

# **Environmental Sustainability, Growth Trajectory and Gender**

*This page intentionally left blank*

# **Environmental Sustainability, Growth Trajectory and Gender: Contemporary Issues of Developing Economies**

EDITED BY

**CHANDRIMA CHAKRABORTY**

*Vidyasagar University, India*

AND

**DIPYAMAN PAL**

*Bethune College, India*



United Kingdom – North America – Japan – India – Malaysia – China

Emerald Publishing Limited  
Howard House, Wagon Lane, Bingley BD16 1WA, UK

First edition 2022

Editorial matter and selection © 2022 Chandrima Chakraborty and Dipyaman Pal.  
Individual chapters © 2022 The Authors.  
Published under exclusive licence by Emerald Publishing Limited.

**Reprints and permissions service**

Contact: [permissions@emeraldinsight.com](mailto:permissions@emeraldinsight.com)

No part of this book may be reproduced, stored in a retrieval system, transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without either the prior written permission of the publisher or a licence permitting restricted copying issued in the UK by The Copyright Licensing Agency and in the USA by The Copyright Clearance Center. Any opinions expressed in the chapters are those of the authors. Whilst Emerald makes every effort to ensure the quality and accuracy of its content, Emerald makes no representation implied or otherwise, as to the chapters' suitability and application and disclaims any warranties, express or implied, to their use.

**British Library Cataloguing in Publication Data**

A catalogue record for this book is available from the British Library

ISBN: 978-1-80262-154-9 (Print)

ISBN: 978-1-80262-153-2 (Online)

ISBN: 978-1-80262-155-6 (Epub)



ISOQAR certified  
Management System,  
awarded to Emerald  
for adherence to  
Environmental  
standard  
ISO 14001:2004.

Certificate Number 1985  
ISO 14001



INVESTOR IN PEOPLE

*This book is dedicated to our parents*

*This page intentionally left blank*

# Contents

List of Figures and Tables	<i>xi</i>
About the Editors	<i>xv</i>
About the Contributors	<i>xvii</i>
Foreword	<i>xxiii</i>
Acknowledgments	<i>xxv</i>
<b>Introduction</b>	<b><i>1</i></b>
<b>Section I: Issues of Environment and Growth</b>	
<b>Chapter 1 Has International Trade Increased Carbon Dioxide Emission in Asia?</b>	
<i>Nneamaka Ilechukwu and Sajal Lahiri</i>	<i>11</i>
<b>Chapter 2 Sustainable Energy Development in Emerging Economies: A Study on BRICS</b>	
<i>Sebak Kumar Jana</i>	<i>23</i>
<b>Chapter 3 Interactive Effect of Population Growth and Institutional Quality on Environmental Sustainability in West Africa Region</b>	
<i>Richardson Kojo Edeme and Emeka Ekene Thank God</i>	<i>37</i>
<b>Chapter 4 Sustainable Socio-intercultural Governance</b>	
<i>José G. Vargas-Hernández</i>	<i>51</i>

<b>Chapter 5 Green Nuclear Energy: A Solution of Environmental Sustainability for Emerging Economies</b> <i>Hasan Dinçer, Serhat Yüksel, Gülsüm Sena Uluer and Çağatay Çağlayan</i>	63
<b>Chapter 6 The Shape of Environmental Kuznets Curve: The Dynamic and Cross-country Variation</b> <i>Krishnendu Maji</i>	75
<b>Chapter 7 CO<sub>2</sub> Emissions Analysis and Underlying Emission Trend in Selected Emerging Countries</b> <i>Denizhan Guven, Gizem Kaya Aydın and M. Ozgur Kayalica</i>	89
<b>Chapter 8 Is Growth of Output and Productivity in Indian Manufacturing Industries Sustainable? A Cost Function Approach with Adjustment for Capacity Utilization: 1980–1981 to 2016–2017</b> <i>Mihir Kumar Pal and Pinki Bera</i>	105
<b>Chapter 9 Factors Behind Economic Growth for BRICS Nations: An Examination within the Neoclassical Growth Framework</b> <i>Aloka Nayak and Ramesh Chandra Das</i>	119
<b>Chapter 10 Corruption, Democracy and Growth: Evidence from Emerging Market Economies</b> <i>Amrita Chatterjee</i>	137
<b>Section II: Linkage between Environment, Gender and Growth</b>	
<b>Chapter 11 Gender Gap, Intensive Growth and Economic Welfare in Sub-Saharan African Countries</b> <i>Ebikabowei Biedomo Aduku, Ogochukwu Christiana Anyanwu and Richardson Kojo Edeme</i>	153
<b>Chapter 12 Status of Women Empowerment: A Comparative Study Among the SAARC Countries</b> <i>Pinaki Das and Shama Firdaush</i>	167
<b>Chapter 13 School Dropout of Girls: A Study on Selected Indian States</b> <i>Tanusree Mishra and Tanmoyee Banerjee (Chatterjee)</i>	181

<b>Chapter 14 Gender Equality and Women Empowerment: South Asian Perspective</b> <i>Sudin Bag and Deboshree Barman</i>	195
<b>Chapter 15 Does an Increase in Enrollment of Girls Relative to Boys Stimulate Technical Efficiency of Secondary Education? Empirical Evidence Using Non-parametric Data Envelopment Analysis With Indian State Level Data</b> <i>Sangita Choudhury and Arpita Ghose</i>	207
<b>Chapter 16 Gender Gap and CO<sub>2</sub> Emissions in Emerging Markets Economies: A Panel Data Study</b> <i>Gizem Kaya Aydın, Denizhan Guven and M. Ozgur Kayalica</i>	219
<b>Chapter 17 Gender Equity and Politics for the Enhancement of Environmental Sustainability: Empowerment of Women for the Fight Against Climate Change</b> <i>Egemen Sertyesilisik</i>	233
<b>Chapter 18 Environment Sustainability Development Through Cost-effective Elimination of Hazardous Gases for Gender Development</b> <i>Suparna Banerjee and Aparna Banerjee</i>	243
<b>Chapter 19 Empowerment of Women and Increasing Women Employment in the Construction Industry to Support Environmental Sustainability and Sustainable Development</b> <i>Begum Sertyesilisik</i>	255
<b>Chapter 20 An Analysis of the Impact of Environmental Degradation on Female Health Status and Their Labor Force Participation Rate in Urban India: A Simultaneous Panel Approach</b> <i>Kaushiki Banerjee and Arpita Ghose</i>	267
Index	281

*This page intentionally left blank*

# List of Figures and Tables

## Chapter 1

Table 1.1	Data Sources	17
Table 1.2	Summary Statistics	17
Table 1.3	Trade's Impact on the Environment	18

## Chapter 2

Fig. 2.1	Emission–GDP Ratio in BRICS (kg/2015\$ GDP PPP) During 1992–2018	31
Table 2.1	Percentage Share of Different Sources in Energy Production in BRICS	27
Table 2.2	Panel Regression Results	32

## Chapter 3

Table 3.1	Summary Statistics of the Variables for Empirical Analysis	42
Table 3.2	Arellano–Bond Test for Zero-order Autocorrelation and Sargan Test of Over-identifying Restrictions	44
Table 3.3	Result of the Effect of Population Growth on Environmental Sustainability and Interactive effect of Population Growth and Institutional Quality on Environmental Sustainability	45

## Chapter 5

Table 5.1	The Evaluations of the Experts	69
Table 5.2	Analysis Results	70

## Chapter 6

Fig. 6.1	Relationship Between Environmental Degradation and Economic Activity	87
Table 6.1	The EKC: An Overview of Empirical Literature	79
Table 6.2	Estimated Regression Coefficients	83

## Chapter 7

Fig. 7.1	UET of Selected Developing Countries	100
Table 7.1	Diagnostic Test Results	94
Table 7.2	Estimation Results	98

**Chapter 8**

Table 8.1	Estimates of Productivity and its Components (Annual Average)	113
Table 8.2	Annual Average Estimates of CU and its Trend	114
Table 8.3	Comparative Analysis Between the Estimates	114

**Chapter 9**

Table 9.1	Average Values of the Indicators for 1991–2020 and All the Sub-periods	128
Table 9.2	Unit Root Test Results and the Regression Results in all the Phases	132

**Chapter 10**

Fig. 10.1	Average Value of Corruption and Democracy Index	142
Table 10.1	Impact of Democracy and Corruption on Growth	144

**Chapter 11**

Table 11.1	Results of Unit Root and Cointegration Tests	161
Table 11.2	GMM Estimates of the Effect of Gender Gap in Labor Force Participation on Intensive Growth and Economic Welfare	163

**Chapter 12**

Table 12.1	Status of Women Across the Indicators of Women Empowerment	171
Table 12.2	WEI in SAARC Countries	172
Table 12.3	Results of Panel Data Regression	174

**Chapter 13**

Fig. 13.1	State-wise Distribution of the Incidence of School Dropout of Daughters	183
Table 13.1	Sex of First Born, Son Dominance and School Dropout Among Daughters	185
Table 13.2	Descriptive Statistics of the Variables and Result of Mixed Effect Probit Regression	188

**Chapter 14**

Table 14.1	GII in South Asian Countries	201
Table 14.2	Unit Root Test of ADF	202
Table 14.3	Results of Panel Data Regression	203

**Chapter 15**

Table 15.1	OUTTE of GCS for ISE	214
Table 15.2	OUTTE of SCS for ISE	215
Table 15.3	Significant Determinants of OUTTE for GCS and SCS Considering ISE	216

**Chapter 16**

Table 16.1	Descriptive Statistics of Variables	225
Table 16.2	Result of Panel Data Stochastic Frontier Regression	226
Table 16.3	CO <sub>2</sub> Emissions Inefficiencies of Emerging Markets Economies	228

**Chapter 17**

Fig. 17.1	GE-based Humanity's Fight Against Climate Change as a Key for the Victory in this Fight	238
Fig. 17.2	Relationship Among Empowered Women, Climate Change Fight and Mitigation of its Effects	239

**Chapter 18**

Fig. 18.1	Different Characterizations of As-prepared Cerium (III) Oxide Nanoparticles	249
Table 18.1	Procedure Conditions and Physicochemical Properties of Ceria Nanoparticles	250
Table 18.2	Results of Economic and Mathematical Analysis	251

**Chapter 19**

Fig. 19.1	Relationship Among Women Empowerment in the CI, Increasing Women Employment in the CI and SD	259
Fig. 19.2	Relationship Between Women Employment in the CI and Achievement of the SDGs	261

**Chapter 20**

Table 20.1	Estimated Result of FLE	274
Table 20.2	Estimated Result of FLFPR	275

*This page intentionally left blank*

## About the Editors

**Chandrima Chakraborty** is currently serving as an Assistant Professor in the Department of Economics, Vidyasagar University in West Bengal, India. She did her postgraduate degree in Economics from the University of Calcutta, India and then obtained her MPhil and PhD degrees in Economics from Jadavpur University, India. Her major areas of academic interest include industrial growth, productivity and efficiency. She is also interested in environmental economics, gender issues, agricultural economics as well as health and economics of education.

**Dipyaman Pal** is currently serving as an Assistant Professor in the Department of Economics, Bethune College, West Bengal, India. He did his postgraduate degree, MPhil and PhD degrees in Economics from Jadavpur University, India. His major areas of academic interest include agricultural growth, productivity, volatility and efficiency. He is also interested in environmental economics and gender issues.

*This page intentionally left blank*

## About the Contributors

**Ebikabowei Biedomo Aduku** is a Researcher. He is the General Overseer of the “Opportunity Research Team,” Bayelsa state Nigeria. He is also a PhD student at Department of Economics, Nnamdi Azikiwe University, Awka, Nigeria. He has attended several national and international conferences. He has publications in books and journals of reputation.

**Ogochukwu Christiana Anyanwu** is a Lecturer in the Department of Economics, University of Nigeria, Nsukka. She is currently a PhD student in the same department. She has attended several national and international conferences. She has publications in journals of reputation. Her areas of interest include development economics and environmental economics.

**Gizem Kaya Aydın** was a Research Assistant. She was a Member of Istanbul Technical University. She has a BA in Statistics from Yıldız Technical University, MA in Economics from Istanbul Technical University and PhD in Econometrics from Marmara University. Her research areas include income distribution and consumer economics.

**Sudin Bag** is an Assistant Professor, Department of Business Administration, Vidyasagar University, India. He has more than 10 years of working experience in colleges and university. He has published 18 research papers in the reputed national and international journals, and authored three books. He has awarded a research project from ICSSR under special call for studies focusing on Social Science Dimension of Covid-19.

**Aparna Banerjee**, PhD, is currently working as an Assistant Professor of Economics in Serampore College, India. She had been awarded Doctoral degree in Economics from Calcutta University. She presented various papers in workshops, seminar and conferences. She had many publications in reputed journals and books. She has research interests in various fields of Economics.

**Kaushiki Banerjee** is currently Assistant Professor of Economics, Barasat Government College, and Research Scholar, Department of Economics, Jadavpur University, India. She was a UGC-NET Junior Research Fellow (1st-class-2nd in B.Sc.). She has presented papers in National/International Conferences, reviewed articles. Research interests include gender, social sector and econometrics.

**Suparna Banerjee**, PhD, is currently working as an Assistant Professor in Bangabasi Evening College, India. She had been awarded a doctoral degree from Jadavpur University. She presented various papers in workshops, seminar and conferences. She has published in many reputed journals and books. She has research interests in various fields of Nanoscience.

**Tanmoyee Banerjee** (Chatterjee) is a Professor in Department of Economics, Jadavpur University, India. Her areas of interest are industrial organization, microeconomic theory, micro econometrics, microfinance, financial inclusion and gender analysis and economic growth. She has undertaken various empirical research projects funded by national agencies of India like ICSSR, UGC. She has published extensively in reputed international journals.

**Deboshree Barman** is a Research Scholar, Department of Business Administration, Vidyasagar University, India. She has research interests in Marketing, HR and Business Management. She has published many research papers in reputed national and international journals and presented a good number of research papers in different conferences.

**Pinki Bera** is a PhD Scholar of Department of Economics, Vidyasagar University, India and obtained MPhil degree in Economics from Vidyasagar University in 2019.

**Çağatay Çağlayan** is a 2nd grade Economics & Finance Student in Istanbul Medipol University. He is also student of Health Management Department in Istanbul Medipol University. His research interests are sustainable energy economics, renewable energy and nuclear energy.

**Amrita Chatterjee** is an Assistant Professor at Madras School of Economics. She received her PhD from Jadavpur University, Kolkata in 2011. Her primary research interest is development economics with special inclination toward financial inclusion. She has both national and international peer-reviewed journal publications.

**Sangita Choudhury** is a PhD Scholar (State-Senior Research Fellow) in the Department of Economics, Jadavpur University.

**Pinaki Das**, PhD, is an Associate Professor and Former Head, Department of Economics, Vidyasagar University. He was awarded with the Gold Medal in MSc in Economics. He has conducted three MRP funded by UGC and ICSSR. He has published six books and 50 research papers. He has guided 14 research scholars.

**Ramesh Chandra Das**, PhD, is currently an Associate Professor at the Department of Economics, Vidyasagar University, India. He has more than 20 years of teaching and research experience in the areas of theoretical and applied macroeconomics, environmental economics and political economics.

**Hasan Dinçer** is a Professor of Finance at Istanbul Medipol University, Faculty of Economics and Administrative Sciences, Istanbul-Turkey. He has BAs in Financial Markets and Investment Management from Marmara University. He received his PhD in Finance and Banking from the same university.

**Richardson Kojo Edeme** is an Associate Professor in the Department of Economics, University of Nigeria and also Research Fellow Institute of Business Research, University of Economics Ho Chi Minh City Vietnam. He holds a PhD in Economics. His research interest includes public finance and policy, trade analysis, infrastructure, environmental sustainability, poverty and human development.

**Shama Firdaush**, ICSSR Fellow, is currently pursuing her PhD research from Department of Economics, Vidyasagar University. She continues to publish actively and has seven publications in international and national refereed journals. Her research interests include women empowerment, economic and social well-being.

**Arpita Ghose**, is currently Professor in Economics, Jadavpur University, Chair Professor (Honorary), Planning and Development Unit, JU (NITI Aayog), Government of India. A PhD of ISI, she authored/edited books/published many journal-papers from renowned International publishers, completed renowned national/International-Institution's funded projects, supervised PhDs, with research interest includes econometrics, macroeconomics, productivity, efficiency, empirical studies on international trade, applied development economics and social sector.

**Denizhan Guven** is a Member of Eurasia Institute of Earth Sciences at Istanbul Technical University (ITU). He received MS degree in Energy Science and Technology from ITU. He is still a PhD candidate at ITU and his research areas include energy and data analysis for climate change and air quality sciences.

**Nneamaka Ilechukwu** earned her doctorate from Southern Illinois University Carbondale in 2021. Before joining the PhD program at Southern Illinois University Carbondale, she worked as an Assistant Lecturer at Nnamdi Azikiwe University, Awka in Nigeria. She is now an Assistant Professor of Economics at Snow College Ephraim, Utah.

**Sebak Kumar Jana** is currently Professor of Economics in the Department of Economics, Vidyasagar University, India. His major areas of research interest include environmental and resource economics. He, as Principal Investigator, has completed research projects funded by ICSSR, UGC and NABARD, IWMI and IFPRI.

**M. Özgür Kayalica** is a Senior Lecturer in the Energy Institute and at Istanbul Technical University. His research focuses on environmental economics, energy economics and trade theory. He is the Co-author of International Environmental

Efficiency: A Critical Analysis (Routledge, 2017). He also published numerous articles in SCI/SSCI indexed journals.

**Sajal Lahiri** earned his doctorate from the Indian Statistical Institute (1977). He worked at the University of Essex in England (1978–2002) and joined Southern Illinois University Carbondale in 2002 as the Vandeverer endowed Chair in Economics and is a Distinguished Scholar at SIUC. He has written extensively on issues in international and development economics.

**Krishnendu Maji** is an MPhil in Economics (Specialization: Econometrics) from University of Calcutta and Masters in Applied Economics (Specialization: Econometrics & Finance) from Presidency University. He has more than 10 years of experience in Teaching & Research.

**Tanusree Mishra** is an Assistant Professor of Economics in Sister Nibedita Government General Degree College for Girls in Kolkata. Her research interest primarily lies in women empowerment, child marriage, violence against women and other women-oriented socioeconomic problems.

**Aloka Nayak** is presently a Research Scholar at the Department of Economics, Vidyasagar University, India. She has research interests in growth economics and environmental economics.

**Mihir Kumar Pal**, PhD, is a Professor of Economics, Vidyasagar University, India. He was awarded Gold Medal at both UG and PG level from University of Kalyani. He has completed a number of research projects and published several books, articles in reputed national and international journals. His areas of research interest are industrial productivity, capacity utilization, environmental economics, and applied econometrics.

**Begum Sertyesilisik** is a Professor in Izmir Democracy University. She has received her PhD degree at the Middle East Technical University, her MSc, MBA and BSC degrees at the Istanbul Technical University. Her specialization areas include sustainable construction project management, construction contracts, project management, green marketing, sustainability and sustainable built environment, contract and dispute management.

**Egemen Sertyesilisik**, PhD, has been awarded a BA degree on Political Science and Public Administration at the Bilkent University, a MA degree on the Politics and the Mass Media at the University of Liverpool, a MBA degree at the Yıldız Technical University, and a PhD at the Marmara University on the Political Economy of the Middle East. He has publications on political economy, water resources and sustainability.

**Emeka Ekene Thank God** is currently a PhD student in the Department of Economics, University of Nigeria, Nsukka. His area of research interest includes development and environmental economics.

**Gülsüm Sena Uluer** is a 4th grade Business Administration student in Istanbul Medipol University. She is also student of Business Administration Integrated Master with Thesis student in Istanbul Medipol University. Her research interests are sustainable energy economics and project finance, electricity, renewable energy and nuclear energy.

**José G. Vargas-Hernández** is a Research Professor at Instituto Tecnológico Mario Molina, Unidad Académica Zapopan, Member of the National System of Researchers of Mexico. He completed his PhD in Public Administration and also did PhD in Organizational Economics.

**Serhat Yüksel** is an Associate Professor of Finance in İstanbul Medipol University. He has a BS in Business Administration (in English) from Yeditepe University (2006) with full scholarship. He got his Master's degree in Economics at Boğaziçi University (2008). He also has a PhD in Banking from Marmara University (2015).

*This page intentionally left blank*

# Foreword

Several recent global assessments, scientific literature and expert opinion seeking surveys are showing that one of the 17 sustainable developmental goals (SDG) which has the most likely potential and chance to constraint developmental objectives for many countries in this century is the SDG 13, which focuses on the climate action. State of the climate system will determine economic outcome while economic development model of each country makes a choice for determining the state of the climate system. However, other local environmental issues, like water quality, air quality, soil quality, biodiversity, and so on, are equally important determinants of economic growth trajectories and human well-being. In a globally connected world that shares same global common good like climate system, consumption-induced externalities and production externalities need disruptive technological change, innovative governance and new institutions to enable accelerated societal transformation toward sustainable development. It is well established now in the literature that human well-being is a much broader concept than economic well-being measured by single-dimensional metric like gross domestic product. How various social groups participate in decision-making process defines not only political agency but also creates social trusts among various actors within a governance system and enhances productive base of the economy. In this century, productive base of the economy is no longer confined to a single-dimensional array of man-made physical capital but is a portfolio of capital assets that includes additionally human capital, natural capital, social capital and knowledge capital. Persistent policy blindness and lack of appropriate institutions to manage overlapping risks across economic, social and environmental dimensions exacerbate current threats to sustaining growth outcomes due to increasing natural hazards, exposure and vulnerabilities. On these issues regional examples based on good quality scientific evidence-based analysis within a clear analytical frame from the developing world are abysmally low compared to developed counterparts.

This book can be considered as a major contribution from the experts based on regional analysis from Asia, Africa and emerging economies of the world in bridging this knowledge gap. Various articles chosen for compiling this volume brings out one point very clearly that the developing region is caught up structurally in economic growth dilemma with rising environmental constraints, lack of state-of-the art technologies and social inequities. Regional diversity in authorship and study contexts provide a very rich set of information and wide-angle lens to see the developmental challenges.

Conclusions based on empirical evidence from various studies at various scales in this book support the triple bottom line of sustainable development. The new granular insights brought in by the various articles in this book are very useful for informing larger global debate. From intellectual point of view compilation of articles by the editors from across various regions and arranging them thematically helps in understanding the complexities and multidimensional challenges of sustainable development. The articles in this book will be of considerable interest and use to the authors of various regional and global assessment reports, future researchers, decision-makers like national governments, bilateral and multilateral funding agencies, civil societies engaged in developmental actions in the region and will generate more interest for taking forward more in depth studies to advance deeper regional debate, struggle and understanding of the challenges for turning the current development processes on sustainable development trajectories.

*Joyashree Roy  
Bangabandhu Chair Professor  
Asian Institute of Technology, Thailand  
Professor of Economics (On lien) and Founder Advisor to Global Change  
Programme & SYLFF-JU Programme of Jadavpur University, India*

# Acknowledgments

With long-term efforts on the stages from submission of the book proposal to final submission of the proposed book titled, Environmental Sustainability, Growth Trajectory and Gender: Contemporary Issues of Developing Economies, it is a great pleasure for the editors as well as the chapter contributors that the book is now published.

In carrying out the entire project, the help and support of different organizations, academicians and other members of the society who are directly or indirectly associated to the project cannot be forgotten.

First *and foremost*, we must acknowledge the cooperation and support of the Emerald Publishing Ltd. Team for approving the proposal and continuously guiding us at all stages of developments of the book.

Secondly, we are highly grateful to all the contributing authors for their valuable chapter contribution and adding to the existing literature through this volume. *We would like to express my special thanks to the contributors for helping me to complete the project and effectively on time.*

Thirdly, we are indebted to our little daughter for the support and sacrifice in carrying out this lengthy project.

*At last but not in least, we would like to thank everyone who helped and motivated us to work on this project.*

Although all care has been taken, no one other than us, as the editor, discloses to remain entirely responsible for any errors that still stay behind this book.

Chandrima Chakraborty  
Dipyaman Pal  
The Editors

*This page intentionally left blank*

# Introduction

Developing economies has made significant strides in stepping up their rate of economic growth during the past few decades. Sustainable development goals (SDGs) set out a vision for a world free from poverty, hunger and disease. The SDGs aim to be relevant to all countries, poor, rich and middle income, to promote prosperity while protecting the environment and tackling climate change. They have a strong focus on improving equity to meet the needs of women, children and disadvantaged populations in particular so that “no one is left behind.”

Climate disruption also poses a serious and growing threat to short- and long-term economic prospects. One of the major constraints of developmental objectives for many countries in this century is the SDG 13, which focuses on the climate action. The issue of environmental sustainability stirs uneasiness in the minds of the economists.

Another area of concern among others are whether the growth is gender equitable or not from the point of view of creating decent work and productive employment opportunities for both women and men. There exists interlinkage between environmental sustainability and gender equity. Due to environmental issues like pollution and ecosystem degradation, gender inequality is becoming more noticeable. Women, due to household responsibilities, are excessively open to indoor air pollution than their male counterpart. Also women and children are more likely to die than men during disasters and climate change. Gender gap limits or confines women’s access to resources and decision-making opportunities thereby creating obstacles to effective sustainable development and livelihoods.

It is very much needful to understand these inequalities, weaknesses, roles and capabilities of men and women in order to achieve growth and inclusive environmentally sustainable solutions for the people around the world.

This deserves analysis of the growth trajectories, gender equity and sustainable environmental development in the perspective of the above-mentioned issues across a range of sectors and development concerns, such as trade, health, education, governance, industry, energy, climate change, consumption and production, and urbanization.

In view of the above perspective, this book tries to touch upon a range of issues which may be considered as important as well as critical in the sphere of environmental sustainability, growth trajectory and gender issues in the context of developing economies.

## 2 Introduction

There are 20 chapters which are broadly classified into two sections. Section I covers the issues on environment and growth (Chapters 1–10) and Section II (Chapters 11–20) discusses the interlinkage between environment, gender and growth.

Brief sketch of all the chapters is presented below:

### **Section I: Issues of Environment and Growth**

Chapter 1 investigates how international trade affects pollution using annual data from 34 Asian countries for the period 1970–2019. The impact of trade on environmental pollution is divided into three effects – scale, technique and composition effects. This chapter measures pollution using carbon dioxide (CO<sub>2</sub>) emissions (metric tons per capita) obtained from the United States Energy Information Administration. The study estimates a regression model that provides estimates of the magnitudes of trade's impact on pollution as per the aforesaid three effects. It is found that the scale and the composition effects of pollution are positive, but the technique effect is negative, and that the net effect is negative, that is, international trade leads to a lower level of emission when the underlying model is linear, but it is positive, that is, international trade leads to a higher level of emission when non-linearities are considered.

Sustainable energy like renewable energy plays a critical role in achieving SDGs including energy security in emerging economics. BRICS (Brazil, Russia, India, China and South Africa) constitutes about 23% of the world's GDP, 40% of the world's population and 36% share of the supply of primary energy in the world. Obviously the bloc has tremendous potential in influencing the global sustainable clean energy transition with the advantages like lowering the costs of renewable, boosting employment in the sector of green energy, enhancement of energy security and improvement of local air quality. Despite the existence of varieties of renewable energy resources in the BRICS economies, renewable energy resources are found underdeveloped. The major objectives of Chapter 2 are thus to assess progress of different forms of energy especially renewable energy, impact of development of renewable energy on carbon emission and policy issues in renewable energy development in the context of sustainable energy development of BRICS countries. The study reveals that the progress of renewable energy development varies widely among BRICS countries and that pollution decreases with renewable energy development.

While environmental sustainability may have been intensified by different occurrences, such as global warming, increased carbon emission, loss of biodiversity and natural resource depletion. There are concerns that rising population combined with the quality of institutions have serious implications on the attainment of environmental sustainability. While this may seem factual, tackling environmental problems by adopting population reduction policies might not necessarily guarantee a sustainable environment without addressing the quality of institutions. So Chapter 3 examined the effect of population growth on environmental sustainability as well as the interactive effect of population growth and institutional quality on environmental sustainability in West Africa region, using data from 2006 to 2019. Findings indicate that population growth has a positive

but insignificant effect on environmental sustainability. But population growth when interacted with institutional quality had negative and significant effect on environmental sustainability. Environmental problems thus cannot be effectively addressed through population policy alone, hence the additional need for strong and institutional quality to ensure environmental sustainability in the region.

Chapter 4 analyzes the interrelationships between the elements of sustainability, socio-interculturalism and governance. This analysis advances from the assumption that the sustainable socio-intercultural governance requires to be supported by the development of systems that enable the economic growth, the social development and environmental socio-ecosystems of communities, institutions, organizations and individual levels. The method employed is the reflective-analytical based on the review of literature. It is concluded that on the new geographies of sustainable socio-intercultural governance are affected by the coexistence that have solutions to the capacity deficits and dysfunctionalities of processes, institutions and knowledge systems which have many systemic failures on the capacities of the natural resource management systems. This analysis proposes a new model of socio-intercultural sustainable governance.

Chapter 5 examined the significant factors to improve the green nuclear energy investments in the emerging economies with DEMATEL methodology. The findings demonstrate that technological improvement and financial issues are the most important issues for the improvement of the green nuclear energy investments in these countries. Nuclear energy working with thorium can also be obtained with proton accelerator technology that is currently quite expensive. Because of this problem, the investors are not willing to make investments for green nuclear energy projects. Hence, emerging countries should make the necessary technological investments to have proton accelerator technologies. With the help of this condition, it will be possible to reduce the cost of green nuclear energy projects which attracts the attention of the investors. This situation has a powerful contribution for the sustainable economic development of these countries.

Chapter 6 empirically tests the truth behind the Environmental Kuznets Curve (EKC) hypothesis. In addition to that, it analyzes the variation in the shape of the EKC; that is, cross-country variation, as well as variation over time for 75 countries for a fairly long period of time from 1960 to 2016. This study used polynomial regression equation of modeling structure to understand cross-country as well as dynamic variation in the shape of the EKC. In this study, firstly the selected countries are grouped on the basis of the shape of the EKC. Secondly, the dynamic behavior of each parameter in the polynomial equation is analyzed to understand the degree of association between economic activity and environmental degradation. It suggested a decline in degree of association between the two over time.

Chapter 7 examined the impact of energy consumption, economic structure, population and manufacturing output on the CO<sub>2</sub> emissions of selected emerging countries by utilizing time series model employing data ranging from 1965 to 2019. The model is built up using total primary energy consumption, GDP per capita, population and manufacturing value-added, and, finally, a stochastic underlying emission trend as explanatory variables. The model is extended by the

## 4 Introduction

introduction of the notion of underlying energy demand trend as a factor for exogenous effects, including development in technical progress, energy efficiency improvements, changes in human behaviors, economy, and environmental regulations. A forecasting model for CO<sub>2</sub> emissions of the selected emerging countries is framed. The model discovers the significant influences of all selected variables of CO<sub>2</sub> emissions. The results *r* that the most forceful factor in CO<sub>2</sub> emissions is the total primary energy supply. Furthermore, while the long-term impact of economic growth on CO<sub>2</sub> emissions is negative for some emerging economies, it is positive for several others. The model also measures the long-term manufacturing value-added elasticity of CO<sub>2</sub> emissions in these emerging economies.

Chapter 8 analyzed energy intensity, capacity utilization (CU), output and productivity growth of aggregate manufacturing sector in India during the period 1980–1981 to 2016–2017. A decadal analysis as well as a comparison between pre- and post-liberalization period of productivity growth is also made. Total factor productivity growth (TFPG) is also adjusted with CU to obtain adjusted TFPG. The trend in energy intensity is also analyzed to answer the question of sustainability. Results show that TFPG declined in the post-reform period, highlighting the fact that liberalization process has its adverse impact on productivity growth. From the study a declining trend is observed in adjusted TFPG in the post-reform period, but the rate of decline is higher. Energy intensity and CU of the Indian manufacturing industries is found to be increasing over the study period. Increasing energy intensity, quite significantly, would increase the level of pollution generated by the manufacturing industries. So, interestingly enough, this may lead us to conclude that the growth of the manufacturing industries is not in line with the basic essence of sustainable development.

The literature on growth economics mostly covers the studies on growth trajectory, convergence, issues of sustainability, etc., which are related to the so-called developed economies of the world. But the emergence of a few economies such as the members of the BRICS group in the recent past has provoked the theoreticians to shift their focus from the developed economies to these highly emerging economies as they are now chasing the countries of the developed world at least in terms of gross domestic products. But there may be differences in the roles of different factors in explaining the growth trajectories of the so-called developed economies *vis-à-vis* the highly emerging economies. Chapter 9 investigated the factors responsible for economic growths in the BRICS nations under the neo-classical growth framework for 1991–2020. The study finds that savings rate has been identified as the driving force behind the huge growth trends of the member countries in the group with a major contribution by China and India in the entire period, however, the results differ across sub-periods.

There is a long-lasting debate on the relationship between democracy and economic growth, though it remained inconclusive. On the other hand, corruption is one of the greatest challenges of the contemporary world that lessens the efficiency of good government, distorts public policy, leads to the misallocation of resources, harms the private sector and particularly hurts the poor. Moreover, the corruption–growth relationship has been shown to be contingent upon the political regime. Chapter 10 has chosen a set of emerging market economies,

which consists of democratic as well as authoritarian countries, to throw light on democracy–growth relationship through the channel of corruption using a system generalized method of moment estimation of a panel of 27 countries for a period of 2006–2018. Results show that democracy is growth-enhancing but corruption dampens its positive impact to some extent. However, for authoritarian countries corruption can enhance growth.

## **Section II: Linkage between Environment, Gender and Growth**

Chapter 11 examined the relationship between gender gap in labor force participation, intensive growth and economic welfare in Sub-Saharan African countries from 1981 to 2020 under the framework of the classical production function. The generalized method of moment technique was employed in analyzing the data. The empirical result showed a negative and significant effect of the gender gap in labor force participation on intensive growth and also negative but insignificant effect on economic welfare. Other findings showed that male labor force participation had a positive and insignificant effect on both intensive growth and economic welfare, while female labor force participation had a negative and significant effect on intensive growth and a negative and insignificant effect on economic welfare. Trade openness had a positive and significant effect on both intensive growth and economic welfare.

For the prosperity of both gender and for social justice, independence and empowerment of women is essential. Empowerment of women not only ensures her personal or household welfare but also spreads positivity throughout the community. This generation of positive externality by empowering women has actually attracted attention worldwide toward exploring the concept of women empowerment as well as analyzing their status. Chapter 12 focuses on comparative analysis of the status of women empowerment among the SAARC countries and side by side explores its relationship with the various macro-indicators related to growth and development. This study reveals that Maldives and Sri Lanka had a relatively better status of women empowerment as compared to other SAARC countries. Further, based on the panel data analysis, it is found that urbanization and globalization have a significant impact on women empowerment.

According to Chapter 13, Karnataka, West Bengal, Meghalaya, Tripura, Telengana, Arunachal Pradesh and Andhra Pradesh showed higher rates of school dropout of girls compared to the all India level based on exploration of DLHS 4 data. Using multilevel probit technique, the study showed that the incidence of school dropout of girls decreases if the first born of the parents is male and mother is more educated than father while it increases with lower asset endowment, land-holding and high spousal age-gap between parents. Further it is high among the Muslim religion and schedule caste category.

Chapter 14 evaluated the impact of economical, educational, health and political empowerment on Gender Inequality Index (GII). The crux of the study is that empowerment of women has a positive impact on reducing GII. The economic empowerment and participation, education, sound health and political

## 6 Introduction

participation and engagement are needed to reduce GII and in turn increase economic growth for the betterment of society. The result suggests a negative relation between economic empowerment and GII and also between educational attainment and GII which is desirable. Health and survival also has negative and significant effect on GII while increase in political empowerment will decrease GII. Thus, the result reveals that gender equality and women empowerment has a positive association in the south Asian countries.

In contrast to the available literature which uses common frontier for efficiency measurement of Indian secondary education (ISE) with state-level data, in Chapter 15 output-oriented technical-efficiency (OUTTE) of Indian states and union territories (UT) is estimated by creating two separate frontiers for (i) General Category States (GCS) and (ii) Special Category States (SCS) & UT, as two groups operate under different economic and fiscal conditions, for 2010–2011 to 2015–2016 under variable-returns-to-scale and using non-parametric Data Envelopment Approach. It is found that OUTTE of ISE varies within and between GCS/SCS. A second step determinant analysis suggests both for GCS and SCS, OUTTE is related positively to (i) percentage of girls to boy's enrollment in ISE, supporting the positive role of gender equality in education regarding enrollment; and (ii) ratio of government education expenditure to aggregate government expenditure and negatively to poor infrastructural variables. OUTTE is also positively related to per capita net state domestic product at factor cost (constant prices), proportion of para teachers for GCS and percentage of ST enrollment for SCS.

Chapter 16 empirically verified that gender equality has a positive effect on reducing CO<sub>2</sub> emissions per capita in emerging markets economies and also determined and rank the countries that are inefficient in terms of CO<sub>2</sub> emissions per capita (metric tons). The panel data stochastic frontier model is estimated. The Global Gender Gap Index, which measures gender equality, primary energy consumption per capita (gigajoule) and GDP per capita (constant 2010 US\$) are used as independent variables of 24 countries from 2006 to 2018. The results of the model supported the negative impact of gender equity on CO<sub>2</sub> emissions. This study indicated that gender equity can be suggested both as a driving force for economic development and sustainable environmental efficiency in which growth can be linked to lower emissions of CO<sub>2</sub>.

The world economy has developed significantly causing increase in greenhouse gas emissions level resulting in the global warming and related natural disasters. Women are more vulnerable to these disasters and global warming compared to men especially with respect to mortality rate and increase in the workload. For example, especially in developing countries women's workload increased due to the global warming and water scarcity, as they spend more time to carry water to their homes as they get water from longer distances. This example reveals opportunity cost of climate change for females as their increased workload can obstacle their education affecting their entire life and their contribution to their countries' sustainable development. Women are underrepresented in the workforce and politics all over the world. This situation prevents humanity to get benefit from their potential in and contribution to the climate change fight. Women

encouragement in economics and political life can support their participation in the climate change fight. Empowerment of women and enabling them to take more active role in decision-making process especially in the climate change fight can contribute to mitigate the climate change's effects and support sustainable growth. Based on literature review, Chapter 17 investigated women's role in the climate change fight and ways for empowering women to mitigate climate change's adverse consequences.

Chapter 18 mainly focused on utility of the nanotechnology and its beneficiary in creating a sustainable environment in economic world, particularly for gender development. Since the gas sensors will detect and reduce gaseous toxic pollutants from the environment, so lower the pollution, greater will be sustainable environment development in terms of human development index and hence higher will be overall economic development in favor of gender development index across world. However, as major findings, developing countries, have been successful, in maintaining a sustainable human development, in spite of higher PCI growth, as compared to the role of least developing countries, with lower PCI in this global world, in favor of their respective gender development. Cerium (III) oxide nanoparticles were prepared by co-precipitation method using hydrogen peroxide as the precipitant in slightly alkaline medium which is greener and environmentally suitable, cheap and best as compared to other conventional methods. Here, hydrogen peroxide acts as precipitating, reducing and stabilizing agents. Since studies worldwide reveal a very strong, significant positive association between air pollution and COVID-19 cases, hence, this environment friendly synthesis process will prove to be most economically effective one to combat the COVID situation. The synthesized cerium (III) oxide nanoparticles were initially noted through visual color change from colorless pale yellow cerium (III) to light yellow cerium (IV). Moreover, the formation and size of cerium (III) oxide nanoparticles were evidenced by the X-ray diffraction, transmission electron microscopy and UV-Vis spectroscopy studies. The very high surface area and very small average crystallite sizes of these prepared cerium (III) oxide nanoparticles (5–20) nm in size is mainly responsible for their catalytic properties and hence can be effectively used for the removal of hazardous toxic pollutant gases, such as CO<sub>2</sub> and SO<sub>2</sub> from the environment with a view to combat the pollution within the environment to increase sustainability and also ensure a better, healthy and safe environment, particularly, in context of COVID in globalized world.

Construction industry (CI) is a labor-intensive industry, women employment rate is significantly low in the CI. CI is one of the significant labor-intensive industries having environmental footprint. As reduction in its environmental footprint can contribute to environmental sustainability, investments in CI and in reduction in its environmental footprint can have multiplier effect on the countries' development as well as on the sustainable development. Increase in the women employment in the CI can support achievement of SDGs as it supports reduction in the gender gap in this industry. Furthermore, it can support sustainability performance of the CI as women have potential to prioritize sustainability criterion in their decision-making processes. Especially, women at the top management levels can foster their companies' sustainability performance. Chapter 19 explains the

gender gap in the employment in industries differs based on the industries. Even if CI thus investigated roles of empowerment of women and increasing women employment in supporting environmental sustainability and sustainable development. This chapter identified causes of the low employment rate of women in the CI. Furthermore, it examined ways for empowering women and increasing their employment rate in the CI to support environmental sustainability and sustainable development. Additionally, recommendations on future policies and strategies at the CI level to support reduction in the gender gap to enhance CI's role in the environmental sustainability are provided.

Chapter 20 established a simultaneous dependence between female labor force participation rate (FLFPR) and their health status, the roles of air pollutants in explaining female life expectancy (FLE) and joint interactions of different explanatory variables in determining both FLFPR and FLE, by estimating a simultaneous panel model comprising equations of FLFPR and FLE, using Baltagi's Instrumental Variable EC2SLS method and 13 major Indian state-level data for urban sector, over 2004–2005 to 2011–2012. The air pollutants such as  $\text{SO}_2$  and  $\text{NO}_2$  have significant negative impacts on FLE. The interaction effect of air pollutants with economic growth on FLE is negative implying that the partial effect of a change in growth depends on air pollution level. FLFPR can be improved by reducing air pollution through health, as FLE significantly affects FLFPR positively.

The purpose of this book is to raise awareness among stakeholders and institutions, reaching gender equality and inclusiveness, climate change adaptation and mitigation efforts, foster inclusive green growth inventiveness and ensure equal rights on clean air, water, energy and access to natural resources for all.

We hope that the book will provide immense knowledge base to postgraduate students, researchers and faculty members around the globe related to various subjects such as Economics, Business & Management, Sociology, Gender Studies, Environmental Studies, among others. The volume will also be helpful for policy-makers, multinationals and government officials as well as the general readers interested in the field.

Chandrima Chakraborty  
Dipyaman Pal  
The Editors