

## Teaching and research productivity in Tarbiat Modarres University

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### ABSTRACT

**Background** Universities play an important role in training people to meet the community demands for skilled manpower. Furthermore, It is a fact known that universities do most of the research projects in Iran and in most countries through out the world. It is, therefore, important to know about teaching and research productivity in universities and to determine this productivity. Theoretically, a systemic approach is considered to be necessary for productivity measurement in an academic setting.

**Purpose** This study was undertaken to measure teaching and research productivity in Tarbiat Modarres University.

**Methods** We developed the method based on relatively simple and commonly used partial productivity ratios in universities, which can be easily achieved. So, the decision to measure total productivity based on partial productivity in one year period was made. We used a Delphi investigation for compiling data needed for calculating partial productivities.

**Results** Teaching productivity in Tarbiat Modarres University was found to have increased by 87% and research productivity was found to have increased by 1133% during the period between 1985 and 1992. There has been almost 84% increase in teaching and research productivity in the same period.

**Conclusion** Results of this study demonstrate that there has been a considerable increase in teaching and research productivity in Tarbiat Modarres University from 1985 to 1992. The method that we used for productivity measurement has produced what we believe to be valid results, and our hope is that other researchers will benefit from our attempt at quantification by using our methodology, and we wish they develop it further.

**Keywords** SYSTEM, UNIVERSITY, PRODUCTIVITY, DELPHI

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### Introduction

Universities are widely believed to play an important role in training people to meet the community demands for skilled manpower. Furthermore, it is a fact that most of the studies done by universities are in basic sciences. Studies in basic sciences, however, are the ultimate driving force behind technological progress. It is, therefore, important to know and to determine teaching and research productivity in universities.

### Terminology description

1) **System:** any ordered and comprehensive

assemblage or combination of correlated things or parts (1).

- 2) **Productivity:** the amount of output per unit of input (labor, equipment, and capital).
- 3) **Index:** a numeric variant expressing the amount of some property or ratio (in this study, indices applied for calculating partial productivities).
- 4) **Productivity enhancement:** we consider productivity enhancement as the process to achieve higher level of output while consuming same or less amount of resources, we also believed if the same output level is reached in a shorter time period, it indicates productivity improvement (2).

Theoretically, the systemic approach is considered to be necessary for productivity measurement (3). Schematic structure of a system is shown in Figure 1. Although, there are many control and feedback loops in real systems and some of them may be very complicated (4) universities like other systems have 'input', 'process' and 'output'. A university is a multi-product institution that high school graduates are its classic 'input', education is the 'process' and finally, undergraduates and graduates are its major 'output'. Systemic approach addresses all program issues, problem identification, selection of alternative solutions, design of procedures implementation, managing the implementation phase and the overall management capability and workforce issues (1,5). Thus, assessment of productivities in universities leads us to determine ob-



FIGURE 1 STRUCTURE OF A SYSTEM

jectives that should be achieved for productivity enhancement. The process of improving productivity is not complete unless a "productivity enhancement program" is properly designed and implemented for achieving these objectives. The list of these objectives is shown in Table 1. Rather than assuming a whole university as a unit of observation, the internal structure of a given university (in this study, Tarbiat Modarres University) is examined by using faculties within university as the units of observation over a

TABLE 1 OBJECTIVES THAT SHOULD BE ACHIEVED FOR PRODUCTIVITY ENHANCEMENT IN A UNIVERSITY

Objectives
1. Improvement of faculty members' knowledge and skills
2. Making faculty members, motivated and interested in teaching and research
3. Employing new faculty members in university
4. Providing services and equipment required for research and teaching
5. Increasing capacity of student acceptance in university
6. Increasing number of PhD and postdoctoral students in university
7. Enhancement of students' productivity in training and research
8. Providing services required for students education
9. Promoting university curriculums success in education of students
10. Success in creating an environment of trust and honesty for working in educational and research fields
11. Encouraging other institutes and units to contract university to provide educational and research services
12. Increasing equipment and facilities required for research
13. Developing creativity and innovation in university, and also development of technology and science
14. Inviting high quality performance students who graduate from university to work as teachers or researchers
15. Success in allocation and management of finances for paying adequately to faculty members and providing adequate financial resources for education and research in university

given 9-year period. We measured Tarbiat Modarres University productivity in teaching and research. The other aim was to illustrate how the measurement method presented can be implemented in practice.

## Materials and Methods

The statistical value of total productivity cannot be measured in practice, only the changes of productivity can be measured. After several experiments with the existing performance data about productivity (6), we developed the method based on relatively simple and commonly used partial productivity ratios in universities, which can be easily achieved (7). Therefore, the decision to measure total productivity based on partial productivity in a one-year period was made. Relative partial productivity levels were reached in 3 steps:

**Step 1:** We defined two parts in university consisted of teaching and research parts, 12 indices in teaching part of university (part T) and 8 indices in research part of university (part R) were determined. Also, each index was mathematically formulated. List of indices and their specified equations are shown in Table 2.

**Step2:** The Delphi method is an exercise of group-communication among a panel of experts. The technique allows experts to deal systematically with a complex problem or task. The essence of the technique is fairly straightforward. It comprises a series of questionnaires sent to a pre-

**TABLE 2** TEACHING AND RESEARCH INDICES AND THEIR EQUATIONS

Teaching Indices	Equations
<b>T1:</b> number of professors ratio	= total professors serve as faculty member / total faculty members* in university
<b>T2:</b> number of associate professors ratio	= total associate professors serve as faculty member in university/ total faculty members* in university
<b>T3:</b> number of assistant professors ratio	= total assistant professors serve as faculty member in university/ total faculty members* in university
<b>T4:</b> number of educator and master educator ratio	= total educators and master educators serve as faculty member in university/ total faculty members* in university
<b>T5:</b> number of students per faculty member	= total Master of Science students / total faculty members* in university
<b>T6:</b> teaching time per faculty member	= total teaching time (in hour) of faculty members* / total faculty members* in university
<b>T7:</b> number of books translated or authored per faculty member	= total number of books translated or authored by faculty members* / faculty members* in university
<b>T8:</b> non official Educational curriculums ratio	= total number of educational contracts with other institutes and units /total student enrollment in university
<b>T9:</b> number of seminars per faculty	= total number of seminars held /total number of faculties
<b>T10:</b> number of professional courses credits carried by each student	= total credits of professional courses carried by students/ total student enrollment in university
<b>T11:</b> number of general courses credits carried by each student	= total credits of language/culture related courses carried by students/ total student enrollment in university
<b>T12:</b> conditioned students ratio	= total conditioned students/ total student enrollment in university
Research Indices	Equations
<b>R1:</b> number of research units per faculty	= total number of research units /total number of faculties
<b>R2:</b> research project ratio	= total number of research projects/total full-time regular faculty members
<b>R3:</b> dissertation completed per faculty member	= total number of completed dissertation/total faculty members*
<b>R4:</b> research expenditure per faculty	= research expenditures (rials)/total faculty members*+total research units in university
<b>R5:</b> research expenditure per student	= total research expenditures (rials)/total enrollment students
<b>R6:</b> research expenditures per faculty member	= total research expenditures (rials)/total faculty members*
<b>R7:</b> research opportunities per faculty member	= total number of research opportunities / total faculty members*
<b>R8:</b> number of papers per faculty member	= total number of paper returned by faculty members*/total faculty members*

\* Part-time and full-time regular faculty members.

selected group of experts. These are designed to elicit and develop individual responses to the problems posed and to enable the experts to refine their views as the group's work progresses in accordance with the assigned task. The main point behind the Delphi method is to overcome the disadvantages of conventional committee action. Anonymity, controlled feedback, and statistical response characterize Delphi. The group interaction in Delphi is anonymous, in the sense that comments, forecasts, and similarity are not identified as to their originator but are presented to the group in such a way as to suppress any identification. In the original Delphi process, the key elements are:

- 1) information flow structuring,
- 2) feedback to the participants,
- 3) anonymity for the participants.

Clearly, these characteristics may offer distinct advantages over the conventional face-to-face conference as a communication tool. A panel director or a monitor who filters out material not related to the purpose of the group controls the interactions among panel members. The usual problems of group dynamics are thus completely

bypassed. Consequently, we use a Delphi investigation for compiling opinions of members of panel about the impact of each one of the indices listed in Table 2 and about the achieving each one of the objectives listed in Table 1. Chancellor, vice-chancellor, heads of faculties, other principal directors, heads of departments, chiefs of different divisions and faculty members comprised the panel. From 90 questionnaires that were distributed among panelists, 45 were returned; that among those, 40 were acceptable. Panelists were instructed to rate each one of the indices impacts on achieving each one of 15 objectives, via filling out a questionnaire. They were asked to value each index impact on achieving each objective by choosing equivalent numeric value of categorized impact levels as shown in Table 3. As a result, there were 15 numeric values for each index in every questionnaire. Total number of these numeric values demonstrated "numeric value" of index in opinion of the panelist who had filled out the questionnaire.

**Step3:** We selected some indices shown in Table 2 to calculate their partial productivity, because we found that their equivalent numeric values can

**TABLE 3** LEVEL OF INDICES IMPACT ON ACHIEVING THE OBJECTIVES AND THEIR EQUIVALENT NUMERIC VALUES

Level of indices Impact on achievement objective	Equivalent numeric values
Highest level of impact for achievement objective	9
High high level of impact for achievement objective	7
Intermediate moderate level of impact for achievement objective	5
Low level of impact for achievement objective	3
Lowest lowest level of impact for achievement objective	1

be implied for calculating relative level of partial productivity, selected indices were calculated for every academic year (from 1984 to 1992) by means of equation specified for each one. Numeric values reached through these equations for each selected index was named "real numeric value of index in year Y" which Y is one year between 1984 and 1992. Information and data requested as variables in indices' equation were derived from university history. The average of each selected index 'numeric values' in all usable questionnaires was named 'value of index'. We also calculated a numeric value indicating level of each part impact (teaching or research) in enhancing university productivity by using data gathered via questionnaire. This value was named "significance of part". Total number of these two values should be equal to 1.

**Eq. 1:**

$$\text{"Significance of part T"} + \text{"significance of part R"} = 1$$

We calculated each relative partial productivity level in teaching part as follows:

$$\text{Relative partial productivity level of index T}_n = \frac{\text{[real number of index T}_n \text{ in year Y]}}{\text{[value of index T}_n \text{ / total value of selected indices in part T]}} \times \text{[significance of part T]}$$

Y = one year between 1984 and 1992.

We also calculated each relative partial productivity level in research part as follows:

$$\text{Relative partial productivity level of index R}_n = \frac{\text{[real number of R}_n \text{ in year Y]}}{\text{[value of R}_n \text{ / total value of selected indices in part R]}} \times \text{[significance of part R]}$$

Y=one year between 1984 and 1992.

We supposed that there are the linear relations among partial productivity values. Therefore, relative university productivity level in each part (teaching and research) will be equal to total relative partial productivity levels calculated for selected indices of that part. The relative uni-

versity productivity level in teaching and research was determined as shown in Eq. 2.

**Eq. 2:**

The relative university productivity level in research and teaching = Relative university productivity level in teaching + Relative university productivity level in research

In this method for productivity measurement, base year can be used to commensurate dissimilar amounts of productivity in other years. Now, the relative changes in total productivity (in this study, university productivities in teaching and research) during specific period of time can be expressed easily.

**Results**

We calculated relative partial productivity levels of 8 teaching indices in Tarbiat Modarres University from 1984 to 1992. Therefore, the relative level of university productivity in teaching was equal to total numeric values of these 8 relative partial productivity levels. Relative university productivity levels in teaching and research for every year are reported in Table 4. Base year was 1984 in this study. Relative productivity levels in teaching from 1984 to 1992 in Tarbiat Modarres University are shown in Figure 2. The university productivity in teaching had not any significant rise between 1984 and 1990 as can be seen more clearly in Figure 2. This was an outcome of a rise in number of total student enrollment in university and low quality performance of faculty members, during this period. As seen in Figure 2, university productivity in teaching has shown steady increase from 1990 to 1992. Teaching productivity in university was found to have increased by 67% during the period between 1985 and 1992.

Tarbiat Modarres University relative productivity level in research was equal to total numeric values of relative partial productivity levels of indices R1, R2, R3, R7, and R8. University productivity in research rose in 1985, 1986 and 1990 as seen in Figure 3. Increasing of partial productivities of indices R3, R7, R8 resulted in enhancement of university productivity in research in 1990. There was a decline in university productivity in research in 1992 as an outcome of decreasing partial productivity of indices R2 and R3. The university productivity in research was found to have increased by 1133% during the period between 1985 and 1992.

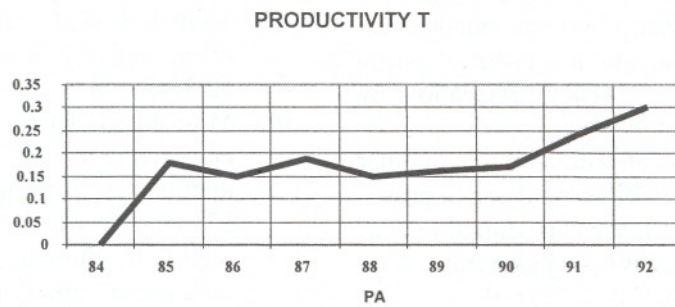
**TABLE 4 THE RELATIVE PRODUCTIVITY LEVELS FROM 1984 TO 1992.**

Year	1984	1985	1986	1987	1988	1990	1991	1992
Teaching relative productivity	0.18	0.15	0.19	0.15	0.16	0.17	0.24	0.30
Research relative productivity	0.003	0.016	0.014	0.018	0.015	0.040	0.036	0.037
Teaching and Research relative productivity	0.183	0.166	0.204	0.168	0.181	0.210	0.276	0.337

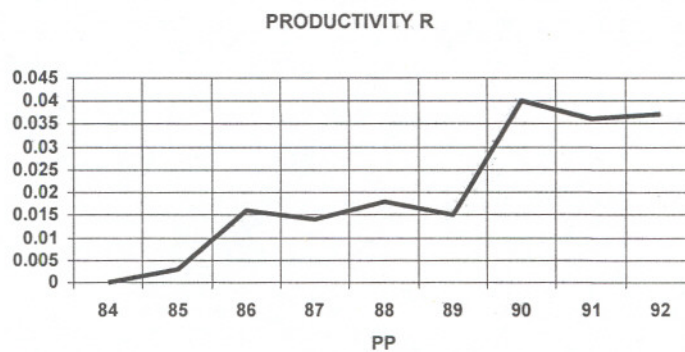
**Discussion**

Results of this study demonstrate that there has been a considerable increase in teaching and research productivity in Tarbiat Modarres University from 1985 to 1992. This study also demonstrates the measurement of total productivity based on partial productivity is to be looked at as potential method for productivity measurement in

other universities. Other universities, of course, may demonstrate quite different teaching and research performance relationship for their departments and their faculties. This method has produced what we believe to be valid results, and our hope is that others will benefit from our attempt at quantification using our methodology, and we wish they develop it further.



**FIGURE 2 TEACHING RELATIVE PRODUCTIVITY LEVELS IN TARBIA T MODARRES UNIVERSITY FROM 1984 TO 1992**



**FIGURE 3 TEACHING AND RESEARCH RELATIVE PRODUCTIVITY LEVELS IN TARBIA T MODARRES UNIVERSITY FROM 1984 TO 1992**

### PRODUCTIVITY T+R

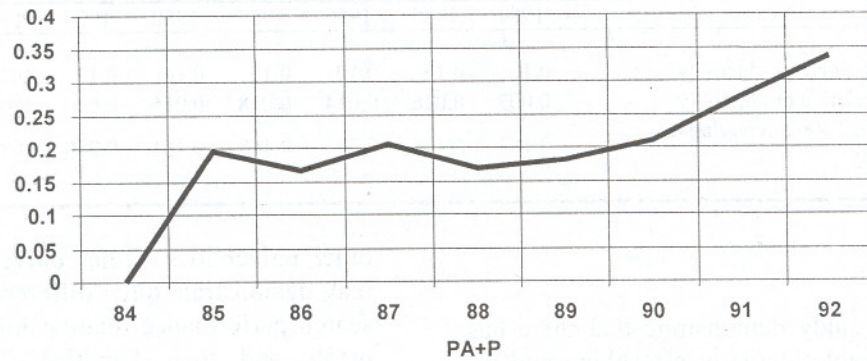


FIGURE 4 TEACHING AND RESEARCH RELATIVE PRODUCTIVITY LEVEL IN TARBIAAT MODARRES UNIVERSITY FROM 1984 TO 1992 .

### References

1. West C, Churchman. Systems theory. 1st ed. Tehran: Governmental management center publication. p. 29-51. [Farsi translation by Aslani R.]
2. Marashi N. Analysis of productivity and other technical control ratios essential for improvement of factories performance. Bulletin of industrial and productivity engineering congress. No 1. 1992. p.231-42. [Farsi]
3. Bishon J. Systemic though. 1st ed. Tehran: Pishpord publication. p. 120. [Farsi translation by Janbaglou AH.]
4. Farshad M. Systemic approach. 1st ed. Tehran: Sepehr publication. p. 165. [Farsi]
5. Eghtedari AM .Organization and management. 16th ed. Iran: Moulavi publication. p. 52-3. [Farsi]
6. Mojdani M. Factors effective in productivity enhancement. Bulletin of industrial and productivity engineering congress; No 1. 1992. p. 231-41. [Farsi]
7. Shams N, Moballegh M. Development of an instrument for universities productivity measurement [thesis]. Amirkabir University of Technology. [Farsi]