HARVARD Kennedy School
BELFER CENTER
for Science and International Affairs

SCIENCE, TECHNOLOGY, AND PUBLIC POLICY PROGRAM
ENVIRONMENT AND NATURAL RESOURCES PROGRAM
POLICY BRIEF
MARCH 2017

University-Industry Collaboration in Science and Technology in Kuwait and the United Arab Emirates:

Current State and Future Opportunities

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The study underlying this report was supported by a grant from The Kuwait Program at Harvard Kennedy School.

Key Findings:

University-Industry Joint Research

1. **Faculty who collaborate with firms have greater publications output than their colleagues who do not collaborate.**

2. **University authors in Kuwait and the UAE publish articles with co-authors in the private sector less frequently than do university authors in Norway and Singapore.**

    a. Policymakers should assess best practices in other countries and consider incentives, such as grants and R&D tax credits, for firms collaborating with local universities.

    b. University administrators could encourage science and engineering faculty who engage with industry partners.

    c. University administrators can engage business and industry technical leaders in the design of engineering and related curricula to align student preparation and training with industry needs.

Wider Range of University-Industry Linkages

3. **The links between university and industry vary by discipline and type of collaboration.**

    a. Policymakers should take a strategic and differentiated approach to encouraging university-industry linkages (UILs)—including collaborative research, co-publication, student employment, conferences, consulting, etc.[1]—in each industrial sector by designing sector-specific policies.

    b. University administrators can encourage collaboration types (ranging from giving time to faculty for consulting to providing sabbaticals to faculty for starting research-related enterprises) that fit with the scientific discipline and match the R&D needs of local firms.

4. **University support services for connecting with industry are inadequate.**

    a. Policymakers could offer guidelines to universities that delineate best practices for engaging in UILs, and they could increase funding for incubators and exchange venues (including science parks) to facilitate interaction.

    b. University administrators could consider specific mediating offices, such as university technology transfer offices (TTOs) or industrial liaison offices (ILOs), to increase opportunities to collaborate, improve communication, and reduce administrative delays.

Introduction:

Policymakers in the Gulf region recognize the importance of strengthening science and technology (S&T) to boost competitiveness and economic development. A number of efforts have been made in recent years to bolster higher education, establish technology parks, and invest in regional research and development (R&D). Collaboration between local universities and the private sector is instrumental to advancing S&T and the national innovation agenda, and countries in the Gulf have the opportunity to benefit from enhancing university-industry linkages (UILs).[2,3]

In order to target policies and identify strategies for increasing UILs, a better understanding about the state, nature, and output of existing linkages is necessary. To address this, our research team at the Harvard Kennedy School's Belfer Center for Science and International Affairs conducted ***detailed surveys of faculty and administrative staff at seven leading universities in Kuwait and the UAE.***[4] The data of the surveys was analyzed in conjunction with a ***bibliometric analysis of publications from those seven universities. Additionally, the bibliometric data was***

collected for three S&T universities in Singapore and three S&T universities in Norway for comparative analysis were chosen as a comparison group to characterize UILs because of their population size, the richness of fossil fuel resources in Norway, and the relatively recent development of Singapore in building a strong innovation ecosystem compared to other OECD countries to characterize UILs.[5,6]

Analysis of the surveys and bibliometrics elucidated new insights about the current state of and future opportunities for strengthening university-industry collaboration in science and engineering. This report presents key findings and concludes with several policy recommendations.

Study Results:

We summarize some of the key results that focus on the research productivity of collaborating faculty, frequency of co-publication with industry, industrial sectors of collaborating firms, and extent of university support for linking with industry. These results represent a snapshot of the issues that emerged in the surveys—some of which we investigated further with the bibliometric analysis. We note that the data needs to be treated with caution, as the response rate was low in some cases and self-selection bias among the respondents is a possibility.[7]

Faculty who collaborate with firms are more prolific researchers.

Analysis of the survey results reveals that faculty in S&T fields at universities in Kuwait and the UAE who collaborated with a private firm at least once since 2009 published more papers than those who did not collaborate (Figure 1). The average number of publications per person from 2006-2015 was 6.45 for the group that said "yes" to having collaborated and 1.5 for those who reported "no." The study did not determine the causality of this relationship. Nonetheless, the possible causes of this finding—that UILs improve scientific productivity, that more productive academics are more likely to collaborate with industry, and anything in between—point to the clear value of UILs (*i.e.,* more productive researchers would not collaborate with industry if they saw no value in this collaboration).

Faculty rarely collaborate with the same firm more than once.

Importantly, the faculty respondents who collaborated with firms typically only engaged with each firm once; repeated collaboration with the same firm on a new project was relatively infrequent. The lack of repeated collaboration was also evident in the bibliometric analysis: the majority of private sector co-authors with universities had only one joint publication.[8] The lack of

repeated collaboration indicates the presence of either obstacles in UIL operation or the misalignment of university output with firms' needs. This indication was further supported by the findings of our surveys, in which respondents reported a need for greater university support with respect to completing administrative requirements, networking with industry representatives, and elucidating regulatory requirements.

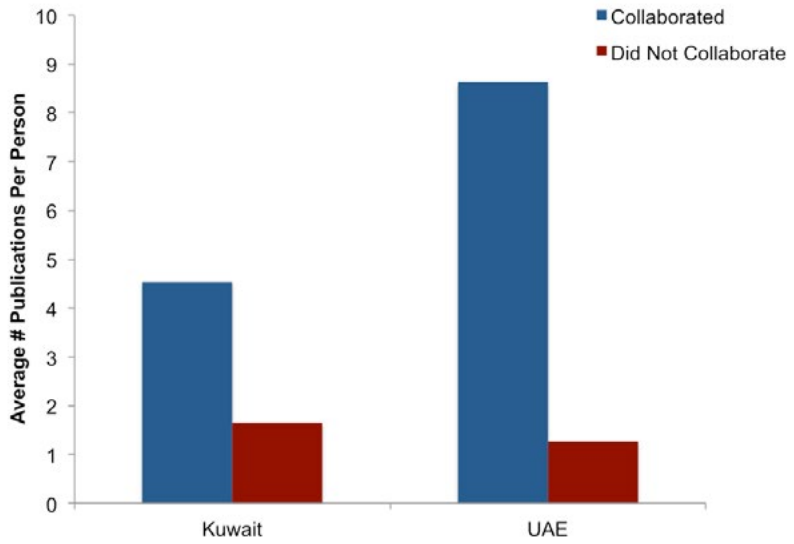


Figure 1. Average number of publications per person, 2006-2015.

Source: Authors' analysis of the publications output of the survey respondents who reported collaboration and no collaboration with industry since 2009.

University authors in the UAE and Kuwait co-published papers with the private sector less frequently than did university authors in Norway and Singapore.

The bibliometric analysis investigated the types of co-authoring organizations that published papers with university authors at the 7 universities in Kuwait and the UAE and at 6 universities in Norway and Singapore.[9,10] We found a smaller proportion of private sector co-authors for the universities in the UAE and Kuwait than for the universities in Norway and Singapore (Figure 2).[11] The data reveal that co-publication with the private sector is not entirely absent in the Gulf countries (a fact which is not frequently recognized), suggesting that there is room for strengthening this type of linkage.

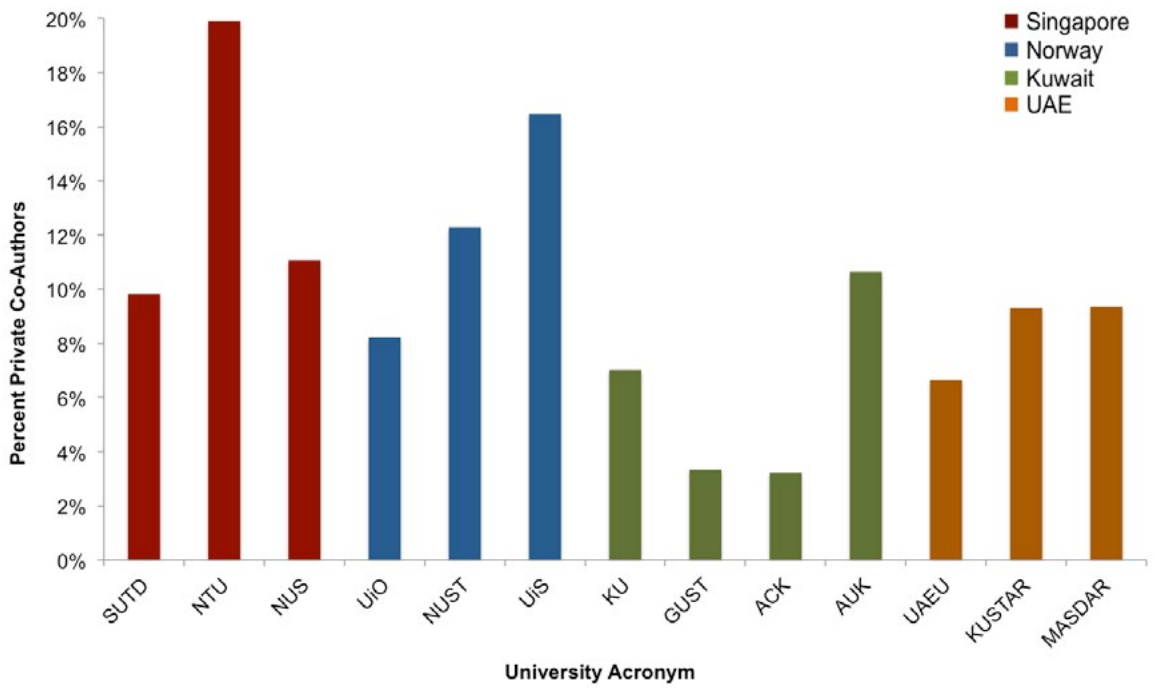


Figure 2. Percent of co-authors that were private companies, 2001-2015.[12]
Source: Authors' analysis of the bibliometric data. (University names and acronyms are provided in Appendices B and F).

Collaboration type is correlated with industrial sector.

The study grouped the different forms of university-industry collaborations into six types: research services, research partnerships, academic commercialization, informal interactions, human capital development and transfer, and other activity types (Appendix C provides examples of each collaboration type). We found that the type of collaboration is related to the scientific discipline, or industrial sector, of the private sector partner. For example, co-publication was the most common form of engagement with firms in the biotechnology, energy, and information and communications technology (ICT) sectors (Figure 3 and 4). The large number of co-publications in biotechnology aligns with the results of a recent study by Siddiqi et al. (2016), which finds an increasing emphasis on medical research in the region.[13] Among the firms that collaborated with the survey respondents, the majority operated in mature sectors in the region, such as energy, transportation, and mining. The results are robust across the two Gulf countries represented by the 7 universities that we investigated. This confirms prior research findings that industry-specific demands influence the type of UILs pursued.[14,15,16] The results are also consistent with Agrawal and Henderson's (2002) finding that the types of firms that collaborate with universities on patented research are different than the types of firms that collaborate on published research.[17] The fact that academic commercialization was the least frequent collaboration type engaged in by the

survey respondents—comprising only 11% of the collaborations, compared to 22% for research partnerships and 25% for informal interactions—also validates the aforementioned study's finding that patenting is not a significant mode of knowledge transfer from universities to firms.[18]

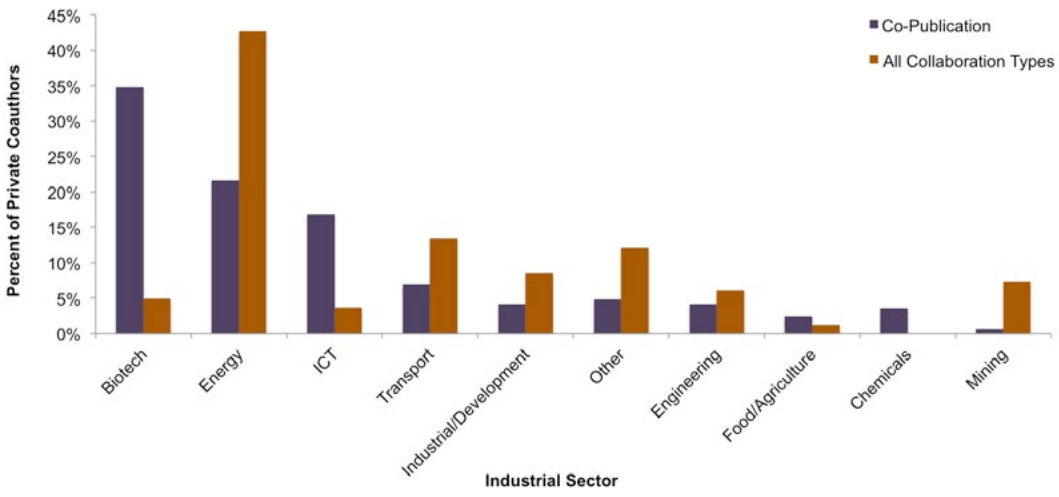


Figure 3. Industrial sector of co-authoring firms and of firms engaged in all collaboration types with universities in Kuwait and the UAE. Energy firms have the most linkages with universities in Kuwait and the UAE as compared to firms in other sectors.

Source: Authors' analysis of the survey results and bibliographic data.

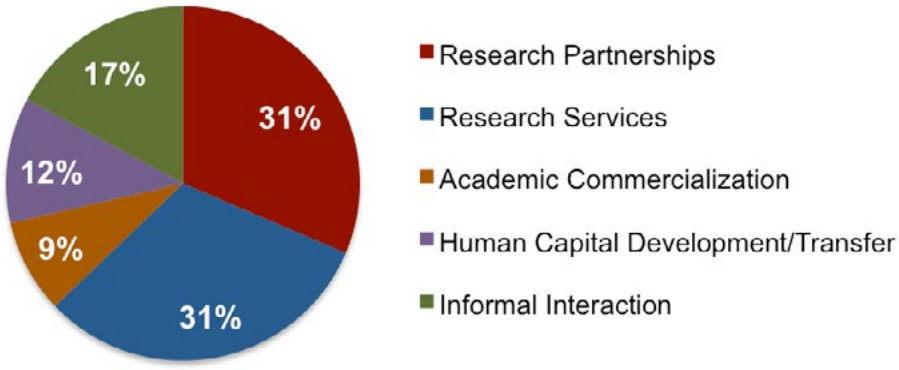


Figure 4. Breakdown of collaboration types of firms in the energy sector. The nature of connections ranges from joint research (research partnerships and services) to student sponsorship (human capital development) and information interactions. Commercialization of academic research constitutes a small fraction of the linkages.

Source: Authors' analysis of the survey results and bibliographic data.

University support services for linking with industry are inadequate.

In the administrator surveys (which included some questions that differed from the faculty and research staff surveys), 62% of the respondents reported that there was no Industry Liaison Office (ILO) or Technology Transfer Office (TTO) at their university. However, within some universities, there was discrepancy among the respondents' opinion about the presence of these offices. This discrepancy implies that these offices may not be engaging with the university beyond certain administrative levels or departments. In addition, the faculty and research staff surveys also revealed a need for greater university support for fostering linkages with industry. In fact, the respondents most frequently described 'university support services' when asked what types of administrative support they need for their work.

The survey also included an open-ended question about the main challenges to UILs. There were no pre-defined categories for that question in the survey to influence the responses. The results were analyzed and grouped into broader categories (Figure 5). Of the total 133 responses, 71% fell into one of the following groups: communication issues, lack of access to industry collaboration opportunities, lack of funding, administrative delays, distrust between partners, regulatory gaps, and lack of university support.[19] All of these categories are, in many capacities, related to the general responsibilities of ILOs and TTOs, which assist with advising faculty on engaging with industry, facilitating connections with industry partners, marketing and networking, organizing laboratory visits, coordinating university seed capital funds, defining strategies for technology transfer, etc.[20]

In a similar vein, 81% of the faculty and research staff survey participants felt that they did not have sufficient opportunities for entrepreneurship, and both faculty and administrators reported low numbers of university start-ups and spin-offs. If enhancing the entrepreneurial output of the university is desired, increasing the involvement of ILOs and TTOs could catalyze the initiation of university spin-offs and associated business planning, as described by Siegel, Veugelers, and Wright (2007).[21]

We note, however, that the low level of academic entrepreneurship activity reported in the Gulf is not unique when considering the broader scale of university-industry engagement worldwide. Lester (2005) asserts that universities engage in a wide variety of activities with regard to industry and economic development, and he cautions that evaluating the extent of university-industry interaction solely through measures of entrepreneurial activities such as patenting, licensing, and start-ups could lead to misleading expectations and incomplete conclusions.[22]

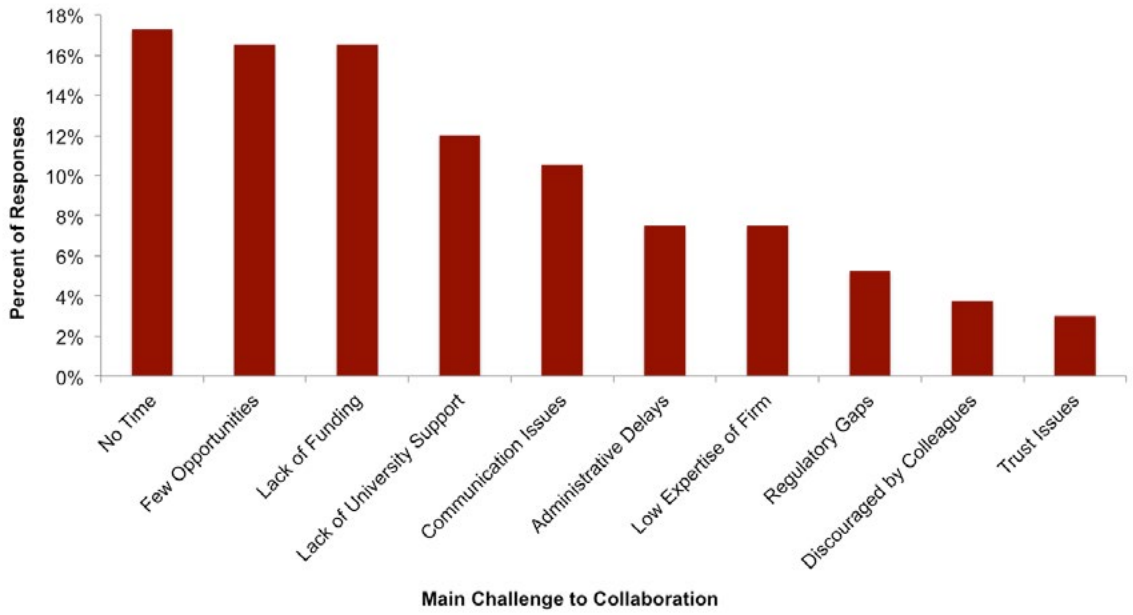


Figure 5. Main challenges of collaboration with industry.

Source: Authors' analysis of the faculty and research staff survey results. Each open-ended response was sorted qualitatively into one of the 10 categories listed on the horizontal axis below.

Policy Recommendations:

Given the benefits of UILs and the positive relationship between collaboration and research productivity in technical fields, policymakers and university administrators in Kuwait and the UAE should increase their efforts to encourage faculty in science and engineering to collaborate with private sector partners. University leaders might incentivize researchers by **utilizing a holistic approach to access faculty performance and by rewarding university personnel who engage with industry**. Academic faculty evaluation can include include measures of UIL activity that account for the impact of collaborations on teaching and research, the receipt of private funding for research projects, the rate of co-publication with industry authors, etc. With regard to rewards, universities could provide special sabbaticals to launch research-related enterprises or embed in research divisions of firms. Similarly, faculty could be allowed to conduct regular short-term consulting engagements with private firms or to provide their expertise to local industry, allowing the firms and professors alike to update their knowledge of current trends, technologies, and opportunities for innovation that address local needs.

At the government level, **policymakers could allocate more funding to science and engineer-**

ing R&D and offer financial incentives to universities that have made or are making efforts to harness more regular collaborations with firms.[23] The metrics for determining which universities receive government R&D funding might include the number of collaborative or consulting research projects that involve private sector partners. A similar approach successfully led to increased university-industry collaboration in other countries, including the United Kingdom, Canada, India, and Singapore.[24] In addition to incentivizing universities to expand their UIL activity, providing funds to universities could indirectly encourage firms to engage because universities could use the additional resources to improve their research, technological capabilities, and human capital, thereby enhancing their attractiveness and utility to local firms.

Governments should incentivize local businesses to engage with university researchers in R&D by **offering grants to companies that collaborate with universities and ensuring adequate protections for innovators.** Instruments such as tax deductions, research grants, and matching grants could be directed at emerging local firms pursuing R&D. In Norway, the notable SkatteFUNN program uses tax deductions and direct grants to increase industry R&D, particularly helping firms that collaborate with universities.[25] The government also provides loans and risk-reduction provisions to private investors that offer seed capital to university projects. To target projects in later stages of commercialization and benefit local technology development, Norway's National Research Council provides R&D funding to firms pursuing user-driven research projects in Norwegian trade and industry.[26] Singapore also provides a useful model for incentivizing the private sector; the government encourages firms to pursue UILs by, "providing monetary incentives for undertaking research, hiring research personnel, and introducing environmentally friendly technologies."[27] Finally, innovation vouchers—a tool used by governments to offer credit to firms that are purchasing services from universities—proved successful in fostering greater UILs in the Netherlands, Ireland, and the UK.[28]

Governments should take a **comprehensive legislative approach to providing protections for the various stakeholders in the UILs**. According to the World Economic Forum's Executive Opinion Survey (2016), the strength of investor protections in the UAE was given a ranking of 4.3 out of 10, which was lower than other developed and developing countries such as the UK (8.0), Norway (6.7), and Singapore (9.3).[29] Policymakers can create regulations that offer greater protections to firms involved in innovation through UILs. Examples of these initiatives include making adjustments to, "active bankruptcy laws, disclosure of information on transactions, and the liability of directors for damages caused."[30] Given the importance of patents and publications to progress in science and engineering, establishing clear and rigorous intellectual property (IP) guidelines could reduce some of the barriers to UILs—especially for interactions that involve

co-publication and commercialization.

Many industrial sectors in the Gulf are in the early stages of development. To encourage UILs—and therefore innovation—in any of these areas, **a differentiated and strategic, sector-based approach** is necessary. Policymakers can foster greater collaboration in areas where they would like to build national expertise or areas that would benefit most from greater R&D activity. Leaders at the government and university levels alike should account for sector-specific differences in collaboration types. Scientific disciplines that frequently involve new discoveries and breakthroughs, such as biotechnology, are more predisposed to collaboration in research projects that produce outputs in the form of co-publications, whereas more mature fields, such as R&D-intensive manufacturing, transportation, and mature industrial areas, are more liable to involve contract research or consulting. Previous studies in other countries confirm the effectiveness of a sector-based approach, indicating that the activities and role of universities in industrial development vary depending on the sector and stage of industrial transition.[31]

University administrators have additional opportunities for encouraging university-industry collaboration in the region. They can **invite representatives from local industry to contribute to engineering and technical curricula**, to offer student research project suggestions, to identify new avenues to pursue research, and to participate in the thesis committees of doctoral students.[32] By involving local firms in the training and preparation of students in science and engineering, universities can better cater to the needs of regional business and prevent the mismatch of university expertise with firms' research needs, which Guimón (2013) cited as an obstacle to UILs in the Gulf and which was also confirmed by the survey results.[33] Engaging multinational companies that have local branches in the region would foster international partnerships that can inform efforts to build an innovation culture and keep up with the increasingly rapid processes of globalization and growth in S&T.[34, 35]

To ameliorate many of the challenges to UILs that were reported by the faculty and research staff who participated in the study, university administrators should also make efforts to **increase the presence and level of engagement of TTOs and ILOs**. These entities could reduce burdensome communication problems in Kuwait and the UAE, where effective interaction between university researchers and their collaborating partners in the private sphere is often limited.[36] These mediating offices can also assist universities with networking efforts, which many of the survey respondents cited as needing improvement in order to encourage UILs. Governments could bolster the activity of TTOs and ILOs by increasing the presence and efforts of science parks in the region. In fact, the majority of survey respondents (67%) felt that close geographic proximity, which the inherent nature of science parks provides,

would benefit both the initiation of UILs and the quality of the interactions that comprise them.

Further Research:

This study offers insights on the existing state of, as well as future opportunities for, collaboration between private firms and universities in Kuwait and the UAE. Further research is needed to expand the survey beyond these two countries to include Saudi Arabia, Qatar, and other nations in the Gulf Cooperation Council. Additional studies might gather quantitative data on the levels of industry funding received by universities in the region, which were unable to obtain in this study due to low response rates to the questions relating to funding amounts. Further, the bibliometric analysis could be expanded to include comparison with other developing and developed countries, which would broaden the points of comparison and identify other avenues for potential policy reform. It would also be interesting to compare the patenting activity of faculty who collaborate with that of those who do not. Finally, further impact might be generated through comparing the findings of this study with data about the opinions of private sector firms on UILs in the region. Exploring the motivations and perceived challenges of the collaborators in industry could clarify areas of agreement and miscommunication between the university and private partners, and it could reveal new areas for improvement of the initiation, operation, and impact of UILs.

Appendices

Appendix A: Categorization of the collaboration types presented in the survey questions.

1. Research Partnerships: Collaborative R&D, grants, fellowships, etc.
2. Research Services: Contract research, consulting, etc.
3. Academic Commercialization: Transfer of university IP, development of research-based technologies for commercial use, etc.
4. Human Capital Development/Transfer: Training industry employees, graduate student hiring by industry, etc.
5. Informal Interaction: Conferences with industry participation on campus, social relationships and networking, etc.
6. Other Activities: Respondents were asked to explain the form of engagement with industry.

Appendix B: Details of the universities in Kuwait and the UAE that participated in the surveys and were included in the bibliometric analysis.

University Name	Abbreviation	Country	# of Faculty/ Research Staff Respondents	# of Administrator Respondents	Year Founded	Public/ Private
Gulf University for Science and Technology	GUST	Kuwait	12	6	2002	Private
Kuwait University	KU	Kuwait	83	10	1966	Public
American University of Kuwait	AUK	Kuwait	11	2	2004	Private
Australian College of Kuwait	ACK	Kuwait	25	1	2004	Private
Masdar Institute of Science and Technology	MASDAR	UAE	11	9	2006	Private
United Arab Emirates University	UAEU	UAE	34	18	1976	Public
Khalifa University of Science, Technology and Research	KUSTAR	UAE	7	3	2007	Public

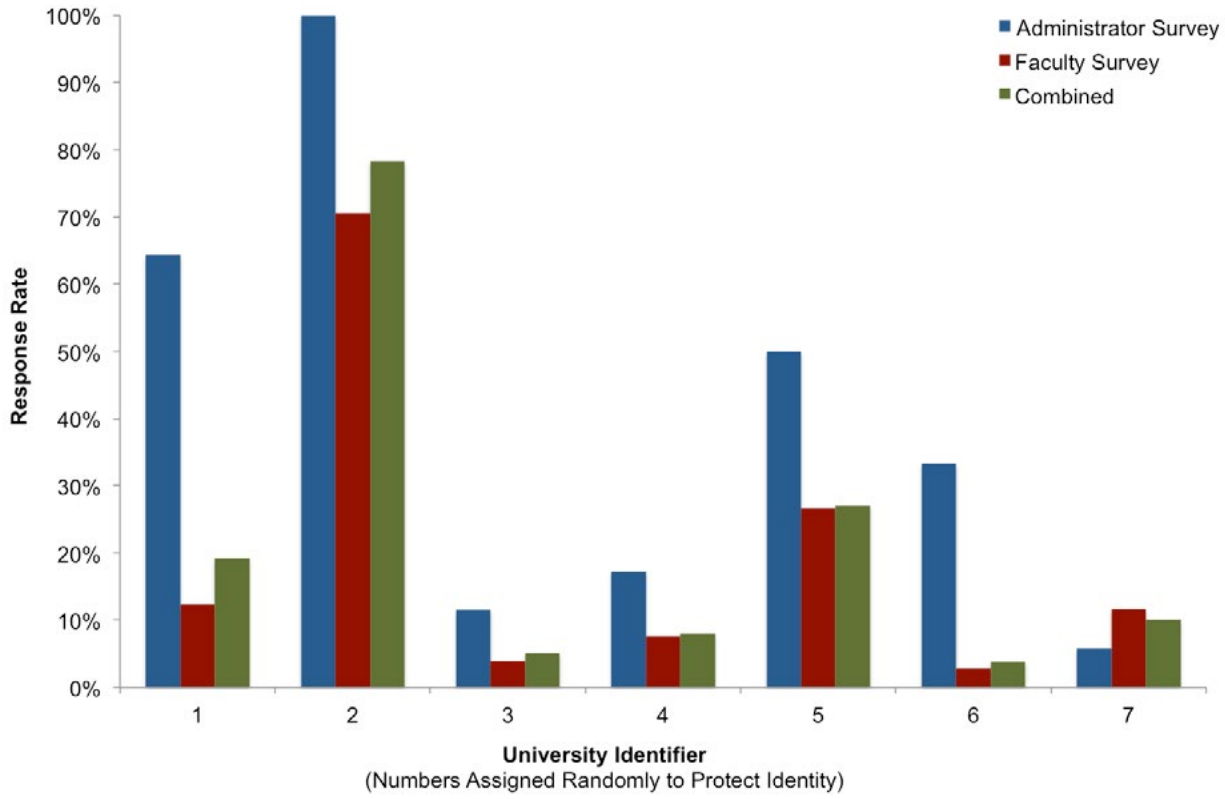
Note: As a means of evaluating UILs on the regional level, we sought to conduct surveys at major science and engineering universities in Kuwait, the UAE, and Saudi Arabia. We initially reached out to 10 universities in these three countries. Seven of the universities responded favorably and agreed to participate; however, we were unable to conduct the survey at any of the chosen universities in Saudi Arabia.

Appendix C: Number of collaborating and non-collaborating faculty used for publication productivity analysis.

	Kuwait:	UAE:
	# of Respondents	# of Respondents
Collaborated with Firm(s) Since 2009	38	26
Did Not Collaborate with Any Firms Since 2009	36	9

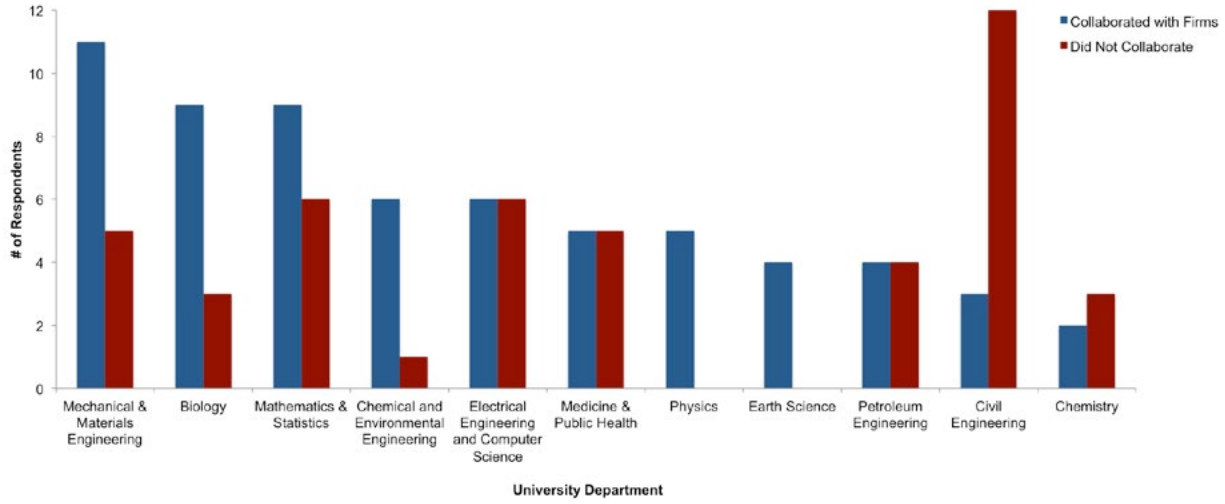
Appendix D: Response rates for the faculty and administrator surveys at the universities.

Source: Authors' analysis of the survey data.



Appendix E: Department affiliation of the survey respondents.

Source: Authors' analysis of the survey data.



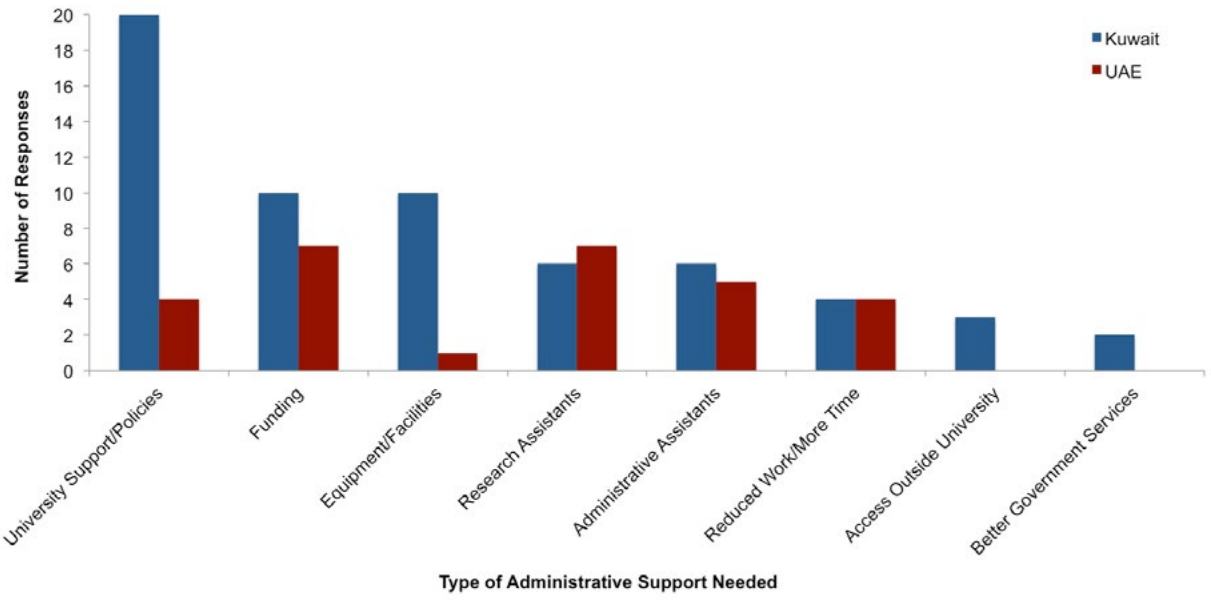
Note: There were 64 respondents in total who reported at least one industry collaboration and 45 respondents in total who reported having no industry collaboration since 2009.

Appendix F: Universities in Norway and Singapore that were included in the bibliometric analysis.

University Name	Abbreviation	Country	Year Founded	Public/ Private
National University of Singapore	NUS	Singapore	1905	Public
Nanyang Technological University	NTU	Singapore	1981	Public
Singapore University of Technology & Design	SUTD	Singapore	2009	Public
Norwegian University of Science & Technology	NUST	Norway	1996	Public
University of Stavanger	UiS	Norway	2005	Public
University of Oslo	UiO	Norway	1811	Public

Appendix G: Administrative support that faculty need to improve their work.

Source: Authors' analysis of survey results.



Notes

1 Please see Appendix A for details about the collaboration categories utilized in this study.

2 The World Economic Forum's Executive Opinion Survey from 2010-2011 asked business leaders to rank the extent of university-industry research collaboration with 6 being 'intensive and ongoing' and 0 being 'minimal or nonexistent.' Kuwait received a rating of 3.2, which was lower than that of the UAE (4.2), Saudi Arabia (4.6), and Qatar (5.3). The Gulf countries lagged behind other developed and developing countries, including the United States (5.7), Singapore (5.5), and Norway (5.0).

3 World Economic Forum. (2016). *Global Competitiveness Report 2015-2016.* Retrieved from http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

4 See Appendix B for detailed information about the universities, Appendix C for the number of collaborating and non-collaborating survey respondents used in the publications comparison, Appendix D for graphical depiction of the anonymized university-level survey response rate data, and Appendix E for information about the departmental affiliation of the survey respondents.

5 Surveys were disseminated to faculty, research staff, and administrators at seven universities in the region. In addition, bibliographic data was collected from online citation databases to investigate co-publication patterns.

6 Two databases were used: Thomson Reuters' Web of Science Core Collection and EPSCOHost's Inspec.

7 The authors made multiple attempts to increase participation at the universities with low response rates, but they were unable to increase the output in some cases.

8 The few private co-authors who did produce more than one publication with university authors were primarily large multinational corporations (MNCs), such as Microsoft, GlaxoSmithKline, and AT&T.

9 See Appendix F for a list of the universities in Norway and Singapore that were analyzed in the study.

10 For the purposes of this analysis, the co-authoring organizations were sorted into one of the following categories: universities, government entities, hospitals, private sector firms, and 'other.' Examples of 'other' organization types include non-profits, non-governmental organizations, private research institutions, etc.

11 The total number of co-authoring organizations included in the bibliometric analysis for each country are as follows: Kuwait - 2,904; the UAE - 4,006; Norway - 12,203; and Singapore - 12,769.

12 Please see Appendix B and Appendix F for complete university names and the respective abbreviations.

13 Siddiqi, A, Stoppani, J, Anadon, LD, & Narayanamurti, V. (2006). Scientific Wealth in Middle East and North Africa: Productivity, Indigeneity, and Specialty in 1981—2013. *PLoS ONE 11(11): e0164500. doi:10.1371/journal.pone.0164500*.

14 Bekkers, R., & Bodas Freitas, I. M. (2008). Analysing knowledge transfer channels between universities and industry: To what degree do sectors also matter? *Research Policy,* 37(10), 1837–1853.

15 Este, P. D., & Patel, P. (2005). University-Industry linkages in the UK: what are the factors determining the variety of university researchers' interactions with industry? In *The DRUID Tenth Anniversary Summer Conference 2005.*

16 Lester, R. K. (2005). Universities, Innovation, and the Competitiveness of Local Economies: A summary report from the local innovation systems project-phase 1. Massachusetts Institute of Technology, Industrial Performance Center, Working Paper Series, MIT-IPC-05-010.

17 Agrawal, A., & Henderson, R. (2002). Putting patents in context: Exploring knowledge transfer from MIT. *Management Science*, *48*(1), 44-60.

18 *Ibid.*

19 See Appendix G for analysis of the administrative support needed by faculty and research staff.

20 Fassin, Y. (2000). The strategic role of university-industry liaison offices. *Journal of Research Administration*, *1*(2), 31.

21 Siegel, D. S., Veugelers, R., & Wright, M. (2007). Technology transfer offices and commercialization of university intellectual property: performance and policy implications. *Oxford Review of Economic Policy*, *23*(4), 640-660.

22 Lester, R. K. (2005). Universities, Innovation, and the Competitiveness of Local Economies: A summary report from the local innovation systems project-phase 1. Massachusetts Institute of Technology, Industrial Performance Center, Working Paper Series, MIT-IPC-05-010.

23 The Gulf countries spend less on R&D relative to Gross Domestic Product (GDP) than other developing and developed countries. As of 2012, the R&D expenditure as a percentage of GDP was lower for Kuwait (0.10%) and the UAE (0.49%) than for Singapore (2.00%), Norway (1.62%), the USA (2.70%), China (1.93%), Israel (4.13%), and Finland (3.42%). Source: The World Bank. (2012). *Research and development expenditure (% of GDP).* Retrieved from http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

24 Yusuf, S., & Nabeshima, K. (Eds.). (2007). How universities promote economic growth. *World Bank Publications*. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/6631/383330Universi101OFFICIAL0USE0ONLY1.pdf

25 Clausen, T. H. (2009). Do subsidies have positive impacts on R&D and innovation activities at the firm level? *Structural Change and Economic Dynamics*, *20*(4), 239-253.

26 Rasmussen, E., & Rice, M. P. (2010). 4. Models for government support to promote the commercialization of university research: lessons from Norway. *The Life Cycle of New Ventures: Emergence, Newness and Growth*, 61.

27 Wong, P. K. (2001). Leveraging multinational corporations, fostering technopreneurship: the changing role of S&T policy in Singapore. *International Journal of Technology Management*, 22(5-6), 539-567.

28 OECD. (2010). Innovation Vouchers. In *OECD Innovation Policy Handbook,* OECD Publishing. Retrieved from http://www.oecd.org/innovation/policyplatform/48135973.pdf

29 World Economic Forum. (2016). Executive Opinion Survey. *Global Competitiveness Report 2015-2016.* Retrieved from http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf

30 Jaruzelski, B., Moujaes, C.N., Eltayeb, R., Raad, H., & Samman, H.A. (2012). The Role of Coherent Linkages in Fostering Innovation-Based Economies in the Gulf Cooperation Council Countries. *The Global Innovation Index 2012*, 109.

31 Lester, R. K. (2005). Universities, Innovation, and the Competitiveness of Local Economies: A summary report from the local innovation systems project-phase 1. Massachusetts Institute of Technology, Industrial Performance Center, Working Paper Series, MIT-IPC-05-010.

32 This approach was taken in Chile. Source: Guimón, J. (2013). Promoting University-Industry Collaboration in Developing Countries. *Policy Brief. The Innovation Policy Platform*, *1*(3), 1-12.

33 Guimón, J. (2013). Promoting University-Industry Collaboration in Developing Countries. *The Innovation Policy Platform: Policy Brief*, *1*(3), 1-12.

34 Siddiqi, A. and Anadon, L. D., Eds. (2016). *Science and Technology Development in the Gulf States: Economic Diversification through Regional Collaboration*, Berlin: Gerlach Press. ISBN 9783959940023

35 Siddiqi, A., Anadon, L. D., & Narayanamurti, V. (In Press). Science and Engineering Education in the GCC: Challenges and Transformations. In *Higher Education in the GCC: Linkages and Independence*, edited by Dale F. Eickelman and Rogaia Mustafa AbuSharaf (Berlin: Gerlach Press, 2016).

36 Jaruzelski, B., Moujaes, C.N., Eltayeb, R., Raad, H., & Samman, H.A. (2012). The Role of Coherent Linkages in Fostering Innovation-Based Economies in the Gulf Cooperation Council Countries. *The Global Innovation Index 2012*, 109.

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