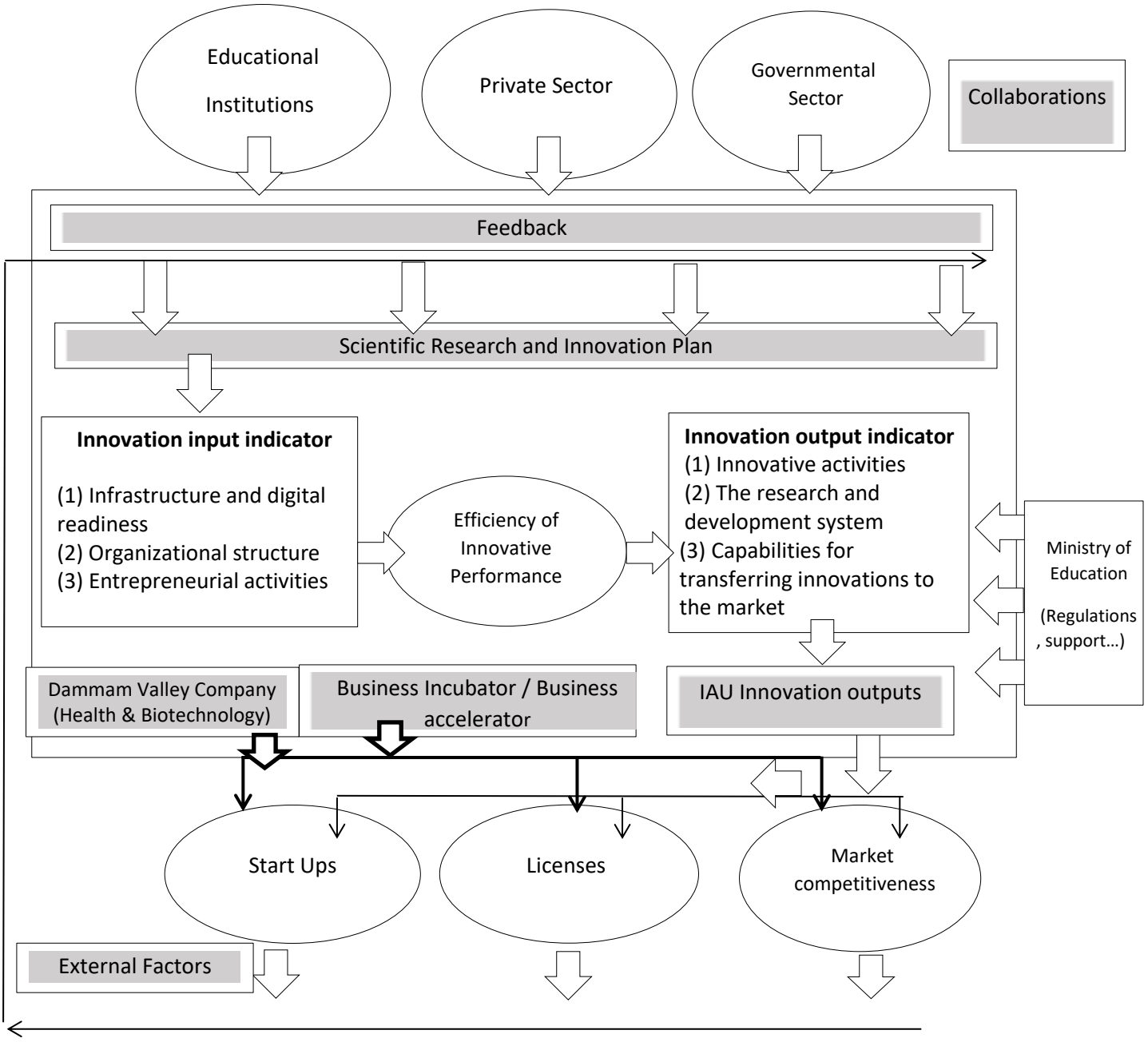

Figure5: The preliminary Innovation Model

The framework of the proposed model includes the following entities:
3.1 The input indicator which consists of the following three main elements:
3.1.1. The infrastructure and digital readiness – which refers to physical needed infrastructure for innovative activities besides overarching digital infrastructure to support online operations and the specific digital support for students and staff alike.

3.1.2. Organizational structure which should include needed human capital for innovation management and ensuring staff have the skills and confidence to make use of digital and innovation infrastructures. The study also investigates the innovative learning techniques in addition to the innovative leadership mechanism inside the colleges.

3.1.3. Entrepreneurial activities which concern not only entrepreneurial business activities but also university research, technology transfer office activities, new enterprise creation, and the entrepreneurial context, including the innovation network.

It is expected that the elements of the input indicator will influence the efficiency of the innovation performance which should affect the output innovation elements.

3.2. The innovation output indicator which consists of:
3.2.1. Innovative activities that include the whole activities which are related to innovation such as: innovative projects, innovation competitions, innovation exhibitions.

3.2.2.The research and development system; Since the previous literature proved that expenditure in scientific research and technological development in most countries provided a set of indicators that reflect the increased economic progress and the advanced technological structure at national level , the study assesses the appropriate use of R&D which provide solutions to the infrastructure systems according to IAU strategic priorities.

3.2.3.Capabilities for transferring innovations to the market: the innovation management in the university requires a special approach to the innovation management system which requires prompt response considering the market demands and external threats challenges. The study determined this element within the output indicator since it is expected that the availability of the elements of the input indicator will positively affect the capabilities for transferring innovations to the market. Furthermore, the Saudi universities and the national market have just begun manipulating technology transfer from universities to the market in comparison to the other international universities. Consequently, the study evaluates the opportunities to create the appropriate conditions for small innovative businesses and technology commercialization such as development of strategies, methods, programs of innovative university development, etc.).
3.3. The study suggests that elements of both the innovation input and the innovation output indexes will be affected by the external factors of the surrounding environment. According to the proposed model, external factors are affected by the Saudi manufacturing capabilities to exploit the university's innovation outputs, types of licenses that are usually preferred by local investors and the market competitiveness. In addition, Saudi Ministry of education is a crucial factor that affects the performance of the suggested model. The influence of the Ministry of education is clearly observed through the defined regulations which are driven as one of the country instruments to facilitate the national transformation program which is based on emphasizing creativity and innovation.

3.4. Collaborations with the industrial sector, private sector and academic institutions are represents another type of external factor since the university should consider the needs and the interest of external parties and stakeholders to conclude suitable collaborations. These needs and interests should be considered by scientific research and innovation practices

3.5. Governmental Regulations and laws are one of the important external factors for example the new administrative regulations of higher education that direct toward mutual collaboration with the private and industrial sectors should drive the strategic goals of the universities towards increasing their engagements with such sectors which should be combined with a set of programs to nurture innovation and entrepreneurship among students, faculty, and the community.

3.6.Dammam Valley Company: IAU established Dammam Company to mainly work on commercializing its output especially in area of health and biotechnological studies.

3.7. The model emphasizes that market penetration can be defined through providing licenses, start ups or other types of collaborations with the industrial and private sectors depending on the power of the competitive advantage of the university's innovations.

3.8. Ensuring a continuous feedback which should be related to the concerns of the concluded partnerships, external factors and monitoring how the university acts in the market. These sorts of feedback should affect the periodical plans of scientific research and innovation.

4. Conclusion:

This study focuses on enhancing the efficiency of innovative performance in Saudi Arabian universities, recognizing their significance in influencing the country's overall innovation capabilities. The research identifies the optimal innovation model for Saudi universities, aligning with the requirements of the new universities system which is considered as a first phase of another future research for testing the efficiency of the proposed model through analyzing the defined entities and measuring its impact. This contribution to the literature is notable as it pioneers the identification of the best innovative model for Saudi universities by evaluating their current innovation readiness.

The study specifically applies its proposed model to Imam Abdulrahman bin Faisal University (IAU), one of the largest universities in Saudi Arabia. The model incorporates two sub-groups of indicators: innovation inputs and innovation outputs. Additionally, the study considers environmental factors that can impact the innovation process. The findings and recommendations of this study can serve as a valuable guide for decision-makers and stakeholders in the education sector, aiding in the improvement of innovation practices within Saudi Arabian universities.

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