

The Near-Term Outsourcing of Traditional BS Mechanical Engineering Technology (MET) Graduate Employment in the United States

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Introduction

The outsourcing of information technology and manufacturing-related jobs is a fact of life in the U.S. The negative consequences of this reality are widely felt in all geographical regions throughout the country. Outsourcing has been blamed for the economic decline of many small communities over the last few decades¹⁻⁴. Unfortunately, the economic pressures that encourage companies to move operations offshore are not going away in the short-term. Several studies support this claim⁵⁻⁸.

Mechanical engineering design and development jobs have also been impacted by this distending reality. The obvious impetus behind such a trend stems from the competition to make a product at a lower total cost while increasing net income. Therefore, it only makes good sense for businesses to outsource engineering design work offshore to engineers who earn, on the average, 30-40% the wages of their U.S. counterparts⁹. It could be argued that the offshore outsourcing of engineering design resources is as accessible as those found domestically¹⁰⁻¹². In essence, the offshore outsourcing of employment in this area could be easily conducted in the *near-term* by any company with this pursuit in mind.

Traditionally, MET students have graduated from programs with curriculums that have prepared them to seek and find jobs predominantly in the manufacturing sector, and many times, in the design and development field. While the job market has been traditionally quite robust for MET graduates with such a technical yet practical skill set, some recent trends, such as offshore outsourcing, have put future expectations for employment in a precarious light.

The purpose of this paper is to present the results of a study designed to assess the career placement trends of BS MET students and to evaluate the potential impact outsourcing might have on their future employment expectations. An effort was made to distinguish

those jobs taken with the potential for near-term outsourcing from those that are not. The paper concludes with a discussion on how well MET curricula and degree programs are structured to meet these changing market expectations.

Methods

Placement data was accessed for Purdue University's BS MET graduates from May 1989 through May 2005. Data kept on each student during this time period included whether or not employment was secured, the company and position, and the starting salary for each of the graduates. As a point of reference, Purdue University has traditionally graduated approximately sixty BS MET students each May, with almost 95% being male and the majority seeking and finding employment in the Midwestern U.S.

For this study, a determination was made on the ease of outsourcing, based on job type, and only the data for May graduates from each of the years was evaluated. A rating scale, based upon the "perceived" ease of outsourcing, was determined. This scale was qualitatively determined to be the *near-term*, *mid-term*, and *long-term*. Those job classifications categorized as near-term included design, CAD, finite element (FE) meshing, and call centers. The categories classified as mid-term included such employment as contract manufacturing to existing off-shore facilities. To be included as long-term outsourceable, the employment venue had to be moved or a facility would need to be built offshore. A summary of these classifications are given in Table 1.

We determined that the need for immediate information was imperative; therefore, those jobs classified as near-term were segregated from those that were not. It was felt that the short-term data would provide the most useful information for the department in their current placement, curricular, and recruitment efforts. Future plans include the closer scrutinizing of the other two categories. This further assessment would

Abstract

This paper presents the findings of a study involving the trends of BS Mechanical Engineering Technology (MET) graduates in employment that would be easily outsourced to offshore entities in the near term. Graduates from Purdue's BS MET program were tracked from May of 1989 until May of 2005. The data was observed for first-time secured employment and a decision was made on whether or not this employment was easily outsourceable with very little effort. The data was also compared to the U.S. Gross Domestic Product (GDP) values for this time period, as well as the overall job placement for MET graduates during this same period. The findings indicated that recent trends should be of an immediate concern to those involved in student recruitment, curricular, and placement activities for MET students. Future efforts will be directed at assessments of employment trends of graduates in mid-term and long-term outsourceable occupations.

MET Employment Outsourcing Category	Employment Classification
Near-Term Offshore Outsourcability	CAD, Design Engineering, FE Meshing, and Call Centers
Mid-Term Offshore Outsourcability	Contract manufacturing to existing offshore facilities
Long-Term Offshore Outsourcability	Positions that require the movement or the building of facilities offshore

Table 1. Outsourcing Category VS. Employment Classifications

provide more information on the long-term planning of curricular issues and graduate job placement.

In an attempt to provide statistical inference and a quantification of the results, a test of means was conducted using a separate variance t-test, comparing MET graduate placement rates in easily outsourcable employment with overall MET employment in strong job market years. Robust overall placement was set arbitrarily at 85 percent and greater; this value was chosen by the authors on a qualitative basis, using primarily past employment rate numbers of graduates in MET and personal experience with graduate placement. The separate variance t-test technique was used because the population variances were calculated to differ by more than a factor of three. If this occurs, or is expected with a particular data set, it has been argued that it is better to use the separate variance t-test than the typical pooled sample variance to determine the t-statistic¹³.

Data and Results

Table 2 provides the placement numbers in easily outsourced employment in the near-term. The table breaks the data down into term and year, total initially placed, the percent initially placed, the number placed in easily outsourced employment (near term), and the percent of total initial employment. Figure 1 shows a graphical representation of the percent graduates placed in near-term, easily outsourced employment from term-to-term as compared to the overall percentage of initial job placement. Figure 2 provides a comparison between the percent of MET graduates taking easily outsourcable employment between 1989 and 2005 with the gross domestic product (GDP) of the US during the same time period. The data used to provide the comparisons is from surveys completed during the first six months after graduation. No other data was used beyond this time period to track the graduates after initial job market entry. The total number of graduates placed ranged from 20 in 1993 to 47 in 2001. The total

number of graduates placed in near-term, easily outsourced employment ranged from 0 in 1989, 1996, 1999, and 2000 to 6 in 2005. The percent of total graduates placed in easily outsourcable employment varied from 0% to 15% of the graduates, with the spikes being in 1993, 2004, and 2005. For accumulative data from 1989 through 2005, the percentage of BS MET graduates employed overall in near-term, easily outsourced jobs was 5%. The total percentage of MET graduates securing employment within 6 months after graduation ranged from 51% in 2001 to 95% in both 1996 and 1997. Cumulatively, the percentage of MET graduates initially employed over this time period averaged to be 80%. It should be noted that this average overall employment percentage is five percentage points less than the 85% cut-off rate we arbitrarily chose as a means to characterize those years with robust job placement numbers from those which were not.

The results from the separate variance t-test of the means were based on $n = 6$ for the overall robust MET graduate placement years (i.e., >85% initial placement) and $n = 11$ for the weaker placement years. The mean, standard deviation, and variance for those graduates accepting easily outsourcable jobs in the robust years were calculated to be 1.7%, 1.4, and 2.0, respectively. The same parameters for the weaker job market years were 7.6%, 5.3, and 28.1.

The data was evaluated at the 95% confidence level ($\alpha = 0.05$) and the two means were defined as follows:

Let μ_1 = the mean percentage of MET graduates taking the easily outsourcable jobs in the years when the overall placement rates were greater than or equal to 85 percent

Let μ_2 = the mean percentage of MET graduates taking the easily outsourcable jobs in the years when the overall placement rates were less than 85 percent

In addition, the null, H_0 , and alternative hypotheses, H_a , were defined as follows:

$H_0: \mu_1 - \mu_2 = 0$ (that is, no difference in the mean percentages)

$H_a: \mu_1 - \mu_2 < 0$ (or that the mean percentage of MET graduates taking easily outsourcable employment in robust job market years is less than the mean percentage for the same in weaker years)

At 95% confidence and twelve degrees of freedom, it was determined from a t-statistic table that the null hypothesis should be rejected if $t < -1.782$. The calculated t-statistic from the separate variance t-test method was determined to be -3.47. Therefore, since $t = -3.47 < -1.782$, H_0 should be rejected, and further, it can be concluded that μ_1 is less than μ_2 . In other words, at the 95% confidence level the alternative hypothesis is accepted, which states that MET graduates tend to seek out and secure fewer easily outsourcable jobs in strong job market years rather than in those that

are less robust.

As would be expected, the GDP data comparison for the US during this duration shows a trend downward in percent value added due to manufacturing since the 1980s, with a leveling-out time period in the early-1990s. During the leveling-out period, the percentage of MET students seeking and securing employment in design-related engineering jobs increased. However, from the late 1990s up until 2003, the trend appeared to be the securing of less easily outsourced employment for MET graduates as compared with noticeable decreases in percent value added by manufacturing. Between the years of 2000 and 2005, while there appears to be a downward trend on the value added impact of manufacturing on the GDP, the number of graduates securing first time employment in design jobs has significantly increased (i.e., from 0% in 2000 to 14% in 2004 and 2005).

Term and Year	Total # Placed	Percent MET Graduates Placed Overall	# Placed in Easily Outsourced Employment (EOE) in Near-Term	Percent of Total in EOE
May 2005	44	63	6	14
May 2004	36	56	5	14
May 2003	32	80	2	6
May 2002	39	81	2	5
May 2001	47	90	1	2
May 2000	45	78	0	0
May 1999	40	75	0	0
May 1998	34	95	1	3
May 1997	42	95	1	2
May 1996	44	90	0	0
May 1995	29	93	1	3
May 1994	35	77	3	9
May 1993	20	51	3	15
May 1992	33	74	2	6
May 1991	27	74	1	4
May 1990	42	83	4	10
May 1989	48	85	0	0

* The near-term is defined as occupations that could be outsourced in a phone-call's notice. These include employment such as CAD, Design Engineers, Draftsmen, FE Meshing, and Call Centers

TABLE 2 Placement in Easily Outsourced Employment (EOE) in the *Near-Term
Purdue Dept. of MET (1989-2005)

The only data excluded from this study was for employment that was not secured domestically. This data was removed from the both the total graduates and the number in easily outsourcable jobs in order to not significantly affect the percent of the total metric. Over the course of the study, the number of MET graduates which could not be accounted for ranged from 22% to 39% with two-thirds reporting being typical. No other data outliers were realized.

Discussion

The most significant result from the data appears to be the recent increasing trend of those BS MET graduates employed in near-term outsourcable jobs. Since May 2000, the number of graduates securing engineering design work has steadily increased from 0% to 14% in May 2004. This is significant because this reality, coupled with an overall decline in U.S. manufacturing and its impact on value added to the GDP, puts our students at an increased risk of not securing (and/or of eventually losing) employment after graduation. In contrast, while the early 1990s indicated a significant number of graduates taking positions in design (and other near-term, easily outsourced employment), a decline was experienced in the mid-1990s with a bottoming out occurring in the late 1990s and staying rather constant until 2001.

A second significant observation from this data is the correlation that appears to exist between initial overall placement numbers for MET graduates and those employment numbers in easily outsourced employment during this same period. The data suggests that those MET graduates seeking and securing easily outsourcable employment decreases appreciably in the robust job market years such as 1996 and 1997; further, the data suggests that the converse is also true. From Figure 1, the most obvious examples of this reality are in 1993, 2004, and 2005. The initial job placement number in these years were less than 65%, however, the numbers of graduates in easily outsourced employment ranged from 14% to 15% of the overall placement – the highest numbers experienced over the sample duration. The statistical analysis conducted also strongly suggests that this is a reality. It was concluded that at the 95% confidence level the mean percentages were different for BS MET graduates securing initial employment in easily outsourcable occupations during robust job market years versus those which were deemed

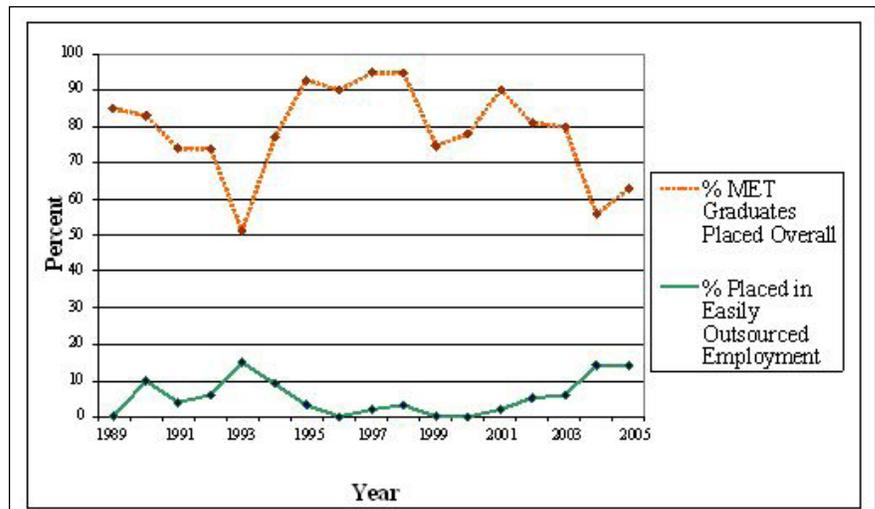


Figure 1. BS MET Overall Initial Job Placement Compared to Initial Placement in Easily Outsourced Employment (1988-2005).

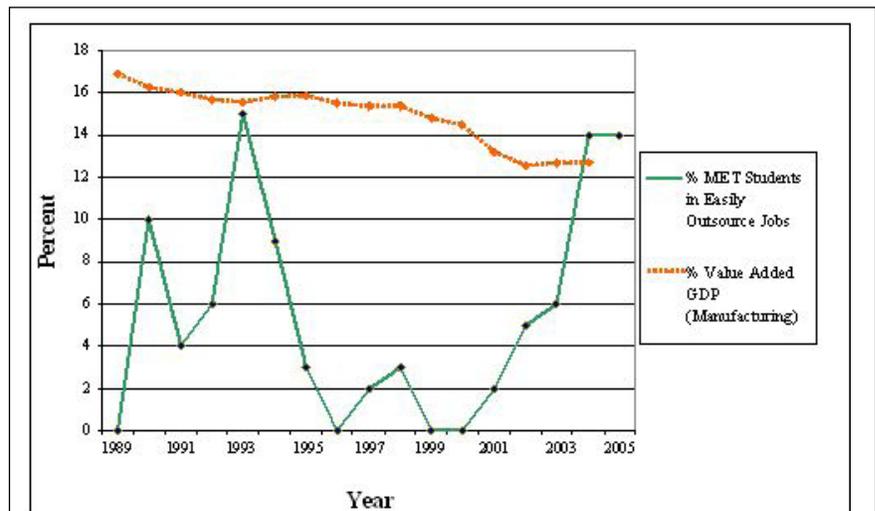


Figure 2. U.S. Gross Domestic Product¹⁴ versus BS MET Job Placement in Easily Outsourced Employment (1988-2005).

lackluster. Thus, the observations and related statistics support the notion that in sluggish job market years, BS MET graduates tend to be more receptive to accepting employment in areas deemed to be more easily outsourcable in the short-term such as CAD work or other design engineering occupations.

While a healthy metric for beginning employment in near-term, easily outsourced employment has not been developed, one could only surmise that the objective of a BS MET program should be to keep this value at a minimum. Thus, it could be argued that the recent indicators show signs for a concern. Assuming that the goal level was to be set at the data average for the duration (i.e., 5%), the recent double-digit data exceeds this significantly. Further, due to a limited data set, it is difficult to discern whether or not the data suggests a trend or a cycle in the placement numbers. Future efforts, conducted with additional data, will concentrate on making a distinction in this area.

In an effort to meet the expectations of a changing economy and world, several engineering and engineering technology programs in the U.S. are seeking strategic personnel hires in alternative technical areas such as green manufacturing, energy systems, sustainability, nanotechnology, and product life cycle management¹⁵⁻¹⁹. However, it is too early yet to determine whether or not there is a major impetus behind making the necessary curriculum changes to accommodate. In addition, the industrial-world's perception of the background and capabilities of graduates from a particular program are somewhat static and predestined. Thus, while the curriculum and infrastructure could be changed internally at an institution, it may take years for the job market to catch up.

Conclusion

In conclusion, a study was presented that segregated near-term, easily outsourced employment from others for BS MET graduates at Purdue University from May 1989 to May 2005. The findings suggest that there could be a recent trend indicating an increase in the number of graduates securing these near-term, easily outsourced jobs in areas such as engineering design. In addition, the data also infers that MET graduates initially seek out and secure more easily outsourcable employment in weak job market years, with the converse also being a reality.

This data suggests MET programs need to

identify the skills that add value for domestic employers and adjust the curriculum accordingly. Thus, efforts should be made institutionally to recognize the significance of this trend and then to, subsequently, take corrective action in developing curricular, marketing, and placement strategies aimed at dissuading graduates from pursuing these potentially short-term types of employment. Instead, programs should direct many recent graduates into alternative technical fields or other long-term employment ventures. Future research will concentrate on the mid-term and long-term easily outsourced employment indicators and their significance to the BS MET programs in the U.S.

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