Students' perceptions and attitudes towards agricultural engineering education in the Sultanate of Oman – Part 2: curriculum content and career preferences

Linus U. Opara, Seif S. Al-Adawi & Talal Y. Al-Shukeili

Sultan Qaboos University
Muscat, Sultanate of Oman

ABSTRACT: In part 1 of this article series, the authors reported on the low appeal of the agricultural and marine science academic programmes among the majority of students enrolled in a bioresource and agricultural engineering major. In the present article (part 2), the authors present students' attitudes towards the overall curriculum content in bioresource and agricultural engineering, their career preferences after graduation, and the skills they considered would enable them to meet the expectations of prospective employers. Students generally expressed apprehension towards basic science courses and core engineering courses, especially when offered by other colleges. Based on the total responses for various career and employment options, 48% of the responses preferred employment in a government ministry/department, 42% preferred employment in the private sector, while a negligible number of students (3%) wanted to start their own business after graduation. The high interest in private sector employment indicates a significant shift among students away from dependence on government ministries for employment. Most students expressed *moderate* to *high* confidence that their current educational programme would enable them to attain the critical skills required for success in their preferred workplace.

INTRODUCTION

There is an ongoing global debate on the future of the agricultural engineering discipline. One strategy to attract and retain more undergraduate students is to reform existing educational curricula and degree plans. Several authors have called for the expansion of the agricultural engineering horizon from its somewhat narrow agricultural base to include other biological industries [1][2]. This call has been most warmly received by universities in North America and is rapidly spreading to universities in other parts of the globe. In addition to curriculum reform, including the inclusion of more biology related courses, many agricultural engineering departments have been renamed; often, the word *biological* (or its variants) has been included in the new name [3].

In a recent article, Opara proposed a reform of the traditional agricultural engineering curriculum (see Figure 1) to include a triad of technological innovations (see Figure 2), which are driving the ongoing revolutions that are, in turn, driving economic progress and wealth creation in modern knowledge economies [4]. It was argued that the fusion of the elements in this triad (information and communication technology (ICT), biotechnology and nanotechnology) in agricultural engineering education and research is essential to transform the discipline and ensure its relevance to the challenges and opportunities for *smart* agriculture in the 21st Century.

Despite the considerable debate among faculty and within professional agricultural engineering associations and societies on the need and nature of such educational reform, the authors are not aware of documented evidence of inputs of students who are important stakeholders in this issue. In a previous article, undergraduate students enrolled in agricultural engineering at Massey University in New Zealand preferred their academic programme to be more closely aligned towards the agricultural and horticultural sciences (as opposed

to engineering and technology) [5]. On the other hand, those students also preferred to be considered as engineers and affiliated to a professional engineering society after graduation.
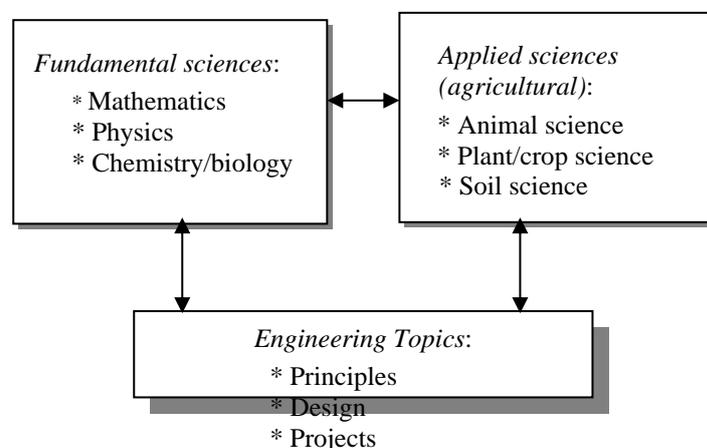
Figure 1: Core educational contents of a typical agricultural engineering curriculum [4].

These findings raise fundamental questions regarding current efforts to refocus agricultural engineering towards biology by many academic departments as part of a suite of strategies to enhance programme appeal and attractiveness among students. In part 1 of this article series, the authors discussed the perceptions and attitudes of undergraduate bioresource and agricultural engineering (BAE) students at Sultan Qaboos University, Muscat, Oman, towards selecting their degree programme and the College of Agricultural and Marine Sciences, where it is offered [6].

The objectives of the current article (part 2) are to present the results of students' attitudes towards the curriculum, their

career preferences after graduation, and the skills that they perceived would enable them to meet the expectations of the prospective employers.

Basic & Applied Sciences:	Emerging Technologies:
* Basic sciences	- ICT
* Agricultural and biological sciences	- Biotechnology
	- Nanotechnology

Engineering:
* Principles
* Design
* Project
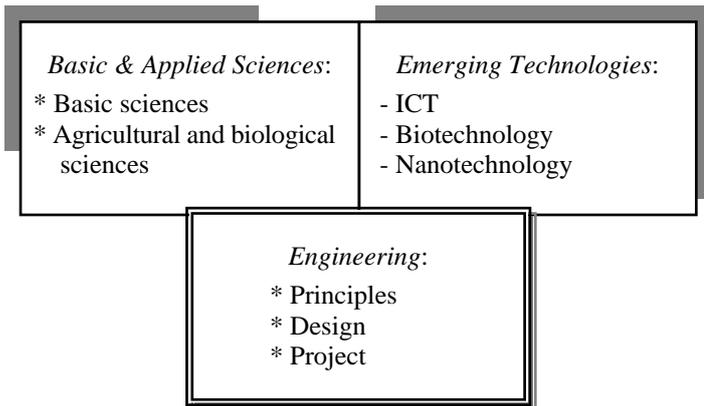
Figure 2: A new orientation for agricultural engineering education curriculum for the 21st Century, incorporating a triad of emerging technologies [6].

METHODOLOGY

The research methodology has been described elsewhere [6]. In summary, the researchers surveyed undergraduate students enrolled in bioresource and agricultural engineering at Sultan Qaboos University (SQU). The written questionnaire was complemented with a group discussion that enabled the authors to explain the objectives of the study and to clarify the questions to students where required. All 18 students who responded to the invitation to participate in the study completed the questionnaire. The frequency of students' responses for each question was expressed as a percentage of the total.

RESULTS AND DISCUSSION

Curriculum Content

Based on the contents of Figures 1 and 2, and the current BAE degree plans in the Department, six broad subject areas were identified, including basic sciences (biology, chemistry, mathematics and physics), applied sciences (agricultural and environmental), engineering and technology, and management. The following question was then posed to the students: *Based on your experience in our current programme and what you think about future roles of agricultural engineers in the 21st Century, how important do you think it is to include more content of the following academic areas in an agricultural engineering programme (score 1=most important, 5=least important).*

An analysis of the responses for *most important* content showed that the highest majority (40%) favoured the inclusion of more engineering and technology content (see Figure 3), while each of the other contents scored 10% or 15% of the total response in this category. When the responses for *most important* and *important* were combined (see Figure 4), both engineering and technology, and management received the highest score for inclusion (24.32%), respectively. The inclusion of more contents of agricultural science or environmental engineering received moderate approval among the students (see Figure 4).

The inclusion of more contents of biology and chemistry, or mathematics and physics, was rated equal as the least important

(see Figure 5). The disapproval expressed by students for more content of these basic sciences in undergraduate agricultural engineering programmes remained the highest compared to the other contents when the responses for *slightly important* and *least important* were combined (see Figure 6).
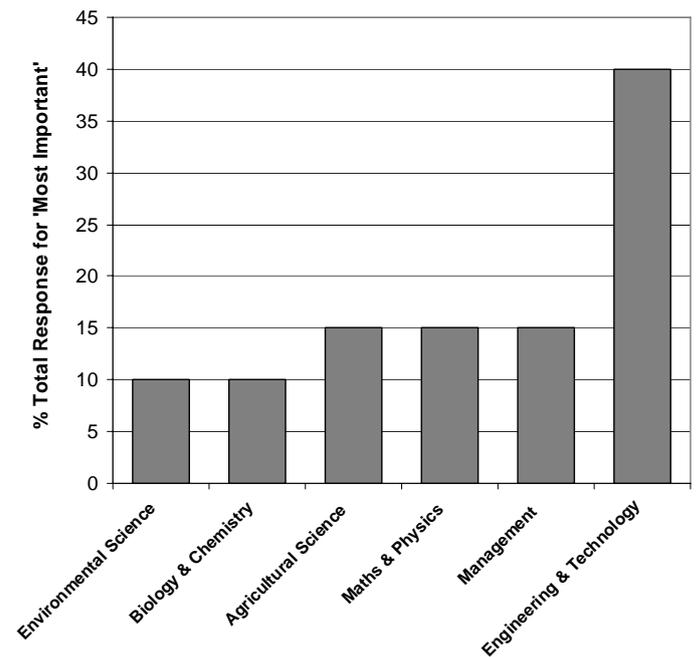
Figure 3: Students' perceptions about *most important* course content.
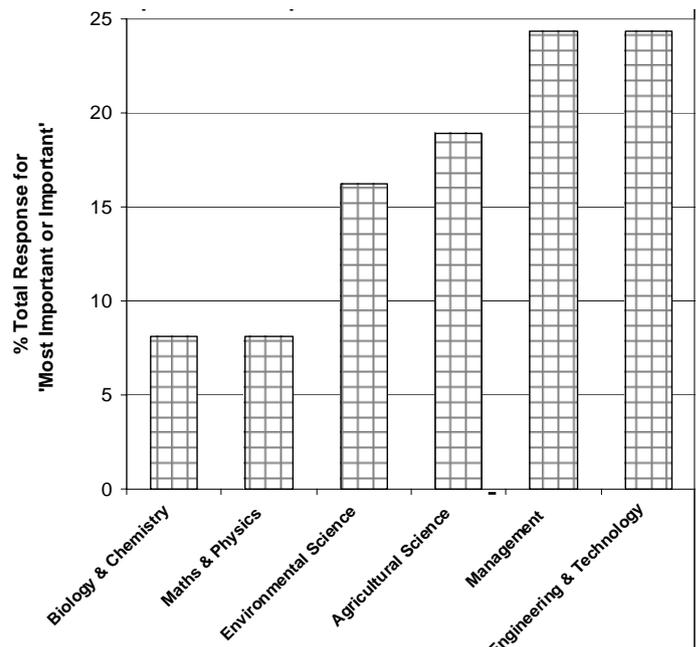
Figure 4: Students' perceptions about *most important or important* course content.

Addition or Removal of Topics in the Current Degree Plan

When the participating students were asked to list other topics that they thought should be added to the current programme of study, the most commonly identified topics were computer programming, communication skills, and *more* engineering courses (engineering drawing and engineering design, including irrigation design and machinery design). Students expressed interest in the application of computer software to solve practical problems in BAE (eg soil and water

management). Students also offered additional comments and suggestions that they thought would strengthen the overall academic programme. These included the implementation of specific programmes to enhance their report writing and presentation skills, and the inclusion of more field practical laboratories (hands-on, experiential learning).
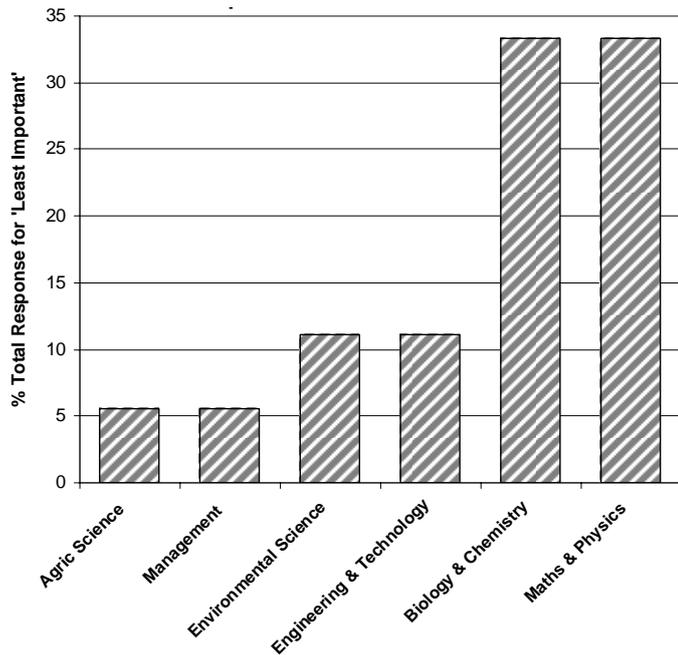
Figure 5: Students' perceptions about *least important* course content.
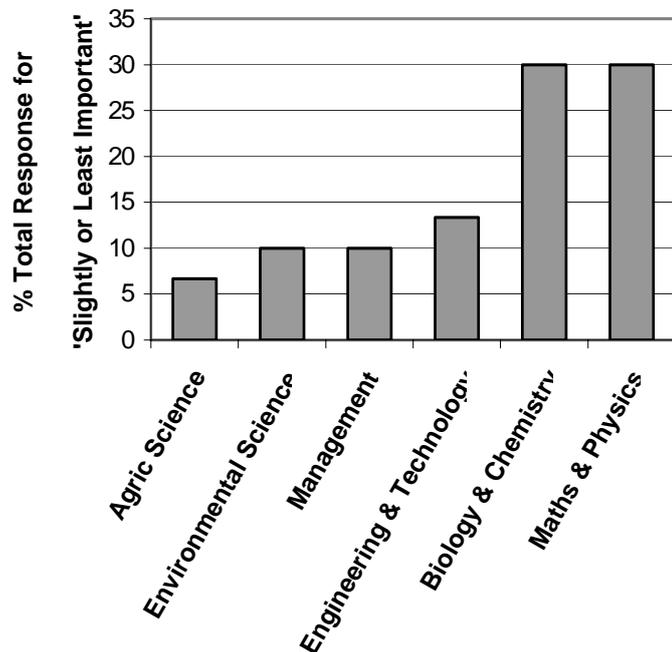
Figure 6: Students' perceptions about *slightly or least important* course content.

During the focus group discussion, many students raised the issue of strengthening the internship programme to enable them to acquire more practical and relevant skills. Specific suggestions to realise this goal included extending the duration of internship to more than the current four weeks, redesigning the internship programme to enable students to undertake it over a full semester, and allowing students to train as volunteers during the semester in companies, farms, consulting firms, etc.

When students were asked to list the courses or topics in the current curriculum that they considered should be dropped, nearly all of the students surveyed identified one of the basic science courses that they took from the Colleges of Science and Engineering. Students who identified *Soil and Water Engineering* as their focal area within the BAE degree specifically questioned the relevance of courses in statics and dynamics in their degree plan and felt that these courses were only *good* for those students interested in machinery engineering.

Many students felt that the basic courses they took from the Colleges of Engineering and Science should be replaced with equivalent courses in the BAE. However, some students felt that the basic science and engineering in their degree plan should be same as those taken by their peers in the Colleges of Engineering and Science. This feeling was much strongly expressed in situations where they take the same higher-level courses with their peers from other colleges who have already completed lower level equivalents of the same course.

Preferred Career Choices

In the Sultanate of Oman, the government (through ministries and other agencies) remains the major employer of university graduates. Indeed, a review of existing records of graduate destinations in the Department of BAE showed that about 84% of all agricultural engineers who graduated from the SQU are currently employed in government ministries and related agencies. Given the ongoing efforts by the government to diversify the economy, plus efforts within the College of Agricultural and Marine Sciences at the SQU to incorporate more management skills aimed at enhancing the employability of SQU graduates, the participating students were also asked to indicate, from a list of options, their preferred type of job or employment after graduation. Respondents were permitted to choose more than one employment option.

Nearly 89% of the respondents indicated that they would prefer to be employed in a government department or ministry. Interestingly, 44% of the students expressed interest to work in private sector agricultural industry (see Figure 7), while starting their own business was the least preferred employment option among the students surveyed. When the preference level for each type of employment was determined based on the total responses by the participating students, employment in government departments or ministries accounted for about 48%, reaching over 57% when *other* employment preferences (at the SQU) were included (see Figure 8).

The relatively high preference expressed by these students for employment in the private sector and the concomitant reduction in dependence on government sector employment highlights a significant paradigm shift in students' outlook on the job market. Presumably, this finding is, in part, due to students' responses to the rising number of unemployed graduates in the job market, as well as the decline in the number of new job opportunities available in various government ministries and agencies.

When the students were asked to write down the skills they thought would enable them to meet the expectations of their preferred employer(s), the most frequently listed skills, as perceived by the students surveyed, were computer, organisational, research, language, machinery management, business and communication skills. Two students specifically

noted improvement in their practical farming skills as being essential. Students generally expressed moderate to high confidence that their current degree programme would enable them to achieve those important skills that they had identified (see Figure 9).

CONCLUSIONS

Students showed a general dislike for courses in the basic sciences (biology, chemistry, mathematics and physics) and basic engineering courses (statics, dynamics and calculus) in their curriculum, especially when another college offered these courses. However, a high majority of the students surveyed
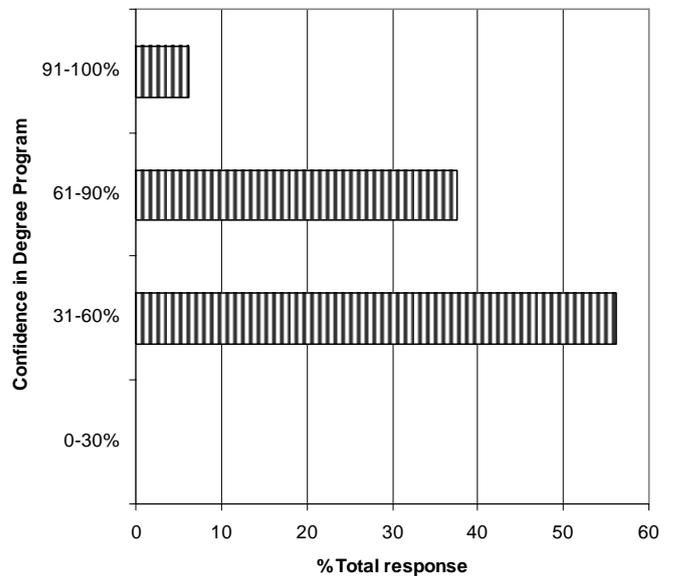
Figure 9: Responses to the question *At what level do you think your current Bachelor programme would enable you to achieve those important skills you have identified?*

perceived that it was essential to include more content of engineering, technology and management courses in agricultural engineering academic programmes.

Employment in government ministries and agencies was considered by those surveyed to be the most preferred career option; however, the number of students who indicated an interest for private sector employment was much higher than existing data on current employment destinations of agricultural engineering graduates in Oman.

Furthermore, students identified improvements in their soft skills and computer literacy as important in order to enable them meet the expectations of their preferred future employer.

Figure 7: Students' employment preferences based on total responses (N=18).
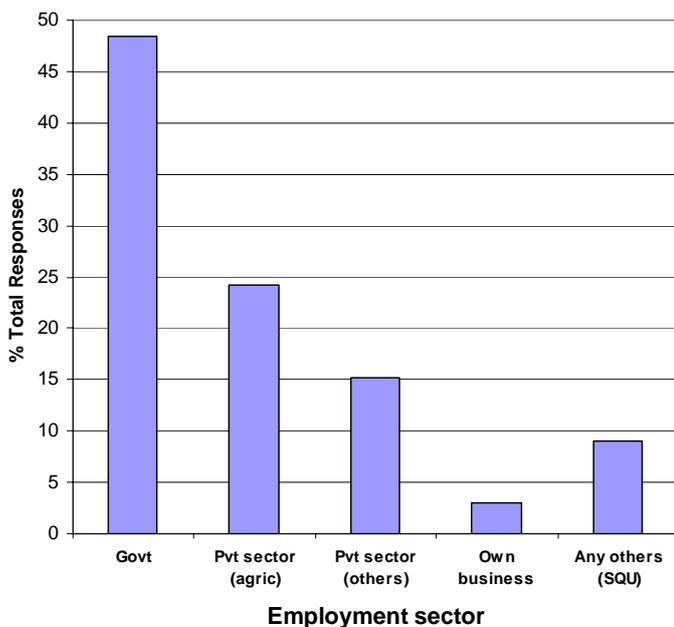
Figure 8: Students' employment preferences based on all responses (N=33).

REFERENCES

1. Cuello, J.L., Choosing biological engineering. *Agricultural Engng.*, 74, **2**, 24-26 (1993).
2. Cuello, J.L., The descent of biological engineering. *Proc. the Institute of Biological Engng.*, 3, 18-30 (2002).
3. Opara, L.U., Agricultural engineering education and research in knowledge-based economy. *Proc. 30th Inter. Symp. on Actual Tasks in Agricultural Engng.*, Zagreb, Croatia (2002).
4. Opara, L.U., Outlook for agricultural engineering education and research and prospects for developing countries. *Outlook on Agriculture*, 33, **2** (2004) (in press).
5. Opara, L.U., From farmers to blue-collar professionals: agricultural engineering students' perspectives on their career prospects, critical skills and discipline name change. *World Trans. on Engng. and Technology Educ.*, 2, **3**, 399-402 (2003).
6. Opara, L.U., Al-Aldawi, S.S. and Al-Shukeiry, T.Y., 2004. Students' perceptions and attitudes towards agricultural engineering education in the Sultanate of Oman, part 1: academic programme selection. *World Trans. on Engng. and Technology Educ.*, 3, **1**, 139-142 (2004).