

REVIEW

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An overview of university-industry collaboration in the Arab world

Zeina Hojeij^{1*}

*Correspondence:
Zeina.hojeij@zu.ac.ae

¹ College of Interdisciplinary
Studies, Zayed University, Dubai,
UAE

Abstract

University–Industry Collaborations (UIC) are increasingly recognized as crucial drivers of economic growth and development. While numerous studies have been conducted on this topic, this paper specifically focuses on UIC in the Arab World. The aim of this study is to explore the establishment of successful UIC by conducting a review of existing literature to identify and synthesize key factors that enable collaborative innovation between industry and universities. The findings are summarized into six main themes: the importance of UIC, barriers to UIC, gaps between universities and industry in the Arab World, partnerships and sustainable growth, current trends and perspectives, and future agenda for Arab countries. These themes are elaborated on and used to summarize results from the reviewed studies regarding facilitators of collaborative innovation. The contribution of this work lies in enhancing the existing body of literature and knowledge regarding collaboration between higher education and industry in the Arab World. This research presents specific measures that can be implemented to ensure successful UIC in the future. Its outcomes are significant for policymakers, academics, and industry experts in the Arab region, who aspire to form productive UIC partnerships that encourage economic development and innovation.

Keywords: University-Industry Collaboration, Higher education, Industry partnerships, Arab world, Sustainable growth

Introduction

University-Industry Collaboration (UIC) refers to the partnership between universities and companies to conduct research, develop new technologies, and transfer knowledge and expertise. The goal of these collaborations is often to drive innovation and economic development, while also providing students and faculty with real-world experience and companies with access to cutting-edge research. UIC can take many forms, including research collaborations, internship programs, technology transfer, consulting and training, and entrepreneurship support as well as others. For research, universities and companies can work together on research projects that address specific industry needs or challenges. This can include basic research, applied research, or the development of new products or technologies. Internship programs can help universities provide students with opportunities to gain hands-on experience in industry. Such programs can help students develop the skills and

knowledge they need to succeed in the workforce after graduation. When it comes to technology transfer, universities can license their technologies and intellectual property to companies, allowing them to commercialize these innovations and bring them to market. Additionally, universities can provide industry with consulting and training services in areas such as management, engineering, and technology. Lastly, universities can offer resources and support to help students and faculty turn their research and ideas into startups and new businesses (Benbouzid & Dahmani, 2020).

The goals of university-industry collaboration are to drive innovation, promote economic development, and provide students and faculty with real-world experience. It also helps companies to have access to cutting-edge research, knowledge and expertise to improve their business.

This paper discusses the significance of UIC in advancing economic growth and development in the Arab World. It analyses available literature to determine the essential components that enable collaborative innovation between universities and industries. These elements are further categorized into six primary themes:

the importance of UIC, barriers to UIC, gaps between universities and industry in the Arab World, partnerships and sustainable growth, current trends and perspectives, and future agenda for Arab countries. The existing literature on UIC, especially in the Arab region, is insufficient and does not offer an extensive exploration and comparison of the multifaceted dynamics of the nature of the collaboration between universities and industries, the existing initiatives and drivers to enhance this collaboration, as well as its impact on promoting economic growth and learning outcomes. The significance of this narrative overview lies in its contribution to the existing literature on UIC in the Arab World and the offering of practical suggestions for establishing successful collaborations. The findings have vital implications for policymakers, academics, and industry specialists in the region interested in promoting productive UIC partnerships that stimulate economic progress and innovation.

Methodology

This overview follows the narrative review approach. It does not pose specific research questions but rather it aims to explore the establishment of successful UIC by conducting a review of existing literature to identify and synthesize the key factors that enable collaborative innovation between industry and universities. A literature search of the following databases was conducted: Education Resources Information Center (Eric), International Education Research Database, JSTOR and Google Scholar. The selection criteria included articles that were all peer reviewed and published between 2014 and 2022. More than 100 articles were scanned after which 37 articles were thoroughly reviewed and analyzed then categorized into six main themes: (1) the importance of UIC, (2) barriers to UIC, (3) gaps between universities and industry in the Arab World, (4) partnerships and sustainable growth, (5) current trends and perspectives, and (5) future agenda for Arab countries. Each of these themes will be further discussed and synthesized in the following sections.

Importance of university-industry collaboration

University-Industry Collaboration is the reciprocal action between universities and businesses that pools resources in an effort to achieve shared aims and objectives that they could not effectively achieve separately (De Wit-de Vries et al., 2019; Singh, 2019). UIC provides numerous advantages to both parties (Alexander et al., 2019; Di Maria et al., 2019). Regarding companies, UIC was seen as an excellent way to promote economic growth by businesses (O'Dwyer et al., 2022). Also, dealing with universities can increase company's capacity to complex problems and improve their market competitiveness through the modification of their goods and services or the development of new goods. Furthermore, through effective collaboration, companies can gain access to a wide range of research expertise, allowing them to have a broader and more in-depth understanding of the fundamental discipline, their area of competence, and the profile of raining provided to their future employees (Barbosa et al. (2022); Lee & Mirza, 2021;. Likewise, creating cooperation with colleges would provide expanded on-the-job learning possibilities (Chryssou, 2020).

On the contrary, universities all across the world are up against new problems, including how to fulfil society's changing demands, define new growth plans, engage with socioeconomic players, and assist the economy to grow by preparing skilled workers who can thrive in the face of quickly advancing technology (Awasthy et al., 2020). From this viewpoint, the university is dependent on the UIC to operate (Imamoğlu et al., 2019). Indeed, because the business organization is seen as a supplier of empirical data, UIC enables universities to modify research programs to meet industry demands and to increase the robustness of studies by using the empirical data. Various studies have indicated that when a university maintains relationships with business, they have access to databases, can verify their findings experimentally, and can get a second perspective on their work (Ahmed et al., 2022; Bertolotti & Johnes, 2021). Additionally, the institution will have the chance to determine whether the industry's current worries are based on the reflections of its researchers (Takieddine, 2019).

In conclusion, university-industry collaboration (UIC) has become increasingly important as businesses and universities recognize the advantages of pooling their resources to achieve common goals that they could not accomplish separately. For businesses, UIC provides an opportunity to promote economic growth and gain access to research expertise, which allows them to have a better understanding of the fundamental discipline and improve their market competitiveness. On the other hand, universities are reliant on UIC to operate effectively and stay relevant, allowing them to adapt research programs to meet industry demands and improve the robustness of their studies by utilizing empirical data. Through effective collaboration, both parties can benefit from the exchange of knowledge, skills, and resources, leading to mutual success and societal impact. As such, it is crucial to foster and strengthen UIC to address the new challenges faced by universities and businesses, promote economic growth, and advance knowledge and innovation.

Barriers to university-industry collaboration

Despite the positive outcomes of interaction between academia, business, and government in both developed and developing nations, research demonstrates that such

connections face a number of barriers and limitations (Al Fazari, 2020; Kleiner-Schaefer & Schaefer, 2022). The most significant obstacle is the mismatch between the cultures, norms, and values of the participants in the innovation process (Benbouzid & Dahmani, 2020; Chryssou, 2020; Nsanzumuhire & Groot, 2020). Furthermore, there are two factors that influence trust in University-Industry partnerships. First, industrial partners are concerned that, due to institutional differences, the academic partner is not working for the same goals as them, and that academics are using the industrial partner as a cash cow. Second, there is concern that academic partners would mistakenly communicate sensitive knowledge with other enterprises owing to a lack of expertise dealing with sensitive knowledge (De Wit-de Vries et al., 2019; Pertuz et al., 2021).

Likewise, the management of Intellectual Property (IP) has been noted as a barrier to collaboration, with academic researchers interested in the quick distribution of new information through a publication while the industry is typically more focused on its preservation and monetization (Chryssou, 2020). Besides, there are issues with determining the "proper" way for universities and businesses to collaborate when there are competing agendas and policies in place, or, in certain cases, when there are no governance mechanisms at all. Since universities operate in an area of conflicting stakeholder interests, it might make it more difficult to allocate scarce resources because it is not always apparent whose stakeholders' objectives are being represented and whose interests are being realized (O'Dwyer et al., 2022). In addition, it is noteworthy to mention that while organizational procedures are intended to meet the requirements and expectations of many stakeholders, there is an organizational "cost" when asymmetry, opaque decision-making, and misdirected control exist inside organizational systems (Alexander et al., 2019). Over and above that, many research studies have claimed that financial constraints have been revealed to be closely connected to knowledge-intensive business services' readiness to cooperate with universities and research organizations (Kirby & El Hadidi, 2019; Kleiner-Schaefer & Schaefer, 2022; Silva et al., 2019). For instance, one effect of having financial limitations is the need of universities to finance and guarantee the access of laboratories has mainly encouraged them to seek collaboration with industries (Benbouzid & Dahmani, 2020; Singh, 2019). Additionally, when the percentage of Gross Domestic Product (GDP) invested in Research and Development (R&D) is low and there are human capital constraints such as the case in Oman, investment in applied research areas that the government, national and regional markets have identified as priorities becomes essential, with the business sector involved in a co-funding capacity (Chryssou, 2020). Such cooperation will lead higher education institutions (HEI) to transition from being centers of learning and research to economic growth generators and will also encourage cooperation between business and HEIs (Chryssou, 2020). In fact, most European countries treat UIC as a dynamic factor of stimulating the performance of businesses. However, countries such as Cyprus, Serbia, Montenegro, North Macedonia, Romania, Bosnia and Herzegovina, and Albania who do not invest much in R&D sectors show weak indicators in terms of UIC and thus, rank low as opposed to the remaining European countries (Ćudić et al., 2022). Additional financial obstacles are the costs for the companies to look for partners that can be ready to collaborate and that already possess a suitable level of expertise as well as the costs connected to the collaboration itself (D'Este et al., 2014; Garcia et al., 2019).

In conclusion, while the interaction between academia, business, and government has demonstrated positive outcomes in both developed and developing nations, there are significant barriers and limitations that must be overcome to achieve successful collaboration. Cultural differences, trust issues, intellectual property management, competing agendas and policies, financial constraints, and human capital constraints are among the most prominent barriers identified in the literature. However, collaboration between universities and industries remains crucial in generating economic growth, particularly in countries with limited investment in research and development sectors. Addressing these barriers will require policymakers, business leaders, and academics to work collaboratively to find innovative solutions that foster trust and facilitate effective knowledge-sharing and co-creation between academia, business, and government. The barriers to university-industry collaboration are not insurmountable, and strategies can be developed to overcome them. It is important that both sides communicate, establish clear objectives, and build trust, in order to build sustainable and successful collaborations.

Gaps between university and industry in the Arab world

According to Ryan and Daly (2019) the Middle East makes fewer contributions to the creation of new knowledge compared to other regions of the world. Because the Middle East region is characterized by extremely diverse cultures, heavy turmoil, political diversity, differences in the language, economies, and religions, knowledge production in the form of publications and patents has been under expectation (Gul et al., 2015). Additionally, poverty is another reason that hinders the development of proper infrastructure and research centers, such as in Yemen, as well as political conflicts under many forms that could be full scale armed attacks, or civil wars, or even political overthrows in many parts in the region that can hamper the progress in terms of research (Gul et al., 2015). Proportionally, the latest advances from nations like the UAE and Qatar have demonstrated considerable advancements in knowledge creation and these improvements mostly stem from investments in research in the science and engineering disciplines that is of strategic national significance (Parcerro & Ryan, 2017). Similarly, Kahwaji (2019) stated that in many Arab nations where university leads run research for promotion, prestige, and/or competition and not for the know-how transfer; uncertain feelings and ambiguity rise among the researchers whose impressions and experiences play a major role in the generation of knowledge.

Moreover, agreements of collaboration between industries and universities remain as “ink on paper” also resulting with uncertainty and negativity especially when these results do not answer the industries’ problems highlighting the difference between applied research and theoretical research (Kahwaji, 2019). Therefore, the gap and the lack of homogeneity among the universities’ leaders, the researchers, and the industries renders no practical progress. Hence, due to the rising dominance of the knowledge-based political economy and the supremacy of capitalism over education, the power of scientific autonomy is weakening in this field while heteronomy’s strength is overpowering it (Parcerro & Ryan, 2017; Ryan & Daly, 2019).

These features create a significant gap, particularly in the transfer of knowledge. When it comes to higher education and scientific research, the Arab world encounters a number of challenges, such as a lack of a clear focus on research priorities and strategies, a

lack of time and funding to complete the research goals, a lack of awareness of the significance and impact of high-quality scientific research, insufficient networking opportunities and database, a lack of international cooperative relationships, and power shortages. Academic rules controlling recruitment and advancement in Arab colleges do not correspond to declared goals or national or regional aspirations (Takieddine, 2019).

In contrast, a knowledge driven economy will increasingly rely on proficient, creative human resources as more and more countries everyday are integrating science, technology, and innovation into their national development initiatives in the aim of lowering their reliance on raw resources and building their knowledge-based economies further (UNESCO, 2015, p. 5). Such reform will need more involvement in the courses content and ways of teaching from corporate leaders and professionals who need to be appointed on the planning committees, the course accreditation committees, and advisory boards (Takieddine, 2019). Therefore, to reach the national goals, universities should hire those with industrial expertise, multidisciplinary skills, the ability to bridge gaps, and partnership management skills. They should also encourage the interaction between their faculty with industry researchers and executives who should be allowed to experience teaching, while inviting the professors to work in the industry. This will help create interdisciplinary academic programs and foster business involvement (Takieddine, 2019).

When taking Qatar and Lebanon as an example, Ben Hassen's study (2020) stated that a wide range of factors influences the knowledge-based economies in these two countries. Qatar's biggest disadvantages include a lack of competent human resources, a fear of failure, and a poor innovation system, while Lebanon's knowledge-based economy growth is hindered by the country's political unpredictability and inadequate ICT infrastructure (Ben Hassen, 2020). Another example is Egypt which suffers from a severe lack of university-industry collaboration due to the absence of project coordination, the scarcity of technology transfer officers, the lack of support from the university leaders, the lack of business and professional awareness, the lack of support for inventions targeting national needs, and the absence of any formal technology transfer and commercialization training (Kirby & El Hadidi, 2019). Additionally, one prominent gap prevailing in university-industry collaboration in Arab countries is that the relationship between colleges and industry remains formal and only occurs in the form of agreements and memorandums of understanding that do not witness the light and do not benefit any side (Kahwaji, 2019).

To summarize, the Middle East region faces several challenges in knowledge production, including political conflicts, diverse cultures, and economies, poverty, and insufficient infrastructure. However, recent advancements in knowledge creation from countries such as the UAE and Qatar demonstrate that strategic investments in research can overcome some of these challenges. Collaboration between universities and industries remains formal in many Arab countries, and the lack of homogeneity among universities' leaders, researchers, and industries hinders practical progress. To address these gaps, universities should hire those with industrial expertise, encourage interaction between faculty and industry researchers and executives, and create interdisciplinary academic programs to foster business involvement. Additionally, the Arab world needs to focus on research priorities, establish clear strategies, increase funding

and networking opportunities, and raise awareness of the significance and impact of high-quality scientific research. These steps are crucial to achieving the national goals and building knowledge-based economies, which rely on proficient, creative human resources and integrate science, technology, and innovation.

To overcome these gaps, it is important for universities and industry in the Arab world to develop effective strategies for collaboration. This may include setting clear goals and objectives, building trust and networks, and providing resources and support for technology transfer and entrepreneurship. Additionally, governments and private sectors can play a role in providing funding, legal and regulatory frameworks and support, as well as education and training opportunities to bridge the gaps.

Partnership and sustainable growth

Sustainable Development (SD) is defined as development that satisfies current demands without jeopardizing future generations' capacity to satisfy their own. In the UN Agenda 2030 for Sustainable Development and its definition of Sustainable Development Goals (SDG), the international community expresses its belief that resolving global issues requires cooperation in which the intentional networking of individuals in politics, industry, science, and civil society is highly valued (Di Maria et al., 2019; Dieguez et al., 2020). Companies are designed to adapt and evolve; but, due to current exceptional issues such as Covid-19, businesses must seek solutions to boost their innovativeness and competitiveness and one alternative is to connect with institutions and their diverse variety of offerings (Terán-Bustamante et al., 2021). Taking into account the above-mentioned needs, 22 Arab countries agreed on a regional plan for science, technology, and innovation in March 2014 (STI). The plan intends to improve education and scientific research capacity, increase financial support for Research and Development (R&D), and foster regional and global scientific and educational cooperation. It also improves science education and universities (Terán-Bustamante et al., 2021). Additionally, it emphasizes, around 14 priority areas, comprising biotechnology, nanotechnology, information technology, water, food, agriculture, fishing, space, energy, desert sciences, the environment, renewable energy, poverty, and disease, and is backed up by a new online platform for Arab science and technology (Takieddine, 2019). Thus, there will be a need for collaboration with international science, technology, and higher education institutions, and for initiating cooperation in innovation and research with Arab scientists living abroad (Terán-Bustamante et al., 2021).

Concerning Lebanon, the Lebanese economy is confronted with serious issues in terms of employment and long-term growth. Linking academics and business might help Lebanon address its underperforming economy by using educated human resources to develop research that addresses local socioeconomic needs. Several governmental initiatives have been developed to improve collaboration between academics and practice in Lebanon. Some of these measures were fully executed, while others were only partially implemented (Ben Hassen, 2020). The most recent strategy is the Roadmap for small and medium-sized enterprises (SME) which is a strategy adopted by The Ministry of Economy and Trade in 2020. This strategy includes various measures to help SMEs grow. To improve innovative capacities, the ministry underlined the need of strengthening relationships with academics, training, and R&D institutes, as well as refocusing

expenditures in R&D to further expand the capabilities of SMEs in key industries and generate a competitive advantage for Lebanon (MoET, 2014). Although various measures have been applied to foster collaboration between academia and industry, the mission is hard to achieve especially that this sector in Lebanon is mainly composed of SMEs, which are unorganized and most of them don't possess the culture of research development (Takieddine, 2019). Effective application of any measure will only occur when serious and continuous follow up is done. Finally, though the Ministry of Education aided by the European Union, ensures doing a big effort to guarantee proper networking among universities, it remains a weak network (Takieddine, 2019).

Additionally, Lee and Mirza (2021) stated that with a focus on entrepreneurship, technology, human capital, and lifelong learning, and increasing private sector partnerships, GCC nations have established frameworks for innovation in their national development strategies and policies, with the higher education sector playing a crucial role in the region's innovation ecosystem (Lee & Mirza, 2021). Some examples of the national innovation policies that are taken by GCC countries are given below:

Bahrain

The University of Bahrain has implemented a skills-based curriculum for its foundation year, reflecting Bahrain's emphasis on the need to acquire the "proper skills" to foster productivity and creativity. The institution has also joined together with Microsoft and UNDP to develop a coding academy just for women. Recently, the institution launched a cloud innovation center in collaboration with Tamkeen and Amazon Web Services (United Nations Bahrain, 2019).

UAE

The Khalifa University of Science and Technology (KUSTAR) developed the Khalifa Innovation Centre, and the United Arab Emirates University established the UAEU Science and Innovation Park. The Dubai Free University Zones Strategy (2019) converts Dubai's public and private universities into free zones where students may engage in economic and creative activities. The UAE has also launched a number of well-funded accelerator programs, such as Ghadan 21, Dubai Future Accelerators, and StartAD (Michael, 2021).

Saudi Arabia

To advance innovation and economic development, King Abdulaziz City for Science and Technology (KACST), a scientific government organization that fosters and supports scientific applied research, and the Saudi Arabia Advanced Research Alliance (SAARI), collaborate with King Abdullah University of Science and Technology (KAUST) (Ahmad et al., 2021; Chan et al., 2022; Lee & Mirza, 2021).

Qatar

In cooperation with Qatar University, HBKU, and Qatar Foundation, the Qatar Biomedical Research Institute (QBRI), Qatar Environment and Energy Research Institute (QEERI), Qatar Computing Research Institute (QCRI), and Qatar Science and

Technology Park (QSTP) will play a significant role in advancing entrepreneurship and innovation (Ben Hassen, 2020; Lee & Mirza, 2021).

As a result, it was discovered that in Arab nations, university initiatives to support entrepreneurship and innovation go beyond policy rhetoric and include the recognition and expression of these values by university staff members. However, universities' efforts to support and contribute to innovation in Arab nations, particularly in the GCC countries, are constrained by issues with leadership, the skills gap, curricular constraints, and the external regulatory environment (Lee & Mirza, 2021).

To sum up, sustainable development requires cooperation and networking among individuals in various fields, including politics, industry, science, and civil society, to address global issues. The Arab countries have taken steps to improve their education and scientific research capacity through the regional plan for science, technology, and innovation, emphasizing priority areas such as biotechnology, nanotechnology, and renewable energy. However, effective collaboration with international science, technology, and higher education institutions, as well as initiating cooperation in innovation and research with Arab scientists living abroad, is necessary. In Lebanon, governmental initiatives to improve collaboration between academia and industry have been developed, such as the Roadmap for small and medium-sized enterprises, but follow-up is crucial for effective implementation. The higher education sector plays a crucial role in the innovation ecosystem of the GCC countries, and several national innovation policies have been implemented, including the establishment of innovation centers, free zones for students to engage in economic and creative activities, and well-funded accelerator programs. However, the efforts to support and contribute to innovation in Arab nations, particularly in the GCC countries, are constrained by issues with follow-up and implementation, unorganized SMEs, and weak university networks. To achieve sustainable development, it is necessary to continue to strengthen collaborations and networking among individuals and institutions within and outside the Arab countries.

Current trends and perspectives

The Arab world is witnessing a significant shift towards the promotion of innovation, entrepreneurship, and research-based economic development. Universities are increasingly being recognized as important drivers of innovation, and there is growing interest in strengthening their relationships with industry. UIC has the potential to foster innovation and stimulate economic growth by facilitating the transfer of knowledge and technology between academia and industry Barbosa et al. (2022). The region has been undergoing numerous reforms aimed at transitioning to knowledge-based economies, reducing reliance on oil, lowering unemployment rates, and connecting education and the labor market. Reforms and investments are being made in several Arab countries, including Saudi Arabia, Morocco, Algeria, Oman, Lebanon, Bahrain, and the United Arab Emirates (UAE).

Saudi Arabia has made significant strides in transitioning to a knowledge-based economy, with the founding of King Abdullah University of Science and Technology (KAUST) and the current reform goal of Vision 2030. The changes seek to lessen reliance on oil, lower unemployment rates and connect education and the labor market (Waterbury, 2019).

Similarly, Morocco has donated USD 63 million to assist R&D, innovation, and joint ventures between universities and businesses, while Algeria has made an attempt to enhance the living and working circumstances for its scientists (Ahmad et al., 2021). These changes and investments aim to revive the region's reputation as a hub of learning and scholarship.

The current state of Oman's innovation system is based on a "statist" model, which serves as the foundation for the country's approach to innovation. This model prioritizes state-led efforts to drive innovation and economic development. However, recent developments suggest that Oman is making efforts to shift towards a more "integrated" model, which considers the importance of collaboration between the public and private sectors, as well as the role of individual actors in driving innovation (Chryssou, 2020). According to Al Fazari (2020), these efforts are focused on developing a more inclusive innovation system that involves a wider range of stakeholders, including academic institutions, businesses, and entrepreneurs. This shift towards an integrated model is seen as a response to the challenges facing Oman's innovation system, which has struggled to keep pace with global trends and to foster a culture of innovation and entrepreneurship. The move towards an integrated model is expected to bring a number of benefits to Oman's innovation system. For one, it is likely to lead to greater collaboration between different actors, which could result in more effective and efficient innovation processes. Additionally, an integrated model is likely to be more responsive to the needs of businesses and entrepreneurs, which could help to foster a more vibrant and dynamic innovation ecosystem in Oman (Al Fazari, 2020).

In Lebanon, several initiatives have been taken to promote UIC as this has become a topic of increasing interest in the field of higher education given the potential benefits, they can bring to both parties. Few collaborations have been established between colleges and the market to strengthen relationships at the institutional level. For instance, the BAU and the Lebanese University signed an agreement to ease postgraduate student transfers, faculty exchanges, and the staging of conferences, workshops, seminars, and training sessions to capitalize on the knowledge at both universities (Takieddine, 2019). However, UIC in Lebanon is still in its early stages, with limited engagement between universities and industry. One of the main challenges is the lack of a clear policy framework and institutional support for such collaborations. This has led to a limited understanding of the benefits that can be achieved through university-industry partnerships, and a lack of incentive for academics to engage in such activities. To fully realize the potential of university-industry collaborations in Lebanon, there is a need for greater awareness and understanding of the benefits and opportunities, as well as a supportive policy and institutional environment.

In Bahrain, the University of Bahrain (UOB) has recently forged an exciting collaboration with Benta Pharma Industries (BPI) in the field of therapeutic biotechnology. The partnership agreement is geared towards providing UOB students in the Faculty of Health Sciences with an opportunity to acquire practical and scientific training in the latest therapeutic biotechnology techniques. The collaboration is expected to foster cross-disciplinary research and cooperation between UOB and BPI, which will not only benefit the students but also contribute to the advancement of therapeutic biotechnology in Bahrain. Through this partnership, UOB students will gain access to cutting-edge

technology and equipment, as well as valuable hands-on experience in a real-world setting (Takieddine, 2019). This collaboration is particularly significant given Bahrain's Vision 2030, which highlights the need to restructure the economy, acquire the necessary skills, and increase productivity and innovation. Tamkeen, a government organization, is dedicated to achieving these objectives by providing Bahraini businesses and individuals with the information, skills, and drive needed to succeed. By collaborating with BPI, UOB is helping to build a skilled workforce in Bahrain that can contribute to the country's economic growth and development. This collaboration is also aligned with UOB's mission to provide its students with a world-class education that prepares them for successful careers in their chosen fields (Takieddine, 2019). Overall, the UOB and BPI collaboration represents a significant step forward in Bahrain's efforts to develop a strong and vibrant economy that is driven by innovation and knowledge. With the support of organizations like Tamkeen, the country is well-positioned to achieve its ambitious goals and become a regional leader in the field of therapeutic biotechnology.

Finally, in 2015, the United Arab Emirates (UAE) government launched its Science, Technology, and Innovation (STI) policy. This policy aims to prepare the country for a future beyond its reliance on oil, by fostering a culture of innovation and technological advancements. To support this vision, the government announced an ambitious funding injection of \$82 billion for technological innovation. The goal of this investment is to transform the UAE into a leading global innovation hub, supported by its national universities. This will be achieved through the development of cutting-edge technologies and the creation of a conducive environment for entrepreneurship and innovation. The UAE's STI policy also aims to encourage collaboration and knowledge-sharing between public and private sector entities, to facilitate the exchange of ideas and expertise (Lee & Mirza, 2021). Since the launch of the STI policy, the UAE has made significant strides in its quest for technological innovation. The country has become a global leader in areas such as artificial intelligence, blockchain, and renewable energy. Additionally, it has established itself as a hub for innovation and entrepreneurship, attracting some of the world's top talent and investors.

Therefore, UIC has become increasingly important in the UAE as it provides a means for both universities and industries to leverage each other's expertise and resources. In recent years, there have been several trends and perspectives that have emerged in the realm of university-industry collaboration in the UAE. One significant trend in the UAE is the growing emphasis on research and development (R&D) partnerships between universities and industries. The UAE government has recognized the importance of promoting innovation and entrepreneurship in the country and has encouraged universities to work with industries to achieve this goal. As a result, many universities in the UAE have established partnerships with leading technology companies such as Microsoft, IBM, and Oracle to promote R&D initiatives. For example, the Masdar Institute of Science and Technology has collaborated with Siemens to develop sustainable technologies for energy efficiency and water conservation (Lee & Mirza, 2021).

An additional trend in the UAE is the emergence of innovation and entrepreneurship centers at universities. These centers offer resources and support to students, faculty, and local businesses in developing new products, services, and technologies (Michael, 2021). They also provide training programs, workshops, and mentoring to help entrepreneurs

launch successful businesses. For example, the Khalifa University Innovation Center provides access to funding, prototyping facilities, and networking opportunities for students and entrepreneurs. Furthermore, there has been a growing emphasis on industry-focused curricula in universities across the UAE. This is aimed at preparing students with the skills and knowledge required by industries in the country. Many universities are partnering with industries to offer internships, co-op programs, and job opportunities to students, allowing them to gain valuable work experience and build professional networks. For instance, the American University of Sharjah has collaborated with companies such as Aramex, Emirates NBD, and Dubai Electricity and Water Authority (DEWA) to provide internships and job opportunities for students (Lee & Mirza, 2021). Another perspective that has emerged in university-industry collaboration in the UAE is the need to address societal challenges through research and innovation. Many universities are working with industries to find solutions to pressing societal issues, such as sustainable energy, transportation, and healthcare. For example, the UAE University has established partnerships with healthcare providers to conduct research on disease prevention and treatment, as well as with the government to develop sustainable transportation systems (Lee & Mirza, 2021; Michael, 2021).

To sum up, the UAE has been actively promoting university-industry collaboration, with a focus on R&D partnerships, innovation and entrepreneurship centers, industry-focused curricula, and addressing societal challenges. These trends and perspectives are likely to continue shaping university-industry collaboration in the UAE, as universities and industries work together to promote innovation, entrepreneurship, and sustainable economic growth in the country.

In conclusion, the Arab region has been undergoing significant reforms and investments aimed at transitioning to knowledge-based economies, reducing reliance on oil, lowering unemployment rates, and connecting education and the labor market. The founding of KAUST and the Vision 2030 in Saudi Arabia, donations and attempts to enhance working conditions for scientists in Morocco and Algeria, and collaborations between colleges and the market in Lebanon and Bahrain, are some examples of these changes. Similarly, the transition towards the "integrated" TH model in Oman and the funding injection for technological innovations in the UAE are expected to transform these countries into universal innovation hubs. These reforms and investments are crucial to reviving the region's reputation as hubs of learning and scholarship, and to positioning it to compete in the global economy.

Future agenda for Arab countries

The lack of proper funding to carry on initiatives comprising industry is the main reason behind the poor collaboration between universities and industry (Kahwaji, 2019; Takeddine, 2019). However, many Arab states have launched reforms and have allocated funds to support research especially scientific ones such as in Saudi Arabia with their recent 2030 agenda (Waterbury, 2019). Although research in the Arab world is increasing and science is emphasized, there is no clear prediction on how this will evolve in the future especially that there is a debate that the region still lacks the infrastructure for a knowledge society (Ahmad et al., 2021). The Arab region still ranks low in the linkage between academics and industry even though Qatar and the

UAE were capable of marking a breakthrough in that domain; consequently, there is a pressing urge for policymakers to formulate the proper supporting policies to better university-industry collaboration (Ahmad et al., 2021). Additionally, it is advisable for companies to encourage graduates by hiring them and to support academic researchers in their work (Kahwaji, 2019). Governments play a crucial role in either neglecting or fostering a knowledge-based economy such as the case is in Qatar where they encouraged a diversified economy and worked towards building a knowledge-based industry (Ben Hassen, 2020). Finally, a knowledge-based economy requires a good Information and Communications Technology (ICT) infrastructure, effective institutions, and potential human resources which must all be a major part in a good national strategy (Ben Hassen, 2020).

The Arab region faces significant challenges in establishing a knowledge-based economy, which requires effective collaboration between universities and industry. Insufficient funding for initiatives in industry is a major reason for the limited partnership between the two sectors, as reported by Kahwaji (2019) and Takieddine (2019). Nonetheless, several Arab countries have recently implemented reforms and allocated funds to support research, especially in scientific fields, such as Saudi Arabia's 2030 agenda (Waterbury, 2019). Despite these efforts to increase research and prioritize science, the future of research in the Arab world is uncertain, as some experts argue that the region still lacks the infrastructure for a knowledge society (Ahmad et al., 2021).

While Qatar and the UAE have made progress in bridging the gap between academia and industry, the Arab region still ranks low in this regard. Therefore, policymakers must develop effective policies to encourage and support university-industry collaboration (Ahmad et al., 2021). Companies should also play a vital role in supporting graduates by hiring them and supporting academic research (Kahwaji, 2019). Government intervention is crucial in either promoting or neglecting a knowledge-based economy, as evidenced by Qatar's efforts to develop a diversified and knowledge-based industry (Ben Hassen, 2020). To establish a successful knowledge-based economy, a sound national strategy is required, which must include an effective ICT infrastructure, robust institutions, and a skilled workforce (Ben Hassen, 2020). Therefore, policymakers, universities, and industry leaders must work collaboratively to implement reforms and develop a comprehensive national strategy to establish a knowledge-based economy in the Arab world.

In conclusion, the Arab region faces several challenges in establishing a knowledge-based economy that necessitates effective collaboration between universities and industry. Despite the recent efforts of several Arab countries to allocate funds and implement reforms to support research, the region still lags in terms of infrastructure for a knowledge society, according to experts. To address this gap, policymakers must develop effective policies to encourage and support university-industry collaboration, and companies must hire graduates and support academic research. Government intervention is also vital in promoting a knowledge-based economy, as Qatar has demonstrated through its diversified and knowledge-based industry. To establish a successful knowledge-based economy, a sound national strategy is required, encompassing an effective ICT infrastructure, robust institutions, and a skilled workforce.

Therefore, collaborative efforts between policymakers, universities, and industry leaders are essential to implement reforms and develop a comprehensive national strategy for a knowledge-based economy in the Arab world.

Conclusion and implications

This paper presents an overview of recent literature, exploring the significance and impact of University Industry Collaboration, in the Arab region, as well as the barriers, gaps, and challenges faced by the region towards achieving this collaboration. It further investigates the existing trends, perspectives, and initiatives to enhance the reciprocal association between industries and universities for the purpose of research and development as well as promoting a knowledge based economy and sustainable growth.

This review concluded that UIC has become vital in an era where both businesses and universities recognize the advantages of combining resources and efforts to achieve common goals. Through effective collaboration, both parties can benefit from the exchange of knowledge, skills, and resources, leading to mutual success and societal impact. However, it has been found that cultural differences, trust issues, intellectual property management, competing agendas and policies, financial constraints, and human capital constraints are among the most prominent barriers identified in the literature, particularly in the Arab region. In the Middle East region, challenges arise due to political conflict, culture diversity, financial issues, and infrastructure. Addressing these barriers will require policymakers, business leaders, and academics to work collaboratively to find innovative solutions that foster trust and facilitate effective knowledge-sharing and co-creation between academia, business, and government. Additionally, to achieve sustainable development, it has been suggested to continue to strengthen collaborations and networking among individuals and institutions within and outside the Arab countries.

This paper highlights several implications to be addressed to enhance the positive impact of UIC in the Arab region. There is a need to focus on research and development and building a knowledge-based economy, which can be done by collaborating between higher education institutions and industry experts. Gaps and challenges can be addressed by establishing clear strategies with proper followup, increasing funds networks and raising awareness of the significance of research and UIC. It is also important for universities and industry in the Arab world to develop effective strategies for collaboration. This may include setting clear goals and objectives, building trust and networks, and providing resources and support for technology transfer and entrepreneurship. Additionally, governments and private sectors can play a role in providing funding, legal and regulatory frameworks and support, as well as education and training opportunities to bridge the gaps.

This review provides an extensive overview about the various aspects of UIC, in terms of significance, challenges, existing initiatives and trends, as well as future agenda, which can be used as a supportive basis for UIC projects in the Arab world. It can be also aid in developing a methodology to evaluate the societal impact and benefits of UIC projects. Additionally, it would be beneficial to investigate the variety of successful UIC models implemented worldwide and consider effective approaches into adopting such collaborations in the Arab countries. Finally, this paper provides significant evidence for

policymakers, academics, and industry experts in the Arab region, who aspire to form productive UIC partnerships that encourage economic development and innovation.

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