Is it true that institutions involved in teaching Engineering through ODL conduct less research? If so, why is it? – Sri Lankan Experience

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ABSTRACT

This study is conducted to investigate the general conception that academics/students of institutions where engineering is taught through distance mode conduct less research, compared to other institutions and disciplines taught through the conventional mode. As an introduction to the study, the level of research conducted by Sri Lankan researchers was initially observed, and checked to see how this compared with research conducted in neighbouring countries. Subsequently, the attention focused on the Open University of Sri Lanka (OUSL), which is the pioneer institution in ODL in Sri Lanka. The research carried out at OUSL over the last few years was scrutinised, and comparisons were done between different disciplines. The study aimed to conduct a tracer study to find the research conducted at the Faculty of Engineering Technology over the past years and compare it with research conducted by other faculties at OUSL. Through this study it was clear that the number of research papers presented at conferences and journal articles produced by the Faculty of Engineering Technology was less compared to the other three faculties in the university. Regarding research papers and conference presentations; Faculty of Natural Sciences topped the list, followed by the Faculty of Humanities and Social Sciences, the Faculty of Education, and finally, the Faculty of Engineering Technology. This study highlights the basis for the above listing and why the listing is in this order. The tracer study and questionnaire survey were able to reveal some interesting reasons for the low level of engineering-based research, compared to other disciplines, when engineering is taught through ODL.

INTRODUCTION

THE Faculty of Engineering Technology at the Open University of Sri Lanka (OUSL) is involved in teaching engineering through Open and Distance Learning (ODL) mode over the last 25 years. Although the faculty has produced around 400 engineering graduates in Civil, Computer, Electrical, Electronic & Communication, Mechatronics and Mechanical Engineering fields over the period of its operation, the graduate pass out rate has not been that high compared to the other three conventional type engineering faculties in the country.

OUSL took the bold initiative to launch an engineering degree through ODL way back in 1980, at a time when ODL was not much talked of or taken seriously. Even with current technological advancements that have taken place in ODL, it has yet to see universities and institutions offering the wide variety of engineering disciplines as OUSL does. Anyhow, despite initial setbacks, the number of engineering graduates passing out from OUSL is on the increase (see Figure 1). Although graduate numbers are increasing, it is said that the faculty of engineering at OUSL is not involved in discipline-based research as much as the other engineering faculties of conventional universities. This is evident from the research grants currently active, and the number of conference papers and journal articles published annually by engineering faculty members of different universities.

RESEARCH AND DEVELOPMENT

Scientific research, innovation and creativity leading to technological advancements are the hallmarks of economic development. This is historically evident from the rapid development of Europe, North America and Canada after the industrial revolution. It is also evident from the economic boost of Japan after the Second World War, and more recently, the newly emerging economies such as China, Korea and India (Kulasooriya, 2011).

Before focusing attention on engineering research, if we observe the broader picture by looking at research conducted in the Southeast region, it can be clearly seen that India tops the research publication list (as indicated in Table 1). It is evident from Table 1 that the India is emerging as a leading power in research and development in the region. It can also be seen that Sri Lanka does not paint a satisfactory picture when it comes to research publications; it is only ahead of Nepal. The reason for this low level of research output is that the expenses incurred for research in Sri Lanka is relatively low, when compared to neighbouring countries.

In Sri Lanka, the Gross Expenditure spent on Research and Development (GERD) as a percentage of Gross Domestic Product (GDP) is 0.11%, compared to India which is 0.8%; on top of huge difference between GDPs of the two countries. In Sri Lanka, GERD for the year 2008 is US$46.1mil, whereas in India, GERD for year 2008 is

Table 1: SCI Publications Over Past 5 years

Country	2005	2006	2007	2008	2009
India	19,448	20,705	22,215	25,377	25,647
Singapore	5,316	5,438	5,407	6,257	6,543
Thailand	2,270	2,552	2,940	3,466	3,630
Pakistan	769	877	1,110	1,505	1,591
Malaysia	518	535	661	698	752
Bangladesh	407	455	464	542	558
Sri Lanka	242	241	269	303	300
Nepal	142	183	166	145	170

Source: Science Citation Index: The Thomson Corporation

US$2,263.5mil, which is around 50 times of Sri Lankan figure (UNESCO Statistics, 2009). This probably explains the low number of research publications in Sri Lanka compared to India.

Let us take a closer look at the Sri Lankan researchers who are involved in conducting and publishing research. Table 2 indicates the number of research and development scientists and technicians employed by different sectors from 2006 to 2008. It is clear from Table 2 that more than 60% of research scientists and around 40% of research technicians who carry out research in the country are from universities. This shows the heavy involvement of Sri Lankan universities in research and development.

Table 2: Number of Research & Development Scientists/Technicians by Sector

Sector	2006				2008			
	Scientists		Technicians		Scientists		Technicians	
	No	%	No	%	No	%	No	%
(1) Universities and Higher Education Institutions	2,839	*62.8*	807	*42.1*	2,466	*61.1*	793	36.6
(2) State Sector	1,479	*32.9*	1,031	*53.7*	1,187	*29.4*	1,204	55.6
(3) Private Sector and NGO	202	*4.5*	80	*4.2*	384	*9.5*	169	7.8
Total	**4,520**	***100***	**1,918**	***100***	**4,037**	***100***	**2,166**	**100**

Source: National R & D Surveys, Sri Lanka 2006 & 2008, NSF

RESEARCH AND DEVELOPMENT AT ODL INSTITUTIONS

As cited by Braimoh (2002), despite the glowing virtues of distance education, it regularly comes under fire by public who ostensibly consider this process of teaching and learning as inferior, with less research and innovation. However, the tracer study conducted on graduates passing out in the year 2009 from OUSL showed that more than 80% of engineering graduates have indicated complete satisfaction on laboratory experience and field exposure during their engineering undergraduate programme at OUSL (Gunawardena and Ekanayake, 2010). Paradoxically, distance education, according to Lephoto (2000), has great potential in that it is used to provide for more than what the formal system can do. Hence, the development and sustainability of ODL institutions are increasing

It is commonly said that institutions (especially universities) which conduct teaching through the ODLdistance mode conduct less discipline-based research compared to conventional type universities which has more face-to-face interaction with the students. This accusation is common to all science disciplines, but especially engineering. As mentioned earlier, the Faculty of Engineering Technology at OUSL is one of the very few faculties in universities in the world which have undertaken the very tedious task of teaching core-engineering (mainly Civil, Electrical and Mechanical) through ODL. Although the faculty has been able to overcome some of the difficulties it had to face at the initial stage, that is, at the introduction of the engineering curricula, it has come a long way in improving the quality of graduates, and number of graduates passing out annually from the faculty (Figure 1).

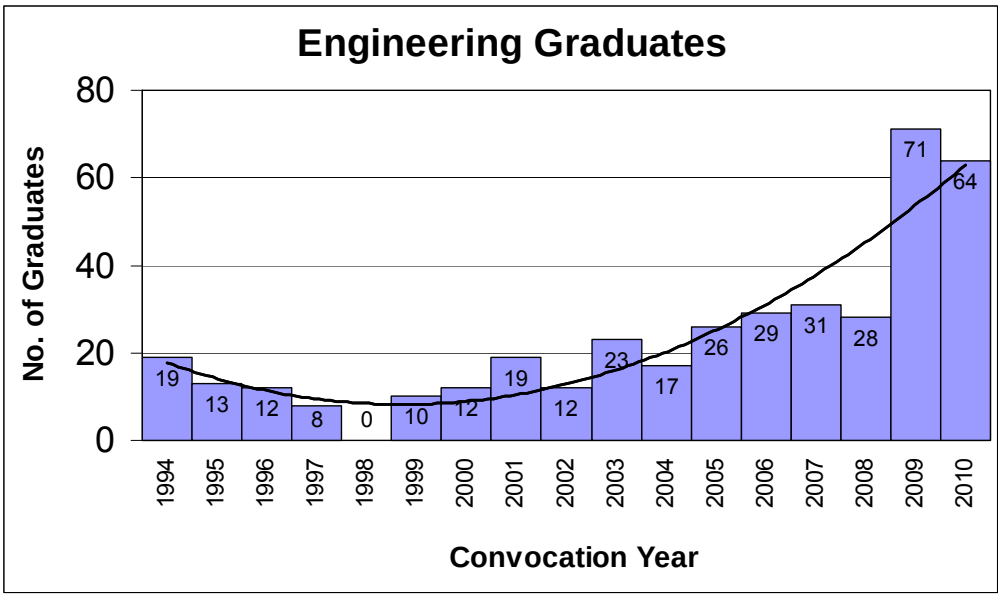

Figure 1: Bachelor of Engineering Technology Graduates, OUSL

But the number of conference papers and journal articles produced by both staff and students of the faculty of engineering technology is less compared to conventional

university engineering faculties. OUSL has four faculties, namely (1) Faculty of Engineering Technology, (2) Faculty of Natural Sciences, (3) Faculty of Humanities and Social Sciences, and (4) Faculty of Education.

During the period 2005 to 2010, OUSL has conducted five research conferences with the participation of the above four faculties where academics and students presented their research outcomes. The number of presentations done by staff members and students of different faculties are listed in Table 3.

(a) ***Conference Papers Presented at Annual Sessions by Faculties of OUSL***
When compared among the four faculties, the Faculty of Engineering Technology produced least number of conference papers and journal articles (Table 3).

Table 3: Number of Research Papers by Faculty, at Annual Sessions at OUSL

	Faculty of Engineering Technology			**Faculty of Natural Sciences**	**Faculty of Humanities & Social Sciences**	**Faculty of Education**	**Outside OUSL**	**Total no. of Papers**
	Engi	**Agri**	**Text**					
25th Anniversary Conference 2005	00	00	02	06	07	08	--	23
Percentage (%)	0 %	0 %	8.7 %	26.1 %	30.4 %	34.8 %	--	100 %
Academic Sessions 2007	00	05	01	16	09	02	--	33
Percentage (%)	0 %	15 %	3.1 %	48.5 %	27.3 %	6.1 %	--	100 %
Academic Sessions 2008	02	08	03	12	10	05	--	40
Percentage (%)	5 %	20%	7.5 %	30 %	25 %	12.5 %	--	100 %
Academic Sessions 2009	07	08	06	18	12	07	--	58
Percentage (%)	12 %	14 %	10.2 %	31 %	20.7 %	12.1 %	--	100 %
30th Anniversary Conference 2010	03	00	00	04	05	10	17	39
Percentage (%)	7.7%	0 %	0 %	10.3 %	12.8 %	25.6 %	43.6 %	100 %
Total	**12** 6.2%	**21** 11 %	**12** 6.2 %	**56** 29 %	**43** 22.2 %	**32** 16.6 %	**17** 8.8 %	**193** 100 %

It is evident from Table 3 that from the conference presentations conducted at OUSL over the last five years, the Faculty of Natural Sciences topped the list with 56 presentations, followed by the Faculty of Humanities and Social Sciences (43 presentations), the Faculty of Education (32

presentations) and finally, the Faculty of Engineering Technology (12 presentations on core engineering disciplines).

(b) ***Research Journals by Faculties of OUSL***

Table 4 indicates the Biannual Research Journals published by the different faculties of the university. Although these are supposed to be published biannually, printing is governed by the number of submissions by the staff members.

Table 4: Journals by Faculties of OUSL and Number of Issues Published

Name of Journal	Faculty	Number of Issues over the last five years
1. OUR – Engineering Technology	Faculty of Engineering Technology	Although this is a biannual journal, none was published between 2005 and 2011 due to lack of articles.
2. VISTAS – Journal of Humanities, Social Sciences and Education	Faculty of Humanities and Social Sciences	Biannual journal, several issues were published between 2005 and 2011.
3. ADEEKSHA - Journal of Education	Faculty of Education	Biannual journal, several issues were published between 2005 and 2011
4. OUSL Journal – Faculty of Education & Faculty of Education	Faculty of Education	Biannual journal, several issues were published between 2005 and 2011.

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3. ADEEKSHA – Journal of Education published by Faculty of Education. Biannual journal.

4. OUSL Journal – Faculty of Education
   Biannual journal. Several issues were published between 2005 and 2011.

It could be seen that the OUR – Engineering Technology Journal was not published during the period 2005 to 2011 due to lack of papers from the Faculty of Engineering Technology staff members. This is another clear indication of lack of research-based articles by the Faculty of Engineering Technology staff members compared to other faculties.

Table 5: Main fields of Sri Lankan Publications in the SCI journals 2007 & 2008

		2007	2008
		Total Number of Publications	**Total Number of Publications**
Engineering, Technology & Earth sciences	– Earth sciences	13	11
	– Engineering & Technology	09	12
	Total	**22**	**23**
Natural Sciences	– Agriculture	20	25
	– Biological sciences	31	20
	– Molecular biology & biotechnology	16	08
	– Chemical sciences	29	16
	– Environmental sciences	08	21
	– Fisheries / Aquaculture	00	01
	– Food science	09	07
	– Forestry	05	07
	– Mathematics	05	04
	– Nanotechnology	02	01
	– Physics	08	20
	Total	**133**	**130**
Medical and Veterinary sciences	– Medical & Health science	107	143
	– Veterinary sciences	07	07
	Total	**114**	**150**
	Total Number of Papers	**269**	**303**

Source: National R & D Surveys, Sri Lanka 2006 & 2008, NSF

Table 6: OUSL Staff Publications 2005 to 2009

Faculty	Type of Publication	Year					Total
		2005	2006	2007	2008	2009	
Education	International Conference	09	11	06	06	05	37
	Local Conference	08	10	16	08	11	53
	Journal Articles	06	02	05	02	02	17
Engineering	International Conference	05	03	07	02	02	19
	Local Conference	08	06	10	17	18	59
	Journal Articles	03	02	05	07	06	23
HSS	International Conference	02	05	14	03	00	24
	Local Conference	07	28	17	26	26	104
	Journal Articles	05	07	03	03	09	27
Nat. Science	International Conference	08	03	06	12	06	35
	Local Conference	14	15	38	38	28	133
	Journal Articles	12	05	03	12	05	37

Source: OUSL Annual Reports 2005 to 2009

METHODOLOGY

A questionnaire survey was conducted among the academic staff members of the Faculty of Engineering Technology in order to take a snapshot of their research profile in 2010, and also to get their views on different aspects of research and their perspectives. The Faculty of Engineering Technology has a permanent lecturing staff of 54, including professors, senior lecturers and lecturers. The questionnaire was given to all the 54 staff members and 44 responded to the questionnaire, which is a quite high return rate (81.5%).

The questionnaire comprised seven questions as follows:

Questionnaire:

Name of Academic (optional) & Designation :…….....

1. No. of Conference Papers Presented in year 2010 :
   Local: ……... International (i.e. overseas) : ……
2. No. of Journal Articles Published in year 2010 :
   Local Journals : …… International : ……
3. Year of your last Conference Paper or Journal Article Published : ……..
   (Conference Paper / Published Article)
4. Any Research Grants you have obtained to conduct research during the year 2010? :
   □ Yes □ No
5. As an Academic, are you satisfied with your research performance in the year 2010? :
   □ Yes □ No
6. If you are not satisfied, reasons for not being able to perform research (you may tick more than one box if you wish)
   □ - Due to dealing with large number of students; lack of time
   □ - Due to poor health and lethargy; lack of motivation
   □ - Due lack of research culture and environment
   □ - Difficulty of obtaining research funding/grants
   □ - Continuous assessment marking; lack of time
   □ - Quality of students you deal with; lack of enthusiasm
   □ - Lack of research training andproper leadership
   □ - State any other reason ……

7. If you compare research publications produced by the Faculty of Engineering with the other three faculties at OUSL, there is lesser number from the Engineering Faculty. This is evident from the OUSL annual report in recent years. The reasons for the lack of publications in engineering and technology is (you may tick more than one box if you wish):
   □ - Engineering related research is more difficult
   □ - Producing papers in some other disciplines is rather easy
   □ - Engineering Faculty staff are comparatively less capable
   □ - Conscious of the quality of paper, not the number of papers.

ANALYSIS & RESULTS

The responses obtained from the 44 respondents are as follows:

1. ***Conference presentations****:*
   In year 2010, there were a total of 26 papers presented by the faculty staff members and out of the 26 papers presented, six have been presented overseas and 20 locally.

2. ***Journal Articles****:*
   In year 2010, a total of nine journal articles have been published by the faculty staff members and out of the nine journal articles, five were published in local journals and four in International Journals.

3. ***Last paper published, either conference proceedings or journal articles****:*
   Another question posed to the staff members was, asking them to state the year when their last work was either published in a journal or presented at a conference. The answers obtained are summarised in Table 7 below.

Table 7: Last Conference Presentation or Publication

The year of last publication or presentation	Number of staff members
2010	12
2009	09
2008	02
2007	04
2006	01
2005	01
2000 to 2005	04
Before 2000	04
No presentations or publications	09

Out of 44 respondents, nine (i.e. 20.5 %) members admitted that they had never published or presented a paper in a conference.

4. ***Research grants***
   There was only one research grant obtained by a faculty member currently.

5. ***Self satisfaction***
Except four members, all the other 40 members (i.e., 91%) of the staff were unhappy with the extent of research they conduct.

6. ***Reasons for not being able to perform research at a reasonable level***
Figure 2 below shows the percentage of staff that indicated different reasons for poor record of research. The main reasons given by the majority of staff members were lack of time for research due to large number of students, lack of research culture and environment, and continuous assessment marking etc. No member admitted to being unable to perform due to poor health or lethargy.

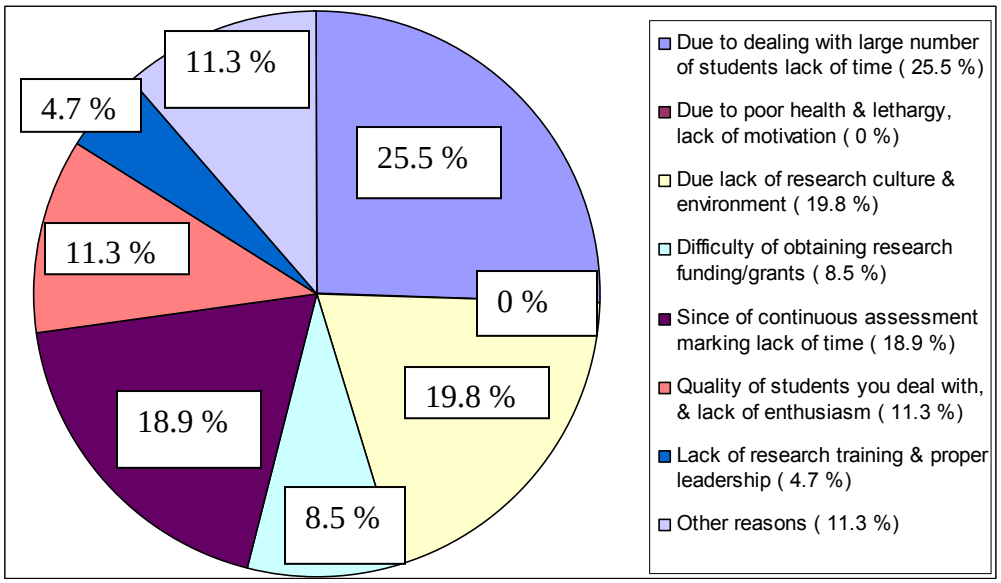

Figure 2: Reasons for not being able to perform Research

7. ***Reasons for comparative poor performance by engineering faculty staff members***
Figure 3 below shows the percentage of staff that indicated different reasons for poor record of research, especially by the engineering faculty staff member compared with other faculties. About 33.8 % members admitted that conducting engineering related research is more difficult. Another 33.8 % members said that they are more concerned about the quality of the paper and not the number of papers they produce. About 27.9 % thought that producing papers in some other disciplines is comparatively easier.

CONCLUSIONS

This study showed that the number of research papers presented at conferences and journal articles produced by the Faculty of Engineering Technology staff is visibly less compared to the number produced by other faculties in the university. Natural Sciences

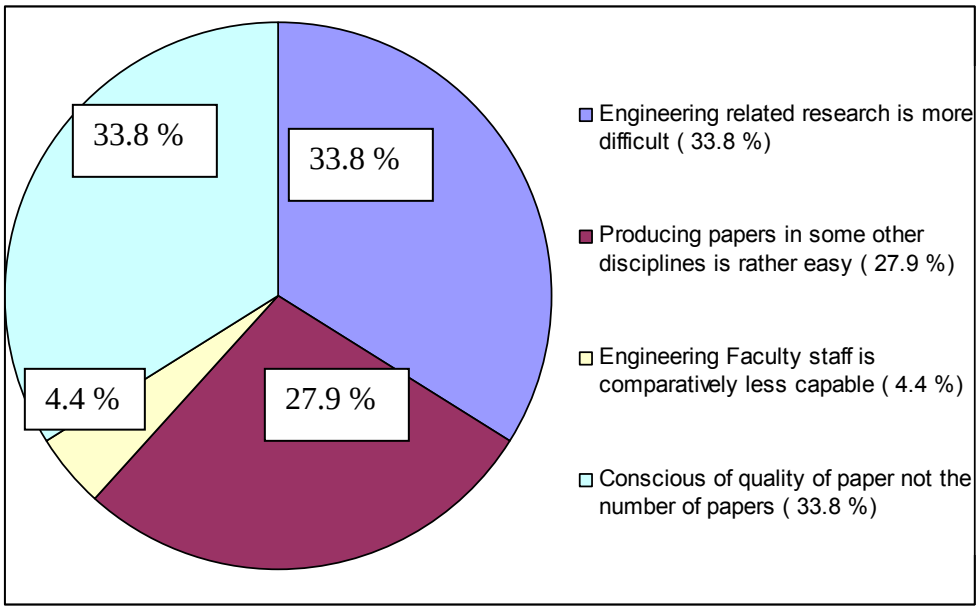

Figure 3: Reasons for comparative poor research performance by Engineering Faculty Staff

top the list, then come Humanities and Social Sciences, followed by Education and finally, Engineering. The reasons for this low engineering-related research output is mainly the lack of time among staff members to devote to research due to the following: (i) handling of large numbers of students, (ii) continuous assessment process, (iii) conducting pre-orientation and orientation programmes in marketing the courses, (iv) having to counsel large number of students and registering them, (v) activities in regional and study centres, (vi) lack of research culture because of ODL, (vii) difficulty in conducting engineering research which involves considerable amount of inputs in field work, laboratory work, data analysis, calibration and validation processes etc. All these factors, combined together, contribute to the low level of research output from the Faculty of Engineering & Technology.

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