

**TECHNOLOGICAL DEVELOPMENT IN
SMALL MANUFACTURING ENTERPRISES:
AN ANALYSIS OF ITS DETERMINANTS AND EFFECTS**

M. USHA

**Centre for Economic & Social Studies
Begumpet, Hyderabad-500 016**

**DISSERTATION SUBMITTED TO
Dr. B.R. AMBEDKAR OPEN UNIVERSITY
FOR THE AWARD OF THE DEGREE OF
Doctor of Philosophy
IN COMMERCE**

April, 1995

2) April, 1995.

Professor V. SURENDAR

M.Com., M.Phil., Ph.D.
Department of Commerce
Osmania University,
Hyderabad - 500 007.

Dr. C.P. NAGI REDDY

M.A. Ph.D.
Manager - Market Research
ITC Bhadrachalam Paper Boards Ltd.
S.P. Road, - Secunderabad.

CERTIFICATE

We certify that this is the original work done by Mrs. M. Usha, Lecturer in Commerce, Kasturba Gandhi College for Women (U.G. and P.G) Secunderabad, under our joint guidance.

C.P. Nagi Reddy
(C.P. NAGI REDDY) 27/4

V. Surendar
(V. SURENDAR) 27/4

DECLARATION

I declare that this dissertation has not been submitted to any other university for any degree.

27th April, 1995.

M. Usha
(M. USHA)

Preface

Development of the Small Scale Sector continues to be the central plank of the industrial development policy of the Government in our country. This priority sector has been making rapid strides for improving its, relative importance in the aggregate manufacturing output, employment and exports. At present, it contributes about two-fifths of industrial output and one-third of total exports. In the context of present liberalisation and globalisation of the Indian economy the Small Scale Sector has to face a number of challenges in the areas related to manufacturing. One such an area is the 'Technology' and its 'Development'. Unless, concerted and genuine efforts are made to improve his technological base it would be difficult, if not impossible for the small entrepreneur to survive and grow in the market. As is well known, these are the days of, 'the survival of the fittest'.

Seen from this perspective, a study of technological development in the small manufacturing enterprises assumes importance. For the purpose of policy formulation, it is relevant to address the issue of the efforts made by the small entrepreneurs, the nature of technological development and its effects. Towards this end, the present empirical investigation focuses on various issues concerning the technological development in the Small Scale Sector. The field study was undertaken during 1992-93. Several visits were made to the units to collect relevant information and have discussions with the entrepreneurs. Necessary information was collected from the national laboratories and other Government organisations, trade associations and other bodies operating both at the national and state level.

In this endeavour, my research supervisor Prof. V. Surendar, Department of Commerce, Osmania University, Hyderabad, has been a guiding spirit and a source of inspiration to me for the conception, and completion of the present study. He was instrumental in the identification of the problem, preparation of the design of the study and materialisation of the present work. I owe a debt of gratitude to my teacher Prof. V. Surendar for having extended his valuable guidance throughout the course at different stages of the study. I also wish to thank Smt. V. Manohari for her hospitality and encouragement during the period of my work.

I am grateful to Dr. C.P. Nagi Reddy, Manager, Marketing, ITC - Bhadrachalam Paper Boards Ltd., the then Fellow at Centre for Economic and Social Studies, Hyderabad, my another research supervisor, for his encouragement and able guidance in the completion of my work.

The untiring enthusiasm for research work of Prof. R. Radha Krishna, Member Secretary, ICSSR, New Delhi, the then Director, Centre for Economic and Social Studies, Hyderabad, has been a constant source of inspiration for me. He has evinced interest not only in the research concern but was also instrumental in getting ICSSR teacher Fellowship for a period of two years. Above all, he has, inspite of busy schedule gone through a few chapters and made valuable comments for further improvement. I am grateful to him for this academic help.

In finalising and drawing inferences on Measurement and Determinants, of Technological Development (Chapters V & VI) Dr. Indrakant, Fellow, Centre for Economic and Social Studies, (on deputation from the Department of Economics, Osmania University) has rendered invaluable help and guidance, for which I owe my deep felt gratitude to him.

Prof. J. Satyanarayana, Emiretus Professor, Dept. of Commerce, Osmania University, has been a source of continuous encouragement. His suggestions for improvement lent sharp focus to the study. I express my heart felt gratitude to him.

I thank the officials of the Indian Council of Social Science Research, New Delhi for considering me for the award of Teacher Fellowship for a period of two years which enabled me to undertake the field work and also tabulation. This was a timely help, but for which, the study would have taken a much longer time than it did.

I am also indebted to Smt. A. Vidya Rani, Principal of our college for her help in many ways. Without her encouragement and support, it would not have been possible for me to undertake the work. I sincerely thank her and the Management of KasturbaGandhi College for women (U.G and P. G.) Secunderabad, for permitting to avail the ICSSR teacher fellowship for two years for early completion of my work.

While the work was in progress, I had the opportunity of discussing my research problem with eminent economist Prof. D.U. Sastry, formerly the Prof, at Institute of Economic Growth, New Delhi, Prof. D. Amarchand, Dept. of Commerce, university of Madras, Madras and Prof. D. Nagaiya, Director, NISIET, Hyderabad. I sincerely thank them for their valuable comments.

I had the benefit of discussing my research problem with Sri A.P.N.S.P. Sastry, Joint Director, Bureau of Indian Standards, Hyderabad, Sri Sitapati Rao, Director, Electronics Test and Development Centre, Hyderabad, Mr. V. Narayana and Mr. Ranga Rao, Senior Faculty Members, Indian Statistical Institute; Hyderabad. I am thankful to them for their guidance and necessary help on different aspects of the study.

The small industrialists, Government officials, Scientists working in the national laboratories, the executives of various Industry associations, have not only responded to the questionnaire but also have spared their valuable time for discussions inspite of their very busy schedule. I sincerely thank each one of them for their unhesitating co-operation in parting with their data.

My thanks are also due to Prof. N. Krishnaji, the Director, Centre for Economic and Social Studies, Hyderabad and the senior faculty members at CESS specifically Prof. Afjal Mohammad, Dr. Mrs. Kanaka Lata Mukund Prof. S. Subramanyam and Prof. J.V.M Sharma, for their valuable suggestions and encouragement. I also thank Dr. Gautam Kumar Mitra, Dr. S. Sudhakar Reddy, Dr. K.S. Reddy and all other faculty at CESS including Cartography section for necessary help.

I wish to thank Sri P. Vijay Kumar, the Librarian at CESS and other Librarians of Dr. B.R. Ambedkar Open University, NISIET, IPE, IICT, ASCI and office of the commissioner of Industries, Hyderabad for extending library facilities.

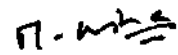
My thanks are also due to all my friends both in my college and at CESS with special mention of Smt. J. Sriprabha, Head Dept. of Commerce and Miss N. Sridevi for their constant encouragement and necessary help.

I thank Mr. Y.R.B. Sharma and Mr. C. Ravi, Bureau of Economics and Statistics, Hyderabad, Dr. Viswaswar Rao and Mr. P. Vidyasagar, National Institute of Nutrition, Hyderabad and Dr. K. Pratap Reddy, Reader, Dept. of Economics, O.U. for rendering necessary computer help for statistical analysis.

I will be failing in my duty if I do not thank all my family members who have given me great moral support. I wish to express my heartfelt gratitude to all of them for their help in many ways without which I would not have dared to take up this academic work.

Finally, I thank Miss A. Kalpana, Siri Computer Services, Lalapet, Secunderabd who voluntarily and cheerfully undertook the typing of draft and the final copy of the dissertation.

Sr. Lecturer in Commerce


(M. USHA)

Kasturba Gandhi College (U.G. and P.G.)

Marredpally, Secunderabad.

27th April, 1995.

CONTENTS

Chapter	Title	Page No.s
	Preface	i - iii
Chapter I	Introduction	1 -32
Chapter II	The Sample: Design and Background	33-52
Chapter III	Public Policy on Technology: An Overview	53-69
Chapter IV	Technological Development: Source	70-92
Chapter V	Technological Development: An Analysis Of Its Measurement	93-122
Chapter VI	Determinants Of Technological Development A Regression Analysis	123-140
Chapter VII	Technological Development: The Effects	141 - 167
Chapter VIII	Technological Development: Entrepreneurial Perceptions, Prescriptions and Practices	168- 178
Chapter IX	Main Findings and Conclusion	179 - 186
	Annexures	
	Bibliography	

LIST OF TABLES

Number	TITLE	Page
2.1	The Net Value Added By The Industry Groups In The State And All India: 1985-86	34
2.2	Spatial Spread Of The Selected Industry Groups	35
2.3	Macro Indicators Of The Sample Units as on 31.3.1990	37
2.4	Select Sample Features as on 31 -3-1990	39
2.5	Product Range Of The Sample Units	40
2.6	Classification Of The Sample Units By Their Nature of Activity	41
2.7	Classification Of The Sample Units By Type of Organisation	42
2.8	Age Classification Of The Sample Units as on 31.3.1990	44
2.9	Geographical Spread Of The Sample Units	45
2.10	Principal Characteristics Of The Sample Units By Size as on 31.3.1990	46
2.11	Educational Background Of The Promoters In The Selected Units	48
2.12	Previous Occupation Of The Promoters	49
2.13	Nature Of Training	50
2.14	Duration Of Training Of Promoters/Employees	51
2.15	Training By Collaborating Countries	51
3.1	Activities Of The National Laboratories And Other Institutions In India	62
3.2	Utilisation of Institutional Facilities By The Sample Units	64
3.3	Sources Of Technology Transfer	65
3.4	Industry-Classification Of The Assisted Units	66
3.5	Details Of the Awards Won By the Sample Units	67

4.1	Sources Of Technology	71
4.2	Classification Of Units By R & D Activities	74
4.3	Objectives Of R & D Of The Selected Small Manufacturing Enterprises	76
4.4	Other Objectives of R & D	78
4.5	Nature Of R & D Activities In The Selected Small Manufacturing Enterprises	79
4.6	R & D Intensity In The Sample Units as on 31.3.1990	81
4.7	Size And R & D Intensity In The Selected Small Scale Enterprises	83
4.8	Nature Of Foreign Collaborations In The Selected Small Manufacturing Enterprises	85
4.9	Duration Of Collaborative Agreements	85
4.10	Year Of Collaborations	86
4.11	Collaborating Countries	86
4.12	Areas Of Collaboration In The Selected Small Manufacturing Enterprises	88
4.13	Reasons For Foreign Collaborations	89
5.1	Relationship Between Correlation Values Of Growth Variables	103
5.2	Behaviour Of Partial Factor Ratios	105
5.3	Actual Ratios And Annual Growth Rates Of Labour Productivity, Capital Productivity And Capital Per Labour	106
5.4	V/L, V/K and K/L Ratios in Accordance With Employment Size-Classes In The Years 1985-86 And 1989-90	10P
5.5	Behaviour Of V/L, V/K And K/L Ratios Classified By Age Of The Units	109
5.6	V/L/, V/K And K/L Ratios In The Units With Special Background (1989-90)	110
5.7	Mean Values Of Growth Rates OF V/L, V/K And K/L Ratios In The Units With Some Technological Achievements	112
5.8	TFP Ratios. Growth Rates And Mean Values For The Three Industries (1985-90)	113
5.9	Estimates Of C-D Production Function - Regression Equation (1)	114

5.10	Estimates Of C-D Production Function - Regression Equation (2)	115
5.11	Estimates Of C-D Production Function - Regression Equation (3)	116
5.12	Estimates Of C-D Production Function - Regression Equation (4)	117
5.13	Estimates Of C-D Production Function - Regression Equation (5)	118
5.14	Estimates Of Input Elasticities In C-D Production Function	119
5.15	Estimates Of Returns To Scale In C-D Production Function	120
6.1	Correlation Coefficients	131
6.2	The Determinants Of TFP Growth Across Industries Model -I	132
6.3	Determinants Of TFP Growth In Units With Special Background Model - II	133
6.4	The Determinants OF TFP Growth In Units With Technological Achievements Model - III	134
6.5	The Determinants Of TFP In Units With Special Background For The Base Year Model - IV(a)	135
6.6	The Determinants Of TFP In Units With Special Background For The Terminal Year Model - IV (b)	136
6.7	The Determinants of R & D Expenditure Across Industries For The Base Year (1985-86) Model - V(a)	138
6.8	The Determinants Of R & D Expenditure Across Industries For The Terminal Year (1989-90) Model - V(b)	138
7.1	Technological Achievements In The Sample Units	142
7.2	Size And New Product Development	145
7.3	R & D Intensity In The Units Which Developed New Products	146
7.4	New Product Development By Age Of The Units	147
7.5	Transfer Of Technical Know-How From The Sample Units	148
7.6	Reasons For Transfer Of Technical Know-How	148
7.7	Award Winning Units By Industry Classification	149
7.8	Classification Of Units By Awards	150
7.9	Nature Of Awards And The Sponsoring Agencies	151
7.10	Other Awards Won By The Sample Units	152
7.11	Special Feature Of The Award-Winning Units	153
7.12	Compound Annual Growth Rates Of Employment, Capital And Output During 1985-86 To 1989-90	155

7.13	Growth In Size (Employment) Over The Period 1985-86 To 1989-90	157
7.14	Exporting Units By Industry-Classification	158
7.15	Channels Used By The Sample Units For Exporting	159
7.16	The Technical Features Of The Exporting Units	160
7.17	Export Growth In The Sample Units	161
7.18	Growth In Export Intensity	162
7.19	Promoted Units	163
7.20	No. Of Units Promoted By The Sample Units	164
7.21	Background Of The Units Which Promoted Other Units	165
8.1	Classification Of Responses	169

LIST OF CHARTS

- Chart I An Overview Of The Technological
Development Sources
- Chart II Classification Of R & D Units

LIST OF ABBREVIATIONS

APEDC	Andhra Pradesh Electronics Development Corporation
APSFC	Andhra Pradesh State Financial Corporation
APSSIDC	Andhra Pradesh Small Scale Industrial Development Corporation
A.P.	Andhra Pradesh
BHEL	Bharat Heavy Electricals Limited
CSIR	Council for Scientific and Industrial Research
CITD	Central Institute of Tools and Development
CPRI	Central Power Research Institute
CES	Constant Elasticity of Substitution
CD	Cobb Douglas
DSIR	Department of Scientific and Industrial Research
DGTD	Director General of Technological Development
ECIL	Electronics Corporation of India Limited
EDII	Entrepreneurial Development Institute of India
ENGG	Engineering
EE	Electronics and Electrical
FICCI	Federation of Indian Chambers of Commerce and Industry
GFC	Gross Fixed Capital
GVA	Gross Value Added
GOI	Government of India
HMT	Hindustan Machine Tools
HMA	Hyderabad Management Association
HI	Homothetic Isoquant
IDBI	Industrial Development Bank of India
ICRISAT	International Crop Research Institute for Semi-Arid Tropics
ITDL	Industrial Test and Development Laboratory
IFCI	Industrial Financial Corporation of India
ICICI	Industrial Credit and Investment Corporation of India
IRBI	Industrial Re-construction Bank of India
ISRO	Indian Space Research Organisation

ISO	International Standardisation Organisation
IICT	Indian Institute of Chemical Technology
NTs	Industrial Institutes of Technology
LSS	Large Scale Sector
MNC	Multinational Corporation
NISIET	National Institute of Small Industries Extension and Training
NRIs	Non-Resident Indians
NGRI	National Geographical Research Institute
NRSA	National Remote Sensing Agency
NRDC	National Research Development Corporation
NSIC	National Small Industries Corporation
NVA	Net Value Added
PPDs	Proto-type Product Development Centres
PDTCs	Proto-type Development and Training Centres
PTCs	Polytechnology Transfer Centres
PSUs	Public Sector Undertakings
PF	Production Function
SIDBI	Small Industries Development Bank of India
SISI	Small Industries Service Institutes
SAC	Space Application Centres
SSS	Small Scale Sector
SSIs	Small Scale Industries
SIs	Small Industries
S & T	Science and Technologies
TCOs	Technical Consultancy Organisations
TT	Technology Transfer
TD	Technological Development
TFP	Total Factor of Productivity
TDICI	Technology Development and Investment Corporation of India
VCCs	Venture Capital Companies