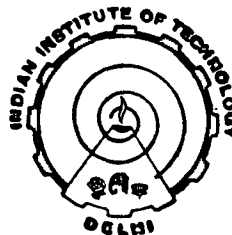


# DETERMINANTS OF ORGANIZATIONAL EFFECTIVENESS: CASE STUDY OF R&D GROUPS

By

V. SIVA RAMA KRISHNAIAH

*THESIS SUBMITTED TO THE  
INDIAN INSTITUTE OF TECHNOLOGY, DELHI  
FOR THE AWARD OF THE DEGREE OF  
DOCTOR OF PHILOSOPHY*

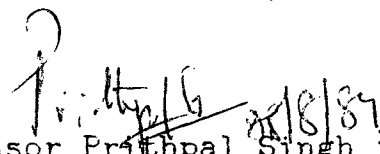


CENTRE FOR MANAGEMENT STUDIES  
INDIAN INSTITUTE OF TECHNOLOGY, DELHI  
AUGUST 1989

CERTIFICATE

This is to certify that the thesis entitled, "Determinants of Organizational Effectiveness : Case Study of R&D Groups", being submitted by Mr. V. Siva Rama Krishnaiah to the Indian Institute of Technology, Delhi, India, for the award of the degree of DOCTOR OF PHILOSOPHY, is a record of bonafide research work carried out by him under my supervision and guidance. The thesis work, in my opinion, has reached the standard, fulfilling the requirements of Doctor of Philosophy degree.

The material contained in this thesis has not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.

  
Professor Prithpal Singh  
Centre for Management Studies  
Indian Institute of Technology  
New Delhi - 110 016, India

## ACKNOWLEDGMENTS

It is my privilege and pleasure to express my sincere regards and profound sense of gratitude to my respected guide Professor Prithpal Singh for his invaluable advise and encouragement throughout the course of study.

I am indebted to Dr. Ashok Jain, Director, National Institute of Science, Technology and Development Studies (NISTADS) for sponsoring me for the Ph.D programme and permitting me to use the resources available in the Institute.

My grateful thanks are due to Mr. P.S. Nagpaul, Deputy Director, NISTADS who helped me readily, whenever approached. The breadth of his knowledge and the gentleness of his criticism have helped me in bringing the thesis to its present shape.

I also express my sincere thanks to the two organizations, UNESCO and NISTADS, for allowing me to use subset of data collected in India for the "International Comparative Study on the Organization and Performance of Research Units (ICSOPRU)". The cooperation extended by a large number of R&D groups who actively participated in the questionnaire survey, is gratefully acknowledged.

I am especially grateful to Dr. N. Seshagiri, Director General, National Informatics Centre, for providing me the support and encouragement necessary to complete this thesis.

My thanks are due to Mr. M Bhaskar Sarma who by his extreme and sincere hard work at odd hours could complete the task of typing this thesis.

Finally, I would be failing in my moral duty if I do not express my thanks to my wife and child who were not only a source of inspiration but also preferred to tolerate my preoccupation with the thesis work and neglecting their legitimate requirements.

While acknowledging the advise, encouragement, suggestions and help of the individuals and organizations referred above, the responsibility for any errors or omissions will be entirely mine.

AUGUST 1989

*V Siva Rama Krishnaiah*  
V. SIVA RAMA KRISHNAIAH

### Abstract

Contemporary research and development has been taking place on the structure of groups or clusters of individuals - moving away from solitary efforts. This trend is stimulated by the increasing complexity of research questions being addressed on the one hand and on the other phenomenal advances in research technology. A major concern of R & D management is how to improve the performance of R & D groups. In the search for optimal configuration of human and material resources and management practices, the most important question is how to evaluate the effectiveness of the R&D groups. The aim of this study is to identify and assess the importance of numerous structural, social and organizational factors which influence the effectiveness of R & D groups. The study also seeks to address how do research groups respond to the goals and purposes they are supposed to serve, or to the functions they are expected to perform.

The study is based on the subset of empirical data collected from 147 research groups for the third round of the "International Comparative Study on the organization and performance of Research Units (ICSOPRU)" sponsored by UNESCO. The selection of R & D groups were made by sampling from groups belonging to a major national research organization, which has a network of laboratories in different fields of agricultural science.

An in-depth study and review of the contemporary research on the effectiveness of R&D groups, its concepts and measurement has been carried out. In this study, the effectiveness of R&D groups has been measured in terms of the goal attainment model. The study has identified various goals pursued by R&D groups.

Four composite effectiveness measures namely Scientific effectiveness of the group, Recognition accorded to the group, Application effectiveness of the group and Administrative effectiveness of the group have been constructed from the original 14 questionnaire items. The multidimensionality of these four theoretically identified effectiveness factors, has been examined by Confirmatory Factor Analysis.

The study has reviewed the concepts of group size, group age, research planning, human and material resources, leadership, work climate and communication. After synthesizing the previous research, the study has defined each of these concepts and identified their conceptual dimensions. In that process the study has advanced 19 predictor measures that are likely to be important in the description and study of effectiveness of R & D groups.

One way analysis of variance has been carried out to examine the relationship between Group size and effectiveness measures; Group age and effectiveness measures. Correlation analyses have been carried out to ascertain the relationships of each of the 19 so-

cial, organizational variables as independent variables to effectiveness measures as dependent variables.

A further step in the study was to relate all these predictor variables together with effectiveness measures and thus finding out the important predictor variables that explain significant variance in the effectiveness of R & D Groups and their relationship to the goals of their activity. It has been hypothesised that the determinants of effectiveness of R&D groups vary with the nature of goals they pursue. Two different sets of predictor measures have been proposed for determining the scientific contribution and extra - scientific contribution of R & D groups respectively. The validity of these propositions have been tested through step-wise Regression Analysis.

The results of the study show that if the criterion for effectiveness is contribution to the scientific knowledge or getting recognition from the scientific community, the set of predictors that best determine the effectiveness of a R & D group include the quality of research planning, focus on scientific goals in the selection of research portfolio, leader's experience, leader's contact with hierarchy and communication between R & D groups. If the criterion for effectiveness is contribution to solution of identified economic and societal problems and potential application of the group's research results, the set of predictors that best determine the effectiveness of R & D group include the communication with potential users of research results, leader's experience, focus on applied goals in the selection of research portfolio and leader's contact within hierarchy. The results of the analysis are discussed in detail.

Major recommendations and inferences drawn from this study have been summarized towards the end highlighting the important contributions made by this research work. The limitations of this study along with suggestions for future work have also been outlined.

## List of Contents

	Page
Certificate	i
Acknowledgments	ii
Abstract	iii
List of Tables	vi
List of Figures	vii
CHAPTER ONE : INTRODUCTION	1
I Impact of Science and Technology	2
II Scientific & Technological Research in India	4
III Nature of Work Groups in R&D	11
IV Frame Work of the Present Study	20
CHAPTER TWO : THEORETICAL CONSIDERATIONS	22
I Effectiveness of R&D Groups	23
II The Size and Age of R&D Groups	34
III Research Planning	39
IV Human and Material Resources	45
V Leadership	49
VI Work Climate	57
VII Communication	63
VIII Central Hypothesis	68
CHAPTER THREE : METHODOLOGY	72
I The Sample	73
II Data Collection and Respondents	78
III The Measures	80
IV Organization of Analysis	88
CHAPTER FOUR : ANALYSIS AND RESULTS	90
I Sample Characteristics	90
II Relationships Among Predictor Measures	94
III Confirmatory Factor Analysis of Effectiveness Variables	98
IV Relationships of Size and Age with Effectiveness	104
V Relationships between Independent Variables and Effectiveness Variables	108
VI The Determinants of R&D Group's Effectiveness	117
CHAPTER FIVE : DISCUSSION	121
CHAPTER SIX : CONCLUSIONS AND IMPLICATIONS	179
References	189
Appendix : Questionnaire	204