

Foreign Postgraduate Students in Agricultural Engineering in Canada

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In 1992 five Canadian universities engaged in agricultural engineering education and research were visited. Interviews were conducted with 25 staff members and a questionnaire was completed by 50 postgraduate students from developing countries. The study examined the role of students from developing countries in the activities of the departments visited. This group of students were an essential part of the research and teaching of the departments and their presence was beneficial to the student population, the University, the Canadian research community and the student's home country. There was widespread satisfaction on the part of the students with the programmes and facilities. Absence of this group of students would seriously affect many research programmes.

INTRODUCTION

IN RECENT years there have been of the order of 1.1 million students per annum studying at the tertiary level outside their home country [1]. Within Canada in 1990-91 there were 35 200 foreign students at university level; this represents a decline in numbers from a peak of 36 100 in 1983-4. International undergraduate enrolment declined by almost 10 000 students in the 1980s, from a high of 26 400 in 1983-84 to a low of 16 700 in 1987-88; since then it has expanded to 20 300 in 1990-91. However, international enrolment at the masters level was more constant at just above 6000 through the 1980s, rising to 7200 in 1988-89 and reaching almost 9000 in 1990-91. At the doctoral level international enrolment virtually doubled from 3000 in 1981-82 to almost 6000 in 1990-91. Clearly there has been a marked shift to graduate studies by foreign students over the last decade; in the mid 1980s 29% of all international students were at graduate level whereas by 1990-91 this figure had risen to 42%. In terms of total enrolment: in 1990-91 under 3% of all undergraduate students on Canadian campuses were non-Canadians, compared to 11% at the masters level and 26% at the doctoral level [2].

In the 1990-91 academic year most Canadian universities charged foreign students higher fees than those paid by Canadian citizens and permanent residents; the exceptions were Memorial University of Newfoundland, the University of Manitoba and the University of Saskatchewan. The differential fees ranged from two to six times the domestic fees [2].

In a study of foreign students in six major receiving countries in the late 1980s Chandler [3] highlighted the following issues (amongst others):

1. the growing emphasis on the economic benefits of international students, both in terms of spending on living expenses and in respect of tuition fees bolstering financially battered universities;
2. the need for advanced technological countries to play the 'brain game', whereby they seek to import the 'best brains' to sustain their postgraduate programmes and to fuel their industrial growth;
3. the changing balance between humanitarian goals and international development assistance and as rationales for foreign student enrolments and the reality of current economics.

This study sought to examine the role of students from developing countries in postgraduate programmes in agricultural engineering in Canada and to enumerate the perspectives of both staff and students as to the relevance of the programmes to the development of technical capacity in developing countries.

THE UNIVERSITIES AND THEIR PROGRAMMES

Five universities were visited in the first half of 1992. The universities were MacDonal College of McGill University, University of Guelph, University of Manitoba, University of Saskatchewan and the University of Alberta.

Each university could offer masters and doctoral programmes; in each case the masters programme was available as a thesis option (usually and M.Sc.) or a non-thesis coursework option (an M.Eng. or M.Sc. (applied)). Distinctive features were:

1. in each programme there was a 'communications' requirement which was met through

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- presentation of seminars and participation in discussion;
2. one Ph.D. programme expected candidates to complete a 'teaching and learning in post-secondary education' requirement. This was met through completion of an approved paper;
 3. one university required all candidates in a programme involving a thesis, to complete a 'scientific publication' paper. The requirements of this paper were to review and critique papers that are published in the field of the candidate and to prepare draft papers following the format of leading journals in the field of study undertaken. The implication of the latter requirement being that candidates prepare a draft paper on their thesis research before finishing their programme;
 4. one university was reviewing their requirement that all candidates in their postgraduate programmes be able to meet the educational requirements to register as a professional engineer. There was a view that the research based qualifications did not need this stringency.

With respect to relationships between the Canadian Universities and those in developing countries it was found that all universities had linkages of some form; however most often there was no funding associated with these linkages and so there was currently little action. Only when international aid agencies became involved in, for example, institutional capacity building programmes was there any significant activity.

The universities did not have specific strategies for recruiting students from developing countries. In each case they were receiving more applications than there were either positions or funding available; applications were processed on the basis of academic merit, English language ability and the availability of financial support for the candidate concerned.

Only one university indicated that they were at capacity in terms of the number of postgraduate students enrolled. The remaining four all reported that the major impediment was the lack of funding to provide financial support for further students (that is to say that further students from developing countries could be accepted if finance was available). The primary issue for all the universities was the difficulty in attracting Canadian students to postgraduate study.

ACADEMIC STAFF SURVEY

Twenty five academic staff members from five universities were interviewed. Each interview was formally timetabled and a standard set of open-ended questions were put together with supplementary questions. The responses were recorded by hand by the interviewer. The majority of the staff (80%) had worked professionally in at least one

developing country; their collective experience encompassed 22 countries with six of these in Asia, eight in Africa, seven in the Americas, and one in the Middle East. In the past, a number of staff from each university had participated in the establishment of educational programmes in developing countries.

Benefits and costs of postgraduate students from developing countries

Four benefits were commonly cited by staff:

1. students from developing countries made up the numbers in the postgraduate programmes when sufficient Canadians could not be attracted (cited by 10 staff members);
2. in selecting students from developing countries the University was able to recruit candidates of high intellectual calibre who also displayed high levels of motivation and (because they were generally older than Canadian postgraduate students) were more mature in their outlook (cited by nine staff members);
3. such students add cultural diversity (cited by eight staff members);
4. students from developing countries exposed international applications of agricultural engineering and provided a global viewpoint (cited by 12 staff members).

Other benefits quoted were: the establishment of networks, a source of low cost labour, and a source of future university staff. Only two individuals could not see any benefits.

When asked 'how sound or viable would your research programme be without postgraduate students from developing countries?' the responses were:

1. the programme would be limited, but still viable (16 responses);
2. the programme would not exist without students from developing countries; thus the staff member would be the only active researcher (five responses);
3. with (the anticipated) smaller programmes the funding which was gained for research support would be allocated to technician and research associate appointments (two responses);
4. the programme would be reduced, but still viable and the output would focus solely on Canadian issues (two responses);
5. it would not make any difference since students from developing countries lack the maths/electronics/robotics/food processing knowledge and lack the conceptual skills to identify with the problem (two responses).

The majority of the staff (84%) believed that Canadian postgraduate students benefitted from the presence of students from developing countries through the cultural exchange and the opportunity to learn from each other. In addition two staff members believed that more Canadians were looking to the international arena for employment

prospects, and thus their contact with developing country students helped develop their perspective on relevant issues. In terms of the undergraduate student community a significant proportion of the staff members (16 responses) were of the view that undergraduates did benefit through their contact with developing country students in laboratory sessions (when the developing country student acted as a teaching assistant); furthermore most felt that the perspective of the staff was broadened by developing country students and that this flowed onto the undergraduate class teaching through the use of different examples. However most agreed that there was no evidence to suggest that it actually occurred.

The issue of whether the presence of developing country students was seen as being of benefit to the staff member's career development elicited the following responses:

1. there is a correlation between the number of publications, the size of the research operation and academic standing. Larger numbers of postgraduate students *can* mean a larger research operation and therefore better opportunity for career advancement. Thus the developing country student made possible a larger research programme; the number of students was important rather than the country of origin (17 responses);
2. contact with developing country students gave a different perspective and developed interpersonal skills (four responses);
3. no benefit to date because of limited contact with this student group (three responses);
4. marginal benefit, except that there had been students which came fully funded from developing countries. However these students needed their research shaped to their country's needs (one response).

In terms of the financial cost of having students from developing countries enrolled in postgraduate programmes the responses were equivocal; they included;

1. there is no difference (eight responses);
2. students from developing countries often take longer to complete their programme; therefore they occupy space and staff time for longer and this is a cost to the University (four responses);
3. in some provinces there is a differential fee for overseas students. Thus students from developing countries incur greater costs. The staff member whose research programme is supporting the student must attempt to provide more financial support (four responses);
4. Canadian students can be self-supporting through summer earnings whereas developing country students usually need financial support (one response);
5. some developing country students bring funding with them (one response);
6. the cost difference is minor and only includes

more secretarial time for letters for visas etc. (two responses).

However, in terms of the personal cost (time and effort) to the supervisor of developing country students the majority indicated an increased cost compared with that for Canadian students. The responses were:

1. in most cases developing country postgraduate students required more input (ten responses). This was attributed to:
 - (a) the students not being familiar with the Canadian 'system' and therefore needing more things explained;
 - (b) a poor understanding of Canadian agriculture;
 - (c) a longer adjustment period due to the need for cultural adaptation;
 - (d) a reluctance, in some cases, to admit that they did not understand.
2. there was no difference in most cases, except at the time of thesis preparation, when poor communication skills prolonged writing the thesis; however, it was noted that some Canadians have been poor in this area too (seven responses);
3. it depended on the students and not the country of origin (eight responses).

Future trends

There was a wide range of responses to the issue of future trends in enrolments of students from developing countries; however, an underlying theme was the expectation that there would continue to be a large number of enrolment applications from candidates in developing countries. In terms of the origin of these requests there were three schools of thought. Firstly there was the view that it was influenced by the international contacts established by the academic staff. Secondly there was the opinion that students would come from developing countries which have an established history of education and have the infrastructure to support tertiary education (these are typically middle income, high population countries). Thirdly there was the idea that the state of Canadian relations with the country of origin was of importance; this implied that countries which were seen in a favourable political light would be receiving Canadian aid and that relationships between academics and researchers would be conducive to the movement of students.

It was clear that the number of students admitted to postgraduate programmes (and hence the proportion of postgraduate students from developing countries) was limited solely by financial and physical resources. Furthermore, in the case of those provinces with a differential fee for overseas students, it was anticipated that given fixed financial resources there would need to be a decline in actual enrolments of overseas students, since it would take relatively more funds to support each incoming student.

The number of Canadians enrolled in the postgraduate programme would also affect the number of overseas students admitted (given a scenario of limited physical and financial resources). A small number of those interviewed expected the number of Canadians in postgraduate programmes to rise, although they acknowledged that this would be strongly influenced by the conditions of the Canadian economy.

A minority of the interviewees commented that it is not solely the pursuit of education and technology which drives the prospective students from developing countries, but rather it is the opportunity to obtain immigration into Canada and thus obtain improved career prospects and lifestyle.

Development of technical capacity

When asked: 'do you believe that students from developing countries who complete your programmes, contribute to the development of the technical capacity of their home country?' the majority were positive (15 responses). Their view was that the graduates 'were undoubtedly better in every sense for having completed the programme'. The fact that the graduates understood the relevant principles and concepts was seen as the key to enabling them to adapt their knowledge to their home situation. It was commented by some that the restriction in implementing technological change in developing countries was an infrastructure limitation, but that graduates with initiative and drive would go ahead in any environment.

A second group of nine respondents were more guarded; they believed that a contribution could be made by their graduates but only if they returned home. It was commented by seven respondents that only 30 to 50% of the graduates returned to developing countries; furthermore it was felt that the developing countries' internal difficulties often deter the return of graduates.

One staff member was of the view that little gain in the technical capacity would be made because the developing countries needed technicians rather than engineers, while the universities were educating the upper class.

The curriculum of the programmes was considered to be appropriate for enhancing the technical capacity of a developing country by the majority of those interviewed (16 responses). The ethos was that the fundamental concepts, principles and methodologies of agricultural engineering research were the most important and also the most transferable.

A small minority commented that the curriculum should ideally be aligned with the needs of developing countries, and one staff member felt that low technology systems were more appropriate. However, it was recognized that the number of students and the lack of funding prevented this approach.

The matter of the transferability of the laboratory and computer skills to the home country of developing country students was discussed. The

majority (16 responses) were of the opinion that the skills were transferable since as long as the student understands the basics of the method they can operate with both high and low technology systems. The pursuit of excellence in research was seen as being of great importance, as was the provision of the best opportunities for the student.

As to the question of the prevention of technical obsolescence of a graduate who returns to a developing country, two schools of thought surfaced: firstly, it was a problem and the graduates should be encouraged to establish a network of international contacts, recognize the value of a good library and adapt to the circumstances they find themselves in. Conversely, others soundly rejected the concept, and argued that the postgraduate programme covered the methodologies and principles; this was complemented by the knowledge and skills garnered during the individual's career so that there should be continued development of skills and knowledge. Thus obsolescence occurred only when the individual lost the motivation for professional growth and development.

STUDENT SURVEY

Fifty students from the five universities responded to a questionnaire left for them to complete in their own time. The responses are analysed below.

Background

The respondents came from 16 countries. Eight countries were in Africa (15 students), five were in Asia (31 students), two were in the Middle East (two students) and one student was from South America. The countries most commonly represented in the student body were: India (19 students), People's Republic of China (nine students) and Ghana (six students). It is to be noted that one university had two projects involving India which were sponsored by an international aid agency; this accounted for nine of the respondents.

The majority of the respondents were male (48 male, 2 female) and married (41 married, 9 single). Of those who were married 71% had their family with them in Canada; for those whose family was still in their home country, 50% expected their family to join them in Canada.

The average length of time the respondents had been in their programme was 2.2 years. For masters candidates the average time in the programme was 1.7 years and for doctoral candidates it was 2.6 years; there was an equal number of masters and doctoral respondents.

Prior to coming to Canada 26% of the respondents had studied outside their home country and 88% had been employed in their home country. In terms of English language proficiency 94% believed they had adequate language background for their studies.

Programme

The majority of respondents (82%) felt they received adequate information on their programme before arriving in Canada. The nine who were dissatisfied cited lack of information on the coursework and the nature of the research topics which were available. In the case of three students on an international aid project, difficulties were experienced because their home country selected them at the last moment. Thus they had no opportunity to gain information on their prospective programmes.

The majority (62%) were undertaking a programme which was available in their home country; this proportion was the same for both masters and doctoral programmes.

Ninety six percent of the respondents felt that they had sufficient advice, supervision and academic support. Of the two who were dissatisfied, one felt that the coursework was identical to that already covered in their home country; whilst the other was frustrated with the lack of suggestions coming from their supervising committee.

When asked to rate their chief academic supervisor's knowledge of the issues affecting agricultural engineering in developing countries 48% of the respondents used 'excellent', 35% used 'very good', 15% used 'adequate' and 2% used 'poor'. In terms of the relevance of the content of their study programme to the needs of their home country, 26% felt that all parts were highly relevant, 60% thought all parts were relevant and 14% responded that some parts were irrelevant.

When asked the relevance of the skills (computer, laboratory, analytical etc.) they were mastering to their projected career, 46% responded that they were all highly relevant, 50% felt that they were all relevant and 4% thought some were irrelevant.

The vast majority (92%) of the respondents had selected a major project or thesis topic and 95% of these believed their topic was of relevance to their home country.

General issues

This section sought to elicit opinions on the level of satisfaction with the services and facilities available to the students and to examine the cultural exchange occurring between Canadians and the international students. In terms of the welfare services available (social support, assistance with housing, ease of access to medical services etc.), 61% felt that the services were 'excellent' or 'good', 33% responded that they were 'fair' and 6% said they were 'poor' or 'inadequate'. The study facilities made available to the students (office space, access to library, photocopiers and computers) were rated as 'excellent' by 45% of the respondents, 'good' by 47% and 'fair' by 8% of the respondents.

The majority (91%) of the respondents said that the orientation to the University and the Department was adequate; for those who were dissatisfied the elements which were lacking included: 'not

taking into account the point of view of the new student' and 'means of communication to express our feelings without fear of victimization'.

When asked if they had been able to talk to Canadians about their country and culture, problems, lifestyles etc., 80% replied in the affirmative. Of these responses the following groups of Canadians featured: students (36 responses), academic staff (22 responses), and church groups (13 responses). Only nine respondents had made formal presentations concerning their home country; these included speaking to service clubs, seminars within the University and international 'nights' on campus. Sixty percent of the respondents had established relationships with Canadians which they expected to continue after completion of their programme.

Obtaining housing at the start of the study programme can be a stressful event; to determine the source of support at this time the respondents were asked to indicate who organized their housing. 'A friend' was the more common (42%) followed by their supervisor (36%), with 16% doing it themselves.

Personal

A key question is: 'why are you studying outside your home country?'. In response to this 60% of the respondents reported that they sought to gain expertise or knowledge which their country needed and/or they wished to take advantage of the facilities and opportunities in Canadian universities. The second major reason given was the desire to have an international experience to witness other cultures and allow for personal development (cited by 18% of the respondents). A minority (10%) were studying in Canada because the programme was not available in their home country.

In terms of financial position, 86% described their family as having a modest income in their country. The data on financial support during their studies was:

I pay all expenses myself	5 respondents
My family pays some expenses and I pay some	2 respondents
My family pays all the expenses	0 respondents
I have a Canadian scholarship which meets most of the expenses	24 respondents
I have a scholarship from my home country which meets most of the costs	7 respondents
Other	9 respondents

Of those who replied 'other', many had dual or triple combinations of the above options.

The majority of the respondents (85%) expected to return home on completion of their programme, with 65% having a position to return to. All respondents were confident that their future position would enable them to use the postgraduate education they had received in Canada. Further-

more, 71% were of the opinion that there were good employment prospects in their country for people with the education they were receiving. However, when asked if they thought that employers in their country preferred to hire those who had studied abroad the responses were: yes (49%), no (18%), don't know (33%).

DISCUSSION AND CONCLUSIONS

It is clear that postgraduate students from developing countries play a key role in the Departments of Agricultural Engineering visited. Their presence is in many ways a pragmatic response to the decline in student enrolments in agriculturally related subjects which occurred through the 1980s. This led to a dearth of Canadian postgraduate students and pressure to increase enrolments in order to maintain staff positions.

The majority of the staff members viewed postgraduate students from developing countries in a positive light and acknowledged that their research programmes would be curtailed without them. Thus many staff members saw these students as important in terms of their career as an academic. At the same time most staff members recognized that such students required more input on the part of their supervisor(s), but that there was little or no additional financial cost.

There was a widespread belief that the internationalization of the postgraduate student group was a positive effect and that Canadian postgraduate students benefitted from the cultural exchange and the opportunity to learn from students from developing countries. However, support for this belief was largely anecdotal. The only data supporting the view came from the postgraduate student questionnaire which determined that 80% of the students had discussed their country, lifestyle etc. with Canadians and that 60% had established relationships with Canadians which they expected to continue.

There were in effect two distinct groups of postgraduate students from developing countries: firstly, there were students enrolled in research-based degrees, and secondly there were students enrolled in coursework masters degrees (professional upgrading). The first group were generally funded from Canadian sources and in effect made up for the shortfall of Canadian candidates. Thus the research was relevant to Canadian needs and employed technology which was appropriate to the Canadian situation. The second group was generally funded by an international aid agency and the content of the programme was relevant to the needs of the developing country. These students were normally enrolled in coursework masters programmes.

Two staff in particular expressed concerns regarding the need to maintain a balance within the department between these two groups of students. It was considered to be detrimental to the long-

term well-being of the Department if the coursework masters programme dominated. The rationale was that the coursework masters programme focused on applying existing engineering knowledge to a developing country situation, whereas the research-based degree focused on the generation of new knowledge through the research conducted to satisfy the thesis requirements.

Students expressed satisfaction with the programmes they were enrolled in and with the relevance of the programme to their home country situation. Even though students were working on research projects related to Canadian situations both the students and staff agreed that it was the fundamental principles which were of prime importance. This approach was further supported by the primary reasons given for studying in Canada, which were to gain knowledge and expertise and to take advantage of the opportunities available in Canada.

The potential role of postgraduate education in the development of a country's technical capacity was well accepted by the staff, with the majority indicating that they believed it occurred (although some staff clearly disagreed). A major concern of the staff was that students did not wish to return to their home country and would prefer to stay on in North America. This perception clearly clashed with the responses of the students who indicated that 85% expected to return home on completion (this may be a case of students responding in a manner which they perceived as most prudent). A final observation on this point is that a significant proportion of younger staff in the Departments visited had originated from developing countries.

The enrolment of most research-oriented postgraduate students from developing countries was predicated on the availability of low tuition fees and a stipend in the form of a graduate assistantship or similar. Thus there was in effect an investment in the student by the Canadian taxpayer or corporate entities, with the return being the research conducted by the student on issues relevant to Canada. Higher tuition fees create problems for the students because they can no longer meet fees and living expenses from the standard stipend of approximately Can. \$14 000. The important role played by these students in research programmes in agricultural engineering in Canada has been established. It now behoves the Departmental Chairpersons to monitor Government policy on tuition fees and to ensure that the Government is aware of the ramifications of changes. In essence this is an issue of the Universities' contract with society for postgraduate education.

The following conclusions may be drawn from this study:

1. Postgraduate students from developing countries were an essential element of the research and teaching of the Departments of Agricultural Engineering visited; their absence would seriously affect many research programmes.

2. There were two distinct groups of students from developing countries: firstly, those who were enrolled in research-based degrees with research relevant to Canadian needs and who were generally funded from Canadian sources; secondly, those who were funded from international sources and who were typically enrolled in coursework masters programmes.
3. There was widespread satisfaction on the part of the students with the programmes and facilities; furthermore all parties believed the programmes were appropriate to the needs of developing countries in the longer term.
4. The presence of postgraduate students from developing countries was seen by both staff and students as beneficial to all parties viz. Canadian universities, the Canadian research community, students themselves and their home country (if they returned home).
5. The issue of differential tuition fees for foreign students had significant implications for the Departments of Agricultural Engineering visited.

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