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# INDUSTRY-ACADEMIA RELATIONS IN THE ARAB GULF STATES: CONVERGENCE OR DIVERGENCE?

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**ABSTRACT.** The paper examines the current stance of industry-academia relations in the Arab Gulf States and argues that meaningful, long-lasting relations have not been properly cultivated. The paper calls for increased “relevancy” of engineering education, with greater industry-academia collaboration on many fronts. It was inspired by a round table discussion, back in 2000, where engineering graduates of the Region’s colleges have suggested ways to start developing viable and enduring connections between local industries and the academic institutions of the Arab Gulf States. Strategies to help promote the collaboration effort are outlined. In particular, activities (plans, and scenarios) perceived as effective in closing the gap between academia and industries are described. Slanting curricula and academic programs more towards industrial relevance and the “practice”, regarded by many as a step in the right direction, will help equip graduates with the “tools of the trade”, thus lessening the burden on the industry in the locale, i.e., having to spend time and effort preparing and training employees at the start of their career. The objective is to further motivate educators to collaborate with industry and to begin to integrate greater relevancy into engineering education.

## 1. INTRODUCTION

Engineering education in the Arab Gulf States (Saudi Arabia, Bahrain, Kuwait, United Arab Emirates, Qatar, and Sultanate of Oman) faces many challenges today. Changes in the external environment (e.g. reduced funding, increased costs, demands by industry for well-seasoned graduates, rapid advances in technology, and novel educational methods) coupled with the quest for educational relevance in undergraduate engineering, are pressuring the colleges of engineering in the Region (*the Arab Gulf States*) to “rethink” engineering education and to undertake constructive steps towards reforming the current systems<sup>(1, 2, 3, 4)</sup>.

To come to grip with the current state of engineering education in the Arab Gulf States, it is important to familiarize one’s self with the prevailing educational system, its establishment and growth-back in the seventies and eighties-and the causal factors that have lead to the status quo. A comprehensive summary that traces the development of engineering education in the Region, is highlighted in another paper to the Conference by the author, and titled: “On Engineering Education in the Arab Gulf States: Challenges and Imperatives”<sup>(5)</sup>.

The higher education arena interacts in a complex way with a variety of external partners whose role, participation, and expertise must be harnessed to help overcome some of the challenges that have beset engineering education in the Region. Perhaps the most notable partner in this endeavor is the industrial sector whose role and participation in shaping

engineering education has, unfortunately, been extremely modest by best estimates. Establishing a beneficial working relationship between colleges of engineering in the Region and industries at large, has proven to be somewhat difficult, often short-lived, and appears at the outset, not to be rewarding to either side. Among the many factors contributing to this failure, is the tremendous inertia of the educational systems of the Region, in place today. <sup>(2, 3)</sup>

The paper sheds light on the seemingly complex issues that have curtailed proper “connectivity” between academia and industry in the Arab Gulf States, and argues for the urgent need to work together towards developing mutually beneficial and long-lasting relations, at the grass root level, so that the interests of people on both sides (students, graduates, faculty members, industrial staff, industry managers, research proponents, etc) will be properly served. Perhaps the greatest achievement in such an endeavor is to improve the “relevancy” of engineering education, by bringing the College closer to the “realities” on the ground. There is a tremendous need for faculty and students to be involved with “real problems” and to share in providing solutions. Drawing materials out of textbooks is not enough. We, *as engineering educators*, need to bring our own contributions to the classroom! Academia’s reluctance to work with industry and industry’s indifference to those issues that have beset academics, has been a major cause of the “malaise” that has gripped the colleges of the Region. Unfortunately, this “detached” role of the university is seen by some as justified; partly because they believe (and wrongly so!) that the role of the university is to teach the fundamentals, and not necessarily applications. These misconceptions need to be corrected, and industries have to be “lured in” to participate in shaping the academic programs; and have “a say” in what kind of skills and aptitudes are transmitted by the colleges of engineering. By having a stronger voice in academic matters, industry would keep the “taught skills” in check, and, at the same time, provide more appropriate “on the job” training to students and fresh graduates.

This paper, asserts author’s views, expressed in a prior publication, <sup>(6)</sup> on cultivation of working relations between industries and academe, and focuses on strategies that would help to promote collaboration between the colleges of engineering in the Region and neighboring industries. Those activities (plans, and scenarios) perceived as effective in narrowing the gap are explored. In particular, the paper focuses on: the mission, the nature, extent, and relevant bench marks of such a collaborative effort. Training, capstone courses, consulting by faculty, and joint research projects- aimed at serving the interest of both parties (academia and the industrial partners) are addressed. At this critical juncture, if engineering faculty and program planners, would slant curricula and programs more in the direction of “industrial relevance” and the “practice”, it would help a great deal in equipping engineering graduates with the “tools of the trade” thus lessening the burden on the industries.

The author draws on his own experience as a faculty member in the Arab Gulf States (a while back in Qatar and earlier in Saudi Arabia); in addition to views and suggestions of: colleagues, students, graduates, and business leaders in the Region. The author has recently traveled through the Region and met with many leading industries and university personnel, to discuss the state of industry-academia relations. The good news is that leaders on both sides, and throughout the Region, are convinced that such relations, if properly cultivated, will help both camps, in reaping benefits, i.e., academia will have more relevant engineering education, and industries would have better prepared graduates. But the main concern, as expressed by most whom the author has conversed with, is in implementation. Many have argued that having a well “thought-out”, implementable, and enduring plan(s) is difficult to come up with, even if mandated by the Ministry of Higher Education.

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## 2. ACADEMY AND INDUSTRY

When universities and industry find common ground to meet each other's needs, the mutual benefits can be substantial. Not so long ago, most industrial firms' involvement with engineering education in North America was limited to a few activities: the process of hiring graduates, occasionally funding research projects, and, from time to time, donating some funds from their foundations. Today, industry partners appear to have a great deal to offer to universities, particularly when educators are willing to descend a few flights of the "ivory tower" to embrace the new realities of engineering research. The most significant challenge to any engineering college is: remaining relevant to the profession, a quest that is challenging enough during times of relative stability. Today, with the engineering profession undergoing dramatic changes on many fronts, including: less predictable employment patterns, globalization, reduced job security, shifting funding opportunities, broader intellectual alliances, changing accreditation expectations, new tools, new skills, and new approaches to teaching and learning- remaining relevant has become far more difficult under the circumstance. Despite the many uncertainties that surround engineering education, industry could assist engineering colleges' accreditation efforts and many other challenges. *Engineering Criteria 2000* <sup>(7)</sup> has two basic parts: it gives each engineering college the opportunity to define its unique mission, and also requires that the college assesses the outcomes of its educational process, determine whether it is meeting its own objectives, and take corrective actions if and when necessary. Needless to say that people of the industry are ideally positioned to render a helping hand to an engineering department in defining its mission and sustaining its long-term goals in a way that is relevant to the "real engineering world"; where the majority of graduates will eventually find themselves in. Also, industry has a great deal of experience assessing outcomes, and could suggest effective assessment mechanisms to assist academic departments.

It was a logical progression for some of the colleges of engineering in the Gulf Region to turn towards industries in their locale attempting to build bridges and set up advisory boards to guide and support joint efforts and programs. Establishing a working relationship between selected industries and the engineering college, by and large, has proven to be somewhat difficult and often short-lived. It seems to take more than an enthusiastic faculty member acting alone, or a single joint project that has seen daylight, to claim that a long-lasting and beneficial relationship has been achieved. While it is difficult to generalize, the prevailing perception, as expressed by Region's graduates, is that connectedness between the two parties (i.e., industry and academe), by and large, has fallen terribly short of what graduates aspire for. <sup>(8)</sup>

Unlike North America, academe and industry in the Gulf States, reaching out and attempting to work together, is a relatively new experience. Except for oil and oil-related industries, the bulk of the industrial sector in the Region is small-size entrepreneurial, and sees no direct benefits in opening up to the College of Engineering. On the other hand, and in all the states of the Region, major industries (oil industry in particular) have maintained some lines of communication with the University in general and the College of Engineering in particular. With one or two exceptions, the industry-college relations can be described as intermittent, short-term, and does not seem to be rewarding to either side. Who is responsible for the *status quo*? What would it take to build long-lasting mutually beneficial relations? While there are no clear-cut answers, certain factors appear to have contributed to the state of "malaise" that tends to exist today. These factors include:

- continued lack of interest (to the extent of indifference) on the part of most industries to get involved with engineering institutions;
- clear differences between the two cultures - that of industry versus academe;
- inability of the College to market its services and products properly;
- reliance of most industries on expert opinion and/or technical support from abroad, thus reducing opportunities for potential collaboration with the College;
- the prevailing misconception that expatriate faculty should not be allowed to consult or engage in after-hours activities; and
- the petty attitude of intermediaries (civil servants, administrators) that hinders collaborative effort and often adversely affects the outcome of a joint venture.

On the bright side, some of the industries of the Region have responded rather well to students' training and cooperative education programs in general. All present curricula require successful completion of either an eight-week training period, or two consecutive semesters of cooperative education. The major industry players in these domains are primarily: oil and gas companies, chemical and steel companies, large-size building and road contractors, electric utility companies, some government agencies; and, to a lesser extent, small engineering service firms. Despite some setbacks, misjudgments and unpleasant outcome experienced by some - the vast majority of graduates has positive impressions and believes that the training or co-op period is time well spent. <sup>(3, 6, 8)</sup>

**i. Benchmark Assumptions of Engineering Education in the Gulf Region:** Studies of education and specifically of engineering education in the Arab Gulf States, have pointed towards omissions and weaknesses in undergraduate engineering education. Many believe that emphasis on the practice, while preparing graduates would result in tangible advantages upon entering industry. Unfortunately, majority of faculty members of the Gulf Region today - expatriates and nationals - have hardly practiced engineering any where prior to becoming faculty members! And personal experience based on *practicing engineering* - at least for sometime - has never been a requirement to become a teaching faculty. Fortunately, more and more educators are becoming aware of this "acute" problem; and some are taking steps to remedy the situation. One approach has been to form symbiotic partnerships between a "willing" industry and a respective engineering department through "capstone" projects. While little if any has been reported in the Region, on the extent and success of this type of partnership, it appears that a lot could be done, to bring *the practice* into the classroom. A particularly exemplary US institution, that has been successful in this domain, is Harvey Mudd College, <sup>(9)</sup> where industry-academia projects, known as Engineering Clinics, have been conducted for nearly 40 years.

A list of weaknesses and/or deficiencies of Gulf States engineering graduates, shown in Table 1, has been agreed upon and compiled by a group of industry personalities who have had a chance to interact with recent Gulf graduates. The consensus of these leaders were inspired by an informal roundtable discussion addressing the relevancy of engineering education in the Arab Gulf States. <sup>(10)</sup> Evidently, from the perspective of industry, the definition of a quality graduate is markedly different from the way academia views it. Industry, by and large, looks forward to a graduate who is flexible, versatile, fits well within the company (trainable), and is able to exercise engineering judgment on his/her own. One of the root questions that should be asked, and be on the table for an evolutionary debate is: What engineering students need to learn and how/where can they best learn it, as well as what engineering colleges

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should teach and and/where can they best teach it? The “what” lies at the crux of the matter. What is currently taught and, presumably, learned at the undergraduate level should include much more than the technically circumscribed material agreed upon today. Certainly, there are differing views and conflicting interests. Answers to the “what” questions require an infusion of: wisdom, understanding, breakthrough thinking, and perseverance. To this infusion of wisdom, the voice of industry - the prime “customer” of academia must be added! Industry must establish the “requirements” for the quality and technical and non-technical education of the engineers they hire. Industry need to provide clear customer requirements (expectations or educational outcomes), and academe must develop curricula that meet these requirements (i.e., prepare graduates). Unless, and until, industrial leaders speak out and express their views clearly on who they will hire as new graduates, academics will, continue to pursue their present course.

**ii. Pre-University Education and its Impact on Engineering Education in the Region:**

To try to understand the state of engineering education in the Region and its ramifications; it is important to come to grip with the challenge that Region’s pre-university educational systems exert on ubiquitous realization of the new paradigm in engineering education.

The most significant change in the pre-university systems occurred in the decades of the 70’s and 80’s, as a direct result of the substantial wealth derived from oil revenues, which have found its way to the Region. Public schools, in particular, were substantially and positively impacted by the increase in revenues. The major improvements realized, as a consequence of increased funding, have included: (i) substantial increase in the number of well-equipped modern school buildings; (ii) significant modifications to curricula and academic programs, in conformity with standards and guidelines prevalent (at the time) in some other Arab countries(Egypt, Jordan, Syria); (iii) provision of qualified teaching staff drawn from neighboring countries;(iv) improved management; (v) introduction of special education for physically and/or mentally challenged students; and (vi) the emergence of a more concerned general public with education issues.<sup>(2, 3)</sup>

Table 1: An industrial perception of weaknesses and/or deficiencies in new graduates of Region’s Engineering Colleges

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| <ul style="list-style-type: none"><li>• Thoroughly deficient in thinking critically and independently</li><li>• Lack of design capability and/or creativity</li><li>• Lack of appreciation for considering alternatives</li><li>• No knowledge of value engineering</li><li>• Lack of appreciation for variation</li><li>• Majority wanting to be analysts</li><li>• Do not know how to utilize time and/or resources</li><li>• Poor perception of the overall “engineering” process</li><li>• Inadequate communication skills</li><li>• Do not desire to get their hands dirty</li><li>• Trained to work as individuals. No experience working in teams</li><li>• Do not have the desire and/or the skills to do their own search or learn on their own</li></ul> |
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Public schools, by and large, are under the auspices of the Ministry of Education who is solely responsible for planning, operations and budget. Hardly any difference exists among schools of the same category in any of the states of the Region. Admission policies, teaching materials, teaching methods, counseling, and testing & grading standards are nearly identical in all the public schools of the Region. Schools, at all levels, are free (i.e., free tuition, no fees, free textbooks) for Gulf nationals and expatriates alike. In addition, a stipend, up to approximately US \$200 per month is provided to students in need, in most pre-university public systems.<sup>(1, 2, 3)</sup>

Despite the progress made and the many positive aspects that have been introduced to various facets of the K-12 educational arena over the last three and a half decades; there are those aspects that seemingly are extremely difficult to modify, despite some efforts on the part of many concerned groups and individuals. The main issue that troubles most people involved with education in the Gulf is: the *traditional* methods of teaching that have persisted over many years and appear to be “immune to any change”. Practiced on a wide scale, the traditional approach embodies all or most of the following: (i) students are bombarded with information, drawn primarily out of textbook(s); (ii) students do not participate! The process is “one way,” with minimum interaction between students and instructor; (iii) emphasis on *rote memorization* - over all other kinds of learning - has always taken precedence; and (iv) most students study to get the grade rather than “to understand” and retain knowledge. This shallow approach to learning is decidedly incompatible with engineering education, in general, and in direct conflict with the “ethos” of the engineering profession.

The main difficulty with pre-university education in the Gulf Region, as seen by both insiders and outsiders, is that the “set up” today *promotes rote and uniform learning over independent thought*. In fact one can go as far as say, that it suppresses independent thinking. While these systems appear effective in developing students who are able to learn vast amount of “testable” information, it falls terribly short in fostering creativity, analytical skills, and critical thinking that are more difficult to monitor and test. The skills referred to here, are those that need to be acquired by students who wish to get into engineering. The author’s perception of some of the weaknesses and deficiencies in high school graduates, as they prepare to get into science and or engineering, are listed in Table 2. As previously noted, (2, 3) the reluctance or inability of decision makers to reform public education in the Region has continued to adversely affect outcome. Students finishing high school and applying to engineering are only marginally prepared. To rectify the current situation and rid the schools of the Region of the “malaise” that has gripped public education, at all levels; bold steps have to be taken by policy makers, i.e., to start a “reformation” process that will eventually do away with the existing “traditional” methods in favor of “student-centered” approach that has “active learning” as a prime feature.<sup>(4, 10)</sup>

**iii. Proposed Measures:** Forging long-lasting relationships with industry is a quest that colleges of engineering in the Region should embrace and work hard to achieve. As faculty members, we cannot be professionally satisfied with teaching only. Today, with the engineering profession undergoing dramatic changes on many fronts – there is need to be involved with real problems and to share in providing solutions. We owe it to our students to prepare them to meet the challenge ahead by focusing on real issues derived from tangible situations. Drawing materials out of textbooks is not enough; we do need to bring our own contributions to the classroom!

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Therefore, we have to communicate with industries around us and genuinely attempt to understand their point of view.

Table 2: Author's perception of weaknesses in high school graduates applying to Engineering

- Insufficiency in math & science and lack of real understanding of basics in both!
- There is a “disconnect” between pre-university courses and first year engineering.
- Their “thinking” process is primarily confined to what they have been tutored to respond to. They remember only what they have memorized!
- Their communication skills (including English language) are well below the required levels for entering engineering.
- Inability to improvise and/or consider alternatives.
- Trained primarily to work as individuals. No experience working in groups.
- Do encounter difficulties: when integrating knowledge, connecting previously acquired knowledge with more recently learned, in seeing interactions between different concepts, and in conceptualizing in general.
- Do lack the drive, the patience, and the discipline to carry out independent tasks.

It is argued that, constructive measures have to be taken to rectify the current stalemate and turn things around. The measures referred to would include the following:

- (i) Introduce sweeping changes to current regulations and bylaws, in an attempt to reduce red tape that impedes the process. To be effective, these changes have to be recommended by the University administration and mandated by the Government.
- (ii) Encourage faculty members (expatriates and nationals alike) to reach out to the industrial sector to cultivate meaningful contacts, develop (one on one) connection with their counterparts, and attempt to gain experience in their area of specialization.
- (iii) Institute a Faculty Fellowship Program, where tenured or tenure-track engineering faculty could spend 10 weeks, a semester, or an academic year gaining valuable industrial experience in their field of technology; preferably in the locale or the Region
- (iv) Facilitate the formation of “symbiotic” partnerships between selected people of industry and faculty members through: senior capstone projects, research projects in selected domains, and in areas of relevance to the Region.
- (v) Set up advisory boards to facilitate collaborative efforts and to provide logistical support to collaborators. Also, to restructure programs, redefine mission, and provide required resources to parties on both sides, i.e., industry side as well as academic side.
- (vi) Encourage experienced engineering personnel from surrounding industries, who may be interested in working with students, to take part in teaching and guiding senior students, i.e., with particular reference to capstone design.

The most probable areas for such collaborative ventures in the foreseeable future are:

- short-term, stop-gap consultation, trouble shooting, and professional advice by experienced well-seasoned faculty, in sought-out domains;
- longer term joint research studies aimed at resolving chronic problems of industry, and help find longer lasting solutions;

- help the industry in setting up appropriate analysis and design methodology, and help develop applicable standards and relevant testing methods.

The author is of the opinion that the initial hurdle is to get started. Faculty and staff members with industrial experience are ideally positioned to play a major part at the start of a collaborative joint venture. Their insight and experience would help greatly in defining the mission and chartering an appropriate “workable” course of action.

Contrary to what some entrepreneurs in the Region believe, joint participation need not be for philanthropic reasons; nor should it be undertaken to gain favors, improve company’s image, or win government approval. These ventures can, and thus should, provide real benefits for all involved. Industry can benefit by gaining access to university facilities and its human resources. Also, by receiving the services and products that faculty and staff generate. In turn, joint collaboration can provide the College with additional revenue and access to industrial equipment and setups not available on campus. Successful ventures also help overcome the complaints about engineering education: lack of hands-on experience, not enough teamwork, and textbook problems rather than real-world application. Students’ involvement in such collaborative efforts can boost their self-confidence and help in improving their communication skills. Joint undertakings could provide professional development to faculty members as well, by exposing them to practical situations and relevant technologies. As an added benefit, and when conditions are right, project data and outcome may get published, thus enhancing faculty members’ list of publication. Invariably, we will continue to have those who can research and publish on their own; but, at the very least, the *lone wolves* will have to learn to travel in more collaborative packs.

**iv. Some Encouraging Results:** Although the overall impression portrayed here, on collaboration of engineering colleges and surrounding industries of the Region has not been positive, to say the least; there are nevertheless some success stories that deserve to be reported.

During the late seventies, the Research Institute of King Fahd University of Petroleum and Minerals (KFUPM), Dhahran, Saudi Arabia was founded. Housed on campus, with its own skeleton staff and facilities; it began to reach out to potential partners (industry and government) with a well-defined mission. Despite some setbacks in the beginning, the Institute became fully operational within a few years. It has been rendering services to participating industries and Government agencies in the domains of: economic modeling, oil and gas technologies, water resources management, environmental impact studies, characterization and testing of materials, setting up new standards, etc., plus other domains. All faculty/researchers at KFUPM are encouraged to contribute to the arena of applied research projects and consultancies through the Institute. Faculty are encouraged to remain abreast of the needs of local industry and government organizations, and to be able to address the inherently practical nature of problems encountered in a modern society.<sup>(11)</sup> Quoting from the Institute’s website “*Opportunities for faculty and researchers to interact with industry and serve the needs of society arise on a regular basis. These opportunities vary from broad basic studies to very specific problem solving situations. Many of these studies require multidisciplinary teams, which span many academic departments, divisions, and subject areas.*”<sup>(11)</sup> Through cross-coalition collaboration, the Institute has developed proper exchange and resource links among a host of in-house researchers and their counterparts in industry;

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thus enabling researchers to focus on issues and concerns of local industries. The synergy of this interaction and resulting research will benefit all concerned.

In the author's opinion, the Research Institute of Dhahran, Saudi Arabia is a success story by all measures. Factors contributing to its success have included:

- its well-defined mission and appropriate organizational structure;
- its proper administrative setup with staff that can relate to industry, thus help foster collaboration; and
- having campus as home-base has helped provide easy access to university's vast human resources.

Perhaps additional factors that may have come to play in the case of KFUPM Research Institute, is its unique position with, and close proximity to, Saudi Aramco, the largest oil producer in the Middle East. KFUPM has always enjoyed the tremendous support provided by Saudi Aramco since its establishment.

### **3. CONCLUDING THOUGHTS AND SUMMARY**

Engineering colleges in the Arab Gulf States (Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates, and Oman) – established in the late sixties, seventies and early eighties, and modeled after North American colleges, has many of the symptoms that “beset” engineering institutions in their natural sequence of progression. Changes in the external environment (increased costs, reduced funding, technological innovations, and demands by industry for better prepared graduates) coupled with the quest for educational relevance in undergraduate engineering education, are ample reasons for the colleges of the Region to “update” and “revise” current systems in a direction consistent with societal needs.

Amongst the many issues being debated on college campuses today, is the need to collaborate with industry in the Region, in order to meet common goals and work harmoniously together in equipping graduates with the skills and traits desired by the industrial sector. In order to better prepare young graduates, and foster improved technology transfer practices and policies, the industry of the Region will need to seek stronger voice in academia. Unfortunately, academia has been reluctant and slow in “opening up” to industry. Apparently, engineering educators in the Region have not as yet conceived of working with industry to increase “relevance” in higher education, and many see no motivation for change at this time.

These problems are ripe for change, but, in the short-term, the outlook is not very encouraging. On the whole, industry in the Region is not calling on engineering educators and educational policy makers, to reform higher education. Also the rigid education system, that currently grips the Region, seems to perpetuate itself. Challenging times await!

The paper sheds light on the complex issues that appear to have curtailed proper and enduring connections between academia and industry in the Arab Gulf States, and argues for the urgent need to establish proper relations, at the grass-root level so that the interests of people on both sides of the isle (students, graduates, academics, industrial managers & staff, researchers, etc) will be properly served. Making headway, through collaboration, would eventually “bridge the gap” between academia and industry, resulting in better prepared students for the challenges ahead.

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