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Duplication among Engineering Academic Program Names in Saudi Arabian Public Universities

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ABSTRACT. This paper provides an overview of engineering academic programs in the currently existing 24 Saudi Arabian public universities, with emphasis on program names. The aim is to suggest a unified naming scheme for Saudi engineering programs in public universities. Recent data regarding engineering program names in Saudi public universities has been compiled, tabulated, and analyzed in order to determine common trends and differences. Data shows that significant differences exist in equivalent program names without an apparent basis for such discrepancies. It is alarming to see that no standard, uniform basis has been used to choose program names in Saudi public engineering colleges. The author proposes a unified naming scheme as a step in merging nationwide efforts in Saudi engineering colleges.

Keywords: Program Names, Saudi Arabia, Public Universities, Name Duplication

1. Introduction

The engineer's growing need for knowledge and information has greatly increased the versatility of traditional academic curricula. This has been achieved by the continuous improvement of academic specializations either via the initiation of modern engineering trends or through the merging of traditional programs. Furthermore, the amount of information that should be acquired by an engineer has increased to a level that surpasses the amount that can be accommodated by a single academic program.

Tied to this issue of changing curricula is the issue of program or department name changes. Program names typically base their name and/or name change on a number of factors including attracting new students, promoting a new discipline or sub-discipline, or adjusting to accreditation and/or educational standards. In the following sections, the author first presents some international cases of changes imposed to academic names, including the basis and justifications for such changes. This is followed by a discussion of changes in various academic programs in the Kingdom of Saudi Arabia, with an emphasis on scientific and engineering programs. The author ends with a cost benefit analysis of a modified, unified naming scheme for engineering programs in KSA.

New Engineering Trends

Until the early 1980's, for instance, most chemical engineering graduates were in direct demand by petroleum and chemical companies. In recent years, however, a growing need exists for non-traditional engineering fields, such as computer engineering, environmental engineering, and biomedical engineering. Engineering education trends have recently focused on moving away from a certain specialization and towards the integration of knowledge through focusing on collecting and continuously enhancing a number of basic, essential engineering skills [1], [2].

A number of leading worldwide engineering colleges have begun to identify and realize the significance of recent engineering trends which have resulted from technological progress, patents, as well as the synergy and collaboration of different engineering disciplines. Their main goal has been to attract students to an engineering education that fulfills both their interests and aspirations. This is in addition to the increasing market demand in engineers who possess multidisciplinary (aka integrational) engineering knowledge and skills [2-4].

The International Case – Changing Program Titles

At the institutional level, an article by US News [5] shows that almost 18% of US colleges and universities have since 1996 increasingly introduced some change to their names. Such changes have been mostly marketing techniques to attract new students, and -in some cases- have been misleading or even dishonest. Another marketing technique is upgrading a college to a university name, partially to make it sound more prestigious, or by adding such words as "Science and Technology" to the university name.

Some of the reasons of academic name changes have been motivated by the concept of globalism and inclusiveness. For instance, the "Department of Languages" at the University of Dayton changed its name in 2012 to the "Department of Global Languages and Cultures" in order to promote the department's mission and curriculum [6]. A 2013 extensive study also shows how names changes aimed at reflecting improved goals and degrees have also extended to the health education field [7]. A 2014 article regarding Agribusiness Education in African institutions also reports how changing department names has been driven mostly by increasing the number of graduates and adapting to industry needs [8].

It's also possible to extend this discussion to engineering departments worldwide. Purdue University describes how it has recently initiated the unique "Environmental and Ecological" department to reflect addressing complex practical problems in this field [9]. Similarly, Shinshu University (Japan) expands this naming strategy to include all its engineering departments, and how it integrates into this strategy the objective of producing graduates that satisfy industry needs in the region [10]. Program names should, thus, be chosen wisely. Luppicini [11] illustrates the tendency of graduates of a certain discipline to attach themselves to the original title even if there exists a need to change that title.

Literature shows that engineering curricular names can have a significant effect on student interest and enrollment in different- both classical and new or multidisciplinary- engineering disciplines. Shoup [12], for instance, discusses how reviewing the name of the agricultural engineering program title with one that is more reflective of the career potential led to a doubling of student enrollment figures as well a significant increase in job market interest in the specialization. Further evidence of this is observed at the University of Arizona, where its Department of Agricultural Engineering was changed after 1990 to the Department of Agricultural & Biosystems Engineering, with resulting additional BS degrees thereafter offered in Agricultural & Biosystems Engineering (in 1990) and Biosystems Engineering (in 2002) [13].

Literature also shows how minor modifications in the program title can yield a significant effect with regards to promoting more undergraduate and graduate students, hiring more specialized and faculty, as well as helping to increase departmental research ranking. This is shown by Young [14] who discusses the positive statistical significance

that the subtle addition of the 'bio' suffix has had on the increase of undergraduate enrollment in agricultural engineering and other engineering programs (such as biomedical and chemical engineering). Many engineering programs across the US have also modified their names in order to better reflect their academic mission and research activities, as with incorporating the 'bio' suffix into several chemical engineering departments [15] and [16]. Noteworthy of mentioning is where researchers have invested millions of dollars to get credit of such a name, the F. Joseph Halcomb III, M.D., Department of Biomedical Engineering at the university of Kentucky [17].

Such discussion can be extended to several other engineering disciplines. For instance, as part of an increasing nationwide effort, the University of Rochester addressed this issue in 2012 by giving a focus on computers in electrical engineering departments [18]. Also, in 2003, the Department of Civil and Construction Engineering at Iowa State University changed its name to Civil, Construction and Environmental Engineering mostly to match the increasing demand in environmental engineering graduates, as well as providing more educational and research programs [19]. Most Aeronautical academic programs in the US have also changed their names to Aerospace engineering in order to be more inclusive of both military and commercial aircraft inside and outside the atmosphere (e.g. satellites) [20]. Turkey has even taken serious steps into deploying more competent graduates into the job market by transforming their technology college programs into better theory-oriented engineering programs [21].

A notable example has been the recent efforts to renaming Industrial Engineering (IE) departments in many US universities to Industrial and Systems Engineering (ISE), again with a focus on attracting graduates to a larger host of industrial jobs and modern trends within this specialization [22]. This has also extended to the recent change in 2016 after serious consideration (due to the added executional costs) of the Institute of Industrial Engineers (IIE) to the Institute of Industrial and Systems Engineers (IISE), aimed also at expanding the relevance of the industrial engineering profession as a whole, as well as increasing student enrollment and job opportunities for graduates, especially that they have to compete for jobs with mechanical engineering students [23].

The Case in KSA – Satisfying MCS Requirements

The Saudi Council for Engineers (SCE), the official Saudi professional engineering society, reported in 2013 how it currently only registers engineering members (totaling about 104,000 Saudi and international members) belonging uniquely to seven distinct disciplines, civil (33%), electrical (31%), mechanical (16%), architectural (14%), chemical (3%), industrial (2%), and petroleum (1%) engineering [24]. SCE further reports how it handled "profession name changes" for over 4500 engineers, a process involving matching graduate degree names to one of those disciplines.

This is attributed to a current restriction imposed by the Saudi Ministry for Civil Services (MCS) requiring all Saudi engineering graduates to hold bachelor's degrees belonging to one of limited, predefined engineering specializations in order to secure a job in the public Saudi job market. The Saudi employment accreditation system imposed by the MCS defines standards and criteria that are necessary for practicing the engineering profession in Saudi Arabia, as well as evaluating their academic credentials and professional expertise [25]. One of those standards dictates that no graduate (whether Saudi or expatriate) can be considered as a registered engineer without holding an applicable bachelor's certificate from one of those few engineering sub-disciplines.

Recent developments by the MCS in 2018 have involved approving engineering technology graduates given that they are holders of bachelor's degrees from technical colleges [26]; this has also very recently (May 2018) been expanded to include graduates from technical and vocational training [28]. Also, nationwide graduates from computer science and information systems colleges, as well as architecture colleges, have also recently gained approval as engineering graduates, after a lengthy and thorough examination of the academic curricula by both the Saudi SCE and MCS [29], [30].

Some disciplines have been struggling for years to satisfy MCS employment accreditation standards and criteria, including graduates from environmental health studies who have been denied government careers in their disciplines as the Saudi MCS has refused to issue "Employment Classification Card" due to the same aforementioned reasons [32]. Saudi engineers have also been recently proposing the integration of new trends in engineering into the list of MCS-approved degrees, such as maintenance engineering, and Nano/MEMS engineering, and rightfully so as such are currently in increasing demand in the Saudi public job market [4].

Engineering Education in Saudi Arabia

There has been a strategic movement in Saudi Arabia to replace the currently existing petroleum-based economy with a knowledge-based economy. Saudi higher education has witnessed an unprecedented surge from only four public engineering colleges (namely in *King Saud University, King Fahd University of Petroleum and Minerals, King Abdulaziz University, and Umm Al-Qura University*) and 25 corresponding programs about ten years ago, to 23 colleges and 123 programs today (i.e. 475% and 392% respective increases). These figures, although promising, have recently shown that a rush in establishing academic institutions has, inevitably, had its drawbacks.

2. Presentation

In view of what has been presented in the introduction section, it is clear that academic names must be carefully driven and adapted to a number of factors primarily addressing drawing students then subsequently securing jobs for them into the job market, while also adapting to global views and trends. Furthermore, when focusing on the Saudi case, one must be conscious of the additional local restrictions currently imposed by MCS, SCE, and other public ministries (such the Saudi Ministry of Labor and Social Development – MLSD) in order to match degree names with jobs available for engineers in the public sector.

Therefore, the purpose of this manuscript is first to shed the light on the currently used naming scheme for the different bachelor-offering engineering programs available in Saudi Arabian public universities. It also aims to investigate redundancy patterns existing in different engineering programs among colleges nationwide, particularly how and why new universities are duplicating programs in existing universities. The author subsequently provides some suggestions intended to restructure some programs to cope both with global educational changes and national demographic resources and restrictions.

This study is based on analyzing and potentially restructuring the 23 existing engineering colleges, pertaining to 21 of the 24 existing public universities in the country. Both *King Abdulaziz University* (KAU) and *Taibah University* have been counted twice due to the existence of regional engineering campuses, namely the *KAU at Rabigh* and *Taibah University at Yanbu* engineering colleges. Three Saudi universities do not currently offer engineering degrees, which are *King Saud bin Abdulaziz University for Health Sciences*, the *Islamic University*, and *Princess Nora Bint Abdul Rahman University* (a female-only institution), all of which have been excluded from this study.

It should be noted that the proposed restructuring mechanism is mainly targeted towards the mentioned, main conventional -or traditional- engineering disciplines, being civil, mechanical, electrical, industrial, and chemical engineering, which constitute more than 70% of the current total engineering program count in Saudi Arabia. The mechanism for analysis has heavily focused on program names, which usually offer a good reflection and indication of the educational nature of the program.

The main sources for this research are the 2009 *Saudi Ministry of Higher Education*'s (MOHE) statistics report regarding university education [34], as well as the Saudi MOHE's official website [35]. The information and data retrieved from these sources has been translated by the author from Arabic to English.

3. Discussion

First, it is important to point out that clear discrepancies do exist in the naming scheme currently adopted by Saudi public universities for various engineering disciplines, as shown in Table (1). This is also a possible indication that no clear or standard reference was used by most universities for such process, as evidenced by the many, inconsistent name variations of a certain specialization and the possible addition of a sub-discipline in some cases. Please note that the university names abbreviated in Table (1) are shown in full in Table (2).

Importance of a Unified Academic Program Naming Scheme

A career in the public sector is usually a popular choice for fresh engineering Saudi graduates due to high job security and superior salaries. The problem, however, lies within the recruitment process, particularly since the Saudi MCS requires engineering graduates to hold degrees that necessarily match one of those available in the MCS job classification guide [37]. An applicant must access this guide and apply for a job title that exactly matches one of currently 63 available engineering discipline titles, with numerous name variations for each of the major engineering specialization, as mentioned in the previous sections.

The author recently conducted a phone conversation with the official MCS spokesman regarding this issue [39]. He has made it clear that the majority of public universities in KSA, and (particularly within their engineering colleges), are quick to initiate departments, whereby the degree/program name is almost identical to the department name. Additionally, such name choices are generated without referencing or consulting with the Saudi MCS or MLSD in order to conform to the Saudi job market. Therefore, a graduate from such programs is likely to hold a degree with such name that is non-existent in the MCS job classification guide, in which case he/she is shocked that his/her job application is consequently denied. Usually, this is followed by an appeal from the applicant, and may require up to a six-month period to be resolved, which in many cases results in the applicant losing many job opportunities.

Such conformation between the degree title and MCS standards is therefore a necessity to ensure a speedy and smooth employment process for engineering applicants in the Saudi public sector. Furthermore, such problems are even common even in the private sector who commonly associate themselves with professional bodies and require all applicants to conform to the latter's employment requirements (such as with the Saudi SCE) [39], in addition to evaluating the quality of the applicant's transcripts.

This serves to further affirm public engineering colleges nationwide have predominantly set program names without first returning to the MCS to follow a

predefined naming scheme, particularly since such does not currently exist. This, consequently, leaves an almost unlimited number of possibilities open for choosing program titles, and an additional burden on both the MCS and more importantly the graduate to conform –necessarily– to the different name variations.

An additional problem targets the more than 148,000 expatriated students traveling overseas to different countries for higher education [40], many pursuing degrees in scientific disciplines. Some of these graduates have enrolled in modern engineering specializations (such as mechatronics and engineering nanotechnology), which are not currently existent within the MCS guide, and, therefore, suffer greatly when trying to find an appropriate matching job to their earned degree.

Therefore, engineering students interested in a public sector career usually stick to conventional specializations due to the added job flexibility that a general degree in, say, electrical engineering may provide, e.g. a job in power or communication engineering. A degree in, say, mechatronics engineering would, on the contrary, require a complicated and time-consuming process by the MCS committee of job classification [41].

Finally, it is also worthy of mentioning here that the MCS naming condition is a far greater concern than that involved with accreditation standards. The latter has been set by the Saudi Arabian NCAAA (*National Commission for Academic Accreditation and Assessment*). Recognizing a certain engineering diploma or academic program, e.g. when transferring from one national college to another, is not usually a concern since accreditation addresses such issues as curricular content and learning outcomes rather than program or department names [42].

Suggested Academic Program Naming Scheme

The author has, accordingly, addressed these concerns by merging similar program names under nominated, simpler, yet more representative titles in order to facilitate the analysis, without imposing fundamental changes. Consequently, Table (2) illustrates the engineering program count (totaling 123) in each of the 23 Saudi public engineering colleges. Each of these 25 programs is listed in descending order of its frequency in various Saudi public engineering colleges. The same program order has been, accordingly, maintained throughout the manuscript.

The same results are summarized in Table (3). This reflects the program counts (shown in Table (2)) and the possible alternative names (previously shown in Table (1)) that each could have.

Table (4) demonstrates that electrical, civil, mechanical, chemical, and industrial engineering are the more dominant among engineering disciplines as indicated -in the third column- by their presence in the majority of the 23 currently existing public

engineering colleges. It is expected that such became the basis for the program naming scheme in most newly established universities. The dominance of these programs is also apparent in new universities, as evidenced by the data shown in the last three columns.

The distribution of engineering programs in Saudi public universities, both new and established, at the bachelor's level is further illustrated in Figure (1). The equivalent distribution for newly established public universities is shown in Figure (2). This also serves to show the dominance of the five previously-mentioned disciplines in both new and established Saudi public universities. Note, that in both these figures only the first 10 disciplines are listed, which are precisely the ones present in two or more public engineering colleges nationwide.

It is obvious from the above analysis that program names in most new universities have been chosen almost exclusively by the well-established public universities that were initially appointed by the Saudi MOHE to supervise them. This is a clear indication a) of the absence of a serious study invested in the naming process; and b) of the almost complete inconsideration of the expectation that new and/or remote universities should emphasize disciplines that highlight their prospective and existing demographic and geographic potentials, nor adopting similar successful international experiences as models for the process.

For example, the engineering programs at both the *Northern Border University* and the *University of Tabuk*, both of which were established under the direct supervision of King Abdulaziz University hold the exact same names, including 1) electrical e.; 2) mechanical e.; 3) chemical e.; 4) civil e.; and 5) industrial e. The same can be said for universities affiliated from *Kind Saud University*, including *Al Jouf University*, *Qassim University*, and *Prince Sattam bin Abdulaziz University*, all of which not only share the same engineering program names (which include 1) electrical e.; 2) mechanical e.; and 3) civil e.), but also have identical program and course contents. This duplication pattern is also partially existent among most other engineering colleges nationwide.

On the other hand, the college of engineering at the *University of Dammam* has chosen to host several contemporary engineering disciplines for all its programs, including 1) construction and building e.; 2) environmental e.; 3) medical e.; 4) mechatronics; 5) marine e.; 6) safety and security e., and 7) engineering education. *King Faisal University* has also adopted a similar approach; programs include 1) civil and environmental e.; 2) electrical e.; 3) mechanical e.; 4) chemical e.; 5) desalination e.; 6) biomedical e.; and 7) materials e.

The author does not find it surprising that many of the disciplines mentioned in the previous paragraph are not among those listed within the MCS job classification guide. This is primarily justified by the fact that the two universities are located at the Eastern

province of the kingdom, where many graduates strive to join renowned private sector companies (such as Saudi ARAMCO), where (as mentioned in the previous section) engineering recruits are judged according to their transcript rather than discipline title. It is, thus, evident that these two universities have employed a sound naming strategy that fulfills the country's current academic needs.

4. Conclusions

This study serves as a status quo investigation with an eye on the future. It illustrates that the existing naming scheme for engineering programs in Saudi public universities contains inconsistencies and has not been based on a standard reference. It is also clear that some program names consist of an additional or combined engineering discipline, examples being the chemical and materials e. program, and the program of electrical and computer e. as illustrated in Table (1). To simplify the study, the author proposes a unified, merged, representative name scheme for programs with similar specializations as shown in Table (2 and 3).

Furthermore, the study shows that a majority of engineering programs in both established and new Saudi universities consist of classical disciplines, as shown in Table (4). There is also a very close match or "easy" imitation in the program scheme of most new versus corresponding established or parent equivalents. A few new universities like the *University of Dammam*, however, have adopted novel, unconventional disciplines at the bachelor level, which are hardly present in any established university. Some of these disciplines have been chosen as to be compliant to the environment and location of such universities.

Initiating new engineering sub-disciplines/programs/departments, especially for those holding non-conventional names, requires first a thorough feasibility study assessing the projected employment demand for such fields, in addition to close pre-coordination with related responsible public sectors (including the Saudi MCS, MLSD) and professional societies (the SCE). Therefore, at the time-being, there may be some advantages and disadvantages to the proposed, unified naming scheme, and it only serves to minimalize the disadvantages imposed by the strict currently-imposed job classification requirements.

5. Recommendations

The author highly recommends that the Saudi MOHE seriously consider (in collaboration with the MCS) unifying the existing engineering program names nationwide according to the scheme proposed in this paper. Furthermore, a project should be undertaken to enhance the various Saudi engineering programs as to satisfy market demands for graduates, adapt to international engineering trends, as well as to take advantage of new universities' demographic and social constraints. In addition, the author

highly recommends that at least some of the many new Saudi engineering colleges should focus on adopting novel, multidisciplinary engineering specializations. Well-established Saudi universities should, on the other hand, focus on typical engineering disciplines, especially at the bachelor and master levels.

Furthermore, a survey is needed to show the extent of the market's need for contemporary engineering programs and disciplines. This is one essential step towards preparing engineering graduates for the various challenges of the twenty-first century.

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الازدواجية في أسماء البرامج الأكاديمية الهندسية في الجامعات السعودية الحكومية

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ملخص البحث. تقدم هذه الورقة نظرة عامة على البرامج الأكاديمية الهندسية في ٢٤ جامعة سعودية حكومية، مع التركيز على أسماء البرامج. الهدف هو وضع اقتراح لمخطط تسمية موحد للبرامج الهندسية السعودية في الجامعات الحكومية. تم تجميع البيانات الحديثة المتعلقة بأسماء البرامج الهندسية في الجامعات السعودية الحكومية، وجدولتها، وتحليلها من أجل تحديد الاتجاهات والاختلافات العامة. تشير البيانات إلى وجود اختلافات كبيرة في أسماء البرامج المتكافئة بدون أساس واضح لمثل هذه التناقضات. من المثير للقلق أن نرى أنه لم يتم استخدام أي أساس أو معيار موحد لاختيار أسماء البرامج في كليات الهندسة الحكومية السعودية. يقترح المؤلف نظام تسمية موحد كخطوة لدمج الجهود الوطنية في كليات الهندسة السعودية.