Liberalisation of Technical Education in Kerala

Has Higher Enrolment Led to a Larger Supply of Engineers?

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There has been a significant increase in the college seats available in undergraduate engineering degree programmes in Kerala. This has happened by licensing a number of privately-owned engineering colleges. Consequently, enrolment in engineering increased from about 2,800 in 1991 to about 28,000 in 2008. After a careful analysis of a unique data set, this study reaches the conclusion that actual out-turn rates have been steadily declining, especially since 2004. This decline is observed at the aggregate level, across different branches and also across different colleges. It then hypothesises about the probable causes for this steady decline in out-turn rates and concludes with the larger implications of this state of affairs.

Earlier versions of this paper were presented at an open seminar in the Centre for Development Studies, Thiruvananthapuram on 7 November 2007 and at the International CDS-British Northern University's India Forum seminar on 24 March 2009 and at the conference, "Kerala's Economy: Situating the Present and Imagining the Future" on 26 February 2012. We are grateful to the comments received during these presentations and to R V G Menon and R Nagaraj for comments on an earlier draft.

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Economic liberalisation in 1990s gave a major impetus to the Indian software services industry. It grew dramatically from the mid-1990s and continued to show a significant growth performance until it was adversely affected by the global financial crisis of 2008-09. India gained a comparative advantage in this industry through its low labour cost. Firms took advantage of availability of trained human resources in the country to provide software services for other countries. Fuelled by domestic human resource and raise in demand for software services in the United States (US) and Europe from the late 1980s, software services emerged as a success of economic liberalisation. As industry grew, labour supply became a major challenge. It is generally accepted in both industry and policy circles that technical education system in India was not supplying enough human resources to the labour market. The same all-India pattern could be found across the states, and even for a state like Kerala, which had just begun to make a presence, albeit, small in the information technology (IT) services sector. Late 1990s saw a significant growth in software exports from Kerala. Given the extreme shortage of trained engineers in the disciplines related to computer science, the IT services firms were prepared to recruit engineers of any discipline and then subject them to in-company training as a way of equipping them for the growing service contracts that these companies were receiving. Very soon this recruit strategy came to a grinding halt. Given the sudden surge in the demand for engineering graduates coupled with limited enrolment possibilities for the same, students were forced to migrate, especially to the self-financing types of engineering colleges located elsewhere.

Engineering education in the state was essentially public-funded until 2001. Most of these colleges were government-owned, although there were a small number of government-aided private engineering colleges which were also, by and large, subjected to the same enrolment policy as far as student admissions were concerned. Considering the inability of the state to invest further in technical education, and given the growing demand for engineering graduates even from within the state, liberalisation of technical education became an inevitable choice. This led to the liberalisation of technical education from 2001 or so, which dramatically increased the number of engineering colleges in the state. One argument that was furthered during the period was that by allowing private investment in technical education in a self-financing mode will reverse the capital flight from Kerala.

There is a tendency on the part of commentators, both industry and otherwise, to use this increased capacity of technical education institutions as an indicator of expanding human resources supply in the state. There exists a fair amount of confusion between enrolment and actual supply of engineers. The present study is an attempt to correct this distortion in our understanding by systematically working out the trends in actual supply of engineers from the engineering colleges in Kerala. It is based on the data compiled by the National Technical Manpower Information Systems (NTMIS) supplemented with data on enrolments and actual out-turns from one of the oldest leading universities in Kerala, namely, the University of Kerala. It must, however, be stated at the very outset that the NTMIS is not up to date with its data. For Kerala, the latest available out-turn rates (OTRs) can be computed for the 2004 cohort of undergraduate students in engineering passing out in 2008.[1] Actual OTRs computed with this data for 1991 through 2004 cohorts of students enrolling for undergraduate engineering courses in the state show that the OTRs have actually come down significantly and a branch-wide analysis shows that there has been a significant reduction in the rate of out-turn in the more popular branches. It is evident that the expansion in capacity of undergraduate education has not led to improvements in supply. This state of affairs has precipitated a serious public debate in the state, questioning the policy of liberalisation which, it appears, does not seem to have improved the quantity to the desired extent, even as it appears to have had a deleterious effect on the quality of engineers produced within the state. The only consolation perhaps is that the problems that are alleged to have been brought about by liberalisation of technical education are not restricted to Kerala alone, but explicit reverberations of this could be found in other states as well. In short, the effect of liberalisation on technical education as well as its likely impact on both the quantity and quality of engineers in the country is a key policy challenge faced at the central and state levels.

The choice of the Kerala situation as a specific case for an in-depth examination is justified because Kerala has one of the largest number of seats for undergraduate courses in engineering, especially when it is related to its population: Kerala's share in the total intake for undergraduate engineering studies accounts for about 5%, and this intake in 2008-09 has increased by about five times more than the intake of two decades earlier in 1990-91 (Annexure 1, p 72).

Given the above scenario, the paper is structured into six sections. Section 1 maps OTRs of engineers, both at the aggregate and across various engineering branches for the state as a whole. This macro picture on OTRs is further supplemented with those obtained at the micro level from one of the universities in Kerala. The two throw light on the effect of self-financing colleges on the out-turn of engineering graduates. This forms the focus of Section 2. Section 3 speculates on the possible reasons for this state of affairs, observed both at the macro and micro levels. Section 4 discusses the interventions by the state towards reversing this trend. Section 5 delves into the implications of the declining OTRs and Section 6 sums up the main findings of the study.

1 Out-turn of Engineering Graduates at the Macro Level

Courses in engineering have emerged as one of the most preferred options for students passing out of the secondary school system. This higher demand to a great extent is influenced by the increasing demand for engineers in a rapidly growing economy. This is reflected in the ever-increasing average salaries of graduate engineers most of whom get absorbed in one of the fastest growing industries in the country, namely, the IT services industry. In response to this growing demand, there has been a tremendous increase in the capacity and actual intake of places for engineering in the state (Table 1).

Table 1: Trends in Number of Engineering Colleges, Sanctioned and Actual Intake
(in numbers)

	Number of Engineering Colleges	Intake: Sanctioned	Intake: Actual
1991	9	2,810	2,795
1995	16	3,930	4,441
1996	17	4,699	4,657
1997	17	4,871	4,792
1998	17	4,979	5,122
1999	24	6,668	6,126
2000	33	8,820	8,739
2001	45	11,293	11,147
2002	74	18,280	16,143
2003	81	19,889	16,563
2004	87	23,643	16,837
2005	91	24,526	21,857
2006	91	26,349	25,471
2007	91	28,578	27,975
2008	94	30,069	29,635
2011	142	45,147	NA

Source: NTMIS Nodal Centre for Kerala (various issues), Kerala State Planning Board (2012).

It is seen that the real growth in capacity and intake started from around the end of the 1990s and continued all through the last decade. Another interesting fact is that although sanctioned intake and actual intake were moving in tandem until 2001 or so, the two started diverging from each other from around 2002 onwards until 2006 or so with actual intake being considerably less than the sanctioned one. Once again, since 2006 onwards the two have started moving in tandem. A significant increase happened in the number of engineering colleges in 2002, when 29 new colleges were sanctioned. Almost all these new colleges are in the private sector and they are usually referred to as self-financing colleges as they do not receive any grants from the state. But their main income is increased fees and donations of various kinds, charged from prospective students. In fact, their arrival has been the subject of a virulent debate on the consequences of privatisation of education and its repercussions on quality of instruction, etc. Often enough, this debate had violent overtones. In fact, the arrival of these self-financing colleges although has increased the capacity of engineering education in the state, at the same time, also brought to the fore, serious deficiencies in the higher education scene in Kerala. Although these colleges are distributed across all the 14 districts of the state, approximately half of them are located in the three districts of Thiruvananthapuram, Kollam and Ernakulam. In addition, 50% of the colleges are affiliated to two of the main universities, namely, University of Kerala and Mahatma Gandhi University.

An analysis of the branch-wide actual intake presents an interesting picture (Table 2, p 65). Although there are 19 branches now, five branches (electronics and communications, computer science and engineering, mechanical, electrical and electronics and IT) accounted for about 75% of the intake in 2007. However, in 1991 the top five branches (electrical and electronics, mechanical, civil, electronics and communications and computer science and engineering) accounted for about 85% of the intake. Interestingly, the concentration has come down with the emergence of a number of new branches, IT being one of the latest branches.

Traditional branches such as electrical and electronics, civil and mechanical have gone considerably down in student preferences. Electronics and communications, computer science and engineering and IT have taken up the share vacated by these three. In fact, electronics and communications has become the most preferred branch although the fastest growth rate is in IT. However, irrespective of the branch, most of the graduating students have been finding jobs in the IT services space where their previous training or background has become irrelevant.

Table 2: Changes in Branch-wide Intake: 1991 and 2007

Branch	1991 (in numbers)	Share (%)	2007 (in numbers)	Share (%)
Agriculture engineering	0	0	39	0.14
Applied electronics and instrumentation	45	1.61	1,078	3.95
Architecture	75	2.68	157	0.58
Biomedical	42	1.50	145	0.53
Chemical	78	2.79	215	0.79
Civil	584	20.89	2,050	7.51
Computer science engineering	255	9.12	5,603	20.52
Electrical and electronics	580	20.75	4,031	14.76
Electronics and communications	375	13.42	6,697	24.53
Electronics and instrumentation	0	0	377	1.38
Industrial engineering	21	0.75	17	0.06
IT	0	0	2,674	9.79
Instrumentation and control	32	1.14	120	0.44
Mechanical	581	20.79	3,842	14.07
Naval architecture and ship-building	28	1.00	35	0.13
Polymer engineering	0	0.00	26	0.10
Polymer science and rubber technology	18	0.64	22	0.08
Production engineering	81	2.90	142	0.52
Safety and fire engineering	0	0	32	0.12
Total	2,795	100	27,302	100

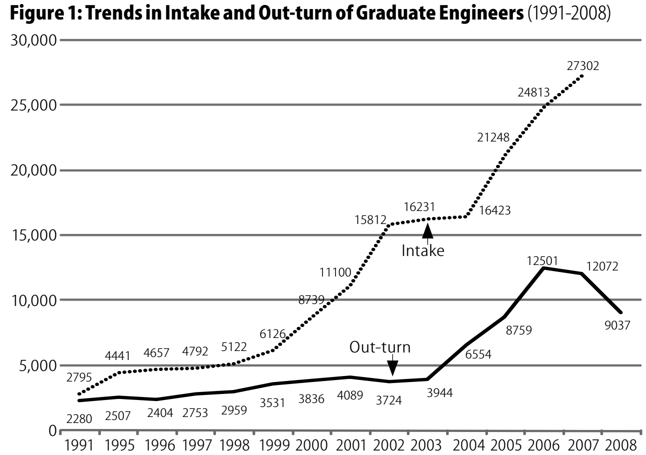
Source: NTMIS Nodal Centre for Kerala (various issues).

We understand that the more recent intake data shows a slightly different picture with the traditional branches gaining in importance. Student choices seem to be dictated more by the perceived demands from the labour market and these are individual choices, which may not be faulted upon. A natural correction for this distortion is bound to happen in the long run, although in the short run, such a lopsided structure may prevail.

The intake has increased at an annual average rate of 17%, while the out-turn has increased only at 15% per annum during the period 1995 through 2007 (Figure 1). Despite sharp increases in out-turn since 2004, it is seen that the out-turn has been on a declining mode since 2006. In 2007, for instance, when the intake is about 24,000 students, the actual number of engineers graduating is only about 9,300. In discussions among policymakers and industrialists as well, there is a tendency to use intake or enrolment figures to speak about actual supply of engineers. This is really fallacious. Enrolments are only indicative of potential supply of engineers, while the out-turn is a more a direct measure of the actual supply of engineers. In short, our analysis clearly shows us that, despite tremendous increases in enrolments or intake the actual supply of engineers has been considerably less, owing to high failure rates and dropout rates. This issue has, of course, attracted considerable attention in the popular press. Privatisation of engineering education, although increasing enrolments, has actually led to deterioration in the quality of engineering education as indicated by lower out-turns. However, in all fairness, this deterioration has actually started in the 1990s, when the provision of engineering education was still in the government sector. The fall in out-turn, which had already started happening, has been accentuated with the so-called privatisation.

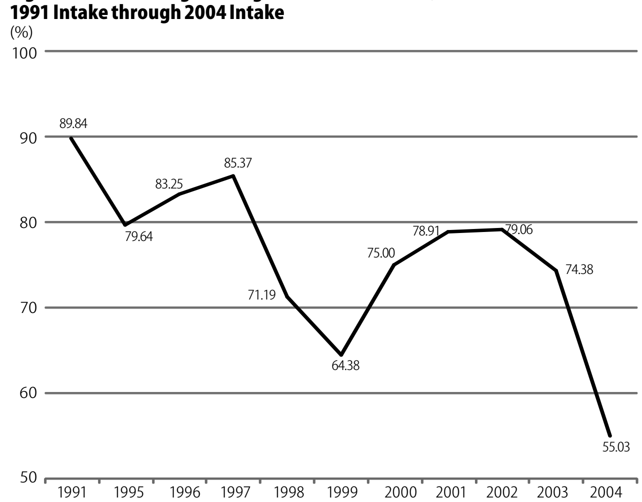
We now turn our attention to the OTRs. These rates measure the actual supply of engineers. Given the fact that undergraduate degrees in engineering in universities in Kerala (which, of course, follow the All-India Council for Technical Education (AICTE) pattern) is four years in duration, OTR in year "t" is obtained by dividing the out-turn in year "t" by the intake in year "t-4".

Figure 1: Trends in Intake and Out-turn of Graduate Engineers (1991-2008)



Source: NTMIS Nodal Centre for Kerala (various issues).

Figure 2: OTRs for Engineering Graduates in Kerala, 1991 Intake through 2004 Intake



Source: Computed from NTMIS Nodal Centre for Kerala (various issues).

We have worked out the OTRs both at the aggregate level (Figure 2, p 65) and at individual branches (Table 3). Given the four-year time lag and the availability of data, we are in a position to compute the OTRs for the intakes from 1991 (graduating in 1995) to 2004 intake (graduating in 2008).

This shows a rather alarming situation. The OTR, which was almost 90% for the 1991 intake, has started coming down over the years, and currently stands at about 55%. This means that currently, one out of every two students who join the four-year degree programme in engineering either drops out, or fails in the exams, resulting in low OTRs. This has serious implications for the actual supply of engineers. Even more is the social cost of such large failures. We deal with this issue in some more detail in Section 5.

How do these OTRs for Kerala compare with the all-India pattern? This is not available for India as a whole, as the National Technical Manpower Information System (NTMIS) does not report this data. However, the Annual Technical Manpower Review (ATMR) does report this data for some of the states. Banerjee and Muley (2008) have compiled this data on OTRs for the available states which include Kerala as well, but for the period 1991 through 2004. This is presented in Table 3. No clear trend is visible, excepting to say that the OTRs in Kerala compare favourably with the other states. West Bengal appears to have the best OTRs. However, it must be stated that the OTRs presented in this table does not tally with what we have presented in Figure 2, where these have been computed, employing the same methodology as Banerjee and Muley (2008). In specific terms, OTRs as computed by us is lower than OTRs computed by the latter authors. One explanation for the difference may be that Banerjee and Muley's estimates end with the 1998 intake (graduating in 2002), whereas our estimates refer to the intakes until 2004 (graduating in 2008).

We now analyse the OTRs at the disaggregated level – at the level of individual branches (Table 4).

There has been an across-the-board drop in OTRs in all the 19 branches in 2004 compared to 1995. The fall has been rather heavy in some of the more popular branches of electronics and communications, computer science and engineering and IT. We also notice that the OTRs have started falling, with fluctuations, from the 1998 intake onwards and the worst results were obtained for the 2004 entry.

Table 3: OTRs of Engineering Graduates across States in India (1992-2004, in %)

	Karnataka	Tamil Nadu	Maharashtra	Andhra Pradesh	Kerala	Delhi	West Bengal	Himachal Pradesh	Chandigarh	Orissa	Haryana	Assam	Gujarat
1992					0.84								
1993					0.82								
1994					0.78								
1995		0.76			0.9								
1996		0.86			0.86								
1997		0.74			0.92		1.01						
1998		0.69			0.86		1.01						
1999	0.63	0.72		0.97	0.91	0.94	1.02				1.09		
2000	0.61	0.73		0.94	0.86	0.9	1.01		0.85		1.2		
2001	0.62	0.7		0.93	0.81	0.82	1.06	0.66	0.75		0.53	0.74	
2002	0.6	0.75		0.75	0.75	0.74	0.88	0.82	0.83		0.83		
2003	0.59	0.77	0.11			0.64		0.78	0.8	0.89	0.37		1.03
2004	0.56					0.57		0.61		0.98	0.32		

Source: Banerjee and Muley (2008), Table 1.4.

Table 4: Trends in Branch-wide OTRs, 1991 Intake through 2004 Intake

Branch	1991/1995	1995/1999	1996/2000	1997/2001	1998/2002	1999/2003	2000/2004	2001/2005	2002/2006	2003/2007	2004/2008
Applied electronics and instrumentation	97.78	97.12	2000.00	82.73	86.36	75.15	63.79	69.02	76.54	69.27	54.26
Architecture	86.67	57.50	75.95	40.00	68.87	30.05	44.00	77.27	108.65	82.00	54.55
Biomedical	71.43	56.41	61.11	83.78	60.98	50.00	97.50	89.47	84.85	85.86	73.40
Chemical	94.87	71.95	77.11	83.15	64.08	75.17	75.35	87.32	84.00	94.52	77.40
Civil	89.21	69.94	76.10	77.47	65.86	59.46	74.67	81.85	88.10	76.31	65.38
Computer science engineering	82.75	78.01	87.52	89.62	71.45	64.84	77.38	78.07	81.07	75.04	57.62
Electrical and electronics	88.97	85.15	87.65	80.43	76.65	70.01	79.89	79.84	85.55	71.10	61.32
Electronics and communication	94.13	85.31	82.98	95.73	77.67	65.69	78.56	78.73	77.05	78.27	52.17
Electronics and instrumentation							49.04	59.18	70.76	69.01	44.38
Industrial engg	104.76	76.19	85.71	73.33	76.67	40.00	93.33	100.00	93.33	93.10	89.66
Information technology	0.00	96.05	108.00	72.58	76.67	67.83	77.43	71.00	70.49	63.11	42.57
Instrumentation and Control	103.13	96.67	93.75	92.50	62.50	76.32	59.32	66.10	85.71	57.66	50.00
Mechanical	89.71	76.71	75.50	87.15	67.82	63.61	66.85	87.97	74.06	72.44	49.90
Naval arch and ship-building	100.00	96.55	100.00	68.97	100.00	71.43	100.00	72.41	56.76	52.63	57.89
Polymer engg	0.00	0.00		103.77	78.85	51.35	138.89	181.25	190.63	0.00	38.46
Polymer science and rubber technology	100.00	88.89	23.08	106.25	100.00	77.78	39.29	113.33	100.00	87.50	63.64
Production engg	85.19	85.23	82.11	80.43	82.22	54.29	69.77	96.59	80.68	169.41	74.16
Safety and fire engg	0.00	0.00	100.00	83.33	62.96	31.03	54.05	56.67	93.33	96.67	60.00
Average	89.84	79.64	83.25	85.37	71.19	64.38	75.00	78.91	79.06	74.38	55.03

Source: Computed from NTMIS Nodal Centre for Kerala (various issues).

Results of 2008 show also that on an average the students who failed account for about 90% of those who passed (Table 5). In a number of popular branches the number of students who failed actually outnumbered those who passed. Recent press reports and our subsequent micro-level analysis lead us to believe that this trend is likely to continue in the future as well.

2 Out-turn of Engineering Graduates at the Micro Level

The University of Kerala, established in 1937, is the oldest university in Kerala. The oldest engineering college in Kerala, the College of Engineering, Thiruvananthapuram is affiliated to this university. This section provides a micro-level picture of engineering education in the state, with the help of data on intake and out-turn of engineers from engineering colleges affiliated to the University of Kerala. As of 31 March 2011, 39 engineering colleges are affiliated to the University of Kerala.

The number of engineering colleges affiliated to the university started increasing after the liberalisation of engineering education in 2001. From five colleges in the pre-liberalisation regime, the number of colleges increased to 16 by 2002. All the newly formed colleges have a self-financing model. There was a sudden increase in engineering colleges affiliated to the university in 2009.

In terms of capacity and OTRs, the data from Kerala University show the same pattern seen in state level data. The intake and out-turn for three cohort of students from 2004 to 2006 (Table 6) show that while intake has grown fast, the OTR has not increased at the same pace. The results for the 2006 cohort show a substantial reduction in OTR at 35%. Even the absolute number for the 2006 cohort is actually less than the absolute level of out-turn for the 2004 cohort.

Table 5: Ratio of Students Failed to Those Who Have Passed (%)
(Based on the 2008 Examination Results)

Polymer engineering	1.60
Automobile	1.59
Electronics and instrumentation	1.45
Printing	1.38
IT	1.18
Instrumentation and control	1.14
Electronics and communications	1.09
Naval architecture and ship-building	1.00
Mechanical	0.98
Computer science	0.86
Safety and fire engineering	0.83
Applied electronics and instrumentation	0.82
Electrical and electronics	0.79
Mechanical production	0.79
Mechanical automobile	0.68
Architecture	0.62
Civil	0.59
Marine engineering	0.53
Polymer science and rubber technology	0.50
Biotechnology	0.46
Biomedical	0.42
Chemical	0.36
Production engineering	0.35
Instrumentation	0.19
Agriculture engineering	0.13
Industrial	0.08
Total	0.90

Source: Computed from NTMIS Nodal Centre for Kerala (2010).

Table 6: Intake and Out-turn of Engineering Graduates from University of Kerala

Year of Intake	No of Students		Annual Growth (%)		OTR according to Year of Intake (%)
	Intake	Out-turn	Intake	Out-turn	
2004	4,486	2,814			62.73
2005	5,204	3,092	16	10	59.42
2006	7,286	2,517	40	–19	34.55

Source: Public Relations Office, University of Kerala.

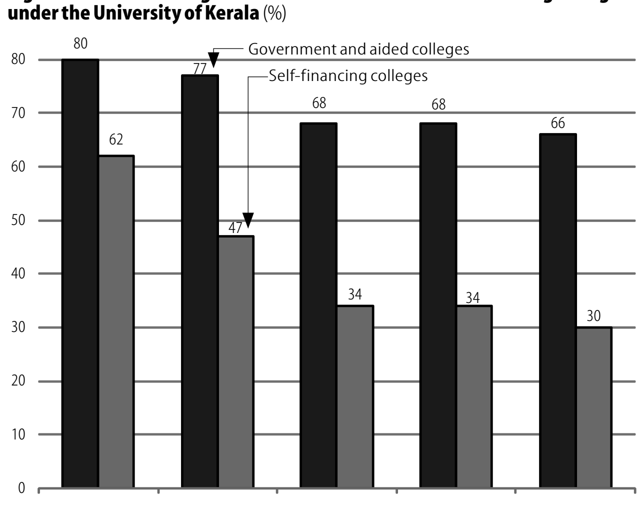
An analysis of results of individual colleges helps to better understand the source of failure in out-turn. Table 7 (p 68) gives the pass percentage of individual colleges affiliated to Kerala University between 2006 and 2010. Based on their financing model, colleges are grouped into government-funded, government-aided, and self-financing. It can be seen that the government-funded and government-aided colleges have a better pass percentage than self-financing colleges across the five years (Figure 3). While there is a drop in the pass percentage across all groups of colleges, it is much higher in the case of self-financing colleges. The difference between the pass percentage of self-financing and government-aided colleges continued to increase during 2006-10 and reached a stable level during the last three years. Two colleges from the self-financing mode, which show, relatively speaking, better results, are Mar Baselios College of Engineering and Technology and LBS Institute of Technology for Women. Of the two, LBS Institute of Technology for Women is under an autonomous government agency.

There has been a significant drop in the pass percentage since 2008 (2004 cohort).[2] This is attributed to the fact that before 2004, in 50% of the seats for engineering education, the government admitted candidates at a lower fee. As fee increased and the control of admission went to managements of self-financing colleges, many students with capability came to be excluded from self-financing colleges. This is reflected in the lower pass percentage from 2008 onwards. Either the students who gained seats in self-financing educational institutions did not meet the basic requirement for technical education, or the newly formed institutions did not have the ability to train the students suitably.

3 Some Hypotheses for the Decline in OTRs

We have now presented quantitative evidence to show that the OTRs have declined rather significantly for the state as a whole and at individual branches of engineering. This finding was further supported by a micro-level analysis of a leading university in the state. In specific terms we observed two major

Figure 3: Pass Percentages across Government and Self-financing Colleges under the University of Kerala (%)



Source: Based on data contained in Table 8.

Table 7: Pass Rates of Individual Engineering Colleges Affiliated to University of Kerala (in %)

Name of College	Year					Type of College
	2006	2007	2008	2009	2010	
College of Engineering, Thiruvananthapuram	87	85	73	74	73	Government
Government Engineering College, Barton Hill, Thiruvananthapuram	81	75	66	64	65	Government
SCT College of Engineering, Thiruvananthapuram	69	71	62	62	40	Self-financing
TKM College of Engineering, Kollam	72	72	64	66	60	Aided
University College of Engineering, Kariavattom, Thiruvananthapuram	58	53	62	47	38	Self-financing
LBS Institute of Technology for Women, Thiruvananthapuram	77	75	58	77	54	Self-financing
Marian College of Engineering and Technology, Thiruvananthapuram	66	54	34	40	46	Self-financing
Mar Baselios College of Engineering and Technology, Nalanchira, Thiruvananthapuram	69	63	53	50	53	Self-financing
Mohandas College of Engineering and Technology, Thiruvananthapuram	70	57	42	48	34	Self-financing
Baselios Mathews II College of Engineering, Sasthamcotta, Kollam	39	30	15	19	22	Self-financing
Shahul Hameed Memorial College of Engineering, Kadakkal, Kollam	52	27	14	19	9	Self-financing
Lourdes Matha College of Science and Technology, Thiruvananthapuram	61	40	23	33	34	Self-financing
Sree Buddha College of Engineering, Nooranad, Alappuzha	77	55	37	30	40	Self-financing
Muslim Association College of Engineering, Venjarammoodu, Thiruvananthapuram	58	39	24	16	21	Self-financing
Younus College of Engineeing and Technology, Kollam	59	40	25	27	25	Self-financing
Travancore Engineering College, Oyoor, Kollam	57	30	16	17	16	Self-financing
PRS College of Engineering and Technology, Thiruvananthapuram	0	12	18	2	6	Self-financing
P A Azeez College of Engineering, Thiruvananthapuram	0	53	23	22	19	Self-financing

Source: Website of Kerala University Computer Centre, http://kucc.keralauniversity.edu/frntresultanalysis.asp (accessed on 14 February 2012).

findings: (1) the OTRs declined significantly since the intake of 2004; and (2) the OTRs for self-financing private sector colleges were considerably lower than the government colleges. How does one explain this decline? We have a few conjectures in this regard. We divided them into two broad categories, namely: (1) decline in quality of instruction; and (2) aptitude and capability of the students.

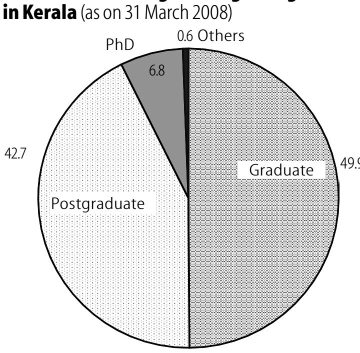
3.1 Quality of Instruction

There is a general feeling that the quality of instruction has declined steadily. This is in turn due to three separate but interrelated factors: (1) poor quality of faculty; (2) an outdated syllabi (Banerjee and Muley 2008); and (3) substandard infrastructure (especially, library, workshops and labs). We examine the first of these three, as we do not have much data on the latter two. In fact, in the case of the syllabi, the complaint is usually from the industry, and this is reflected in the low employability quotient discussed later, however, without the existence of objective indicators.

Quality of Faculty: The number of technical institutions in India, imparting education and research skills in engineering and technology has risen to 1,475 with an annual intake of nearly 5,00,000, according to the AICTE (2006). According to the AICTE, the approved intake for 2011-12 (at the undergraduate engineering level) is 10.66 lakh.[3] Currently, based on the established AICTE norms of student:teacher ratio (1:15) and the cadre ratio of 1:2:6 for professors:readers:lecturers, the total shortage of teaching staff is over 40,000 and the shortage in the different cadres is professors – 4531, readers – 9,063 and lecturers – 27,187. The shortage of PhDs exceeds 30,000, while the shortfall at the master's level is over 24,000. This is the picture for India as a whole, and the situation in Kerala is actually no better, or in some cases, even worse than the all India pattern (AICTE 2006).

First of all, the most recent report, *Annual Technical Education Review 2008* (NTMIS Nodal Centre for Kerala (2008)) reports a shortage of teachers: as against the sanctioned strength of 6,982 teachers (as on 31 March 2008), there were only 6,466 teachers on the rolls of the various engineering colleges leaving an uncovered gap of 516. The shortage is more acute in the popular branches of electronics and communications, computer science and IT. Second, even most of the existing teachers have only a graduate degree themselves (Figure 4) and it is not immediately clear about their experience, although discussions have revealed that most of these graduate teachers are fresh hands with very little experience. In addition, the attrition rate among the teachers is as high as 30%[4] as for most of them a teaching assignment is only a stop-gap arrangement till they find themselves better employment in the industry, where salary and conditions of work are far more attractive. This is, especially, so in the most popular branches.

Figure 4: Distribution of Teacher Qualification in Engineering Colleges in Kerala (as on 31 March 2008)



Source: NTMIS Nodal Centre for Kerala (2010).

In order to quantify the effect of faculty qualification on results obtained, we did an exercise based on data from a sample of colleges under the University of Kerala. For this, we designed a "Faculty Qualification Index" which is defined as the weighted average of scores obtained based on the level of qualification (a score of 1 for just being a graduate teacher, a score of 2 in the case of a postgraduate qualification, and finally, a score of 3 for having a doctoral degree). The index will range from 1 to 3 and the closer it is to 3, the better it is. Only one government and one aided college were able to cross the index of 2. Except for the two colleges from the self-financing sector, which could get a score of 1.9, all the others are close to 1.5. As the quality of teachers is an important factor that affects the results of students, we hypothesised a positive correlation between the index and the pass rates of colleges in the sense that colleges having a score closer to 3 have a higher pass rate, and so on. The results of this exercise are reported in Table 8.

The zero-order correlation between faculty qualification index and the pass percentage shows a statistically significant (at 1% level) positive correlation (r=.74 p=.0059). If we eliminate LBS College from the sample, the correlation coefficient increases (r=.87, p=.0005). What is unique to LBS is that, being under the government, it has faculty visiting from other government colleges on a special working arrangement which gives it access to highly qualified teachers. While this result supports the hypothesis, it should not be taken as evidence to prove that quality of teachers is what determines the results. Due to lack of data we have not controlled for other factors like ability of students and infrastructure. It is also expected that students with a better ability having obtained higher ranks would choose government and aided colleges for a lower fee and quality teachers.

Higher learning in the technical education sector in Kerala is also affected by capacity problems. There are only a few seats for postgraduate education in the state. Between 1991 and 2007, intake in graduate, postgraduate and diploma courses in Kerala grew 10 times (Table 9). In the same period, intake at the postgraduate and diploma levels increased only three times. The total intake at the graduate level surpassed that at the diploma level in 2001. This limits the supply of capable teachers in the immediate future.

The only positive change that has happened lately is the improvement in the salary structure of the staff of government engineering colleges. It has made academia a bit more attractive than earlier. When the quality of engineering institutions, which offer higher education, is low, it is unlikely that they can provide quality teachers for graduate level education. This poor quality and in some cases even a shortage of faculty has been thrown up by a number of detailed university-wise inspection reports, done by the department of technical education, on self-financing colleges under each of the five universities in the state. Although the detailed reports are not available, abstracts of the reports[5] give in a tabular form the situation regarding the self-financing colleges with respect to the availability and quality of faculty. These further confirm the observations that we have made and also show that the government has enough quantitative evidence with it to take corrective actions.

The drawbacks of higher education in the state indicate that the technical education system in the state may not be able to address the need of quality teachers in the immediate future. Interventions made by the state in the form of the Technical Education Quality Improvement Programme (TEQIP) was restricted to a few of the established government colleges, and therefore, has not been of any help to reverse the quality of faculty in any significant sense. The ability of TEQIP to improve the quality of teachers of even the participating institutions is a debatable proposition. This aspect is discussed in some more detail in Section 4.

Table 9: Student Intake – Graduate, Postgraduate and Diploma Levels

Course	Year								
	1991	2000	2001	2002	2003	2004	2005	2006	2007
Postgraduate	256	303	336	433	453	611	647	724	782
Graduate	2,810	8,820	11,293	18,280	19,889	23,643	24,585	26,349	28,578
Diploma	4,488	10,140	10,295	10,350	10,285	10,435	10,760	10,853	12,342

Source: NTMIS Nodal Centre for Kerala (2008).

3.2 Aptitude and Capability of the Students

The common entrance exam was created to allocate seats to students applying for graduate level technical education. It is also expected to be a filter, which will select students with aptitude and capabilities for technical education. Apart from the performance in the common entrance exams, there is also a requirement of certain minimum marks for qualifying education for admission to colleges (50% marks in mathematics and 50% marks in physics, chemistry and mathematics put together, those with a three-year diploma in engineering with 50% marks in the final examination are also eligible and there is a 5% relaxation for students from socially and economically backward communities). While these mechanisms are expected to ensure that only candidates with an aptitude for engineering gain admission to technical education institutions, in the liberalised regime these filters began to show their weakness.

The entrance examination based on the objective tests is completely detached from the learning that happens at school. While preparations for the entrance exam help students qualify for admission to engineering colleges, they do not prepare them for higher academic challenges. The boom in private entrance coaching shows how crucial these preparations are for fulfilling students' aspirations. Many educationists in

Table 8: Relationship between Faculty Qualification and Pass Percentage (2010)

College	Faculty Qualification			Index of Faculty	Pass Percentage
	PhD	MTech	BTech	Qualification (1-3)	(2010)
College of Engineering, Thiruvananthapuram	35	163	23	2.054	73
SCT College of Engineering, Thiruvananthapuram	2	46	39	1.575	40
TKM College of Engineering, Kollam	27	75	20	2.057	60
LBS Institute of Technology for Women, Thiruvananthapuram	0	16	35	1.314	54
Marian College of Engineering and Technology, Thiruvananthapuram	4	29	52	1.435	46
Mar Baselios College of Engineering and Technology, Nalanchira, Thiruvananthapuram	1	87	9	1.918	53
Baselios Mathews II College of Engineering, Sasthamcotta, Kollam	2	49	48	1.535	22
Shahul Hameed Memorial College of Engineering, Kadakkal, Kollam	2	2	69	1.082	9
Lourdes Matha College of Science and Technology, Thiruvananthapuram	1	53	33	1.632	34
Sree Buddha College of Engineering, Nooranad, Alappuzha	3	68	14	1.871	40
Muslim Association College of Engineering, Venjarammoodu, Thiruvananthapuram	2	28	55	1.376	21
PRS College of Engineering and Technology, Thiruvananthapuram	2	22	48	1.361	6

Source: Own compilation.

Kerala have pointed out the flaw in selecting students through objective tests. They emphasise the need to include marks from the qualifying education among the criteria for selection. In 2008, an expert committee constituted by the government for reform of entrance examinations submitted its report.[6] This report suggested major reforms, which included giving 50% weightage to marks obtained in the qualifying examination, while calculating the rank. This will reduce the significance of entrance examination coaching. This new approach was adopted in the entrance examination from 2011 onwards.

Another problem with the entrance examination is that students may obtain a high rank in it even after scoring very low marks (sometimes even negative) in mathematics. A random check on the actual marks obtained by candidates in one of the recent entrance examinations revealed this lacuna (State Planning Board 2006). This means that students with very little mathematical capability are able to get into engineering, which can also affect their subsequent performance.

New self-financing institutions have made the selection process even worse. They allow students who can afford the fees to join engineering courses even if their rank is low. The minimum mark for the qualifying exam has become the only important criterion to ensure that students with the right ability for technical education are selected. Unfortunately, this requirement is set at such a low base, that many who do not have the required basic knowledge also enrol for technical education. Conflict between the managements of these institutions and the government has led to a situation where different sets of criteria are used for selection by different institutions every year. Some even conduct their own entrance tests. In short, there is no good mechanism to ensure that only meritorious candidates gain admission for technical education.

3.3 Other Arguments

There is an argument that poor showing by self-financing engineering educational institutions is not necessarily due to their inferior quality but due to the fee differential which attracts better students to government colleges. While there is a logic in this argument, there is some evidence, which suggests that it need not be the case. The post-liberalised phase has also seen a spurt in private tuition centres for engineering graduate students. The demand for these centres indicates that colleges are not able to fulfil the learning needs of students.

Hiring teaching staff is a challenge for these newly formed colleges. They mostly employ teachers who have retired from government engineering colleges and also fresh graduates. These fresh graduates often do not have any academic experience. A quick look at the list of faculty in engineering colleges under the University of Kerala shows that only the government and aided colleges and one self-financing college with good results have substantial number of teaching staff with postgraduate or higher level education.

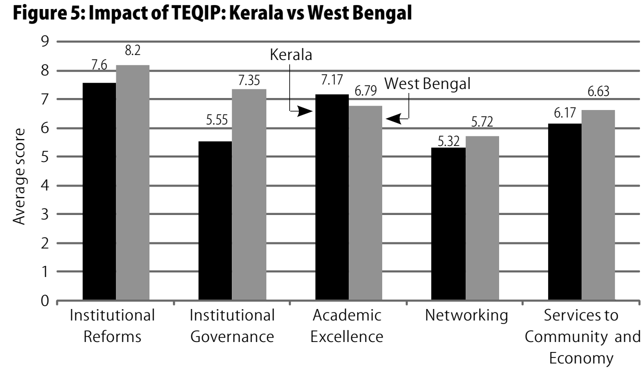
4 Intervention by the State to Reverse the Trend

For quite some time, there has been recognition, especially at the national level, that the government has to intervene to improve the quality of technical education in the country. While at one extreme, the country has the prestigious Indian Institutes of Technology (IITs) and the lesser National Institutes of Technology (NITs), the majority of the engineering institutes in the country suffer from poor quality, so much to say that most of the graduates produced by these institutes are not employable by industry. This has been a constant refrain of the industry (Banerjee and Muley 2008). Because of the quality factor, there is the paradox of unemployment of engineers coexisting with shortages of it.

As a way of reversing the trend, the government, based on a soft loan from the World Bank, initiated a programme known as the TEQIP. It was started in 2003 with a five-year validity, but was later extended up to 2009. The project was meant to support the production of high quality technical professionals through reforms in the technical/engineering education system in the country. It had two components. The programme covered selected engineering colleges in 11 states across two cycles. Kerala was one of the first states selected for implementing the programme, and within Kerala five colleges[7] were selected for implementing quality improvements. A cumulative expenditure of Rs 52.9 crore was spent on the five colleges, majority of which (almost 50%) went to one of the oldest colleges under the ownership of the state, namely, the College of Engineering, Thiruvananthapuram. Since the total number of students in all these five colleges works out only to about 15% of the total number of engineering students in the state, TEQIP coverage was not significant enough to make a dent into the quality of technical education in the state as a whole. Further, the colleges selected were some of the better performing ones. An official evaluation of the TEQIP (Spectrum Planning 2010) showed that while the programme has been very successful in improving physical infrastructure, it has not been that successful in terms of faculty development. For instance, the programme's impact in raising the quality of the faculty is very limited (ibid) and also the score that Kerala has received on five of the performance parameters was inferior to the best performing state, namely, West Bengal. The impact on academic excellence, although better performing than West Bengal, could have been more if efforts were made to accredit more programmes in the institutions (Figure 5).

Recent changes in the AICTE norms for appointment of engineering faculty and the initiatives from state government with regard to the qualification for fresh appointments at engineering

Figure 5: Impact of TEQIP: Kerala vs West Bengal



Source: Spectrum Planning (2010).

colleges have the possibility of reducing the scope for fresh graduates of good quality emerging as faculty in engineering colleges. For details of this scheme, see Annexure 2 (p 73).[8]

It is interesting to note that the poor quality of engineering education in the state has attracted the attention of even the High Court of Kerala. Following the observations made by the court, the government has appointed an expert committee to draw up guidelines for extension of approval, sanctioning of new courses, increase in intake in existing courses, etc, in self-financing colleges. Based on the recommendations of this committee, the government has on 31 January 2012 passed an order[9] setting out the conditions under which the licences of existing self-financing colleges may be extended (see Annexure 3 (p 73) conditions for securing extensions). This extension is now clearly tied to the colleges achieving a certain threshold level of pass rates. The threshold levels fixed are rather low and most of the colleges may not have much difficulty in measuring up to it. However, it will now be instructive to see if the government has any resolve to implement even this order.

Table 10: Trends in Educational Loans Sanctioned, Disbursed and Outstanding (Rs in lakh)

	Applications	Loans Sanctioned		Loan Disbursed		Outstanding as on 31 March		NPA as at March	
	No	No	Amount	No	Amount	No	Amount	No	Amount
2005-06	34,855	33,800	62,812			1,11,572	1,34,120	2,016	1,939
2006-07	46,949	45,224	58,437			1,47,633	1,87,112	1,887	1,697
2007-08	45,276	51,974	1,29,534.67	76,978	1,30,859.77	2,22,748	4,01,054.67	5,651	6,996.96
2008-09	69,300	61,501	1,62,448.34	74,268	1,46,296.29	2,29,963	3,72,519.34	8,926	11,385.24
2009-10	52,928	45,953	1,08,854.76	84,473	1,12,519.93	2,79,111	4,85,448.17	10,116	14,908.05
2010-11	NA	NA	NA	NA	NA	3,14,492	6,01,317.3	10,070	27,895.94

Source: Vinayan (2011: 44); and State Level Bankers' Committee-Kerala (Convenor: Canara Bank).

5 Implications of Low OTRs

The low OTRs have a number of adverse implications. First, despite increased investments in engineering education, although in most cases this increased investment has come from the private sector, the actual output in the form of number of engineers graduated has not been commensurate. At a time when the demand for engineers is very high, this low OTR can result in shortages in supply leading to significant increases in the average salary of a graduate engineer. As argued earlier, the declining OTR is also indicative of the declining quality of these engineering graduates. Employability of Indian engineering graduates has been a subject of debate. Although it is generally held that only a small fraction of the graduate engineers are employable, there are no objective indicators for measuring employability. Recently, companies have been using the scores obtained in a test called Aspiring Minds' Computer Adaptive Assessment (AMCAA) to judge employability. Of course, the AMCAA test[10] scores are used, at present, only by IT companies.

According to the AMCAT scores obtained by engineering graduates from Kerala, only 20% of the engineers who took the test are employable in IT services industry.

Kerala's rank is 10 out of a possible 17. The only consolation, perhaps, is the fact that her position is better than her southern neighbours of Tamil Nadu, Karnataka and Andhra Pradesh. This, of course, does not make the quality of engineering graduates from Kerala any better.

A second implication of these low OTRs, which has wider societal implications, is the repercussions that these rather high failure rates have on individual families to which these students belong, and indeed even to the commercial banking system in the state. Given the high cost of securing a seat in the self-financing colleges, families have secured educational loans from the commercial banking system. The educational loans became popular around 2003. Political pressure and popular campaign forced banks to adopt a liberal policy for educational loan approval. This led to a situation where loans were being made available without checking the repayment capacity of the borrower. Even collateral was not required for loans of up to Rs 4 lakh. According to Vinayan (2011), in 2005-06, 97% of the applicants for educational loans were successful in obtaining a loan. This has since tended to come down to about 89% or so by 2008-09. Table 10 summarises the data on educational loans during the 2005-06 to 2010-11 period. The data are not separately available for various disciplines of study (like engineering, medicine, nursing, and so on). Vinayan's sample of loan-takers indicates that only 12% are for engineering. So the numbers provided in Table 10 may be taken as a broad indication and must not be seen as covering engineering alone. What is striking in the table is the ever-rising non-performing assets (NPAs) in educational loans, which have increased sharply from just Rs 19 crore in 2005-06 to around Rs 279 crore by 2010-11. So the low OTRs are not just a personal waste or tragedy of sorts, but also a societal waste. This certainly calls for some urgent thinking.

Finally, it may be argued that declining OTR can also be a result of rigorous quality control through tough exams. We do not agree for the following two reasons. First, during the early 1990s, the OTRs were close to 100%. This does not mean that there was less rigorous quality control during the time. So we do not believe in an inverse relationship between OTRs and the degree of quality control. Second, the additional evidence that we have presented in terms of low employability lends further credence to the fact that low OTRs mean low quality.

6 Summing Up

The conflict between the management of self-financing colleges and the government has now become an everyday affair. The casualty is the technical education system in Kerala. It is evident that there are no shortcuts to meeting the need for technical human resource in the state. Liberalisation of education has not brought in the expected benefits. It is clear that many students who gain admission to engineering colleges do not have the basic capability, which can be built only by improving school education. The case of teaching capability is similar. The private sector cannot be expected to invest in higher education. Unless we transform the higher education sector (at the engineering postgraduate level), we will continue to face a shortage of quality teachers. Long-term public investment in schools and in higher education is the only solution to the problem. It has its own challenges as the case of TEQIP illustrates.

Controlling the negative consequences of the liberalised regime is another challenge. Driven by the dream of lucrative jobs in information and communications technology (ICT) industry and the easy availability of educational loans, many students opt for technical education without considering their ability and aptitude. Often they are driven by family pressure. Based on the data we have here, increasingly, nearly two-thirds of them do not obtain a degree even after several attempts to clear the exams. It affects their morale so badly that some of them even resort to taking their own life rather than accepting failure. This points a finger to a larger social problem in the making. The situation is partly under control now, because of the boom in services sectors like telecommunications, and insurance, which absorb some of them in non-technical jobs. However, they do not offer a long-term career path, as graduation is fast becoming the basic qualification for any job. With more colleges joining the fray in 2009-10, the issue of failing engineering students is likely to become even more serious. Students from these colleges are yet to reach their final year of education. A similar situation prevails in the case of other technical education streams like Masters in Computer Applications. Neighbouring states like Tamil Nadu, where many students from Kerala have enrolled for technical education, are also affected in the same manner.

One good sign though is that many seats in technical education are vacant these days, which gives the indication that society is becoming more realistic. At the same time, the managements of these institutions are forcing governments to change policies so that they get more students. The demand for reducing the minimum qualification is an example. These institutions only care about intake and fees obtained and not their output. It is unfortunate that the government is driven by pressure from the management and the middle class and not by realities and social development goals as far as technical education in the state is concerned.

NOTES

1 See the website of the NTMIS Nodal Centre for Kerala located at the Cochin University of Science and Technology, http://nodalcentre.cusat.ac.in/ (accessed on 21 March 2008).

2 This finding at the individual college level corroborates what we observed at the aggregate level as well.

3 See the AICTE website: http://www.aicte-india.org/statistics.htm (accessed on 21 March 2012).

4 There are no official estimates of the attrition rate. A recent newspaper report does provide some estimates. See Naha (2007), http://www.hindu.com/edu/2007/09/11/stories/2007091150020100.htm (accessed on 16 February 2012).

5 These are available at the website of the department of technical education, Government of Kerala, http://www.dtekerala.gov.in/index.php?option=com_content&view=article&id=92&Itemid=1 (accessed on 20 February 2012).

6 The main recommendations of the expert committee to reform entrance examinations may be found in the government order, http://www.cee-kerala.org/docs/keam2011/reformsreport.pdf (accessed on 16 February 2012).

7 The five colleges are College of Engineering, Thiruvananthapuram, LBS College of Engineering, Kasargod, Model Engineering College, Kochi, College of Engineering, Chengannur, Sree Chithra Thirunal College of Engineering, Trivandrum. While the former is a government college, the latter four are self-financing colleges of various hues.

8 This is based on a private communication that we had with R V G Menon, a leading engineering educationist from Kerala.

9 See the website of the department of technical education, Government of Kerala, http://www.dtekerala.gov.in/index.php?option=com_content&view=article&id=92&Itemid=1 (accessed on 20 February 2012).

10 AMCAT is a multidimensional test with the aptitude (consisting of English, quantitative ability and logical ability) and Aspiring Minds Personality Inventory (AMPI) modules being compulsory and additional skill-specific module which is required for jobs in different sectors. The skill-specific modules vary from computer programming, electronics and communications, mechanical engineering, civil engineering, accounts, marketing, human resources, financial services, etc. The candidate can choose the skill modules based on his/her education and/or interest.

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Annexure 1: Trends in Intake (in Numbers) at Undergraduate Engineering Degree Courses across States and Union Territories: 1990-91 through 2007-08

States/UTs	1990-91	2007-08	Average Annual Growth Rate (%)
Andhra Pradesh	8,070	82,970	54.60
Tamil Nadu	12,855	80,417	30.92
Maharashtra	20,425	48,250	8.01
Karnataka	19,452	46,375	8.14
Uttar Pradesh		28,953	
Kerala	4,512	24,413	25.95
Madhya Pradesh	2,265	20,210	46.60
West Bengal		15,477	
Rajasthan	1,629	15,045	48.45
Punjab	1,508	14,880	52.16
Orissa	1,325	13,014	51.89
Gujarat	2,780	12,965	21.55
Haryana	1,085	12,785	63.43
Delhi	1,290	4,330	13.86
Chhattisgarh		4,020	
Jharkhand		3,385	
Pondicherry	300	2,370	40.59
Bihar	2,375	1,905	-1.16
Jammu and Kashmir	480	1,545	13.05
Uttaranchal		1,440	
Himachal Pradesh	210	1,260	29.41
Chandigarh	465	800	4.24
Assam	660	750	0.80
Goa	154	740	22.38
Sikkim		525	
Meghalaya		240	
Arunachal Pradesh	210	210	0.00
Tripura	120	180	2.94
Mizoram		120	
Manipur		115	
Total	82,170	4,39,689	25.59

Source: Ministry of Human Resource Development (2011).

Annexure 2: Recent Changes in AICTE Norms for Appointments as Faculty in Engineering Colleges and Its Perceived Implications on Quality of Faculty

Until the most recent AICTE salary reform, the minimum qualification for an engineering college lecturer was a first class BTech. One needed an MTech for promotion as assistant professor (AP). So, after a couple of years of service as lecturer, they would proceed on leave for higher studies. There were also government programmes for deputing them for higher studies. Because they were already employed they would be highly motivated in specialising in some particular area, which was relevant to their work. It was with the last reform that the post of lecturer was abolished and recruitment category was fixed as AP. A new category of AP was created in lieu of the earlier AP post. There can be a difference of opinion about the impact of this change on the quality of the faculty. When the recruitment was open to fresh BTech graduates with good academic record, many young bright graduates used to opt for teaching. However, when MTech is made the minimum qualification, this route is closed. An intending teacher has to first get an MTech and then only can apply for a teacher's post. This could discourage many eager youngsters from opting for teaching career, because of the uncertainty.

Source: Private communication from R V G Menon dated 19 March 2012.

Annexure 3: Conditions Set Out for Securing Extension of the Approval of Existing Self-financing Engineering Colleges in Kerala

- Extension of approval shall be granted to all the existing self-financing institutions in the state for 2012-13. But for 2013-14, extension of approval will be granted only to the institutions with minimum running average pass percentage in the first appearance in all subjects (full pass) up to IV, VI and VIII semesters of 25%, 30%, and 35%, respectively and for 2014-15 at 30%, 35%, and 40%, respectively.
- There shall be an initial period for all institutions to stabilise its academic operations before new courses are approved. From 2012-13, for commencing new BTech courses or for increase in intake of students in existing courses, the following conditions shall apply:
(i) Only those institutions, which have run BTech courses for four semesters (i e, whose first batch of students have reached at least Vth semester of the course and whose results up to IVth semester have been published), are eligible to apply for new BTech courses in the intake in the existing BTech course.
(ii) Sanction will only be given to those institutions with minimum running average pass percentage in the first appearance in all subjects (full pass) up to IV, VI, and VIII semesters having a minimum of 35%, 40% and 45%, respectively.
- Only those institutions which have run BTech courses for three years (i e, whose first batch of students have reached at least VIIth semester of the course and whose results up to VIth semester have been published) will be eligible for starting MTech courses. From 2012-13, for new MTech courses in existing self-financing institutions which offer BTech courses, only those institutions which have at least seven faculty members with MTech degrees in that branch of engineering will be eligible. The minimum running average pass percentage in the first appearance in all subjects (full pass) up to VIth and VIIIth semesters shall be 40% and 50%, respectively in the existing BTech courses.

Source: Department of Technical Education, Government of Kerala, http://www.dtekerala.gov.in/index.php?option=com_content&view=article&id=92&Itemid=1 (accessed on 20 February 2012).