

# Fostering a Culture of Academic-Industry Collaboration and Industrial Cluster Management in Saudi Arabia's Industry: A Saudi-German Initiative

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## Abstract

Industrial clusters, industrial collaboration, and technology transfer are key components to a competitive and innovative economy. Any sort of collaboration between industries or between academia and industry is not only crucial to the industry but also to the country's development and competitiveness (Porter 2008). One of the goals of Saudi Vision 2030 (KSA 2016), a strategic plan for the Kingdom of Saudi Arabia (KSA), is for the country to have a diverse and a prosperous economy. Information sharing and applied R&D are necessities to guarantee the Kingdom progresses from its traditional resource-based economy toward a more expansive innovative knowledge-based society and economy. The first goal of this paper is to shed light on a newly erected comprehensive research center named Jubail Research & Innovation ClusterHUB (J-RICH) and located in Jubail Industrial City, KSA, which is the biggest industrial city in the Middle East and North Africa region and the largest petrochemical cluster on earth. The second goal is to highlight the novelty of this center. It is the first of its kind in KSA to offer comprehensive services that promote industry-industry and industry-academic collaboration as well as cluster management. The uniqueness of J-RICH's mission becomes obvious when described within the broader context of Saudi academic-industry collaboration.

**Keywords:** National Research Centers, Academia-Industry Collaboration, Industrial Clusters, Technology Transfer, Technology Commercialization, Applied-Research.

## 1. Introduction

In this age of competitiveness, applied research, innovation and collaboration are vital ingredients in achieving an advanced position in the global market. In the past few years, industrial clusters have emerged as a vehicle to gain a competitive edge. These clusters—also known as excellence centers or innovation clusters—promote innovation and enhance competitiveness through partnerships among industry, academia, research centers, and government entities (Arikan 2009; Bell 2005; Casanueva *et al.* 2013; Connell *et al.* 2013; Gnyawali *et al.* 2013; Lissoni 2001; Phelps 2010; Tallman *et al.* 2004). A huge body of literature (Nadabán *et al.* 2009; Porter 1989; Delgado *et al.* 2010; Porter 2000; Brown *et al.* 1981) reveals that a cluster approach leads to growth in innovation. Many players are involved in commercializing innovative ideas and participating in the academic-industry collaboration spectrum. On one end, there is the pure/fundamental researcher who is mainly funded by government institutes. On the other end, there is the industrial and commercial marketplace where product development is funded by direct investment. The gap between these two needs to be closed by several approaches and initiatives; one of these approaches is to establish strong collaborative centers of excellence or cluster organizations (Khorsheed 2015).

(Yli-Renko *et al.* 2001) Indicated that many industries lack the resources needed to engage in innovative activities; hence, they try to cooperate to acquire experience, resources, and knowledge. Also, these industries attempt to collaborate with universities and research centers to enhance their innovative performance. Porter's competitive advantage theory (Porter 2008) is based on four broad attributes: *factor conditions*; *demand conditions*; *related and supporting industries*; and *firm strategy, structure, and rivalry*. Porter described these attributes as self-reinforcing and labeled them as the diamond of four forces, a diamond which contributes to the creation of a company's competitive advantage. A report from the United National Industrial Development Organization stated, "Clusters can improve competitiveness and productivity by sharing best practices, labor and management tools, and training. Clusters can drive the direction and pace of innovation and stimulate new firm formation. Clusters can thus become a source of regional competitive advantage, bringing economic benefits to individual firms in the region and the region as a whole" (UNIDO 2006). Collaborative research centers, coupled with government strategies for advanced technology, have proven to be good promoters of cooperative research (Boardman *et al.* 2010).

One of the challenges facing Saudi industries is improving the competitiveness of their products. Other challenges include keeping pace with developments in international markets and expediting the transfer and cultivation of technology. New, high-tech value chains in the Kingdom of Saudi Arabia (KSA) offer promising business opportunities both to Saudi and international companies. Cluster management tools can help to

capitalize on these opportunities more efficiently and effectively. Thus, a new center called Jubail Research & Innovation ClusterHUB (J-RICH) has been built to act as the management, R&D, and promotion hub of cluster-driven industrial development in Jubail Industrial City and the entire Kingdom. J-RICH is already producing promising results despite its age. In this paper, we highlight the role of this new, emerging center by detailing its main industrial services and prove its uniqueness by drawing a comparison with similar centers in the country. The future outlook and challenges will also be described.

## 2. J-RICH and its Partners

Some of Europe's leading research and cluster-management organizations teamed up with Jubail Industrial College (JIC) to set up a joint cluster excellence center known as J-RICH, which is located on the JIC campus. Partners include the Technical University of Munich's International GmbH, InSITE BAVARIA, and VDI/VDE-IT are international firms specializing in cluster building, cluster management, and technology transfer. (GmbH stands for *Gesellschaft mit beschränkter Haftung*, which is a type of legal entity common in Germany, Austria, Switzerland, and Liechtenstein. In the United States, an equivalent type of entity would be called a limited liability company (LLC).) One of J-RICH's aims is to implement some of the relevant and ambitious goals outlined in KSA's *National Transformation Program 2020* (NTP 2020) and *Vision 2030* (KSA 2016). J-RICH was created in the middle of the largest industrial city in the region and the largest petrochemical cluster on earth. This ambitious and, in our opinion, the long-overdue initiative has great potential to spur more industry research and applications in the country as well as inter-industry collaboration. Figure 1 depicts J-RICH's top-notch partners, and subsequent sections of this paper describe each partner.

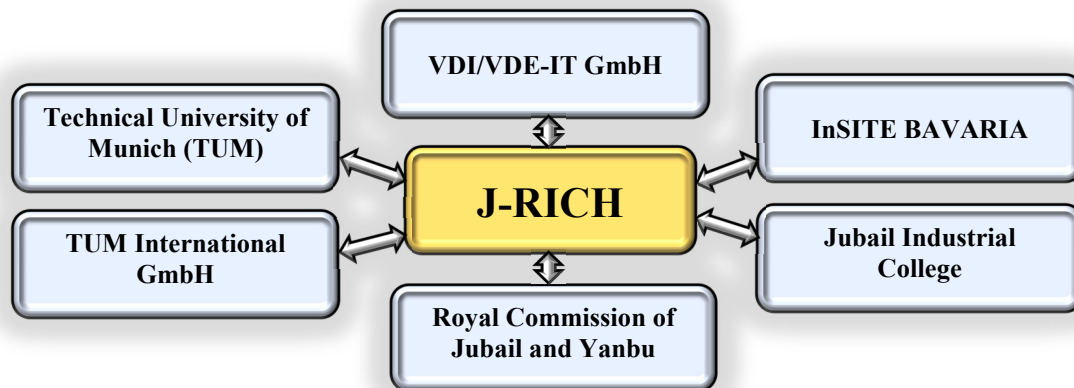


Figure 1. J-RICH's Partners.

### 2.1 Technical University of Munich (TUM)

A leading European research university and a member of TU9 (German Institutes of Technology). It is ranked fourth overall in Reuters' 2017 ranking of the most innovative universities in Europe (Reuters 2017). With its strong links to companies and scientific centers across the world, TUM was one of the first universities in Germany to be named a university of excellence.

### 2.2 TUM International GmbH

A subsidiary company of the Technical University of Munich, TUM International GmbH TUM is one of Europe's leading organization for creating & managing research centers and scientific sites.

### 2.3 InSITE BAVARIA

The international's business division of TUM specializing in industrial site creation and management. InSITE BAVARIA offers services that include strategic consultancy, planning and project management. Also, InSITE BAVARIA has a strong connection to the prominent industrial clusters in European.

### 2.4 VDU/VDE-IT GmbH

A German service- providing company specializing in project management. It provides consultancy services about the promotion of innovation and technology. VDI/VDE-IT is the organizational carrier of European Secretariat of Cluster Analysis (ESCA) which supports cluster managers and policy makers with advice on cluster development.

### 2.5 Royal Commission of Jubail and Yanbu (RCJY)

An autonomous organization that was established in 1975 by the Kingdom to create and run the two industrial cities; Jubail and Yanbu. RCJY's full support to J-RICH was evident from day one, and it's also vital in attracting potential stakeholders.

### 2.6 Jubail Industrial College (JIC)

Initially as a training center then as a full-fledged tertiary college, JIC runs under RCJY and is the source of skilled graduates required by the local industry in particular and the country in general. JIC provides modern education coupled with the state of the rate technology provided by modern facilities. JIC has acquired high standards and accreditation and continually seeking improvements and innovation.

## 3. Services and Units

J-RICH is an integrated service provider with an elaborate service portfolio that provides many professional services. Fig. 2 depicts the primary services of J-RICH which will briefly be outlined in the next few sections.

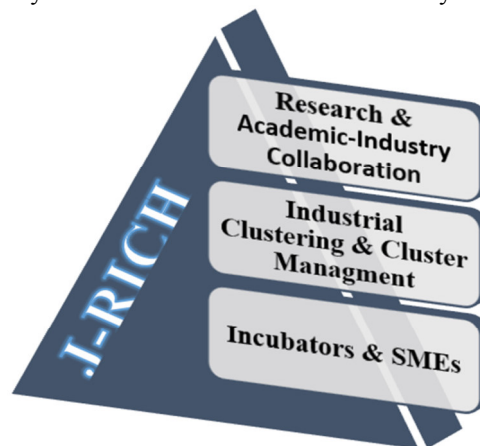


Figure 2. J-RICH's Services.

### 3.1 Research & Academic-Industry Collaboration

This is the main and most significant unit of J-RICH which realizes scientific cooperation (Total Industry Solutions) with the rest of the industry. This international Research & Application unit has a full-service portfolio that includes:

- Technology Transfer.
- Contracting Research.
- Material Testing
- Joint R&D Projects
- Industrial Solutions

A fundamental cornerstone of a long-term and robust collaboration between industry and academia is having a solid set of research and application tools and capabilities that joins technology, knowledge, and business to leverage economic benefits. J-RICH has a world-class lab infrastructure and equipment on its premises at Jubail Industrial College and the locations of its partners. Under the agreement with its partners, J-RICH also has access to a wealth of experienced European and other international organizations involved in projects such as “industry 4.0”, sustainable construction and architecture, industrial biotechnology, new energy or life science.

### 3.2 Cluster Management

Cluster management is key in J-RICH services portfolio. Through the Saudi-European partnership, industry representatives and policymakers will have more exposure and understanding of the concept of cluster organizations and cluster initiatives. This form of technology transfer will translate best practice from Europe to the local industry. Cluster organizations are important institutions within a cluster as they act as innovation support providers. They can improve the cluster's potential by providing the needed services to cluster regarding cooperating with other networks or actors within the cluster that are either active in the same or other industries. One example of such organizations is the German “go-cluster” program (CD 2018), another example is the “European Cluster Excellence” initiative (ECE 2014). These cluster organizations managed to support many clusters by providing added value to their member companies.

Using the standards of the European Cluster Excellence Initiative, J-RICH provides tools and capabilities to

operate cluster management organizations. This indeed is established through the strong links with the prominent European clusters. This form of interaction between the international cluster organizations and the Saudi industry will be manifested in the ClusterHUB, a physical center developed by InSITE BAVARIA that should bring together cluster representatives and will actively support business matchmaking and the elaboration of cross-industrial cluster projects.

### *3.3 Incubators and SMEs*

Support for incubators and SMEs is a top-level necessity in the rapidly growing and competitive world. This type of support is a very productive tool for promoting the entrepreneurial environment and economic development. J-RICH spares no effort in attracting small and medium-sized companies, as well as in settlement of innovative start-ups. A set of initiatives and plans is designed to provide the necessary services such as providing financial, accounting and legal services, support of product development programs, planning and execution of marketing operations and rental of office rooms and workshops.

## **4. Major Saudi Research Centers**

Collaboration between industry and academia in KSA had been initiated long ago. Most of the industry players in the Kingdom don't have in-house research units, a situation that necessitated acquiring academic research capabilities to transform ideas into sustainable solutions either through consultation or collaboration. The Saudi Research and Development scene is populated with over two hundred research centers mostly linked with universities. In this section we shed some light on two prominent key centers for research and development in the country, we will focus on the role of these two centers in establishing collaborative research with the petrochemical industry. The related activities of these selected centers are:

- a) Industrial-related R & D
- b) Cluster Management.
- c) Incubators & SMEs.

### *4.1 King Abdulaziz City for Science and Technology (KACST)*

The country's premier national science agency and regulator. A government institution that regulates, supports and advances applied research in the Kingdom. The KACST is an umbrella organization that houses many research centers and established various initiatives and policies. KACST's main areas of focus are System Integration, Geographic Information Systems, Information Technology, other leading-edge and pioneering technologies. Most of KACST's activities are R&D since its technology, and research capabilities are best in the country. KACST supports R&D in many ways; the Grants Program for Universities and Research Centers supports basic research through 7 programs ranging from support to graduate studies to supporting industrial and innovations centers. KACST also supports R&D under the Technical Leaders Program which houses around 15 Centers of Excellence specialized mostly in science and technology.

KACST extends its R&D arm to the industry through the Technology Transfer and Localization plan, which focuses on conducting R&D in 13 strategic programs that cover vital sectors in the country such as energy, water, agriculture, oil, and gas, etc. Under this plan is KACST's Industrial and Technical Consultations Initiative that aims to utilize local competencies and capabilities to provide industrial and technical consultation services. Governmental and non-governmental entities are targeted under this initiative which provides various professional services in return for fees. We consider this as the only form of collaboration between research and industry. According to KACST's annual report of 2016 (KACST 2016), no collaborative R&D project has been initiated with any petrochemical company in the country. One of the recommendations by UNIDO in their report (UNIDO 2006) stipulated that KACST should focus more on "Establishing a good relationship with the industrial sector and obtaining clients and projects with clear objectives."

BADIR is KACST's program to foster different incubators. Under BADIR's initiative, several incubators were created that cover the areas of Information and Communication Technology, Biotechnology and Advanced Manufacturing program. Many projects were started under these incubators (KACST 2016). As for the SME's, KACST has adopted an initiative to boost SME's with different types of support ranging from technical training to operational consulting services. However, it's not visible from their publications and annual report that any SME has emerged from this initiative. The concept of clustering and cluster management is also not part of KACST's framework nor its innovation-policy plans.

### *4.2 King Abdullah University of Science and Technology (KAUST)*

A modern and huge research institute in the Kingdom. KAUST is significantly promoting the Kingdom's diversification direction to become a knowledge-based and technology-based economy. With around eleven research centers and many faculty and research staff, KAUST had established an excellent research base with vast and advanced resources to tackle many research and development projects in science and technology.

KAUST Industry Collaboration Program (KIPC) assists in finding opportunities and collaboration activities that will add value to the industry. KIPC is a membership-based program that facilitates services to its members. Business or industrial companies can benefit from a range of services such as having access to KAUST's talented researchers and advanced world-class labs. Other specific membership benefits include having a seat on KIAB (KAUST Industry Advisory Board); where latest research activities related to the industry projects at KAUST are discussed. This networking and engagement platform provides an opportunity for interaction and collaboration among all members of the industry and the government agencies.

KAUST had established and maintained a set of programs and initiatives to support start-ups and SMEs. By Saudi Vision 2030 which highlights the importance of SME development to the country's long-term economic growth and sustainability, KAUST is investing in Saudi made technologies and products through its entrepreneurship program. It offers services such as training, mentoring, business plan development, IP protection as well as funding. Although KIAB (KAUST Industry Advisory Board) is the closest platform where inter-industry collaboration might be achieved, KAUST does not support any formal form of industrial clustering nor cluster management.

#### *4.3 National Industrial Clusters Development Program*

NICDP or Industrial Clusters (IC) for short is a government agency responsible for supporting the Saudi government in its mission of economic diversification and GDP growth. IC was established jointly by the Ministry of Petroleum and Minerals and the Ministry of Commerce and Industry to create five new industrial clusters. It's a government regulatory office that ensures compliance with Saudi and international standards. IC's main mission is to establish export-oriented industrial sectors and help potential investors evaluate business opportunities. Promotion of industry-industry collaboration or cluster management is not part of IC's policy and framework.

#### *4.4 Dhahran Techno-Valley Company (DTVC)*

DTVC is the business wing of King Fahd University of Petroleum & Minerals (KFUPM). Established in 2011 to catalyze the development of industrial R& D. DTV supports innovative ecosystem by building a collaborative framework that includes KFUPM, Saudi Aramco and other local and international companies. Again, we see no sign of clustering activities nor cluster management.

#### *4.5 Saudi Technology Development and Investment Company (TAQNIA)*

TAQNIA is a government company created in 2011 to diversify the Saudi economy. TAQNIA works under the Public Investment Fund (PIF), a funding and investing government agency. TAQNIA's mission is to establish strong ties with knowledge-based industries to promote an innovative ecosystem in the kingdom. This innovative ecosystem is manifested by partnerships TAQNIA established with some academic and industry leaders. Although TAQNIA has concentrated its services towards value-added developments through investment and commercialization, supporting cluster management is not part of its business portfolio.

#### *4.6 Saudi Arabia Advanced Research Alliance (SAARA)*

SAARA was established in 2015 as a coalition of six organizations; three academic research centers (KFUPM - KACST - KAUST) and three industrial and service firms (Saudi Aramco - TAQNIA - RTI international). The primary mission of SAARA is to bridge the gap between research and business by commercializing innovative ideas and turning knowledge into practice.

#### *4.7 Other related centers, initiatives, and programs*

There are more than 200 research centers in the Kingdom. Most of these centers are involved in pure academic research. Some of these centers have some R&D towards industrial collaboration. Here is a list of some related centers:

1. King Abdullah Petroleum Studies and Research center (KAPSARC).
2. King Abdullah Institute for Nanotechnology (KAIN).
3. The Saudi GE Innovation Center.
4. SABIC Technology and Innovation Center.
5. Prince Sultan Advanced Technology Research Institute (PSATRI).
6. King Abdullah City for Atomic & Renewable Energy (KACARE).
7. National Industrialization Product Research Applications and Support Center (**NIPRAS**).
8. Pan Arab Research Center (PARC).
9. Prince Mohammad bin Fahd University - Center for Research Development (CRD).
10. Schlumberger Dhahran Carbonate Research Center.
11. National Research Centre for Giftedness and Creativity (NRCGC).

Despite the presence of other numerous organizations and focuses that go on driving the nation towards a more innovation and learning based economy, the vast majority of these focuses and offices are either purely research focuses that have not set up stable communitarian relations with the business, or they are government administrative offices that guarantee that potential investors conform to the regulations and measures. A large portion of the organizations in the different ventures don't have R&D programs, and most scholastic foundations focus fundamentally on teaching. "The country's private sector and universities still operate in silos when it comes to research and technology development" (Khorsheed 2015).

J-RICH research approach is unique and different from research conducted by other centers. While most research in the centers above usually takes the form of a long-term collaboration with the industry to develop new products/processes or enhance existing ones, J-RICH's involvement in applied research with its clients from the surrounding industry focuses on solving existing issues with the industry. Since its inception, J-RICH's main direction is to approach neighboring industry, so they open their doors and share their existing environmental and operational issues. So far, J-RICH has entered into some collaborative applied research projects that have the focus on solving ongoing matters. Through this type of applied research, J-RICH is building its valuable base of expertise that will undoubtedly be very resourceful to the related local and global industry.

## 5. Challenges

Indeed, there will be a few snags and difficulties that obstruct accomplishing the goals of achieving efficient academic-industry collaboration as well as inter-industry cooperation. Here we outline a few possible obstacles:

- Administrative and social factors may negatively affect collaboration among industries. Industrial clusters may also experience lack of smooth communication due to strict organization process or bureaucracy.
- Lack of funding research is a significant obstacle that hinders the proliferation of research activities in general. Despite the growth in the number of research centers in KSA during the past few years, R&D expenditure is still under 1% of the country's GDP (UNESCO 2013). Recent strategic plans have aimed at raising R&D and technology expenditure to 2.5% by 2020. Financial input into R&D by the private sector is still relatively low. Investors tend to avoid financing the development of new products or inventions which quite often have a high-hazard profile. There is a considerable requirement for coordinated efforts by government and private businesses to guarantee to fund as a prerequisite for expanding research, development and innovation capacity.
- Due to some administrative/logistic reasons, sometimes it's troublesome to acquire the needed data/material for research purposes from some companies or government agencies.
- Prototyping tools to create and test first products could be problematic for some academic institutes.

## 6. Concluding Remarks

With a reduction in overall oil costs and urgent calls to lessen dependence on oil, the Saudi government sees the need to widen its income streams by promoting the innovative and knowledge-based economy. Teaming up with the scholarly world and industry improves the country's know-how and extends its worldwide innovation impression through traversing any boundary between lab discoveries and business.

In this paper, we introduced and highlighted the uniqueness of J-RICH by outlining some of the relevant services provided by other similar research centers in the country, we can easily claim that J-RICH is a first of its kind industrial research center in terms of having a holistic and comprehensive set of services under one roof that includes:

- Applied research and application development.
- Academia-industry and industry-industry collaboration.
- Industry-industry and technology matchmaking.
- Commercialization of innovative ideas through incubators and SMEs.
- Cluster organization analysis and cluster management.

We believe J-RICH will become the country's model of academic-industry collaboration as well as international technology transfer. J-RICH will also play a significant role in transforming theoretical knowledge into products and applications. J-RICH will be a leader in cluster building and cluster management.

J-RICH has all the potentials to achieve its goals to create a powerful petrochemical cluster in Jubail. Here we summarize a few of J-RICH's distinctive characteristics:

1. J-RICH is located in the middle of a major petrochemical industry hub. With its proximity to all petrochemical companies in Jubail Industrial City, J-RICH is efficiently contacting the parties involved regarding conducting meetings, obtaining samples and materials or visiting operational facilities.
2. The Royal Commission for Jubail and Yanbu (RCJY) is the governing body of Jubail Industrial City. RCJY was mandated to established and build Jubail Industrial City from the ground up. RCJY oversees all aspects of Jubail Industrial City operations as well as ensuring adherence to government regulations. Being part of RCJY and receiving full support from RCJY is critical in strengthening J-RICH's position

and opening the gate to the surrounding industry.

3. With the unique partnership J-RICH has created with top European and international organizations, J-RICH is first of its kind in the country. This multifaceted coalition can help in providing industrial solutions as well as implementing innovative projects. Cluster analysis and management is also a unique characteristic of J-RICH; no previous cluster management initiative or policy for the petrochemical industry has been proposed or implemented before.
4. Jubail Industrial City houses two industrial institutes and one university; Jubail Industrial College, Jubail Technical Institute, and Jubail University College. All are well-equipped with top-notch labs and facilities and run by local and international academics and scholars.

Finally, J-RICH has already started to show its role as a vital catalyst for the surrounded industry as it's begun collaborating with some local petrochemical companies to provide innovative solutions to issues about waste, process efficiency, high energy cost and corrosion.

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