

FACTORS RELATED TO PROFESSIONAL PRODUCTIVITY :  
A STUDY OF SCIENTISTS AND ENGINEERS  
IN INDIAN INSTITUTES OF TECHNOLOGY

by

SABITA KARUNES (BANERJEE)  
DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES

Thesis submitted in fulfilment of the requirements

of the degree

of

DOCTOR OF PHILOSOPHY

to the

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

January 1983

## CERTIFICATE

This is to certify that the thesis entitled "Factors Related to Professional Productivity: A study of scientists and engineers in Indian Institutes of Technology" being submitted by Mrs. Sabita Karunes (Banerjee) to the Indian Institute of Technology, Delhi for the award of the degree of Doctor of Philosophy, is a record of bonafide research work carried out by her.

Sabita Karunes has worked under my supervision and guidance and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard.

The results contained in this thesis have not been submitted in part or in full, to any other university or institute for the award of any degree or diploma.

*Purnima Mathur*  
(Purnima Mathur)  
Supervisor

## ACKNOWLEDGMENTS

I am extremely grateful to Dr.(Mrs) Purnima Mathur, Head of the Department of Humanities and Social Sciences, I.I.T. Delhi, for her invaluable guidance and interest in the present work. She gave me the time and the freedom to follow my own traits; through her understanding, I was able to work on this as a research rather than a collection of materials. Where it lacks any cohesion, the failing is mine.

I am much indebted to the respondents, the faculty members of all five I.I.Ts, who with unfailing patience and confidence have answered my questionnaires.

I am also indebted to Dr. C.R. Sahay of the Department of Mechanical Engineering, State University of New York, who made me available the literature on the subject which was not available here.

I am grateful to the staff members of Computer Centre, I.I.T. Delhi for their kind cooperation and help.

I am extremely thankful to Dr. B.R. Handa of the Department of Mathematics for his kind help in the statistical analysis of the data. I am also thankful to Mr. A.K. Jain and Mr. A.K. Gupta of Offshore Structures Research Cell and to Dr. T.K. Datta of the Department of Civil Engineering for their help in data processing and computer work.

Finally, I thank Mr. S.K. Mehra for neatly typing the thesis.

SABITA KARUNES

## ABSTRACT

The conditions under which the scientists and engineers perform their best, is a matter of great importance to the group of scientific organizations. Many studies have been made to identify such conditions by examining the relationship between scientists' performance and the factors related to motivation, job-satisfaction, organizational structure, and individual background. Most of these studies were, however, carried out in developed countries, where the organizational set ups and individual's attitude to work are somewhat different than those prevalent in developing countries like, India, because of socio-cultural and economic differences. The findings of these studies, therefore, may not be much useful to the managements of Indian scientific organizations. In India, very few systematic studies have been made in this area.

The present investigation is concerned with the professional productivity of 213 scientists and 336 engineers drawn from Indian Institutes of Technology. These institutes are seats of higher learning in science and technology and are involved in a variety of activities, such as teaching, research, industrial services, and technological development programmes. The investigation attempts to explore the relationships between the performance of scientists

(ii)

(mean<sup>ing</sup> both scientists and engineers) and a set of factors which include scientists' age, position in the hierarchy of organization, financial status, scholastic achievement, motivation, job satisfaction, dedication, communication, freedom, and diversity. The hypotheses, which are tested propose a definite relationship between each of these factors and performance. Three measures of performance have been considered in the study namely, publication productivity, teaching productivity, and productivity in industrial services.

The analysis of the data showed that:

- i) The most productive age of scientists is around mid forties.
- ii) Scientists more productive in teaching and research are self reliant, involved, and deep in their approach to work.
- iii) More productive scientists in research have relatively strong desire for self-actualization.
- iv) Job satisfaction is generally unrelated to performance.
- v) Scientists more productive in industrial services are status oriented.

(iii)

- vi) Restricted freedom with visibility of consequences is most conducive to scientists' performance.
- vii) Informal communications amongst scientists are helpful to their performance.
- viii) Diversity in academic field, as well as in function, is helpful to scientists' performance.

On the basis of the results obtained, recommendations for further research are outlined.

## TABLE OF CONTENTS

CHAPTER		Page
1	INTRODUCTION	1
	Historical perspective	4
	Evaluation of performance - a controversy	9
	Need for the present study	12
	Objective of the present study	14
2	THEORETICAL ORIENTATION	17
2.1	Introductory remark	17
2.2	Theories of motivation	19
2.2.1	Motivational process	19
2.2.2	Maslow's theory of motivation	24
2.2.3	Herzberg's theory	26
2.2.4	Vroom's theory of motivation	29
2.2.5	Porter and Lawler's model of motivation theory	31
2.2.6	Smith and Cranny's model of motivation	34
2.2.7	Cognitive approach to work motivation	35
2.3	Theoretical framework underlying the present study	43

CHAPTER		Page
3	FACTORS RELATED TO PROFESSIONAL PRODUCTIVITY, LITERATURE REVIEWED AND DEVELOPMENT OF THE HYPOTHESES	50
3.1	Factors related to professional productivity	50
3.2	Review of literature	55
3.2.1	Age and performance	55
3.2.2	Position and performance	57
3.2.3	Communication and performance	59
3.2.4	Freedom and performance	62
3.2.5	Diversity and performance	64
3.2.6	Dedication and performance	66
3.2.7	Motivation and performance	69
3.2.8	Satisfaction and performance	72
3.3	Proposed hypotheses for the study	74
4	DEVELOPMENT OF THE INSTRUMENT	77
4.1	Preliminary remark	77
4.2	Description of the questionnaire and construction of the indices for the variables	80
4.3	Feasibility of the instrument	83
4.4	Determination of raw scores for performance measures	84
4.5	Validity and reliability of the instrument	84

CHAPTER		Page
5	DATA COLLECTION, PROCESSING AND ANALYSIS	97
5.1	Collection of data	97
5.2	Data processing	98
5.3	Analysis of the data	102
6	DISCUSSION OF RESULTS	109
6.1	Introductory remark	109
6.2	Productivity Vs Age and Position	111
6.3	Productivity Vs Background Variables	123
6.4	Productivity Vs Freedom	126
6.5	Productivity Vs Diversity	132
6.6	Productivity Vs Communication	139
6.7	Productivity Vs Dedication	146
6.8	Productivity Vs Job Satisfaction	149
6.9	Productivity Vs Motivation	155
6.10	Summary of bivariate correlation analysis	163
6.11	Multiple relationships of some selected variables to performance	165
6.12	Conclusion	174
7	PRACTICAL IMPLICATIONS, LIMITA- TIONS OF THE PRESENT STUDY AND RECOMMENDATIONS FOR FUTURE RESEARCH	177
7.1	Practical implications	177
7.2	Limitations of the present study	181
7.3	Recommendations for future study	183
	BIBLIOGRAPHY	185
	APPENDIX	206