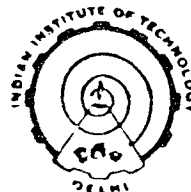


**NATURE OF R&D AND INNOVATION IN A
DEVELOPING COUNTRY - A STUDY ON
PESTICIDES RESEARCH IN INDIAN
NATIONAL LABORATORIES**

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

BY
N. MRINALINI



Centre for Rural Development and Appropriate Technology
INDIAN INSTITUTE OF TECHNOLOGY, DEL

NEW DELHI - 110016

1991

DEDICATED TO ALMIGHTY

ACKNOWLEDGEMENTS

I feel very grateful to Prof. Padma Vasudevan for her valuable suggestions and constant guidance which helped me in bringing the study to a proper shape for submission. I am very thankful to Dr. Santosh, for her guidance and useful comments on my work. I must mention about my supervisors willingness to spare time whenever I called upon them for clarifications. I am indeed very grateful to them for the help and cooperation during the course of my study.

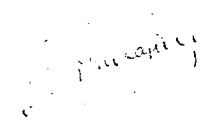
I am very much indebted to Dr. Ashok Jain, Director, NISTADS for sparing his valuable time for discussions, which helped me in sharpening the focus of my study. I got very much benefited by his timely advice, valuable suggestions and critical observations during the course of my study. I am grateful to him for providing the necessary infrastructural facilities.

I wish to thank Dr. A.V. Rama Rao, Director, Indian Institute of Chemical Technology and Dr. L.K. Doraiswamy, Ex-Director, NCL for sparing their valuable time for discussion. I would also like to thank Dr. (Mrs.) Swaminathan, Scientist, Indian Institute of Chemical Technology for the help and cooperation extended to me during my visit to the laboratory. I duly acknowledge the willingness with which Dr. S.H. Iqbal, Scientist, National Chemical Laboratory, and his colleagues, helped me in my data collection during my visit to the laboratory.

I am very much indebted to my friends and family members for giving me the moral strength and support.

I wish to thank my colleagues at NISTADS for their supportive help and cooperation. My special thanks are to Mr. A. Wahid, Scientist at NISTADS for extending the computer facility. My thanks are to Mr. Ajay Sheopuri for his help and cooperation which facilitated me in getting the Laser printout on time. I owe my thanks to Mrs. Neerja Rawal for being very cooperative in typing the manuscript.

Last but not least, I would like to acknowledge the cooperation extended to me by Mr. Suresh Chander and Mr. Joshi of photostat unit at NISTADS.


(N. MRINALINI)

CERTIFICATE

This is to certify that the thesis entitled "Nature of R&D and Innovation in a Developing Country - A Study on Pesticides Research in Indian National Laboratories" being submitted by Ms. N. Mrinalini to the Indian Institute of Technology, New Delhi, for the award of degree of Doctor of Philosophy, is a record of bonafide research work carried out by her.

Ms. N. Mrinalini has worked under our guidance and supervision has fulfilled the requirements for the submission of the thesis, which to our knowledge has reached the requisite standard.

The results contained in the thesis have not been submitted in part or in full, to any other University/Institute for the award of any degree or diploma.

Padma Vasudevan

Prof. Padma Vasudevan
Supervisor,
Centre For Rural Development
and Appropriate Technology,
Indian Institute Of Technology,
new Delhi-110 016.

Santosh

Dr. Santosh
Supervisor,
Centre for Rural
Development and
Appropriate Technology,
Indian Institute of
technology
New Delhi-110 016.

ABSTRACT

Technological innovations are one of the most important components of economic growth. There are two contrasting views on the conceptualization of technical change. One school of thought in economics attributes it to the radical or major innovation activity, whereas, the stresses upon the understanding of the process of technological change and hence, encompasses all the minor, marginal innovations and improvements, modifications etc.. In the developing countries, the nature of R&D activity is very much different from what is observed in the developed countries. It is basically oriented towards adaptations, improvements and modifications of the imported technologies. More than innovative research, adaptive and imitative type of research is undertaken in the developing countries.

There are several firm level studies on adaptive research and technical change. This study focuses on the nature of change in the technological processes in the Indian government laboratories (CSIR laboratories) in the area of pesticides. Broadly under the frame work of A.P Usher, N. Rosenberg, and Nelson and Winter, methodology has been worked out to test the following two hypothesis:

- 1 The policy of import substitution and self-reliance is understood to have made a positive contribution towards self- reliant industrial development
- 2 Though, R&D efforts were directed towards working on known and well established products worldwide, over the years, indigenous R&D has effected change in the technological processes.

The first hypotheses got proved and it has been found that the import substitution of the products has been along with technological import substitution which had new product development, product/process improvement etc. CSIR laboratories have played a positive role in providing technologies to the firms for commercialization, in the process consolidating a self- reliant industrial base.

When the second hypotheses was put to test it was found that, the R&D activity in the CSIR laboratories, in the area of pesticides showed a shift from imitative to adaptive to innovative type of research over the years. R&D activity here was found to be in the form of a learning process from an imitative phase to an innovation phase, resulting in cumulative knowledge base.

Thus, the importance of the study lies in measuring changes in technological processes in government laboratories and in applying the continuity framework by developing a method for measurement. The studies which have focuses on continuity framework and adaptive research are firm level studies.

CONTENTS

S.NO.	CHAPTER	PAGE
1.	INTRODUCTION	1 - 10
1.1	BACKGROUND	1
1.2	PROBLEM DEFINITION AND RATIONALE FOR THE STUDY	6
1.3	SCOPE OF THE STUDY	8
1.4	STUDY DESIGN	8
2.	LITERATURE REVIEW	11 - 27
2.1	TECHNOLOGICAL CHANGE : CONCEPTUAL FRAMEWORK	11
2.2	PLANNING AND ORIENTATION OF RESEARCH	18
2.3	INNOVATION POLICY AND R&D	20
2.4	R&D AND INDIAN NATIONAL LABORATORIES	22
2.5	NOTES	27
3.	METHODOLOGY	28 - 34
3.1	THE HYPOTHESIS	28
3.2	METHODOLOGY FOR TESTING HYPOTHESIS I	29
3.3	METHODOLOGY FOR TESTING HYPOTHESIS II	31
3.4	DATA BASE	33
3.5	THE SOURCES OF INFORMATION	34

4.	MEASUREMENT ON TECHNOLOGICAL PROCESSES	35-66
4.1	R&D AND INNOVATION	35
4.2	CHARACTERISATION AND ANALYSIS OF R&D PROJECTS	39
4.3	APPLIED/EXPERIMENTAL DEVELOPMENT PROJECTS	41
4.4	BASIC/EXPLORATORY PROJECTS	46
	TABLES	51
5.	STATUS OF INDIAN PESTICIDES INDUSTRY: AN ANALYSIS	67 - 95
5.1	PESTICIDES AND THE WORLD SCENE	67
5.2	THE INDIAN SCENARIO	70
5.2.1	INDIGENOUS TECHNOLOGY GENERATION	72
5.2.2	R&D EFFORTS IN THE CSIR LABORATORIES	73
5.2.3	UTILIZATION OF INDIGENOUS RAW MATERIALS	75
5.3	R&D IN BIOTECHNOLOGY/ BIOCONTROLAGENTS	76
	TABLES	80
6.	SUMMARY AND CONCLUSION	96-102
	BIBLIOGRAPHY	103-116
	APPENDIX	117-121
	ANNEXURES	122-129