

Suitability of Environmental Engineering Program for Female in Saudi Arabia: A Case Study on King Faisal University

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Abstract: The purpose of this study is to investigate suitability of Environmental Engineering Program for female in Saudi Arabia focusing on King Faisal University as a leading and recent university offered an Engineering Program for female and encourage women's multidisciplinary education and empowerment through its vision, mission and values. Environmental education for females play vital role in transferring the knowledge to generations resulting in environmentally educated generation. Woman, by her nature as a mother, teaches her children how to make use of available environmental resources. She trains them on economical and effective ways to use water. As well as, she teaches them how to commit to buy what they need without exaggeration. Moreover, she directs them to reduce their daily waste protecting the environment from waste pollution and might provide simple and possible recycling and reuse of dwellings' waste. Participation of both women and men are needed to secure a clean environment and sound life free of toxins and pollutants reflecting on a prosperous economy. Environmental Engineering program for females is essential, distinguished and unique program ensuing strategic plan for King Faisal University that encourages empowerment of women. This program will play a vital role in fill up the gap in engineering profession and contribute to the cultural construction of the nation, as well as being a start point to introduce the concept of scientific, technological and business incubators in the Kingdom.

Key words: Female • Environment • Engineering • Program • King Faisal University • Saudi Arabia

INTRODUCTION

Environment is all it takes in this universe of air, water and soil, so when it is maintained a clean life free of pollution is maintained. The environment is a source of life on Earth and determines the presence of growth and development and directed all human innovations. Environment has a direct impact on the physical, social and economic welfare as long as healthy life is the concern. It is recognized that the majority of diseases known to man, especially in developing countries, are due to contaminated water and poor environmental sanitation and lack of knowledge and environmental awareness. Women have a vital role in promoting environmentally responsible behavior in residential surroundings as well as in all activities related to the conservation of natural resources and economic development [1]. Regardless gender, everyone male or female must have a role to preserve environment and support sustainability. Union and helping each other (male and female) will

make greater achievement than we expected. It is not possible to allocate responsibility and identified only by preserving and protecting the environment in isolation from women. Certainly, the greatest role of women in environment is her natural role with her children from birth. She trains them how to maintain their lives. She teaches them environmental hygiene including food, water, dwelling, clothing and maintaining good behavior that ensures a clean life away from diseases and epidemics with the preservation of natural resources, which are limited.

Accreditation Board for Engineering and Technology, ABET, defines engineering as "Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. " [2]. History of women in engineering predates the development of the profession of engineering itself.

Before engineering was recognized as a formal profession, women with engineering skills often sought recognition as inventors, such as Hypatia of Alexandria who is credited with the invention of the hydrometer. In Saudi Arabia, there is 24 Governmental universities [3] among them there is only one engineering program offered for females. Biomedical engineering program is new program offered for females at only two universities. In 2010 Dammam University accepted females for the biomedical engineering program [4], while King Faisal University after two years [5]. Both universities are located in the Eastern Region of Saudi Arabia. Table 1 shows another two colleges offer engineering programs for females located in the Eastern part of Saudi. Nevertheless one of them is offering engineering programs for male and female at same time and location, while the other is a private college. Environmental Engineering program for females is never offered in Saudi.

Environmental Engineering Program for Females:

Environmental Engineering is the branch of engineering concerning the application of scientific and engineering principles for: 1) protection of human populations from the effects of adverse environmental factors, 2) protection of environments, both local and global, from the potentially deleterious effects of natural and human activities and 3) improvement of environmental quality. Environmental engineering can also be described as a branch of applied science and technology that addresses the issue of energy preservation, production asset and control of waste from human and animal activities. Furthermore, it is concerned with finding plausible solutions in the field of public health, such as waterborne diseases, implementing laws, which promote adequate sanitation in urban, rural and recreational areas. Moreover, it involves wastewater management and air pollution control, recycling, waste disposal, radiation protection, industrial hygiene, environmental sustainability and public health issues as well as knowledge of environmental engineering law. It also includes studies on the environmental impact of proposed construction projects[5].

Environmental engineers study the effect of technological advances on the environment. They might conduct studies on hazardous-waste management to evaluate the significance of such hazards, advice on treatment and containment and develop regulations. Environmental engineers also design municipal water supply and industrial

wastewater treatment systems as well as address local and worldwide environmental issues such as the effects of acid rain, global warming, ozone depletion, water pollution and air pollution. Environment intervene in most engineering disciplines includes: Environmental Technologies, Environmental Science, Rural Development, Environmental Engineering and Built Environment, Environmental Health, Environmental Chemistry, Environmental Protection, Environmental Laws and Regulations, Environment and Islam, Environment and Sustainable Development, Public Health Engineering, Community Health, Occupational Safety, Environmental Safety, Management and Reduction Of Pollutants, Integrated Management Of Water Resources, Waste Management and Environmental Feasibility Studies[6].

Woman, by her nature as a mother, teaches her children how to use water properly and, clean, free of pollutants. Moreover, she trains them on economical and effective ways to use water that directly affect water availability and sustainability. In addition to that, she directs them to reduce their daily waste protecting the environment from waste pollution and might provide simple and possible recycling and reuse of dwellings' waste. As well as teach them how to commit to buy what they need without exaggeration, because over their need goes to waste and counted in a way or another as waste pollution. As well as teaches them how to handle and safe dispose hazardous waste. Hence environmental education for females play vital role in transferring the knowledge to generations resulting in environmentally educated generation. Therefore, participation of both women and men are needed to secure a clean environment and sound life free of toxins and pollutants reflecting on a prosperous economy[7].

Environmental Engineering Program for Females at King Faisal University: The program could be offered by King Faisal University following its mission vision and values.

King Faisal University, KFU, Vision, Mission and Values

Vision: Leadership in community partnership through excellence in education and scientific research and leadership.

Mission: Serving community through excellence in learning, education and scientific research, continuous education opportunities, efficient management, leadership development and Community partnership for mutual enrichment.

Values: Excellence, effectiveness and efficiency, Integrity, Lifelong Learning, Creativity, Community partnerships, Openness and flexibility[8].

College of Engineering at King Faisal University Vision, Mission and Values

Vision: The College of Engineering aspires to be recognized 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 for providing quality services through close partnership with the community by demonstrating commitment to

- Quality education that prepares graduates through a project-based learning with broad basic engineering knowledge to be professionals and to pursue postgraduate studies and research.
- Quality research that leads to better solutions of engineering-related problems with emphasis on issues of national significance by working closely with industry and research centers.

Values: As the College of Engineering realizes that different types of competitive advantages correspond to and require a different set 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). The list of the College values is as below[9]:

- Academic excellence and freedom.
- Assessment and continuous improvement of our programs and processes.
- Being a collaborative part of King Faisal University.
- Diversity among our students, faculty and staff.
- Professional development of our students.
- Success of our students and seek to know them personally.
- The personal and professional development of our faculty and staff.
- Transparency teamwork and initiative.

Proposed Environmental Engineering Program Mission, Vision & Values

Vision: To be a reputable academic domain graduating competitive environmental engineers who can work as designers or managers in the public or private sectors by applying and developing new technologies to minimize pollution to air, land and water resources.

Mission: To offer quality undergraduate, graduate and research programs in environmental engineering that prepare graduates with a sound profession, develop their skills, enhance and maintain sustainable economic development efforts and provide authoritative guidance to stakeholders with a sense of environmental ethical values and social responsibilities.

Values: The department is guided by the values of College of Engineering. Therefore, it will stick to the list of the College values that mentioned previously[10].

Program Admission and Curriculum Development

Program Admission: Similar and parallel to all programs offered by College of Engineering, all newly admitted students to the program must successfully complete the preparatory year according to its regulations. Once the student is registered in the College of Engineering, she must complete two semesters (34 credit hours) and earn at least 3.0 out of 5.00 before selecting the engineering program for females.

For program selection, students are encouraged to complete the attached program selection form and submit it to Dean, before the beginning of the final exams for their current semester. After the final exams are graded and students' GPA are updated, the program selection forms will be reviewed by the college council and assign the program request based on the program requirements and student accumulative GPA[11].

Curriculum Development: Environmental engineering is a relatively new discipline of engineering compared to other classic disciplines (civil, electrical, mechanical and petroleum).

The program passed through several stages of development that incorporated:

- Initiation of curriculum by one faculty member in 2016.
- Regional and International reviewers: inside KSA, within Gulf region and worldwide.
- Benchmarking with similar programs within and outside the Kingdom.

Chart 1 below shows the administrative structure for the proposed environmental engineering program, while Chart 2 shows periodical quality assurance review for the proposed environmental engineering program respectively[12].

Environmental Engineering Program Educational Objectives:

The program educational objectives for the environmental engineering program reflect the mission of King Faisal University and concerned Engineering Departments. They are important for successful professional practice and the ability to pursue advanced degrees. The environmental Engineering graduates from the faculty of Engineering, King Faisal University will be prepared to:

- Use technical, teamwork and communication skills, along with leadership principles, to pursue environmental engineering careers in environmental Engineering areas and/or other fields.
- Pursue graduate degrees in environmental engineering and other fields and engage in life-long learning through independent study and by participating in professional conferences, workshops, seminars, or continuing education.
- Pursue professional licensure, function ethically in their professional environmental engineering roles and understand how variable engineering projects affect society and the environment [13].

Market Demand for Environmental Engineering Profession:

Broad prospects for the proposed future environmental engineering profession for females. The environmental engineer graduate of the proposed department at College of Engineering, KFU, can participate:

- Modeling and Environmental Projects Design.
- Research and Development.
- Consulting.
- Management and Administration.
- Planning and Decision Support.
- Contracting.
- Project Implementation
- Building Capacity and Human Development.
- Community Awareness.
- Environmental Impact Assessment.
- Environmental Monitoring and Quality Control.

Market Response for Environmental Engineering Graduate:

The graduate of this department can acquire an outstanding career and leading role in any of the following domains:

- Industrial field for the purpose of curricula development and pursue the guarantor mechanisms to protect the environment of industrial facilities and corporations

- Environmental institutions to reduce the effects of pollution, save and reduce it.
- Environmental products and services companies that innovate units and devices used in environmental areas.
- Mining, oil and industrial security systems, curricula consultancy, chemical and industrial enterprises.
- Research and technological institutions and productivity in all social and humanitarian areas.
- Sales, marketing, trade environment, trade points and virtual markets.
- Business management and environmental management.
- Environmental consulting.
- Environmental quality control bodies (water, air and soil).
- Energy resources and support systems.
- Waste management and recycling companies and preserving nature.
- Terrain planning organizations, geographic information systems and geographic locations.
- Education and teaching of environmental engineering and environmental education.
- Postgraduates for higher diploma and master's and doctoral degrees in engineering and environmental sciences.
- Vocational and professional training and environmental engineers and workers in the environmental systems of purification and hygiene, treatment, recycling and reuse and others.

Promising Job Market in Saudi Arabia and Arabian Gulf:

Promising job market in the Kingdom and Gulf area featuring a huge collection of companies, organizations, departments and units that are involved in environmental engineering. Among them:

- Light and heavy industries, petroleum and petroleum products such as Aramco, SABIC Sadara and SAFCO.
- Desalination and research units such as Saline Water Conversion Corporation (SWCC) and General Presidency of Meteorology and Environmental protection.
- The Royal Court and Principality and the Secretariat of the Eastern Region.
- Government ministries such as Industry, Water, Electricity and Agriculture, Health, Municipal and Rural Affairs, Petroleum and Mineral Resources and Public Works and Housing.

- Entities of the public works, construction, administration, water treatment, reclamation and reuse waste water, air pollution control, management of solid waste, soil treatment, noise pollution control and public health engineering.
- Development of special environmental Advisory Office for the proposed engineer to design, implementation, construction, research, development, consultancy and visibility studies.

Salary survey released by the American Association of Engineering Societies (AAES) shows that women received nearly one out of every five Bachelor and

Masters' degrees in Engineering. This percentage increases in case of Environmental Engineers (2) [14].

Local, Regional and Global Organizations Involved in Environmental Engineering: There is a quite number of national organizations and agencies at local, regional and international offering opportunities for environmental engineers with all countries of the world without exception in environmental affairs including United Nations (UN), Consultative Group on international agricultural research CGIAR, UNESCO, WHO, UNEP, WFP, IMO, FAO, UNIDO, WIPO, UNICEF, UNWTO, WMO, GWP, IMF, WB, ADB, WWC, APWF, ADB, AMCOW, UNHABITAT, GWA, WSSCC, USAID, WTO.

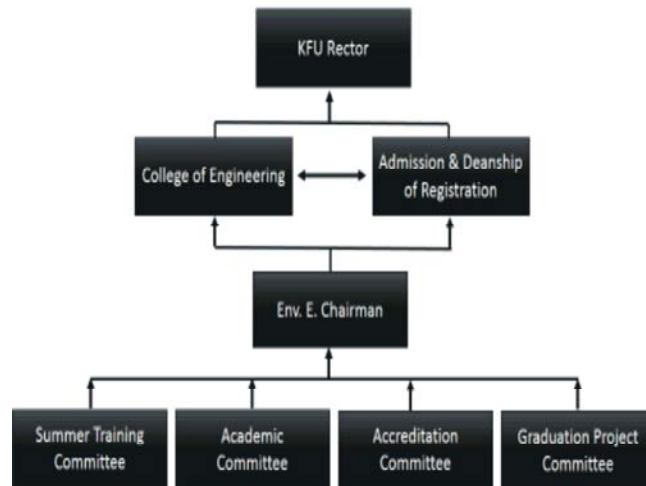


Chart 1: Proposed Administrative Structure for Environmental Engineering Program

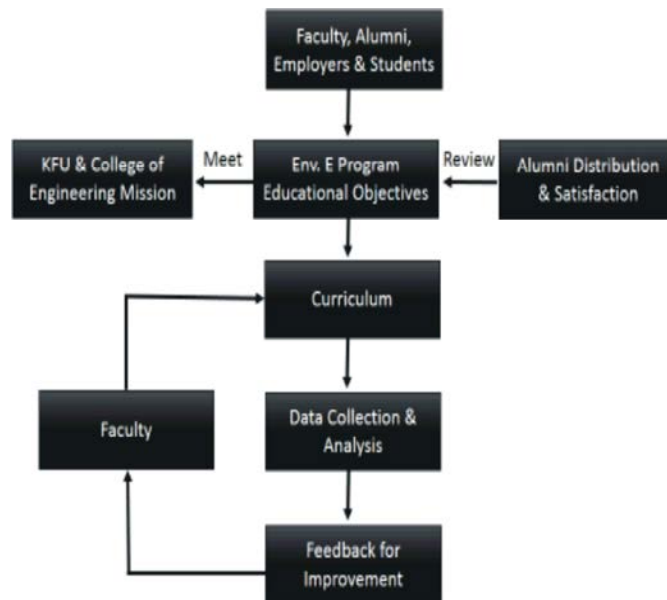


Chart 2: Periodical Environmental Engineering Program Review Process for Quality Assurance

Table 1: Engineering schools in Saudi Arabia

University	Eng. Dept.	Gender	Link
Umm Al- Qura	Electrical, Civil, Mechanical & Islamic Architecture	Male	http://uqu.edu.sa/engineeringarchitecture
Al-Imam Muhammad Ibn Saud	Electrical, Civil, Mechanical Chemical & Architecture	Male	http://www.imamu.edu.sa
King Saud	Electrical, Civil, Mechanical Chemical, Industrial, Petroleum and natural gas, Telecommunications and Electronics	Male	http://engineering.ksu.edu.sa
King Abdul-Aziz	Electrical, Civil, Mechanical Chemical, Material, Industrial, Mining, nuclear and Computer	Male Female	http://engineering.kau.edu.sa
Alfaisal	Mechanical, Industrial, Electrical, Software & Architecture	Male	http://www.alfaisal.edu/ar
King Fahad for Petroleum and Minerals	Information Systems, Electrical, Civil, Mechanical Chemical, Petroleum & Aviation	Male	http://www.kfupm.edu.sa/ces
Al- Qassim	Electrical, Civil & Mechanical	Male	www.qec.qu.edu.sa/
King Khalid	Electrical, Civil, Mechanical Chemical & Industrial	Male	www.kku.edu.sa/male_engineering
Taibah	Electrical, Civil, Mechanical Chemical, Industrial & Architecture	Male	www.taibah.edu.sa
Taibah (Yanbu)	Electrical, Mechanical, Computer and information systems	Male	www.taibahu.edu.sa
Taif	Electrical, Civil & Mechanical	Male	web.tu.edu.sa/tu/ar/college-ofengineering
Hail	Electrical, Civil, Mechanical & Chemical	Male	www.uoh.edu.sa
Gazan	Electrical, Civil, Mechanical Chemical, Industrial & Architecture	Male	www.colleges.jazanu.edu.sa/
Al Jouf	Electrical, Civil& Mechanical	Male	www.ju.edu.sa/colleges/eng
Al Baha	Electrical, Civil, Mechanical, Computer & Architecture	Male	http://portal.bu.edu.sa/web/faculty-ofengineering
Tabuk	Electrical & Civil	Male	www.ut.edu.sa/
Najran	Electrical, Civil, Mechanical Chemical, Industrial & Architecture	Male	portal.nu.edu.sa/web/engineering-college
Northern Border	Electrical, Civil, Mechanical Chemical, Industrial & Material	Male	http://www.nbu.edu.sa/Colleges/Arar/Pages/CollegeOfEngineering
Dammam	Environmental, Construction and Biomedical	Male Female	www.engineering@ud.edu.sa
Prince Sultan	Management, communications and networking	Male	http://www.psu.edu.sa/colleges/Engineering
Prince Muhammad Bin Fahad	Electrical, Civil, Mechanical & Interior Design	Male	www.pmu.edu.sa
Effat	Electrical, Computer and Information systems & Architecture	Females	effatuniversity.edu.sa/Arabic/Academic/College-of-Engineering
Dar Al- uloom	Architecture, Graphics and Interior Design	Male	http://dau.edu.sa/ar/colleges-ar/caddar/cadd-undergraduate
Al Baha Private College	Computer, Electrical, Electronics and communications	Male Females	http://bpcs.edu.sa/
Qassim private College	Computer	Male	www.qc.edu.sa/NewWeb/index.php/colleges/computer-eng
Prince Sultan Bin Fahad	Electrical, Civil, Mechanical & computer	Male	www.fbsu.edu.sa

CONCLUSION

Regardless gender, environmental engineering specialty reduces the negative impact caused by environmental pollution for both available and proposed development projects in construction and industrial fields. In addition to involvement in urgent pressing environmental issues such as effects of acid rain, depletion of the ozone layer and global warming and industrial pollutants. As well as contributes to awareness programs, teaching aids reform, optimization of resources, establishment of regulations and laws that limit

environmental pollution, preserve natural resources and wealth without pollution and misuse, putting good policies and apply them and focus on reuse and recycling systems and zero waste production and waste. Environmental Engineering program for females is essential, distinguished and unique program ensuing strategic plan for King Faisal University that encourages empowerment of women. Moreover, it will play a vital role in fill up the gap in engineering profession and contribute to the cultural construction of the nation, as well as being a start point to introduce the concept of scientific, technological and business incubators in the Kingdom.

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