THE ECONOMIC STRUCTURE OF THE ORGANIZED SECTOR OF THE MACHINE TOOL INDUSTRY IN INDIA

BY
S. P. VALAVADE

A THESIS SUBMITTED

TO THE

UNIVERSITY OF POONA

FOR THE

DEGREE OF

DOCTOR OF PHILOSOPHY

ACKNOWLEDGE ENTS

The machine tool industry, "building machines to build machines," occupies a key position in the industrial development of the country. This study of this industry does not deal exhaustively either with the technological aspects of machine tool manufacturing, or the overall problems of nation's economic development. The study rather gives a balanced and relatively comprehensive analysis of the factors and conditions which have affected the industry in the past and are likely to influence its future development. It is centered on the organization and performance of the organized sector of the machine tool industry and does not attempt the evaluation of the role of machine tool making in the total industrial picture or a very extensive treatment of inter-industry relationships.

I wish to express my thanks to many individuals and organizations for their help which I received in the performance of research for this study.

My thanks are due to the Gokhale Institute of Politics and Economics, Poona, which granted me a two-year fellowship, making possible my gathering of most of the research data and a part of the analysis.

I especially thank Prof. P. N. Mathur, under whose supervision this work was done. His patience must have been

severely tried when I took such a long time to complete this study.

My thanks are also due to Dr. M. V. Namjoshi of Gokhale Institute, Dr. K. Mukerji (formerly of Gokhale Institute) and Prof. B. C. Shah of Indian Institute of Management, Ahmedabad.

I am grateful to Shri V. N. Inamdar, who was responsible for typing the successive drafts.

My final thanks are due to my wife who sustained me in the final stages of this work.

Indian Institute of Management,

Ahmedabad-6.

Shashikant Valavade

CONTENTS

| | | | | Page |
|----------|-------|----------|---|----------------------|
| ACKNOWLE | EDGEM | ent: | 3 | (i) |
| LIST OF | TABL | ES | | (vii) |
| LIST OF | GRAP1 | HS | | (x1) |
| CHAPTER | _ | | The Economic Structure of the Organised sector of the Machine Tool Industry in India. THE HISTORY OF THE MACHINE TOOL INDUSTRY IN INDIA | 1 |
| | | | The Second World War Years The Immediate Post-War Period The Progress during the Period of | 3 5 |
| | | | the Five Year Plans The Small-Scale Unorganized Sector | 12 |
| | | | of the Machine Tool Industry The Machine Tool Industry in the Indian Manufacturing Sector | 18 20 |
| | | | Indian Machine Tool Production in the World Perspective | 22 |
| APPENDIX | 1.1 | \$ | A NOTE ON METHOD | 24 |
| APPENDIX | 1.2 | : | DEFINITION OF MACHINE TOOL | 30 |
| CHAPTER | 2 | : | MANUFACTURING METHODS, EQUIPMENT AND MATERIALS | 33 |
| | | | Manufacturing Processes (a) The Foundry Operations (b) The Machine Shop Operations (c) Assembly Import Content of the Machinery | 33 34 34 39 |
| | | | Installed Agewise Distribution of Machinery Installed | 44 46 |
| | | | Materials Availability of Materials | 50 53 |
| CHAPTER | 3 | . | INPUT INVENTORY AND CAPITAL COEFFI- CIENTS IN THE MACHINE TOOL INDUSTRY | 58 |
| | | | Some Conceptual and Practical Problems in Estimating Input and Capital Coefficients | 58 |

| CHAPTER | 3 | ŧ | The Industry Problem | 58 |
|---|---|---|---|------------|
| (cont'd. | } | • | Output and Capacity Problem | 60 |
| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | • | | Capital Coefficients from Accounting | |
| | | | Data | 61 |
| | | | Methodology and Assumptions | 64 |
| | | | Empirical Results | 68 |
| • | | | A Note on Cost Structure | 74 |
| | | | | |
| CHAPTLR | 4 | 3 | FINANCES OF MACHINE TOOL COMPANIES | 89 |
| CHAPTER | 5 | : | PRICES AND MARKETING | 113 |
| | | | Discounting of Business | 112 |
| | | | Diversity of Products | 113 |
| | | | Setting of Prices | 114 |
| | | | Competition Channels of Distribution | 119 126 |
| | | | | 120 |
| | | | The Machine Tool Marketing Practices in the Great Britain and U.S.A. in | |
| | | | | 130 |
| | | | Comparison with Those in India Customer-Manufacturer Relationship | 132 |
| | | | Exclusion of Foreign Competition | 136 |
| | | | Export Markets for Indian Machine | |
| | | | Tools | 142 |
| | | | The Strategy for Export Promotion | 144 |
| | | | The Government Policies to Promote | ~~~ |
| | | | Exports of Machine Tools | 147 |
| | | | mipus du carette a de au | - |
| CHAPTER | 6 | | HUMAN RESOURCES | 161 |
| Outur 1 mil | Ų | 1 | Human resources | 151 |
| | | | Labour Force | 151 |
| - | | | Nature and Composition of the Labour | |
| | | | Force in Machine Tool Factories | 152 |
| | | | Composition according to Skills | 154 |
| | | | The Methods of Recruitment | 156 |
| | | | The Level of Literacy and Education | 157 |
| | | | The Length of Service | 158 |
| | | | Labour Turnover and Absenteeism | 160 |
| | | | Wage Structure | 162 |
| | | | Other Earnings | 164 |
| | | | Welfare and Amenities | 165 |
| | | | Trade Unionism | 168 |
| | | | Inter-Union Rivalry | 169 |
| | | | Works and Joint Committees | 171 |
| | | | The Productivity of Indian Machine | |
| | | | Tool Worker | 172 |
| | | | Incentives to Increased Productivity | 174 |
| | | | Training Schemes for Workers | 175 |
| | | | Supervisory and Managerial | |
| | | | Personnel Personnel | 178 |

| Companies in the Private Sector Companies in the Public Sector Concluding Observations CHAPTER 8: UTILIZATION OF CAPACITY AND IMBALANCE OF CAPITAL EQUIPMENT IN MACHINE TOOL FIRES Difficulties in Measuring Capacity Utilisation in a Multi-product firm The Utilisation of Capacity in Machine Tool Firms Excess Capacity and the Imbalance of Capital Equipment The Optimum Production Programme The Optimum Production Programme The Linear Programming Model Linear Programming Model Linear Programming Nodel Lits Beasurement Optimum Capacity Empirical Results Utilization of Capacity with reference to the Optimum Production Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand Countrywise Imports of Machine Country Machin | CHAPTER | 7 : | CASE HISTORIES OF GROWTH AND ENTREPRENEURSHIP | 187 |
|--|---------|-----|---|------------|
| Difficulties in Heasuring Capacity Utilisation in a Multi-product firm The Utilisation of Capacity in Machine Tool Firms Excess Capacity and the Imbalance of Capital Equipment The Optimum Production Programme The Optimum Production Programme The Optimum Capacity Empirical Results Utilization of Capacity with reference to the Optimum Production Utal Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand The Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the Working Group The Estimate by the Mational Council The Recession in the Machine Tool | · | | Companies in the Public Sector | 200 |
| Utilization in a Multi-product firm The Utilization of Capacity in Machine Tool Firms Excess Capacity and the Imbalance of Capital Equipment 219 The Optimum Production Programme 220 The Linear Programming Model 223 Imbalance of Capital Equipment and Its Measurement 226 Coptimum Capacity 226 Empirical Results 226 Utilization of Capacity with reference 266 to the Optimum Production 266 Dual Problem 266 Constraints 266 Causes of Under-utilization of Capacity, 266 and Capital Imbalance 266 Concluding Observations 255 CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS 259 I The Analysis of Past Demand 266 Countrywise Imports of Machine Tools 261 Typewise Analysis of Past Demand 266 Machine Tools in India 266 Machine Tools in India 266 The Pattern of Industrywise Demand 274 II Estimates of the Future Demand for 277 Machine Tools 277 The Estimate by the Working Group 278 The Estimate by the National Council 281 Industry 286 | Chapter | 8: | | 215 |
| Capital Equipment 219 The Optimum Production Programme 220 The Linear Programming Model 223 Imbalance of Capital Equipment and 1ts Measurement 224 Optimum Capacity 226 Empirical Results 226 Utilization of Capacity with reference 226 Utilization of Capacity with reference 236 Dual Problem 244 Constraints 244 Causes of Under-utilization of Capacity, 246 Concluding Observations 255 CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS 259 The Analysis of Past Demand 259 Countrywise Imports of Machine Tools 261 Typewise Analysis of Past Demand 274 II Estimates of the Future Demand for 274 II Estimates of the Future Demand for 275 Machine Tools 277 The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool 281 Industry 286 | · | | Utilisation in a Multi-product firm The Utilisation of Capacity in Machine Tool Firms | _ |
| The Optimum Production Programme 220 The Linear Programming Model 223 Imbalance of Capital Equipment and 224 Optimum Capacity 226 Empirical Results 226 Utilisation of Capacity with reference 236 Dual Problem 244 Constraints 244 Constraints 244 Constraints 244 Constraints 246 Concluding Observations 255 CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS 259 I The Analysis of Past Demand 259 Countrywise Imports of Machine Tools 261 Typewise Analysis of Past Demand 06 Fachine Tools in India 264 The Pattern of Industrywise Demand 274 II Estimates of the Future Demand for 275 Machine Tools 276 The Estimate by the Working Group 278 The Estimate by the National Council 281 Industry 286 | | | Capital Equipment | 219 |
| The Linear Programming Model Imbalance of Capital Equipment and Its Measurement Optimum Capacity Empirical Results Utilization of Capacity with reference to the Optimum Production Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTLE 9: DEMAND AND SUPPLY OF MACHINE TOOLS I The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 223 224 225 226 226 227 236 227 236 236 237 246 246 246 246 247 246 259 261 277 278 278 278 277 278 278 278 278 278 | • | | The Optimum Production Programme | |
| Optimum Capacity 226 Empirical Results 226 Utilization of Capacity with reference to the Optimum Production 236 Dual Problem 244 Constraints 244 Causes of Under-utilization of Capacity, and Capital Imbalance 246 Concluding Observations 255 CHAPTER 9: DEMAND AND SUCPLY OF MACHINE TOOLS 259 I The Analysis of Past Demand 259 Countrywise Imports of Machine Tools 261 Typewise Analysis of Past Demand of Machine Tools in India 264 Machine Tools in India 264 II Estimates of the Future Demand for Machine Tools 277 The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool 110 Industry 286 | | | The Linear Programming Model | 223 |
| Optimum Capacity Empirical Results Utilization of Capacity with reference to the Optimum Production Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUZPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 226 226 226 226 227 244 244 245 246 246 246 246 259 261 261 261 261 261 261 262 263 263 263 264 265 265 266 266 277 278 278 278 278 278 279 278 279 278 279 278 279 278 279 278 279 278 279 270 270 270 270 270 270 271 270 271 271 277 277 277 277 278 278 278 279 278 279 270 270 270 270 270 270 271 270 271 271 272 273 274 275 276 277 277 277 277 277 277 278 278 277 278 278 | | | | 224 |
| Empirical Results Utilization of Capacity with reference to the Optimum Production Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUEPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 236 244 246 246 247 259 CHAPTER 9: DEMAND AND SUEPLY OF MACHINE TOOLS 259 II Estimates of Past Demand 261 271 272 273 274 275 276 277 277 278 278 278 278 279 278 279 278 270 278 278 279 278 279 270 270 270 270 271 271 277 278 277 278 278 277 278 278 279 270 270 270 270 270 270 271 271 | | | Optimum Capacity | |
| Utilization of Capacity with reference to the Optimum Production Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 236 244 246 246 259 CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS 259 II The Analysis of Past Demand 259 Countrywise Imports of Machine Tools Fachine Tools in India 264 277 The Estimate by the Working Group The Estimate by the National Council Industry 281 | | | | 226 |
| Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 244 245 246 246 247 259 261 279 261 270 270 270 270 271 271 271 272 273 274 275 276 277 276 277 278 278 278 279 278 279 278 279 270 270 270 270 270 270 270 271 270 270 271 270 271 271 271 272 273 274 275 276 277 277 278 278 279 279 270 270 270 270 270 270 270 270 270 270 | | | | |
| Dual Problem Constraints Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 244 244 245 246 246 247 246 259 261 261 261 277 278 278 278 278 278 278 278 278 278 | | | to the Optimum Production | 236 |
| Causes of Under-utilization of Capacity, and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS I The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 246 259 269 279 261 277 278 281 286 | | | Dual Problem | 244 |
| and Capital Imbalance Concluding Observations CHAPTER 9: DEMAND AND SUPPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 259 259 I The Analysis of Past Demand Achine Tools Achine Tools The Pattern of Industrywise Demand Achine Tools Achine Tool | | | | 244 |
| Concluding Observations 255 CHAPTUR 9: DEMAND AND SUPPLY OF MACHINE TOOLS I The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand 274 II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 286 | | | | 21.6 |
| CHAPTER 9: DEMAND AND SUCPLY OF MACHINE TOOLS The Analysis of Past Demand Countrywise Imports of Machine Tools Typewise Analysis of Past Demand of Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 259 269 279 281 281 286 | | | | |
| The Analysis of Past Demand 259 Countrywise Imports of Machine Tools 261 Typewise Analysis of Past Demand of Machine Tools in India 264 The Pattern of Industrywise Demand 274 II Estimates of the Future Demand for Machine Tools 277 The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool Industry 286 | | | concreding coast Astrona | 273 |
| Typewise Analysis of Past Demand of | CHAPTER | 9: | DEMAND AND SUPPLY OF MACHINE TOOLS | 259 |
| Typewise Analysis of Past Demand of | | | | |
| Machine Tools in India The Pattern of Industrywise Demand II Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 264 274 275 276 277 278 278 278 278 278 278 278 278 278 | | | Countrywise Imports of Machine Tools | 259 261 |
| The Pattern of Industrywise Demand 274 II Estimates of the Future Demand for Machine Tools 277 The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool Industry 286 | | | | 264 |
| Estimates of the Future Demand for Machine Tools The Estimate by the Working Group The Estimate by the National Council The Recession in the Machine Tool Industry 278 | | | | |
| Machine Tools The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool Industry 286 | | | II | |
| The Estimate by the Working Group 278 The Estimate by the National Council 281 The Recession in the Machine Tool Industry 286 | | | | |
| The Estimate by the National Council 281 The Recession in the Machine Tool Industry 286 | • | | | |
| The Recession in the Machine Tool Industry 286 | | | | |
| Industry 286 | | | | 281 |
| | | | | 286 |
| Supply of Machine Tools in the | | | Supply of Machine Tools in the | 200 |
| Fourth Plan 290 | | | | 290 |

| 1 | •- | 4 | ١ |
|---|----|---|---|
| ı | v | ı | |

| CHAPTER | 10 : | GOVER MENT POLICY TOWARDS THE GROWTH OF MACHINE TOOL INDUSTRY | 300 |
|------------------|-------|---|--------------------|
| | | The Import Policy The Licensing Policy The State as a Manufacturer of | 30 1 305 |
| | | Machine Tools | 310 |
| | | Research and Development The Indian Machine Tool Manufacturers* | 315 |
| | | Association The Development Council (Naching | 319 |
| | | The Development Council (Machine Tools) | 322 |
| CHAPTER | 11 : | SALIENT FEATURES OF THIS STUDY | 324 |
| BIBLIO GR | APHY | | 331 |
| ADD, CI | APTER | 2: The Comparison of Prices of Indian and Foreign Machine Tools | |

.

LIST OF TABLES

| No. | Title | Page |
|-----|--|------|
| 1.1 | Imports and Indigenous Production of Graded Machine Tools in India | 6 |
| 1.2 | The Statewise Distribution of Machine Tool Companies Manufacturing Graded Machine Tools in 1964-65 | 17 |
| 1.3 | The Statewise Distribution of Small Units in the Unorganized Sector in 1962 | 19 |
| 1.4 | Machine Tool Industry in the Indian Manufacturing Sector | 21 |
| 1.5 | Production, Exports and Imports of Machine Tools (For Some Selected Countries) 1965 | 23 |
| 2.1 | Machine Tools Installed in the Organized Sector of the Machine Tool Industry and Total Metal Working Industries in India in 1963 | 42 |
| 2.2 | Typewise Analysis of Installed Machines (Numbers) in Three Firms as in 1964 | 43 |
| 2.3 | Import Content of Installed Machinery in Three Firms - Countrywise Analysis (in Numbers) | 45 |
| 2.4 | Age Distribution of Installed Machinery in Three Firms (Numbers) | 47 |
| 2.5 | Monthly Costs of a Specific Machine in India and the United States | 49 |
| 2.6 | Materials Consumed during 1963 by Machine Tool Factories | 54 |
| 3.1 | Input Coefficients | 77 |
| 3.2 | Inventory Coefficients | 80 |
| 3.3 | Capital Coefficients (Unadjusted) | 81 |

| Table No. | <u>Title</u> | Page |
|-----------|---|------|
| 3.4 | Capital Coefficients (Adjusted for Price Changes) | 82 |
| 3.5 | Capital Coefficients (Adjusted for Price Changes) - For Four Firms Separately | 83 |
| 3.6 | Price Indices for Capital Assets (Base 1956-57 = 100) | 84 |
| 3.7 | Price Indices for Output | 85 |
| 3.8 | Capital Coefficients Based on Data for Two Firms (for Machine Shop only) | 86 |
| 3.9 | The Cost of Production Per Rupee of Cutput | 88 |
| 4.1 | Indices of Growth | 101 |
| 4.2 | Sources and Uses of Funds | 103 |
| 4.3 | Selected Financial Ratios | 107 |
| 4.4 | Rank Correlation of Total Assets to Net Sales/Total Assets, and to Net Profits/Total Assets (Data for 1964) | 111 |
| 4.5 | Equity Share Data of Some Companies | 112 |
| 5.1 | Cost-Price Structure of the Products of Three Firms (in the Year 1964-65) | 117 |
| 5.2 | The Productwise Classification of Manufacturers | 120 |
| 5.3 | Value of Orders Placed during 1958-59, 1959-60 and 1960-61 by the D.G.S. and D. | 127 |
| 5.4 | The Customs Duty on Machine Tools | 140 |
| 5.5 | Important Destinations to which Exports of Indian Machine Tools were Directed during 1965-66 | 143 |
| 6.1 | | 153 |

| No. | <u>Title</u> | Page |
|------|---|------|
| 6.2 | Composition of Labour Force in Some Factories as in 1963 | 155 |
| 6.3 | Estimated Rates of Accession, Separation and Absenteeism in Machine Tool Factories in 1959 (in Percentages) | 160 |
| 6.4 | The Ratio of Mandays Lost to Total Mandays during the Month | 161 |
| 6.5 | Basic Wage Rates in Some of the Factories (Categorywise) | 163 |
| 6.6 | The Extent of Trade Unionism in Machine Tool and Other Selected Industries in 1960-61 | 168 |
| 6.7 | Training Schemes at the HMT Training Centre | 177 |
| 8.1 | Data for Linear Programming Model - Firm A | 232 |
| 8.2 | Data for Linear Programming Model - Firm B | 233 |
| 8.3 | Optimum Production Plans for Machine Tool Firms | 234 |
| 8.4 | Optimum Production, Optimum Value Added and Optimum Contribution to Overhead Costs | 235 |
| 8.5 | Excess Capacity and Capital Imbalance - Firm A | 237 |
| 8.6 | Excess Capacity and Capital Imbalance - Firm B | 240 |
| 8.7 | Utilization of Capacity in Firm A and Firm B | 241 |
| 8.8 | Capacity and Production of Machine Tool Firms: Monthly Average (Rupees in Thousands) | 242 |
| 8.9 | Dual Problem - Firm A | 247 |
| 8.10 | Dual Problem - Firm B | 249 |

| No. | Title | Page |
|------|---|------|
| 9.1 | Countrywise Analysis of Imports of Machine Tools | 263 |
| 9.2 | Pattern of Past Demand for Graded Machine Tools in India | 265 |
| 9.3 | Pattern of Demand for Machine Tools in U.K., U.S.A., West Germany and India | 267 |
| 9.4 | Typewise Analysis of Indigenous Production of Graded Machine Tools | 269 |
| 9.5 | Typewise Analysis of Imports of Graded Machine Tools | 271 |
| 9.6 | Typewise Analysis of Exports of Machine Tools | 272 |
| 9.7 | Changes in the Pattern of Demand (Inventory of Graded Machine Tools) | 273 |
| 9.8 | Industrywise Inventory of Fachine Tools Installed in 1963 | 275 |
| 9.9 | Estimates of Demand for Machine Tools by the Working Group | 279 |
| 9.10 | Estimate of Demand for Machine Tools by NCAER | 283 |
| 9.11 | Index Numbers of Industrial Production | 287 |
| 9.12 | Production Trends in Some Machine Tool Using Industries (Monthly Average) | 289 |
| 9.13 | Yearwise Estimates of Demand and Actual Demand | 291 |

LIST OF GRAPHS

| FIGURES | | Pare |
|---------|--|------|
| 1.1 | The Imports Versus Indigenous Production of Graded Machine Tools | 7 |
| 7.1 | Comparative Production Records of Machine Tool Companies in the Public Sector and Private Sector | 209 |
| 9.1 | Total Consumption of Machine Tools (Graded) in India from 1940 Through 1966 | 260 |