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Assessment of Master's Program under Mechanical Department of Pulchowk Campus, Institute of Engineering, Tribhuvan University, Nepal

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Abstract
This research assessed master's programs under mechanical department of Pulchowk Campus in performance of three indicator of quality education i.e. average percentage obtained, pass percentage and drop percentage from year 2067 to 2070 B.S. Mechanical department of Pulchowk Campus has three programs in master's degree viz. Renewable Energy Engineering, Technology and Innovation Management and Energy System Planning and Management. In the respective years 2067, 2068, 2069 and 2070, Renewable Energy Engineering has pass percentage of 73.68%, 80%, 25% and 30%, Technology and Innovation Management has pass percentage of 75%, 37.5%, 43.75% and 25%, whereas Energy System Planning and Management has pass percentage of 64.7% and 20% in 2069 batch and 2070 batch respectively. Students are dropping out in first semester and, dropping rate of Renewable Energy Engineering was 5.26%, 5%, 10% and 5%, dropping percentage of Technology and Innovation Management was 18.75%, 25%, 12.50% and 25%, in 2067 batch, 2068 batch, 2069 batch and 2070 batch respectively. But there was no dropping of student in Energy System Planning and Management in 2069 batch and 17.64% students dropped in 2070 batch of same program. The result shows that dropping percentage of students is increasing and pass percentage is decreasing throughout the year.This paper focuses on reason behind low pass rate, uncompleted thesis, drops out by using observation and survey techniques.Also by this paper, the efficiency of three programs using DEA in 2069 and 2070 batch is observed.There is no surprise that TIM 2069 batch, TIM 2070 batch, and ESPM 2069 batch all received a score of 1 using DEA and these program are efficient.

Keywords
Passed percentage – Dropping – programs – Data Envelopment Analysis – Survey – Efficiency

1. Introduction

Pulchowk Campus of Institute of Engineering, Tribhuvan University univercity is the most well known and recognized engineering institute in Nepal. Pulchowk campus is not only offering B.E. programs but also conducting M.Sc. in Engineering in various disciplines as well as Ph.D. programs [1]. Eligible students from all over the world, aspiring to study engineering appear for this exam and only the students in merit basis get the chance to study in Pulchowk Campus. Students studying in the Pulchowk Campus are considered to be very competitive and talented.

Inception of department of mechanical engineering was in the year 1975. Mechanical department has been running three M.Sc. programs viz Master of Science in Engineering in Renewable Energy Engineering (MSREE), Master of Science in Engineering in Technology Innovation Management (MSTIM) and Master of Science in Engineering in Energy Systems Planning & Management (MSESPM). The MSREE program was launched in December 2001 with first class of sixteen students. Discharged its first graduates in 2003 [2]. Two years (4-semesters) master program in MSTIM was effective from July 2010 as a result of collaboration between Norwegian University of Science and Technology (NTNU), Trondheim, Norway and IOE, TU [3]. Similarly, two years (4-semesters) master

program in MSESPM was effective from July 2012 as a result of collaboration between Institute of Energy Systems and Thermodynamics, Vienna University Technology, Vienna, Austria and IOE, TU [4].

Selection of Student is done by taking entrance test. The nature of entrance test will be decided by the Entrance Examination Board of the Institute of Engineering, Tribhuvan University. The Candidate, fulfilling the Program Entry requirements will be selected for admission on the basis of merit based on respective program entrance test. The M.Sc. Program examinations are based on the course syllabus published by Institute of engineering, Pulchowk campus. MSc program, is Semester basis, have only four semester and last semester consist of only Thesis which weightage sixteen credit hours. The syllabus consist of credit hour and subjects which is determine by Department. Full marks and Pass mark is set accordance with Credit hour or weightage of subjects.The evaluation system is based on the continuous assessment by the course teacher and the final examination. The students have to pass individually in the assessment as well as the final examination. The minimum pass marks for the assessment and final examination is 50% and subject teacher submit the evaluation report to examination division. There is practice that teacher takes internal assessment twice or multiple times and submits average mark (in links with attendance) to examination division.

Final examinations are taken at the end of semester which weightage fifty percent and three hour written exam are conducted. An examination consists of tests with open questions set by course teacher according to weightage that is required for a student to acquire required knowledge to complete the program. The examination can be sat at two sessions during the year according to academic calendar. Examination paper and scoring guidelines lies with the examination board of Institute of Engineering. Exam board finally announces result.

Information generated by evaluation can be helpful for students, teachers, educators etc. to take decisions [5]. Evaluation of students academic performance is one of the most important parts of the educational process. It has to be done for maintain academic quality. Without evaluation of students performance an institution cannot improve its performance.so performance evaluation is one of the key point to improve the quality of education. Evaluation system is the mirror of quality of institutions. The problem was such that regular works of evaluation were not taking place during the past years in MSc program of Institute of Engineering. Students achievement is measured in three dimensions such as graduation success rate, average percentage Obtained, and rating [6].

The paper [7] attempt to shed light on the improvements in the evaluation system of IOE and analysis of the exam results of BE of TU affiliated Colleges. This paper does not consider the drop out students after reform in evaluation system. Evaluation system of exam results for Master's program on IOE was not taken into consideration earlier in literature.

Data Envelopment Analysis (DEA) has been recognized as a valuable analytical research instrument and a practical decision support tool. Data envelopment analysis (DEA) is a linear programming based technique for measuring the relative performance of organizational units where the presence of multiple inputs and outputs makes comparisons difficult.DEA thus may be appropriate where units can properly value inputs or outputs differently, or where there is a high uncertainty or disagreement over the value of some input or outputs.

The main objectives of this paper is to assess the MSREE, MSTIM and MSESPM programs under Mechanical Department of IOE Pulchowk Campus using average percentage obtained, pass percentage and drop percentage through year 2067 to 2070.

2. Methodology

2.1 Data Collection

Primary data collection approach is adopted for this paper. Qualitative and quantitative data collection approach is used. Qualitative data collection techniques through observation and Survey to the student who has dropped and unable to doing their thesis. Marks Obtained of each Student of four Semester of MSREE, MSTIM and MSESPM has been collected from Exam Control Division and Academic Administration and Students drop rate and record had obtained from Students record file from Campus Administration

through year 2067 to 2070. These data are then enter into Microsoft Excel 2013.

There are Two inputs and Three Outputs is selected to evaluate the efficiency using DEA.Inputs are Number of enrolled student in that year and maturity period of a program where as outputs are Number of graduate student in that year, Average Percentage Obtained by student after final examination, and, Retention rate.Inputs and Outputs data has been collected from administration of college.

2.2 Calculation

After entering all the data information in excel, first of all number of dropped student is determined by using countif() function in excel and drop percentage is calculated by following formula.

$$\text{Drop percentage} = \frac{\text{number of dropped student}}{\text{Total student}}$$

Average pass percentage was obtained in each program on specific batch by averaging the number of qualifying student. The percentage obtained by each student was calculated from the following criterion:

$$\text{Total Percentage} = \frac{\sum \text{Credit} \times \text{Marks Obtained}}{\sum \text{Credit}}$$

[2, 3, 4].

Average percentage obtained by students of each program in each year is calculated by Averaging the percentage obtained of qualifying student. After calculating the average percentage obtained, pass percentage and drop percentage of four batches on three programs then program wise necessary graph was plotted using these data from year 2067 to 2070.A simplified equation for calculation for number of samples with confidence interval 95% and precision level e is given by [8]

$$S = \frac{N}{1 + N.e^2}$$

Where,
S = Number of Samples
N = Population Size
e = Precision Level
Substituting, e = 10%

From the population of 21 student who has dropped from year 2067 to 2070 in all three Program, The sample size 18 is determine, from the above formula,and survey is conducted. The sample size 42 is determined from the population of 72 students who have not completed their thesis from the year 2067 to 2070 batch till bhadra 2073 in all three Program and survey is conducted using electronic media.

For the comparison of three program's efficiency(calculated using Data Envelopment Analysis)in year 2069 and 2070, three output data and two input data has been inserted into spreadsheet. The usual measure of efficiency is:

$$\text{Efficiency} = \frac{\text{OUTPUT}}{\text{INPUT}}$$

A common measure for relative efficiency is:

$$\text{Efficiency} = \frac{\text{Weighted sum of Outputs}}{\text{Weighted sum of Inputs}}$$

DEA is a novel approach to relative efficiency measurement where there are multiple incommensurate inputs and outputs [9]. If a suitable set of measures can be defined DEA provides an efficiency measure not relying on the application of a common weighting of the inputs and outputs. It identifies the optimal ways of performance rather than the averages.Inputs and Outputs are enter into excel then by using and running solver(inbuilt in excel)under three conditions, the weightage of inputs and outputs is calculated.After multiplying input with input weightage and output with output weightage, the efficiency of each program on year 2069 and 2070 is calculated.

3. Result and Discussion

3.1 Program in Renewable Energy Engineering

Figures 1, 2, and 3 give the average percentage obtained, pass percentage of graduated student and drop percentage of M.Sc. Renewable Energy Engineering (MSREE) program of Mechanical Department from Year 2067 to 2070. Figure 1 shows the average percentage obtained by each batch.

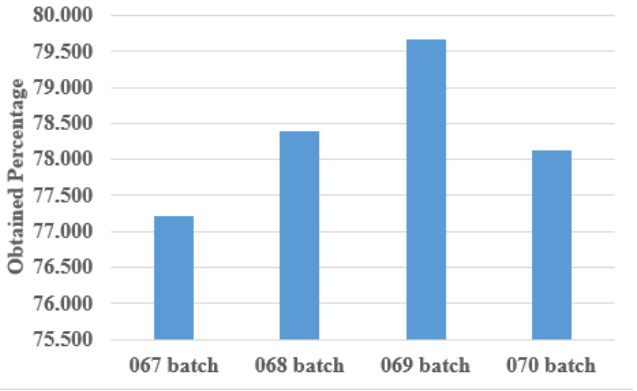

Figure 1: Average percent Obtained of MSREE from year 2067 to 2070

Figure 1, the average percentage obtained of MSREE from year 2067 to 2070, depicts that average percentage obtained by graduate student were significant rises throughout the year. The result in the year 2068 is relatively increase in comparison to year 2067.The 2070 batch's average percentage obtained by students is relatively fall with respect to batch 2069. From the above figure it shows that the average percent obtained by students of MSREE is highest in year 2069. The figure 2 shows that the pass percentage rate of MSREE from the year 2067 to 2070.

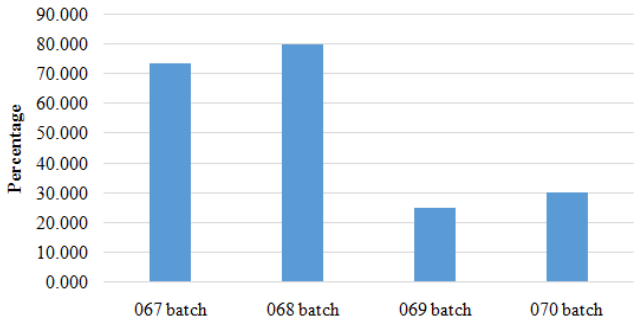

Figure 2: Pass Percentage of MSREE from the year 2067 to 2070

The figure 2 shows that the pass percentage from student of MSREE from the year 2067 to 2070.By analyzing above figure, it infers that pass percentage of students of 2068 batch is increase in comparison with 2067 batch and in year 2070 it has risen with respect to 2069 batch. There is fewer pass percentage of student in batch2069 and 2070. The figure 3 shows drop percentage from student of MSREE from the batch 2067 to 2070.

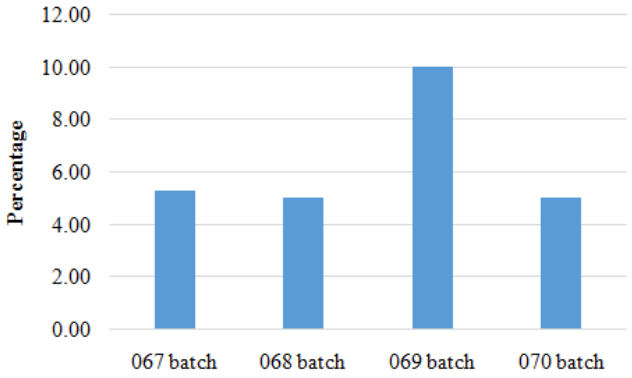

Figure 3: Drop Percentage of MSREE from year 2067 to 2070

Figure 3 shows that the drop percentage rate is highest in batch 2069 among all other batches. The drop percentage rate is fall within four percent to six percent in other batches above except 2069 batch. By analyzing the above three indicator of quality education in MSREE program of Pulchowk campus the performance of 2068 batch is best batch among other batches.

3.2 Program: Technology and Innovation Management

Figures 4, 5, and 6 show the average percentage obtained, pass percentage of graduated student and drop percentage of M.Sc. in Technology and Innovation Management (MSTIM) program of Mechanical Department from Year 2067 to 2070.

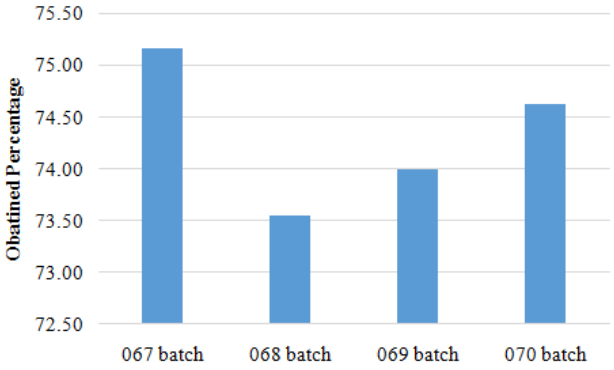

Figure 4: Average percent Obtained of MSTIM program of pulchowk campus from year 2067 to 2070

Figure 4 shows that average percentage obtained by graduated student of MSTIM program. By analyzing

figure 4, it reveals that the average percentage obtained by graduated student of MSTIM were highest in year 2067 and the result in the year 2070 is relatively increase in comparison to 2068 and 2069 batch. There is lowest percentage obtained in batch 2068 in comparison with other batches.

Figure 5 shows that the pass percentage rate of MSTIM program of Pulchowk campus under mechanical department from the year 2067 to 2070.

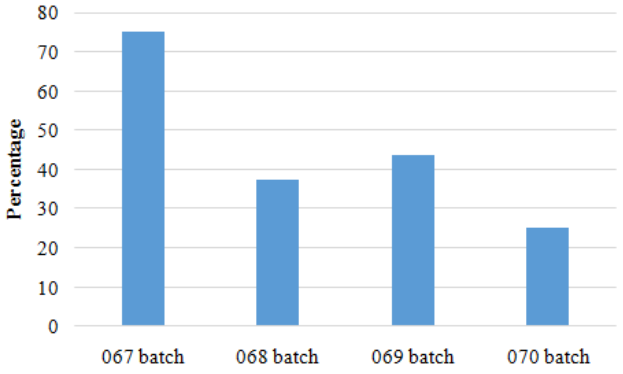

Figure 5: Pass Percentage of MSTIM program from the year 2067 to 2070

Figure 5 depicts that the pass percentage of graduated student of MSTIM of 2067 batch is highest with respect to other batches above. Figure 5 also reveals that pass percentage of 2069 batch is relatively risen with respect to 2068 batch and 2070 batch have lowest pass percentage rate among others.

Figure 6 shows the drop percentage from student of MSREE of mechanical department from the batch 2067 to 2070.

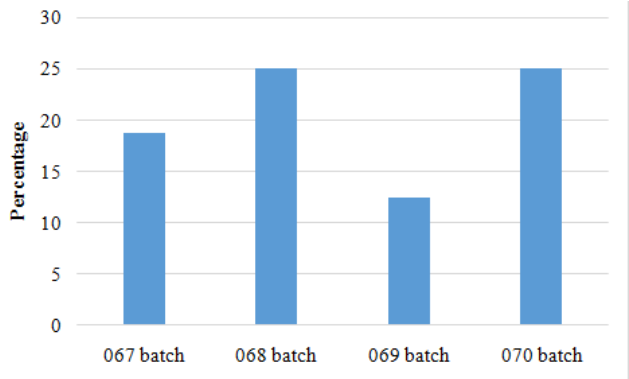

Figure 6: Drop percentage of MSTIM of batches 2067 to 2070

Drop percentage of MSTIM of 2068 batch and 2070 batch have twenty five percentage, which is the highest drop rate in TIM program from the above figure 6. In 2069 batch drop rate is lower than other batches.

By analyzing the above three indicator of quality education in MSTIM program of Pulchowk campus the performance of 2067 batch is best batch among other batches.

3.3 Program: Energy Systems Planning and Management

Figures 7, 8, and 9 shows the average percentage obtained, pass percentage of graduated student from M.Sc. in Energy System and Planning Management (MSESPM) program of Mechanical Department of Year 2069 and 2070. The graph below shows that average percentage obtained by graduated student of MSESPM program of year 2069 and 2070.

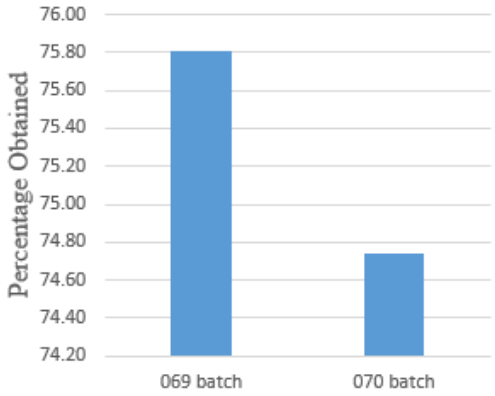

Figure 7: Average percentage obtained from MSESPM program of the year 2069 and 2070

Figure 7 shows that average percentage obtained of graduated student of MSESPM program, which also reveals that 2069 batch's students has the highest percentage obtained with respect to 2070 batch's student.

From figure 8, it can be seen that the pass percentage of ESPM program of 2070 batch is decline with respect to 2069 batch.

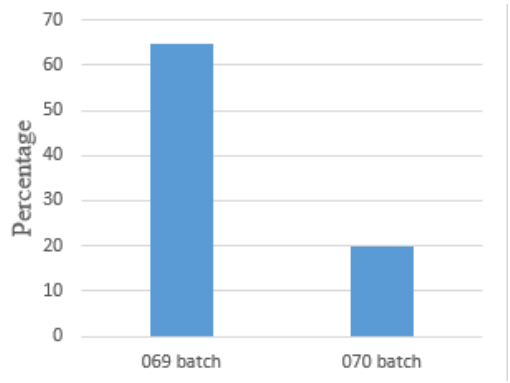

Figure 8: Pass percentage of MSESPM program of 2069 and 2070 batch

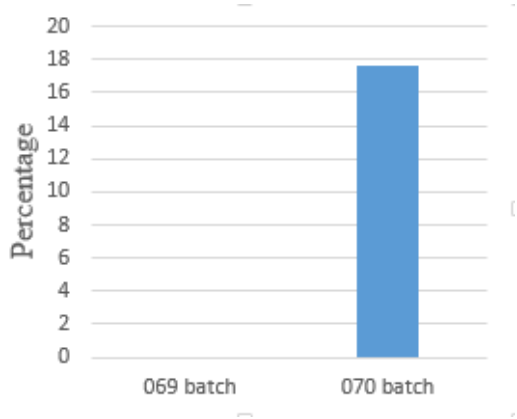

Figure 9: Drop percentage of student of MSESPM program of batch 2069 and 2070

Figure 9 reveals that the drop percentage of MSESPM program's student in year 2070 is seventeen percent and there is no dropped of student in 2069 batches of ESPM program since it is the first batch of this program.

From the results of graphs of ESPM program it can be said that 2069 batch (first batch of ESPM program) has better performance than 2070 batch. Above Graphs shows the comparison of each batch for a program of three quality indicators By analyzing the all the graphs above it can be conclude that the first batch of TIM and ESPM has better performance on three indicator of quality education i.e. Average percentage obtained, pass percentage rate and drop percentage.

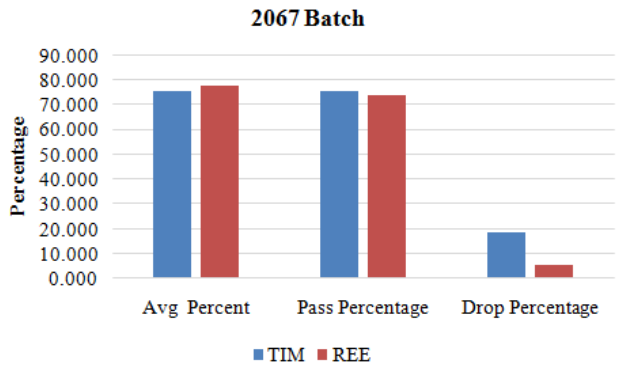

Figure 10: Comparison of two programs based on year 2067

Figure 10 reveals that comparison of two programs along with pass rate, drop rate and average percentage obtained. In year 2067 there are only two programs where renewable energy has a better performance than Technology and Innovation Management in average percentage obtained and drop rate but the Technology and Innovation Management has better result in pass percentage rate indicator.

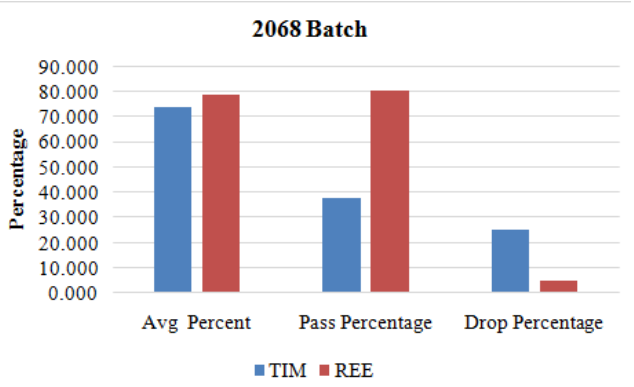

Figure 11: Comparison of two programs based on year 2068

Figure 11 shows that comparison of TIM and REE along with pass rate, drop rate and average percentage obtained. In year 2068 there is also only two programs where renewable energy has a better performance than Technology and Innovation Management in all three indicators.

Figure 12 shows that there are three program from the year 2069 under mechanical department. This graph reveals that ESPM has better pass rate and no drop rate in

year 2069.The average percentage obtained of REE from graduated student is better result than other program in 2069 batch.

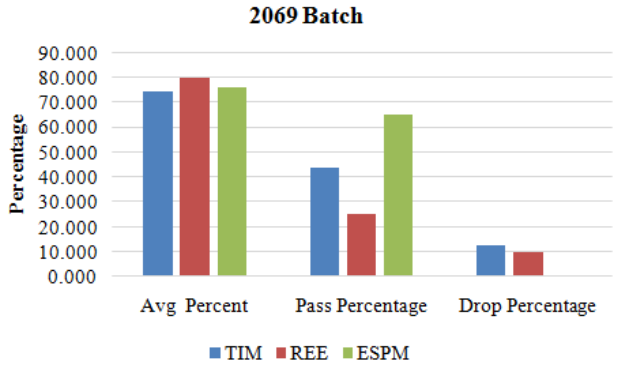

Figure 12: Comparison of three programs based on year 2069

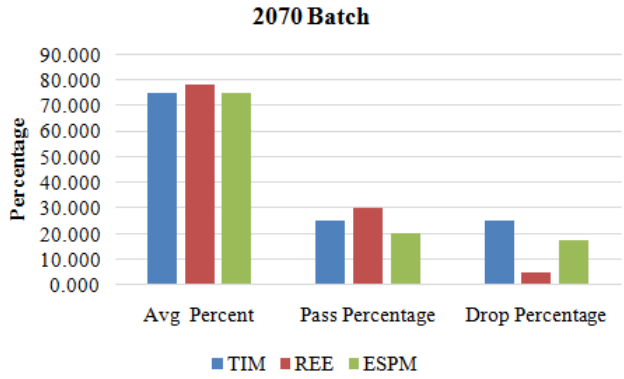

Figure 13: Comparison of three programs based on year 2070

Figure 13 depicts that in year 2070 has three program and among all program Renewable Energy Engineering has good performance in all three indicators till year 2072.From the batch 2069 to 2070 in ESPM number of dropped student was 3. In REE the number of dropped students from year 2067 to 2070 is 5. In MSTIM the number of dropped students from the year 2067 to 2070 is 13.

By taking sampling of students from population of 21 students who had dropped out from three programs from the year 2067 to 2070 sample data is calculated and taking survey of sample data through electronic media it is find that, 57.14% of student who had dropped due to job opportunity outside the valley, 28.57% of students dropped due to get opportunity to study outside the country, 14.28% student drop due to Family pressure and they need to take care of their family because of physical disability and illness of family member.

In MSESPM, 18 students out of the 37 of year 2069 and 2070 has not doing their thesis till now. In MSREE, 33 students out of 75 has not doing their thesis from the year 2067 to 2069 batch till now. In MSTIM, till now,21 students out of 51 students has not submit their thesis from the batch 2067 to 2070.
Also the survey of students by taking sampling of total population who do not submit their Thesis, it is concluded that 44.44% students did not attempt to do their thesis due to Job opportunity and busy schedule of their time, 22.22% students did not submit their thesis because of students go too far with the related work search, reading so much about their intended area of research that they never start that research, 11.11% of students did not submit their thesis due to students are not contacting with supervisors and supervisor did not know what a student is doing, and, 22.22% of students did not do their thesis work due to opportunity to get enroll in foreign country.

A concern with the DEA model is that if all units can adopt their most favorable weights, they may all appear efficient. With the depot data we can see that there is in fact a considerable difference in efficiency.

As seen in Table 1, three outputs are Number of Graduates, Average Percentage obtained and Number of Retention,two inputs are Number of enrolled student and maturity period, First three programs are 2069 batch and other are 2070 batch of respective programs. TIM 2069 , TIM 2070, and, ESPM 2069, batch is efficient.The minimum efficiency is 0.85 in ESPM 2070 batch.This can broadly be interpreted as saying that ESPM 2070 batch should have been able to support its activity levels with only 85% of its resources.This means ESPM 2070 batch would have to decrease its input by 15% or increase its output in order to become efficient.The efficiency of REE 2069, REE 2070, and, ESPM 2070, batch have scores of less than 1 and greater than 0, thus they are identified as inefficient.These programs can improve their efficiency, or reduce their inefficiencies proportionately, by reducing their inputs or by increasing their outputs.

Table 1: Efficiencies of 3 programs using DEA

		Output			Input		Weightage			DEA
Program	Unit	Graduate	Avg.%	Ret. No.	No. Enrolled	Maturity	Wt. O/p	Wtd. I/p	Diff.	Eff.
REE	1	5	79.667	18	20	11	0.9	1	-0.1	0.9
TIM	2	17	73.988	14	16	2	1	1	0	1
ESPM	3	11	76.808	17	17	0	1	1	0	1
REE	4	6	78.128	19	20	12	0.95	1	-0.05	0.95
TIM	5	4	74.625	12	16	3	1	1	0	1
ESPM	6	4	74.737	17	20	1	0.85	1	-0.15	0.85

4. Conclusion

Performance Master's program under Mechanical Department shows that Student drop rate is increasing and pass rate of student is decreasing. This has insured the decrease in quality of program in Institute of Engineering. To improve pass rate and minimize drops out there need to quest to improve the quality of curriculum, teaching strategies, evaluation of students, and program outcomes. Admission, progression, and graduation policies should be reviewed with a balanced approach to identify the best criteria and responses for their program. A greater emphasis should be placed on a process of continuous program assessment and quality improvement.

Results From DEA visualized that MSTIM 2069 and 2070, MSESPM 2069, batch has a sufficient efficiency for two inputs and three outputs.In MSREE 2069 only 90 % of resource is efficiently utilizes even though the maturity period of MSREE programs is high of all. In MSREE 2069 and 2070,MSESPM 2070, batch either number of enrolled student should be reduced for grater concentration on graduation percentage or the number of graduation student should be maximize by utilizing the all available resources and also retention rate need to maximize. The number of graduate is the significant factor that plays vital role in evaluating the efficiency of 3 programs under Mechanical Department. If the passed rate of individual program increased then such program would be more efficient.

Through this result, the department can consult the program coordinator for exercising those faculty members which needs to be improved as well as it can filtered the intake student during the time of selection.

5. Future Recommendation

Assessing the performance of programs can be done with multiple criteria using Analytic Hierarchy Process and asserts the weaker criteria to department for improvement the graduation rate and confine benchmarks.

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