

Research strategy for a newly established college of engineering

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ABSTRACT: This article presents the research strategy of the College of Engineering at King Faisal University, Al-Ahsa, Kingdom of Saudi Arabia. The research directions identified were based on industry needs, and the College's current and potential capabilities. The College adopted several approaches to survey the market and to collect information that could help to achieve this endeavour. The initiative of establishing scientific chairs to have more focus on research themes, as well as to build expertise in these themes are clarified. The research thrust on asphalt pavement and the establishment of a chair on this theme are also a focus of this article.

INTRODUCTION

King Faisal University (KFU) was established in 1975 in Al-Ahsa, Kingdom of Saudi Arabia with the goal of contributing to spreading knowledge and regional development through quality education and research. KFU has witnessed substantial growth and expansion in terms of student enrolment, academic programmes and degrees offered, and published research.

The College of Engineering at KFU was established in 2009 and since then, it has adopted a scientific approach based on the principles of strategic planning in order to achieve excellence and build a brand name. The vital importance of strategic planning lies in identifying priorities and allocating resources to maximise return on investment [1], especially, in light of the frenetic competition for resources, human and otherwise, as well as the fact that there are hundreds of other colleges that had a lead in terms of tradition and resources.

One major facet of strategic planning at the College of Engineering involves specifying an identity for the College as manifested by forging vision and mission statements and a set of values followed by a strategy to guide activities over a given period of time [2]. All along the process, the College was conscious of the fact that its strategy draws on and supports KFU's strategic plan, vision and mission. In order to implement the strategy, a detailed operational plan is put down. To measure and assess the extent of success, a set of key performance indicators (KPIs) for each level of planning are identified. The three levels of strategy and the framework of the strategic plan are shown in Figure 1 and Figure 2 below.

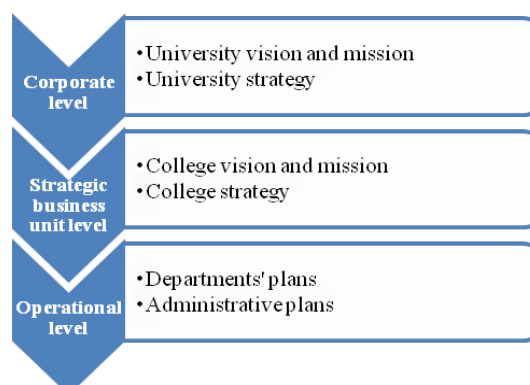


Figure 1: The three levels of strategy.



Figure 2: The framework of strategic planning.

This article presents the research strategy of the College; specifically, it shows the research thrusts and directions, how they were identified, and sheds light on one of the mechanisms that was adopted to build and develop the expertise in these directions. The graduate programmes framework that was designed to align the graduate education with research is also covered.

OPPORTUNITIES AND CAPABILITIES

Sound strategic decisions require information about potential opportunities and capabilities. In light of this fact, the College has adopted a proactive approach and conducted numerous market surveys that included meetings, questionnaires, workshops and an international conference. College stakeholders who participated in such surveys included SAUDI ARAMCO, SABIC, Honeywell, the Advanced Petrochemical Company, the Saline Water Conversion Corporation, KAPSARC and the Alkazaf Saudi Company.

Based on these market surveys, the College has identified a number of potential opportunities the most important of which include the great market demand for engineering graduates, location next to a major petrochemical industry base and world leading companies, readily available and secured government financial support, and strong support from the Ministry of Higher Education for collaboration with international organisations.

Furthermore, the College has underlined a set of capabilities on which it can build, including KFU's top management support, distinguished faculty members with high calibre expertise in education and research, and an excellent network of relations with prestigious international academic and industrial organisations, access to existing specialised research laboratories and centres on the KFU campus, as well as an adequate KFU budget.

COLLEGE IDENTITY

The College identity was defined according to the determination and analysis of the opportunities and capabilities and in such a way that it is aligned with KFU's vision and mission that highlight distinguished education and research to serve KFU's main theme of community engagement. The major items that define the College of Engineering identity are:

Vision

The College of Engineering aspires to be recognised for supporting and sustaining the success of its community and stakeholders to contribute to the Kingdom's development objectives and enrichment of humanity.

Mission

The College of Engineering strives to provide quality services through partnership with the community by demonstrating its commitment to:

- *quality education that prepares graduates through a project-based curriculum with broad basic engineering knowledge to be professionals and to pursue postgraduate studies and research.*
- *quality research that leads to better solutions to hot arid region issues with emphasis on efficiency as it pertains to cost minimisation by working closely with industry and research centres.*

Values

As the College of Engineering realises that different types of competitive advantage correspond to and require different sets of values, the College has selected the following list as its values based on the competitive advantages it seeks to accomplish; namely, quality and community engagement (partnership):

- Planning and continuous assessments and improvement;
- Transparency;
- Understanding the needs of customers;
- Close relationship with customers that is based on courtesy, patience, appreciation and continuous communication;
- The eagerness to provide complete solutions;
- Flexibility through employee empowerment and decentralisation;
- Continuous improvement and learning process;
- Team work;
- Commitment through compliance with procedures, regulations and standards;
- Initiative.

RESEARCH STRATEGY

The research directions were identified according to industry needs and the challenges that are of most significance to the national economy. It was not difficult for the College to underline the issues of national significance within the Saudi Arabian context but it further elected to categorise them under two main classes: competitive advantages and competitive disadvantages [3]. A competitive advantage is an industry or sector where Saudi Arabia enjoys an apparent strength in which it can compete globally (such as oil and gas, and petrochemicals), while a competitive disadvantage refers to a problem or challenge in Saudi Arabia that calls for urgent action like water scarcity and corrosion.

In its efforts thus outlined, the College focuses on specific industries/sectors perceived as most affected by these issues. These industries or potential customers include oil and gas, petrochemicals, fertilisers, mining, energy, water desalination, telecommunications, transportation, construction, air conditioning and energy-efficient buildings, and healthcare facilities.

It is obvious that these themes are quite broad and, therefore, the College has been seeking to narrow them down and be more focused. To this end, the College has passed through two phases: the first entailing selection of the core competency where the College singled out *efficiency* among other significant potential competencies, such as reliability, safety, standardisation, etc. Under the umbrella of this core competency - efficiency - the College has selected the following research thrusts:

- High temperature climate and discomfort;
- Air conditioning and energy-inefficient buildings;
- Corrosion;
- Sand and dust storms;
- Water scarcity;
- Open, unpopulated, and underserved areas;
- High energy consumption.

Using these thrusts, the College went on to the next step to get even more research focus in each theme. It followed several paths including conducting workshops, organising an international conference and hosting international research figures. Based on the outcomes of these paths and other important information, the College drew on the various research expertise and creativity of existing faculty from different disciplines to come up with precise possible research thrusts.

One of the initiatives adopted by the College to build expertise in the research thrusts was establishing scientific chairs. The College has set a list of carefully examined measurable key performance indicators KPIs for the research component, believing that what cannot be measured cannot be managed [4]. The list includes the following:

- Funded research:
 - Internal funded projects (KFU);
 - External funded projects (KACST, SABIC, ARAMCO, etc);
 - Consultancy projects.
- Publications:
 - Number of published international journals;
 - Impact factor of the journal;

- Number of published book chapters;
 - Number of published conference papers;
 - Workshops.
- Awards;
 - Fellowships;
 - Patents;
 - Concentrated research:
 - Research conducted within the College identity;
 - Applied research to help the local community.
- Research activities:
 - College of Engineering organising conferences;
 - Editorial board involvement of a scientific journal;
 - Peer review involvement of a scientific journal.

THE SCIENTIFIC CHAIRS

Scientific chairs are financial grants provided by individuals or organisations to support scientific research and education in higher education institutions. The College of Engineering has given this issue a particular attention because of its conviction that such initiatives agree with and support its strategic priorities and contribute to its distinction. The academic staff (faculty) at the College have been asked to propose specific themes for possible scientific chairs.

Twenty-eight proposals, each with a theme title, description and value were submitted. The list was also narrowed to eight priorities based on the implementation of an *importance* criterion. The chair will be important, if it exploits the environmental opportunities and utilises KFU and College capabilities. The criteria were evaluated according to a scale of three levels: low, medium and high. Tables 1 and 2 contain the criteria, their clarifications and the scales.

Table 1: Criteria for evaluating opportunities.

Criteria for selecting the research themes		Evaluation		
Criteria	Details	Low 1 - 2	Medium 3	High 4 - 5
The theme is consistent with Saudi Arabia identity and strategy	Raise living standards and tackle poverty, diversify the economic base, and develop human resources and improve the outcomes of education and training and address the problem of unemployment, relocation and expatriate labour, the sustainability of natural resources, such as water, agricultural land, and prevent it from deteriorating and to stop desertification and preserving the environment and cleanliness, achieving balanced development between regions, supporting industries with competitive advantages, because of the comparative advantage, such as sources of fossil and renewable energy, mining, petrochemical and palm trees, food processing, fisheries and tourism, as well as contributing to confront the strategic challenges faced by SA that include water, high temperature, high consumption of energy, sandstorms and sand encroachment, wide geographical area, high population growth, environmental pollution, and modern and settlement disease.			
The theme is consistent with Al-Ahsa identity and strategy	Improve the level of medical and educational services, care for the elderly, disabled, and other segments of society, follow-up of compliance with environmental standards in the extractive industries such as cement, support the tourism industry and the preservation of heritage, promote a dimensions of Al-Ahsa identity as a destination for the GCC countries, promote the spirit of brotherhood, openness and citizenship, support the agriculture industry and food processing with more emphasis on palm trees, dates and water, and to encourage growth in the energy sector.			
Industry attractiveness	Limited competition in the chair theme sufficient attention by universities and research centres in the Kingdom is not given to it, there are no chairs or research centres similar to the chair in SA, and the entry into the chair theme is not easy because it requires advanced factor of production.			

The demand	The demand for the outputs of the chair is high, the demand is also complicated, and the customers are strong in terms of their impact on the economic and social conditions in SA.			
Possibility of being differentiated and expansion	There are several sub-areas under the chair theme, particularly those associated with the local environment of SA and Al-Ahsa. And the demand for the chair outputs is expected to grow due to expansion of related and supporting industries.			
Possible accessibility	Possible access to technologies associated with the chair, possibility of establishing networks of researchers and specialists, in addition to the possibility and the probability of getting funding.			

Table 2: Criteria for evaluating capabilities.

Criteria for selecting the research themes		Evaluation		
Criteria	Details	Low 1 - 2	Medium 3	High 4 - 5
The theme is consistent with the University mission and strategy	Community engagement, continuing education and e-learning, leadership, integrity, talent and creativity, productive educational environment, quality and academic accreditation, educational goals (skills and attitudes), date palm research, water, fish, birds and endemic diseases, and solutions to hot arid regions.			
The theme is consistent with the identity of the scientific chairs programme in the University	Support the success of individuals in issues that include entrepreneurship, leadership and teamwork, emotional intelligence, communication and dialogue, sense of belonging and avoid extremism, conviction and rationalise consumption, proper nutrition, practice sports, and avoid causes of diseases and disabilities, and drugs. Also, support the success of organisations through conducting researches that build and maintain its competitiveness and support business ethics.			
Production capabilities	The University has the ability to succeed in the theme of each scientific chair as it has faculty members and researchers in the chair theme, and it has graduate programmes and research laboratories, and there is a synergy between colleges.			
Market share	The University has good facilities and infrastructure in the theme of the chair. It has good size and quality of research, partnerships with universities, research centres and researchers, and the production of the University in the field of the chair is constantly growing.			
Sustainability	Saudi faculty in the chair theme are available, and the faculty who propose the chair are qualified.			
Possible accessibility	Possibility of getting a distinguished professor to be the chair professor, availability of a qualified supervisor in the College, and there are staff in the University who have a link to a potential sponsor.			

The proposed scientific chairs were allocated on a matrix based on the evaluation shown in Figure 3. The matrix has three zones: green where both opportunities and capabilities are high or one is high and the other is medium; red where both opportunities and capabilities are weak or one is weak and the other is medium; and yellow where both are average or one is high and the other is weak. Proposed chairs in the green zone were selected. Again, out of the 28 proposals, nine were selected.

THE SYNERGY BETWEEN GRADUATE PROGRAMMES' STRATEGY AND RESEARCH

The college recognises the significance of graduate programmes as a strategic direction that should eventually complement the College's research priorities and support its mission in the research component that will work to solve pressing national problems.

In the process, a number of challenges were identified and the College has established a framework for its graduate programme. Thirty credits are required to fulfil the MS programme, of which nine credits and a thesis are devoted to a specialisation. The specialisations that should be offered by the College are consistent with its strategic priorities.

A key feature of the framework involves three parties: the College, an industry partner and an international academic partner that is either a university or research centre. The major strength in this framework lies in the synergy among these three parties. The College expects that its graduate programmes will begin in the academic year 2015.

		Opportunities		
		High	Medium	Low
Capabilities	High			
	Medium			
	Low			

Figure 3: The opportunities and capabilities matrix.

TRANSPORTATION AS A STRATEGIC THRUST

Transportation has been selected as one of the College's potential research priorities. Under the transportation umbrella, several themes were identified. Three of these themes will be the focus of the College; rails, asphalt pavement and tunnels. As mentioned before, in the implementation phase, the College has adopted a range of initiatives among which establishing scientific chairs and contacting several scholars to serve as chairs and companies for possible funding. After several meetings with the Consulting Service Department at Saudi ARAMCO, detailed technical and commercial proposals for establishing a scientific chair on asphalt pavement were developed. Saudi ARAMCO has agreed to sponsor this chair.

Two scholars in the area of asphalt pavement were chosen to carry the scientific chair functions and responsibilities. Dr Dallas Little from Texas A&M University has been appointed as the Chair Professor and Dr Imad Al-Qadi from the University of Illinois at Urbana-Champaign has been assigned as the Chair Advisor. The College will partner with Saudi ARAMCO and the Ministry of Transportation from the industry as the industry partner and Texas A&M University and the University of Illinois at Urbana-Champaign as the international partners. The College believes that such a partnership is essential for building a brand name for the College in the area of asphalt pavement, which will have a positive impact on industry.

The Chair will perform several tasks that include the following:

- Develop a strategic plan for establishing a Sustainable Transportation Centre (STC). The Chair/Advisor will work towards establishing objectives and goals to bring synergy among the undergraduate and graduate programmes and research plans aimed toward academic and research focused on asphalt technology and pavements. This will be incorporated in the KFU research and education infrastructure, transportation sustainability initiative and the civil engineering programme in general.
- Develop an operational plan for KSU Research Laboratory. The Chair/Advisor will identify equipment and support staff needs to insure that the KFU asphalt materials laboratory will be able to support the mission of the STC and its strategic plan.
- Identify more focused research needs based on input from stakeholders, including governmental agencies and industry. At present, the Chair/Advisor suggest the establishment of two research initiatives in 2014: 1) utilisation of sulphur produced as a by-product in the region, especially, for the use in modification and extension of asphalt binder; and 2) materials characterisation of local materials.

CONCLUSION

The newly established College of Engineering at King Faisal University has applied the concepts of strategic management to decide its research priorities. Very narrow themes were identified based on several methods of market surveys and faculty expertise, and creativity. Several scientific chairs were established as an initiative to build expertise and competency in specific research thrusts.

A chair on asphalt pavement that was sponsored by Saudi ARAMCO and a chair on rail research that was sponsored by KFU have been established recently. These two themes, in addition to the tunnels theme will constitute the transportation centre. The College has a clear picture of where to go and how to reach, and it expects that it will soon be able to build a brand name for the College.

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