

# **TECHNOLOGICAL TRANSFORMATION IN THE THIRD WORLD: VOLUME II**

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Africa

Edited by  
Surendra J. Patel

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THE ECONOMICS AND BUSINESS OF  
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Volume 36

TECHNOLOGICAL  
TRANSFORMATION IN THE  
THIRD WORLD: VOLUME II

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**TECHNOLOGICAL  
TRANSFORMATION IN THE  
THIRD WORLD: VOLUME II**

*Africa*

Edited by  
**SURENDRA J. PATEL**

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# Technological Transformation in the Third World

Volume II: Africa

*General Editor*

**SURENDRA J. PATEL**

*UNU/WIDER*

A project of the

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Helsinki, Finland

and the

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# Contents

|   |             |
|---|-------------|
| Contents  | v           |
| List of tables and figures                                      | vii         |
| <b>Foreword</b>   | <b>xi</b>   |
| Lal Jayawardena and Charles Cooper                              |             |
| <b>Preface</b>  | <b>xiii</b> |
| Surendra J. Patel   |             |
| I The golden age of south's development                         | xiii        |
| II The framework of approach                                    | xv          |
| III Technological transformation: Volume II - Africa            | xviii       |
| IV Acknowledgements   | xix         |
| Appendix  | xx          |
| Notes   | xxiv        |
| <b>Algeria</b>  | <b>1</b>    |
| Abdellatif Benachenhou  |             |
| I Introduction: technological trends of the colonial economy    | 3           |
| <u>Part 1: The economic and technological situation in 1962</u> | 6           |
| II 1962: State of the country                                   | 6           |

|      |   |     |
|------|---|-----|
|      | <b><u>Part 2: Technological transformation from 1962 to 1984</u></b>                                | 17  |
| III  | The evolution of production and its structure: consequences on international trade and the interior | 17  |
| IV   | Employment dynamics and the qualifications problem  | 27  |
|      | <b><u>Part 3: The technological transformation factors</u></b>                                      | 37  |
| V    | The evolution of investments from 1962 to 1984  | 37  |
| VI   | Technological transformation and producer goods policies  | 49  |
| VII  | Implementation of the scientific and technical option in the educational system                     | 56  |
|      | <b><u>Part 4: The sectorial experiments: iron and steel industry and agriculture</u></b>            | 68  |
| VIII | A successful technological transformation process: the iron and steel industry case                 | 68  |
| IX   | Agricultural intensification difficulties in Algeria  | 76  |
|      | <b><u>Part 5: Conclusion: An attempt to assess the situation</u></b>                                | 88  |
| X    | Technological transformation and development from 1880 to 1984                                      | 88  |
|      | Notes   | 93  |
|      | <b>Tanzania</b>   | 95  |
|      | S.M. Wangwe   |     |
| I    | Introduction  | 97  |
| II   | The economic and technological setting in 1961  | 99  |
| III  | Growth, structural change and technological transformation  | 103 |
| IV   | Managing the dynamics of technological transformation   | 121 |
| V    | Conclusion  | 131 |
| VI   | Appendix tables   | 133 |
|      | References  | 140 |
|      | <b>Zimbabwe</b>   | 143 |
|      | Mohamed B.E. Faye   |     |
| I    | Introduction  | 145 |
| II   | Growth and structural changes in the economy  | 148 |
| III  | Development in technology-embodiment inputs and their utilization                                   | 160 |
| IV   | Managing the dynamics of technological development  | 179 |
| V    | Concluding assessment   | 211 |

# List of tables and figures

## Algeria

### Tables

|     |   |    |
|-----|---|----|
| 2.1 | Distribution of employment in the petroleum sector: 1962  | 8  |
| 2.2 | Structure of industrial production  | 8  |
| 2.3 | Expectations and achievements in the industrial manufacturing sector: 1959-62                       | 10 |
| 2.4 | Evolution of the rate of use of production capacities   | 10 |
| 2.5 | Shares of consumption of imports and local production in European households: 1960                  | 11 |
| 2.6 | Technological dependence of industries established in 1960  | 11 |
| 2.7 | Evolution of agricultural machinery: 1947-60  | 13 |
| 3.1 | Evolution of the GDP and its components   | 19 |
| 3.2 | Evolution of the GDP and its sectorial distribution   | 19 |
| 3.3 | Rate of growth of the GDP and the sectors   | 20 |
| 3.4 | Evolution of the GDP and its distribution: 1979-84  | 20 |
| 3.5 | Evolution of the gross domestic production in constant prices for 1984                              | 23 |
| 3.6 | Rate of growth of the GDP and its components: 1985-89   | 23 |
| 3.7 | Distribution of industrial employment per wilaya group in December 1981                             | 25 |
| 3.8 | Structure of employment offered by each sector relative to the settlement type on December 31, 1982 | 25 |

|     |  |    |
|-----|--|----|
| 3.9 | Structural evolution of imports and exports  | 26 |
| 4.1 | Evolution of employment and unemployment   | 28 |
| 4.2 | Employment growth: 1967-84   | 28 |
| 4.3 | General situation concerning the qualifications structure: 1982  | 30 |
| 4.4 | Employment structure per legal employment sector and academic level: 1982  | 30 |
| 4.5 | Structure of qualifications in the non-agricultural sector: 1969, 1977 and 1983  | 32 |
| 4.6 | Structure of qualifications in the energy and hydrocarbon sectors: 1980  | 33 |
| 4.7 | Evolution of public corporation salaries   | 33 |
| 4.8 | Average monthly salary, all sectors together   | 34 |
| 4.9 | Evolution of the proportion of foreigners in various activities per level of qualification                             | 36 |
| 5.1 | Investment volume and structure: 1963-66   | 39 |
| 5.2 | Investment volume: 1967-78   | 39 |
| 5.3 | Structure of investments   | 40 |
| 5.4 | Evolution of investment: 1979-86   | 40 |
| 5.5 | Direct private investment relative to global investment  | 44 |
| 5.6 | Evaluation of contract distribution per type   | 44 |
| 5.7 | Share of the 'turnkey and turn-out key contracts' of the total number of contracts for each industrial branch: 1966-85 | 46 |
| 5.8 | Share of contract totals of the top four foreign firms   | 46 |
| 5.9 | Equipment imports: 1967-83   | 48 |
| 6.1 | Producer goods in industrial investment: 1967-84   | 50 |
| 6.2 | Evolution of local producer goods production   | 52 |
| 6.3 | Reserve ratio of the local demand by the local production for certain producer goods                                   | 53 |
| 7.1 | Evolution of the number of students  | 58 |
| 7.2 | Evolution of the number of students and graduates; evolution of the teaching staff                                     | 59 |
| 7.3 | Evolution of the structure of student numbers per channel  | 64 |
| 7.4 | Distribution of the number of postgraduate students per channel: 1984-85   | 64 |
| 7.5 | Evolution of the number of graduates from higher education and technology  | 65 |
| 8.1 | Overall evolution of investments: 1970-84  | 70 |
| 8.2 | Evolution of steel consumption   | 70 |
| 8.3 | Evolution of consumption distribution comparing long and flat products   | 70 |
| 8.4 | Evolution of metal steel production: 1967-85   | 72 |
| 8.5 | Evolution of steel imports: 1970-84  | 72 |
| 8.6 | Supervision in the heavy industry sector   | 72 |
| 9.1 | Evolution of food product imports  | 78 |
| 9.2 | Evolution of the food import share   | 78 |

|      |   |    |
|------|---|----|
| 9.3  | Yearly production and growth percentages necessary to fulfill the needs                   | 79 |
| 9.4  | Evolution of the planned investments in agriculture and their share in overall investment | 79 |
| 9.5  | Evolution of agricultural machinery   | 81 |
| 9.6  | Agricultural training assessment: 1962-84   | 81 |
| 9.7  | Evolution of the estimates and achievements for the main products                         | 85 |
| 9.8  | Evolution of yields: 1967-84  | 85 |
| 10.1 | Technological transformation and development: 1880-1984                                   | 89 |

## **Tanzania**

### Tables

|     |   |     |
|-----|---|-----|
| 6.1 | R and D   | 133 |
| 6.2 | Growth in GDP and GDP per capita: 1961-85                 | 136 |
| 6.3 | Sectoral changes in output: 1961-85                       | 136 |
| 6.4 | Structure of foreign trade: 1961-85                       | 137 |
| 6.5 | Indicators of human resource development: 1960-85         | 137 |
| 6.6 | Energy consumption: 1960-85                               | 138 |
| 6.7 | GDP contribution of transport and communications: 1961-85 | 138 |
| 6.8 | Trucking fleet: 1971-85                                   | 139 |
| 6.9 | Capital formation: 1960-85                                | 139 |

## **Zimbabwe**

### Tables

|     |  |     |
|-----|--|-----|
| 3.1 | Changes in real GDP  | 162 |
| 3.2 | Some basic data on education   | 164 |
| 3.3 | University of Zimbabwe: number of students by subject: 1983  | 165 |
| 3.4 | Most important institutions involved in R and D and the number of projects undertaken by them: 1981-82 | 174 |
| 4.1 | Changes in sectoral shares of GDP  | 181 |
| 4.2 | Changes in GDP per head of economically active population in major sectors                             | 181 |
| 4.3 | Changes in sectoral shares of employment   | 182 |
| 4.4 | Changes in branch shares of employment in manufacturing industry                                       | 183 |
| 4.5 | Changes in value added per employee in Z\$: 1980-84  | 184 |
| 4.6 | Changes in branch shares of manufacturing value added  | 186 |
| 4.7 | Changes in trade and its structure   | 186 |
| 4.8 | Some key characteristics of manufacturing industry by broad sub-sector: 1982                           | 190 |

|      |   |     |
|------|---|-----|
| 4.9  | Some key variables of the manufacturing sector in Z\$: 1982 | 191 |
| 4.10 | Key inputs into manufacturing production: 1982              | 192 |
| 4.11 | Manufacturing inputs characteristics by sector: 1982        | 193 |
| 4.12 | Flows within the manufacturing sector                       | 201 |
| 4.13 | Input shares within the manufacturing sector                | 202 |
| 4.14 | Output patterns within the manufacturing sector             | 203 |

# Foreword

*Lal Jayawardena and Charles Cooper*

The papers which are presented in this series of volumes, result from a major research project carried out, under the leadership of Dr. Surendra J. Patel, at the World Institute for Development Economics Research of the United Nations University (UNU/WIDER) in Helsinki. Dr. Surendra J. Patel had been for many years Head of the Technology Division at UNCTAD.

Whilst Dr. Patel's project was in progress, the United Nations University and the Government of the Netherlands reached an agreement to set up a new institute at Maastricht in the Netherlands, to carry out policy research on the economic and social impacts and implications of new technologies, especially in the developing countries. The new institute is the UNU Institute for New Technologies (UNU/INTECH). It is a sister institute to UNU/WIDER, within the UNU system.

Given the mandate of UNU/INTECH, it was obvious to us, as Directors of the Institutes, that Dr. Patel's project should become a joint undertaking. That is why the books in this series are published under the names of both UNU/WIDER and UNU/INTECH. We expect that there will be further joint undertakings in the future.

Dr. Patel focused the country studies, on which the project is based, towards 'technological transformation' within national economies. This reflected his own perceptions, formed by his experience at UNCTAD, that technological change (and policies to promote it) are given too little

attention by policy makers concerned with economic development. Experience in some of the Newly Industrializing Countries (NICs) strongly suggested to some that technological policies played an important part in their success, especially in the rapid and sustained increase in factor productivities on which that success was based. Others, who accept that factor productivity growth has made significant contributions to economic growth, both directly and through sustaining international competitiveness, are more doubtful about the role of policy in the process. Dr. Patel's project seeks to illuminate these issues. From the beginning it was obvious that the studies had to extend beyond the NICs to include other countries where the emphasis on technology policy was either less marked or different in orientation.

It is inherently very difficult to conclude the arguments between those who see technology policy as instrumental in technological change, and those who are sceptical about state intervention in this field. At the centre of the debate is the claim that, in the countries where productivity growth has been important in economic development, technological change would have been as, or even more rapid if there had been no policy interventions. The difficulty is, of course, that this is a counterfactual claim, which is by its nature impossible to prove or to disprove in any particular case. Nevertheless, it is possible that comparative studies can help to inform our judgements on this important matter, even though they do not completely resolve the basic methodological difficulty. The strength and interest of Dr. Patel's project is that it has this internationally comparative orientation. It will be for his readers to judge the evidence, which he and his distinguished colleagues have assembled.

Lal Jayawardena  
Director  
UNU/WIDER

Charles Cooper  
Director  
UNU/INTECH

# Preface

*Surendra J. Patel*

The thirty years since the end of the World War II have been the golden age of political liberation, economic growth and technological progress. Tidal waves of independence movements swept the colonies and dependencies. Empires much larger than any that existed in the past, crumbled like sand-castles in a matter of only a few short years. New and independent nation states were born. The world political map, altered beyond recognition, was completely redrawn.

Meanwhile, the global economy grew at an unprecedented pace. Its total output more than quadrupled. Scientific discoveries piled on one another. The process of technological transformation was swift. New nations adopted processes and techniques that had only recently been invented. Hope spread like wild fire - in the spirit of Shelly's immortal lyric 'Prometheus Unbound' - where man: 'tortured to his will iron and gold, the slaves and signs of power...' But the extravagant visions and promises of that era were smothered in a series of crises beginning in the mid-1970s.<sup>1</sup>

## **I The golden age of south's development**

Concern with contemporary crises has completely overshadowed the real advances achieved in the 35 years since 1950.<sup>2</sup> The overall GDP of the

third world has increased some six times, and per capita GDP 2.5 times, since 1950. Its industrial output is now 11 times higher than in the 1950s.

Technology embodying inputs in these countries have expanded even more impressively. For instance, annual real gross capital formation is now 15 times higher. Enrolment in the third level of learning at universities and institutes of higher education, have simply exploded - rising nearly 25 fold. Educational infrastructure, the foundation for sustained development in the future, has been laid with great effort and sacrifice.

Social advance, particularly in health, was simply spectacular. Infant mortality rates fell from 200 per thousand to between 30 to 70. Death rates declined from 25-30 to only 10-15. And life expectancy rose from below 40 years to about 65. With a spectacular sprint, the south had within less than 40 years caught up with the north of the 1960s.

The average annual rates of growth in these strategic areas, sustained for 35 years since 1950, were impressive - some 5.5 per cent for GDP, 7.5 per cent for industrial output, 8.4 per cent for capital formation, and 10 per cent for third level education. They were much higher than during comparable periods in the technological transformation of the north. Moreover, they were sustained long enough to create a highly visible effect.<sup>3</sup>

Consequent structural changes in the third world were profound. The share of agricultural output in GDP has fallen from about one third to one sixth. Conversely, that of industry has risen from about one sixth to about one third. Industry related services have expanded their share parallel to that of industry.

Shares of the technology embodying inputs have risen much more. Capital formation has increased from 7 per cent of GDP to over 25 per cent in 1980 - generally above that in most countries of the north. Structures of exports and imports have also witnessed similar movements. The share of primary exports has fallen. The shares of producer goods in imports, and of manufactured goods in exports, have risen significantly. Output of capital and intermediate producer goods has expanded sharply.

In consequence, the structure of industrial output in the third world is beginning to resemble that of most developed countries in the inter-war period. The actual volume, however, is of course much lower. Half a dozen developing countries now supply over two thirds of all their capital goods requirements (physical technology) from domestic sources. Another dozen countries supply over two fifths. Availability of skilled manpower, and its quality, have risen very sharply.

Professor Kuznets, reflecting on the 22-year period between 1950 and 1972, was deeply impressed by the high per capita growth rates already achieved by the third world. He considered these growth rates 'quite high in the long term perspective of both less developed countries and the developed countries.'<sup>4</sup> With a touch of bewilderment, he then added in 1975:

If growth rates in the per capita product of the LDCs over almost a quarter of a century were impressively high, one may ask why the reaction to them in the general flow of news about those countries, in the persistent concern about critical conditions with respect to supplies of economic goods, seems to ignore these growth achievements.

He wondered 'why no litanies of praise' were sung 'for these economic miracles!' Instead, there were only references to 'dangers of collapse in the third world.'

## II The framework of approach

These vast changes have not been captured in the narrow confines of contemporary technology studies.<sup>5</sup> At least two reasons may have been instrumental for this. One, concern with technology issues is relatively recent in origin. Second, the literature on technology which has mushroomed over the last 15 years concentrated mainly on several micro facets. The issues covered by these studies were of course very important. They have helped advance our understanding of technological processes. But they overlooked the overall structural changes in a long term historical context.

In order to overcome this weakness, WIDER invited a group of experts to Helsinki in November 1985 to discuss the broad approach to be used in the study of technological transformation in the third world.<sup>6</sup> They discussed the proposals made by WIDER on a comprehensive long term programme of work of WIDER. This also included a detailed outline which was to serve as a guideline for the preparation of the individual country studies.<sup>7</sup> The outline was intended to assure a degree of uniformity in the preparation of the country studies, thereby facilitating a broad comparative assessment of the country experiences. A more detailed framework of our approach is given in the opening chapter of Volume V - *The Overview* of this series. Only a brief summary is therefore given here to facilitate an easier comprehension of the contents of individual country studies.

Following the expert meeting, WIDER initiated in 1985 in-depth studies of long term changes in the following 16 third world countries:

|                     |                       |                |                |
|---------------------|-----------------------|----------------|----------------|
| <u>Asia:</u>        | <u>Latin America:</u> | <u>Africa:</u> | <u>Europe:</u> |
| Bangladesh          | Brazil                | Algeria        | Yugoslavia     |
| China (including    | Island of Puerto Rico | Angola         |                |
| Province of Taiwan) | Mexico                | Nigeria        |                |
| India               | Peru                  | Tanzania       |                |
| Republic of Korea   | Venezuela             | Zimbabwe       |                |
| Sri Lanka           |                       |                |                |

In addition, four developed countries, Finland, Greece, Japan and the USSR were also included in the WIDER project since their technological transformation spanned the twentieth century.

It needs no emphasis that the 16 third world countries differ from one another in so many ways: for instance, in their resource endowment, climatic and soil conditions, degree of external vulnerability, size of their population, the level of development achieved, the rates of growth realized, the structure of their economies and in the policies, plans and priorities pursued by them. They are located in all the major continents.

In terms of countries, these 16 represent only a small minority of the 130 countries constituting the third world as a whole. But the small number of units is potentially misleading. In terms of their population and output, these 16 represent over 70 per cent of the third world total.

An analysis of such widely varying experiences could, it was hoped, help identify the main patterns of technological transformation which have emerged over the last 35 years. It could point to both the strengths and the weaknesses exhibited over this period. Such an effort could, it was hoped, help assess differences in the patterns of technological inputs and in the decision making process governing the acquisition, use, adaptation, diffusion, improvement and innovation of technologies. It could also improve our understanding of both the quantitative and qualitative implications of changes in several parameters which, as an ensemble, could be considered to constitute the process of technological transformation.

The full realization of the technological possibilities open to a country is governed by a number of factors. They are at once economic, social, political and cultural in character. Some are internal to the country while others are external in origin. In combination, they govern the pace of technological transformation and period over which this happens.

The WIDER project, it is hoped, would at least begin charting the trajectories along which the technological transformation in the third world might have proceeded. This is not to imply that such a dynamic process can be imprisoned in the strait-jacket of a rigid structure.<sup>8</sup> Freezing this process into the mould of a rigid definition would not therefore be very meaningful.

It should also be underlined that technological transformation is a process that is much wider in scope than is industrial development. It does include industrial development, but also includes many aspects of agricultural production, as well as development of infrastructure and services. Indeed, the entire economic system is involved in the process of transformation.

Its scope is also wider than that of economic growth,<sup>9</sup> or economic development - a term which has more recently begun to become the current coin.<sup>10</sup> Beyond the simple rate of economic growth, and beyond the rate of capital formation which is conventionally invoked for economic growth, technological transformation includes in particular the influence on growth of human capital formation and associated productivity increases, as well as the impact of major institutional, political, and social innovations on the productive system in general. These differences should not, however, be

pushed too far. Economic growth looks at the outputs, and technological transformation at the inputs: these are after all two sides of the same coin, the process of production.

It is only possible to chart aspects on which data are more readily available. They include a number of crucial points and widely recognized essential profiles. A list of these would certainly include:

- The rate of growth of GDP and per capita GDP
- Changes in the structure of production
- Changes in the structure of trade
- Domestic production of machinery and equipment
- Availability of advanced education
- Infant mortality rate
- Literacy rate
- Consumption of energy per capita

None of these indicators yield absolute targets to be aimed at. Technological transformation is a process - not as a finite objective which, once attained, loses its validity. Several elements of this process may be identified as landmarks, marking the changing terrain of the journey. Like any process, or passage through time, technological transformation too traverses several phases and sub-phases with overlapping interludes. Economic historians have always been fascinated by these. They have attempted to divide the process into its major components. These categorical classifications have too often provoked lively but diversionary controversies among contemporary scholars. Often the heat of this debate has had little relationship to its usefulness. Most schemes later proved too rigid for predictive purposes or policy formation.

Technological transformation is a process so recent in its arrival, so short in its duration, so meteoric in its pace; almost contagious in its spread to so many countries and continents. These countries each have their own specific domestic features. They have faced widely varying external environments, including the historical stock of technological innovations they could draw upon, and their ease of access to that stock. They have varied in the development of their own technological capabilities.

The experience of the 20 countries analysed under the WIDER project was reviewed at the WIDER Conference on Technological Transformation in the Third World, held in Helsinki from August 19 to 23, 1988.<sup>11</sup> A review of the drafts of the studies suggested that 13 of them together with an Overview should be published as a joint project of the two Institutes of the United Nations University: the World Institute for Development Economics Research (UNU/WIDER, Helsinki, Finland) and the newly established Institute for New Technologies (UNU/INTECH, Maastricht, The Netherlands). The studies were grouped into four volumes as follows:

- I Asia
- II Africa
- III Latin America
- IV Developed countries

A fifth volume, an Overview by Surendra J. Patel, will also be added to the series as a concluding contribution to the WIDER project.

These volumes owe a heavy debt to past contributions on the subject. This applies particularly to Volume V - the Overview. We have drawn freely upon the vast research effort which has gone into development economics, economic history, technology studies in general, and country studies in particular. The intellectual debt we owe to these contributions is simply enormous. If many of them are missing in the list of references, it is in no way meant to detract from our debt to them.

### **III Technological Transformation: Volume II - Africa**

The second volume in the series contains three studies from Africa: Algeria, Tanzania and Zimbabwe. The study on Algeria was prepared by Professor Abdellatif Benachou, Director, Division of Development Studies, UNESCO. The study was written by him originally in French in his personal capacity. It was translated into English by Mr Bernard Barondeau. Professor S.M. Wangwe, University of Dar es Salaam, has prepared the study on Tanzania. Dr Mohamed B.E. Fayez, Director of the National Research Centre in Cairo, Egypt, has prepared the study on Zimbabwe.

I am indebted to the authors of the three studies and their collaborators, who have with devoted labour attempted to capture the moving image of a complex dynamic process into a single short story. The three studies published in this volume underline the difficulties which Africa has faced in initiating its technological transformation.

There were many obstacles the wounded continent had to face. It had a tortured history of enforced slavery, followed by colonialization by the west. The rival imperial powers had at the Berlin conference in 1885 drawn up the map of Africa by a footruler splitting the continent into many tiny protectorates.

During the post World War II period, liberation was relatively late in coming to the continent. In fact, by the time the colonies were granted formal freedom, the world economic environment had already turned sour. The countries of Africa therefore seldom had any possibility of participating in the rapid growth of the world output and trade, which took place during the 30 years following the end of the World War II.

The years since mid-1970s have been marked by major economic upheavals: several recessions in the developed countries, slowing down of the growth of their output and trade, the decline in demand for exports and

in prices of primary commodities mainly exported from the African countries, severe balance of payments pressure, large external debts and heavy burden of servicing them. The economic conditions of the continent were aggravated during the 1980s by unprecedented droughts which created near famine conditions in most countries surrounding the Sahara desert. Africa has yet to recover from the twin disasters of the debt trap and the drought. These three studies can hardly be expected to reflect fully the wide diversity of conditions in the African countries. But they all underline the adverse factors listed in the preceding paragraphs.

In addition, these countries inherited very poor infrastructures at the time of their liberation. Illiteracy was near universal with only marginal development of primary education. Secondary and higher education was provided in homeopathic doses. Quite clearly, all these adverse conditions made the continent much more vulnerable to both external and internal disturbances. Each of the three studies in their own way reflect the impact of this vulnerability. Most countries in the continent have not had an opportunity to make a real beginning towards shaping their transformation.

#### **IV Acknowledgements**

A project like this is necessarily a collective venture. It is impossible to list all those who helped the process. But there are some who merit special mention for without their cooperation the project would have been neither initiated, nor completed.

I wish to thank Dr Lal Jayawardena, the Director of UNU/WIDER who encouraged me to initiate this project and helped towards the completion of the country studies. I am indebted to Professor Charles Cooper, the Director of the newly established Institute of New Technologies (UNU/INTECH), who assisted me in selecting the studies for publication.

It has been a pleasure to have the help of Ms Anne Ruohonen, who from the very outset of the project in 1985 has worked very closely with me to ensure the completion of this project. She has gone through several drafts of the country studies as they came in, and meticulously prepared the final print-ready manuscript. I owe special thanks to Ms Liisa Roponen who has with remarkable patience prepared and checked all the tables and charts in the text. In addition I wish to thank Ms Ann Halme and Ms Abby Johnson for their substantial contribution to the typing of the country studies.

Surendra J. Patel  
General Editor  
UNU/WIDER

# Appendix

Lists of participants in UNU/WIDER meetings on Development and Technological Transformation in the Third World: Progress Achieved and Problems Faced

## **Planning Meeting, Helsinki 23-25 November 1985**

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