1 The Why Question

1.1 Rationale for the Book

The journey towards achieving an economy where societal well-being is unequivocally centre staged requires thinking about the path that will be charted till the year 2030 and well beyond it. This is the year for which countries have adopted targets related to the Sustainable Development Goals (SDGs) and is also the year of focus for the much discussed Nationally Determined Contributions (NDCs) in the Paris Agreement. The severe shock posed by COVID-19 has for some constituencies rung the alarm bells for focussing on sustainability as a core principle for development—economic, social and environmental—in the near term and the long term. For many though, it has resurrected single-minded pursuit of economic growth as the need of the hour.

While much has been achieved with economic growth, as Stiglitz (2019) reminds us, there is ample room to change the quality of growth, to reduce its environmental impact significantly (Stiglitz, 2019). This presents an opportune moment in time to
revisit the debates, and for researchers as writers, to don the responsibility of *dredging up to the light our dark and dangerous dreams for the purpose of improvement* (Steinbeck, 1962).

This book is an attempt to further the discussion on the continued coexistence of synergies and incompatibilities, between sustainability and conventional economic development, in a world that considers itself to be plunged into a crisis as never before.

### 1.2 The Enduring Relevance of Sustainable Development

Principles of equity and fairness in distribution of resources, maintaining planetary health, the call for climate justice and economic growth that respects the planetary boundaries have found increasing acceptance over the last few decades. The global sustainable development goals were a major effort to recognise that developmental goals need to be in sync with each other, and to centre stage the relevance of people and planetary well-being. This book probes some contemporary issues that will help in understanding the sustainability narrative in India. The topics explored include the complex challenges at the interface of development and environment, and the conservation of natural resources in the face of conventional developmental approaches. The discourse further extends to the role of economic modelling, governance and institutions, in the theory and practice of sustainability across different sectors and decision-making agents in the economy. It aims to examine, analyse and interpret the topical issues that not only persist in demanding resolution as outstanding concerns for policymakers but emerge as new challenges such as those posed by climate change in building a resilient society. It thus collates past learnings with new understanding, combining views about the big picture with specialised core analytical contributions.

### 2 The How Question

The abundance of perspectives and multitude of dimensions that scholars have associated with the term sustainable development is unrivalled by any other terminology linking environment and development. It is no easy task to knit together nor to pick and choose some topics as having greater salience over others. However, the editors’ task in putting together this book was made easy by contributions from leading scholars. Our contributors were forthcoming in offering their scholarship, and the chapters reflect the foremost challenges and opportunities as “natural fits” for an edited volume on sustainable development. The chapters have been organised into four themes, namely:

- The Big Picture: Evolving Perspectives
- The Energy Scenario: Dilemmas and Opportunities


- Sustainability Cross-Cuts: Developmental Aspects
- Externality Empirics: Knowledge and Practice.

2.1 **The Big Picture: Evolving Perspectives**

The rationale for initiating a discussion on sustainable development with the big picture is self-explanatory in today’s context. The Brundtland Commission, in its pursuit of a global agenda for change, had early on identified that the concern was for three interlocking crises that the globe faced: an environmental crisis, a developmental crisis and an energy crisis (WCED, 1987). The three key advisory panels set up on energy, industry and food security to support the commission’s work had strong participation from India. That integration is the key to advancing well-being is also well recognised in the framing of the Sustainable Development Goals (SDGs); that action in one area will affect outcomes in others, and that creativity, knowhow, technology and financial resources from all of society are necessary to achieve the ambitious SDG targets (Goals et al., 2020). The system view is as critical as the specifics of associations and causes that lead to resilient sectoral solutions and sustainability in society. The grounded realities of the science–policy interface are equally critical to achieving success in pursuing the goal of sustainable development.

2.2 **The Energy Scenario: Dilemmas and Opportunities**

The energy sector has been a key player in discussions of sustainability, especially for India where significant technological advances in conventional forms of energy supply coexist with fairly low levels of per capita energy consumption. Energy policy grapples with formidable challenges in balancing efficiency, equity and sustainability issues in striving to achieve energy security. The dominant share of fossil fuels in the primary energy mix on the one hand and increasing import dependence for meeting the primary energy needs for a growing economy on the other manifests in a gradual pacing of the much-needed transformation and adaptation of India’s energy system. The range of topics in the energy sector on which scholarship has emerged is vast. There can be no two opinions that the attainment of sustainability in the Indian context will depend on the concerted efforts in the energy sector to deal with several of its dilemmas and exploit the potential opportunities.

2.3 **Sustainability Cross-Cuts: Developmental Aspects**

The mainstreaming of sustainability aspects into topics conventionally perceived to fall in the preeminent domain of development is inevitable for the transition to
a sustainable economy. One such dimension involves resorting to a framework of the circular economy, compared to a linear one, that gives due considerations to the feedback impacts on the natural environment emanating from the process of economic growth and development. This, in turn, implies that the strategies in pursuit of economic growth and development in emerging economies such as India should lay adequate emphasis in terms of its quality through protecting the interests of the vulnerable sections of the population, promoting resilience of production systems, the evolution of the institutional and governance structures and envisioning the economy-wide impacts of the transitioning phase. Such considerations, however, if ignored can create much disquietude for well-being, not only in the long term but also undermine the peace and tranquillity in the immediate and near term, a necessary prerequisite for economic progress and prosperity.

2.4 Externality Empirics: Knowledge and Practice

Externalities are core to the discussions of sustainability in economics. The unaccounted environmental effects of production and consumption are often ignored in the science and practice of conventional economics. Bad outputs and negative externalities are integral to the economic systems which in turn pose threats to life on the planet. Production spillovers such as environmental degradation, resource depletion, ecological imbalance and so on are serious concerns in the face of the current climate crises and sustainability threats of the economic system. Different types of environmental hazards emanating from different economic activities need policy attention and institutional intervention of varying degrees in designing the appropriate mitigation strategies. The trends in behaviour, knowledge and practice provide inputs to address the issues related to environmental externalities in the larger backdrop of sustainable production, consumption and overall development.

3 The What Question

This section presents a brief description of the contents of each chapter, highlighting the main points and arguments made by the respective chapter authors.

3.1 The Big Picture: Evolving Perspectives

The dilemma faced by developing countries in fast-tracking economic well-being, which undeniably can deliver substantially on several other fronts of social progress, is how to address the trade-offs in prioritising immediate needs over longer-term sustainability considerations. Economic growth has no doubt helped to address
several concerns such as poverty, but as the size of the cake has grown, increasingly the distribution of the cake has raised troubling questions for social well-being, including environmental impacts. Climate change has since emerged as a major challenge that threatens to sharpen existing inequities while creating new ones, adding layers of complexity to conventional focus on economic growth and its fallouts. If climate action is often considered to be something that may be postponed for the present, the COVID-19 pandemic was a rude awakening, interpretable as an environmental shock. While its implications for economic and social well-being are here to stay for a while, it prompts thinking on whether the shock could lead to the much desired, across the board big nudge for a sustainable future.

In the specific context of India, the immediate concerns can appear overwhelming, many of them interconnected. A key within country concern for development and well-being is urbanisation—it has become a talking point for researchers for its own merits as well as because of its linkages with other socio-economic concerns. Getting the basics right in how we measure and relate to it is important. An equally important concern is how market structures help or hinder the cause of economic progress which again links with several aspects of both international and domestic agencies through trade, competitiveness, access to finance and technology. Understanding the role of policy in supporting synergistic interconnections for sustainable development is most crucial in ensuring that a multitude of goals can be met in the pursuit of sustainability. In the broader framework, monetary policy along with other policy forms has its role to play, more so when the focus is on economic recovery with a human face.

In the forward-looking paper titled “Fast-Growing Developing Countries: Dilemma and Way Forward in a Carbon-Constrained World”, Joyashree Roy, a well-known expert on climate change issues, collaborates with co-authors Nandini Das, Shreya Some and Hasan Mahmud to reflect on the dilemmas and the way forward for the countries moving on a fast growth path in the current world facing severe environmental challenges. The calculation and comparison of national progress are still dominated by the conventional metric, namely the gross domestic product (GDP). While some countries recorded more than seven per cent annual GDP growth rate in this century, many others experienced the same in the last century. Roughly thirty percent of human settlements in the countries traditionally classified as developing have already followed the path of economic progress shown by the highly industrialised countries of today. Their journey in the post-World War II period has proved successful in improving individual quality of life. They are on the way to adopting more solutions for improving social as well as environmental quality. So, the real question is about the remaining seventy per cent who as a country group are the true representatives of the global south. The question of broader equity and justice demands that there can be no denial of progress for this part of the world, given that no difference exists in human aspiration levels in any part of the globe. The faster is the movement towards bridging the gap, the faster will be the attainment of peace and harmony in a society that can wisely deliver the global common good. There is a growing realisation that these debates are emerging mostly due to the changing climate and carbon constraints in this part of the world. This in turn may delay the basic development process further and bring in greater inequity while experts search
for better alternative development strategies. So, the fast-developing countries will need to maintain high economic growth rates merely for providing universal access to a decent life. The authors have presented two short case studies of India and Bangladesh. Poised for fast growth, Bangladesh is setting some new examples of social transformation unlike many predecessors during the last century. The narrative of Indian progress so far has been along the incremental path of growing energy efficiency and inducting renewable energy within the chosen option to show how it can transform ambition into reality.

In his paper titled “Looking Beyond the COVID-19 Pandemic: What Does Our Future Hold?”, Anup Sinha presents a topical discussion on an inclusive and sustainable future, weaving a narrative with masterly subtlety, clarity and objectivity in the post-pandemic world. While elaborating on the various impacts of and responses to the COVID pandemic, the author focusses on the idea of the pandemic as a complex environmental shock. The pre-pandemic, global economic slowdown in 2019 where carbon emissions did not fall in spite of a situation of slackening demand coalesces with many other issues such as increasing authoritarianism, inequality and weakening of environmental laws, to set the stage. The chapter discusses wide-ranging economic, political, social and environmental impacts attributable to the pandemic, subsequent control measures and the policies introduced by different countries, leading to a discussion on possible futures. The economic impacts in relation to output, jobs, investment and stock markets, social implications of the pandemic and social distancing measures, impacts on human behaviour and mental health, and various monetary and fiscal policy actions undertaken by different countries, especially the policy responses in China, USA and India are presented in some detail. In particular, the positive and negative impacts on the environment are elaborated upon. The lessons for society as we live through the pandemic are mapped, and the possible alternative futures that can emerge are discussed. The lessons include reducing the ecological footprint and consumerism, improving policy responses, global sharing of innovations, technological developments, access to affordable education and health care, and the need for transcending entrenched identities. In terms of the future, three options are presented: business-as-usual as though the pandemic had not occurred; a taking over by authoritarian regimes; and the evolution of a more sustainable system. What will the future be? In the wise words of the author: “It is for us as citizens to decide how much we assert our agency, communicate with one another, and restart the world”.

Amitabh Kundu’s paper on “Identification of Urban Centres for Conducting Population Census; Need for Combining GIS with Socio-economic Data” is a combination of rigorous empirical analysis and an adept review of the conceptual issues involved in identification of urban centres and determining their boundaries. A renowned expert on urbanisation, the author brings his experience to bear in taking a critical look at the prevailing procedures of distinguishing urban centres from rural areas (and related terms), proposes new approach for a real classification and details out an interesting operational methodology to address the current deficiencies in the system, followed in South Asian countries in conducting their population census. The chapter provides insights into the current international practices with respect to the
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Definition of urban areas and criteria used for areal classification globally, with focus on South Asian countries (Sri Lanka, Pakistan, Bangladesh and India). An examination of the methodologies used by global institutions for delimiting urban centres’ boundaries and estimating urban population—OECD methods, the framework used in World Development Report and the e-Geopolis project—reveals the importance of combining the GIS data with socio-economic statistics obtained through census, survey or administrative records for capturing the dynamics of recent developments. It demonstrates the relevance of the GIS data, illustrating how existing census procedures fail in including settlements having high current population density and expanding built-up areas within the urban frame. The fourfold criteria proposed for areal classification are based on a selection of a few from a range of demographic and socio-economic indicators and combining these with information built through satellite imagery. The method proposed is illustrated with a case study of Sri Lanka, comparing results with their official estimates. The chapter makes a valuable contribution by integrating the GIS technology with socio-economic data and highlights how existing estimates of urban population would change as a result of the new approach, as practised in a few countries.

“Competition, Technology, Innovation and Exports: Contemporary Theoretical Insights” by Sugata Marjit, Suryaprakash Mishra and Moushakhi Ray is an important contribution to this book as it brings to the fore key enduring and emerging issues of relevance for economic development in India. This scholarly contribution bears the imprint of Marjit’s exceptional achievements in the field and provides an invaluable, updated review of theoretical frameworks and critical understanding on the role of competition in innovation and export decisions, along with technology and financial factors. Topics covered include firms’ choice of collusion or competition and the role played by technology in this choice, innovation incentives and decisions by firms, the role of competition and technology on the export profitability of the firms, credit market and firm behaviour. Important insights are gained. Replacing constant marginal costs with increasing marginal costs in models for behaviour of firms has important implications for market structure and welfare outcomes and on firms’ innovation and export decisions. The inclusion of financial factors in an explicit manner when looking at export decisions of firms facing credit constraints is another key consideration. Expansion of smaller firms is hampered by finance cost constraints, while these very constraints support domination by the larger firms. In conclusion, the authors state that “the assumption of credit market perfection and linear costs both have deterred a healthy growth of the literature in trade and industrial organization”.

The pursuit of economic growth is considered critical for eradicating poverty and undertaking redistributive measures for addressing inequality concerns (SDGs 1 and 10). Managing inflation, especially food inflation, lies at the core of strategies designed to end hunger and achieve food and nutrition security (SDG 2). Ananya G. Dastidar and Kajleen Kaur make a meaningful contribution as they seek to evaluate the performance of monetary policy in terms of its effectiveness in influencing the rate of economic growth and controlling inflation for India in their essay titled
“An Evaluation of Monetary Policy in India: A Sustainable Development Perspective”. The authors take up an interesting issue that has a wide-ranging appeal in the current context. The ongoing COVID-19 pandemic poses unprecedented challenges in achieving the SDGs, especially in mitigating poverty, inequality and ensuring food and nutrition security. The massive socio-economic disruptions caused by the pandemic across the world have adversely affected the functioning of the economic systems, increased volatility in financial systems owing to greater risks and uncertainties, and impacted the access to essential goods and services. They review the various transmission channels for the monetary policy in terms of their effectiveness for the Indian economy. On the basis of an extensive literature review, they conclude that there has been relative importance of the interest rate and credit channels, while asset price and exchange rate channels seem to appear relatively ineffective in affecting aggregate output in the post-liberalisation period. The chapter underscores the relevance of supporting institutions and of business and consumer confidence in influencing the level of consumption, private investments and job creation through monetary policy. In the advent of the global financial crisis, it is observed that the advanced economies seem to be using the policy rate to stabilise the output gap, whereas, in the emerging economies, it is the stabilisation of headline inflation, especially food inflation that seems to be a central concern. The chapter explores the prospects of monetary policy during the ongoing pandemic in stabilising the Indian growth momentum and combatting the severity of a potential recession and overcoming the adverse impact on well-being. The authors also emphasise the need for further research to inform the policy debate in this regard.

3.2 The Energy Scenario: Dilemmas and Opportunities

It is crucial to develop an understanding of the reform process that has been underway for this vital sector of the economy since the 1990s and to explore its key achievements such as the reforms in the power sector and gains from energy efficiency. The electrification of households and meeting their cooking energy needs through clean fuels is a pressing need. In the context of increasing mechanisation and intensity of resource use, sustainability of the agricultural sector is inextricably linked to the fostering of green growth. Further, the unprecedented crises that have unfolded in the wake of the COVID-19 pandemic have far-reaching implications for the business environment as well as the smooth functioning of the energy sector owing to the globally integrated energy markets. It is crucial that the vulnerability of the institutions such as energy markets should be assessed for making them resilient.

In an enquiry into the journey of the power sector reforms, Somit Dasgupta presents an insightful discussion on its evolution over time and the architecture behind this process in the chapter titled “The Genesis of Electricity Reforms in India and the UK, Its Repercussions and the Way Forward”. The Indian power sector came down to almost a dead end in the 1980s with huge losses incurred by the state electricity boards. This justified the initiation of the reform process in the 1990s. It
involved several amendments to the electricity laws, tweaking the role of the Central Electricity Authority and a Common Minimum National Action Plan for Power in the first phase of reforms. Subsequently, the second phase witnessed a couple of acts such as the Electricity Regulatory Commissions Act, 1998, and the Electricity Act, 2003. The author has made a comparison between India and the UK in the power sector restructuring programme with specific reference to competition. The major features of the latter include the unbundling of the utilities, separation of distribution and retail, the introduction of retail competition, creation of a power pool, initiation of contract for differences and the introduction of the New Electricity Trading Arrangement. The author brings his considerable experience and knowledge of the sector to opine that the Indian restructuring programme has been one of mere unbundling into separate entities which failed to make any material difference in terms of efficiency and growth. The chapter contains a description of how the power sector performed in India after restructuring was done and the contribution of the regulatory bodies in this process. The regulatory bodies have not been adequately proactive as in the case of the UK and have degenerated into passive organisations doing the government’s bidding. The author suggests a way forward to improve the functioning of the distribution sector, and the recommendation is one of privatisation of the distribution companies. It is strongly felt that the public-owned discoms can never deliver efficiently due to the lack of accountability which gets further complicated on account of government interference. Therefore, competition and privatisation of distribution are keys to success, along with the simultaneous creation of markets for both generation and retail, along with the strengthening of our regulatory institutions.

Different states responded to the national policy reform agenda differently and evolved policies to suit their local economic and sociopolitical conditions. The political climate and institutional structures prevailing in the states play a crucial role in the effectiveness and success of the implementation of national policies. Md. Zakaria Siddiqui skilfully weaves varying institutional dimensions in presenting the case of the electricity sector reforms in the Indian state of Bihar in his essay titled “Embed- dedness of Economic Reforms in Regional Political Climate: A Case of Delayed Reforms in Bihar’s Electricity Sector”. The story of Bihar’s power sector performance can be characterised by two significant factors, namely change in the government and bifurcation of the state. The previous political regime is known to have practised a well-articulated strategy of “state incapacity by design”. It is interesting to note that this state-motivated destruction of public sector is deeply rooted in caste politics, a dominant social institution in Bihar. Since the public sector bureaucracy was dominated by the so-called upper caste officials, a political party that represents the marginalised poor found it suitable to paralyse the bastion of the privileged, the economic cost of which became very high. Uninterrupted power supply became a luxury commodity for the people in the wake of systemic failure of the power sector. The scenario changed with a change in the political climate when the incumbent head of the state took up the electricity sector reforms with high priority. Several measures have been taken so far in the spirit of good regulatory governance. The electricity sector of Bihar ventured into the expansion of network and consumers, designated
critical role of the holding companies after unbundling, introduced a pool of distribution franchisees, outsourced the process of revenue collection and so on. On the one hand, subsidies have been provided to retain the domestic consumers, and financial resources have been made available at opportune time on the other. Several organisational changes and coordination between political and executive leadership have led to a remarkably better performance of the sector. Use of renewable resources has been given a boost as part of a larger national and global agenda. The recent records of the power sector are a welcome change, though delayed, in the history of the state.

Energy-efficient behaviour is a vital strategy in a carbon-constrained world for decoupling the process of economic growth from energy use and achieving sustainable energy use. In the context of developing economies, there arises a need for suitable policy interventions for promoting such behaviour and thereby ensuring concerted efforts towards bridging the energy efficiency gap. Efficient energy consumption behaviour across economic sectors would be instrumental in reducing the energy intensity of the gross domestic product and can also contribute to climate goals. Sangeeta Bansal and M. Rahul present a focussed and well-balanced discussion on the various policy measures that have been adopted by the government of India to promote energy efficiency across energy-consuming sectors in their chapter “Towards an Energy-Efficient Economy: Policy Measures by Government of India”. They attempt an interesting expert assessment of the energy efficiency programmes and policies and the choice of economic instruments resorted to in bridging the energy efficiency gap for the Indian economy. The institutional framework for energy efficiency in India is based on the Energy Conservation Act, 2001, subsequently amended in the year 2010, which led to the creation of the Bureau of Energy Efficiency (BEE). Several programmes have been initiated by the BEE covering a wide range of sectors (namely households, buildings, electrical appliances, demand-side management in agriculture and municipalities, as well as micro, small and medium enterprises and large industries), and set of economic instruments adopted includes subsidies, standards and labelling, cap and trade scheme as well as information dissemination programmes. They report that as per the official estimates, the total cost savings and CO₂ emission reduction achieved in India through the implementation of energy efficiency schemes stood at Rs.53,000 crores and 108.28 million tonnes (MT) in 2017–18 and that increased to a level of Rs.89122 crores and 151.74 MT, respectively, for 2018–19. Further, based on an extensive literature review of studies assessing the efficacy of India’s energy efficiency schemes, the authors make interesting policy suggestions in this regard for the times ahead.

Access to affordable clean energy is one of the announced goals of sustainable development (SDG 7). Lack of adequate, affordable and clean energy services often lead the households to vicious cycles of deprivation, lower-income and unhealthy living conditions. The use of the modern forms of energy is essential to eradicate poverty, improve the economic condition, generate employment opportunities and promote sustainable human development. Although there has been a significant increase in the use of clean fuels for cooking in recent years, a large part of rural India is continuing with the use of unclean fuels like biomass (fuelwood, dung cake, etc.) and kerosene in their households. Chetana Chaudhuri uses statistical inference
techniques to investigate whether the households are actually climbing the energy ladder by switching fuels or are they stacking multiple fuels despite an access to clean energy “Climbing Energy Ladder or Fuel Stacking in Indian Households: A Multinomial Logit Approach”. The study finds that rural households often stack multiple fuels and do not switch completely to cleaner fuels. Such choices are based on a multitude of considerations, such as affordability, accessibility, monthly per capita expenditure and ownership of cultivable land on the one hand and several socio-economic conditions on the other. Some interesting insights are presented. Family size, occupational category, social groups such as caste and religion, age, gender and educational level of the heads of the households are some of the determining social factors in the rural sector. On the other hand, rich households in urban areas tend to use cleaner fuels such as LPG and kerosene, while poor households rely mostly on the traditional forms of energy. The energy ladder is more observable in the urban areas where the household shifts from unclean fuels to clean fuels with increases in income and standard of living. Biomass is considered to be a polluting fuel because of the associated risk of indoor pollution. Chaudhuri recommends greater use of biomass in the long run in view of its renewable and biodegradable nature. The use of biomass can be promoted through use in pollution-less devices and technologies, such as biomass briquettes, biogas and improved chullahs. Necessary infrastructure, proper maintenance and lowered capital cost of installation can make this fuel option commercially viable and economically attractive, over and above being an environmentally sustainable option.

Manoj Bhatt and Surya Bhushan have examined an extremely relevant concern, namely the intensity of energy usage in the agricultural sector in various states of India in the post-WTO period. The picture sketched in the investigation titled “Understanding Energy Use in Indian Agricultural Production System in Post-WTO Period” demonstrates that spatial and temporal distributions of agricultural productivity vary markedly across the Indian states. The post-reform and post-WTO decade of the 2000s have been unprecedented for Indian agriculture. On the one hand, the sector recorded 3.8% annual growth in value-added since 2004–05 which is the highest since 1950–51. On the other hand, the absolute number of cultivators and agricultural labourers started to fall for the first time in the history of Indian agriculture. The challenges of sustaining food security and promoting growth seem more difficult now than in the past. Sustainable production in agriculture is facing challenges with a decline in the quality of land and water. Moreover, Indian agriculture has undergone some structural shifts in terms of the composition of the input-output mix, such as energy, labour and so on. Human labour, animal labour and electricity are important inputs to agricultural production. Recently, there have been significant changes in farm power availability. There has been a rise in the use of electricity and fossil energy accompanied by a decline in that of agricultural workers and draught animals. Differences in agriculture and infrastructure are the largest sources of inequality among the various regions of India. Further, the results indicate that the highly productive states have seen a negative response of animal labour and chemical fertiliser use in food grain production. Despite some significant changes in the overall structure and intensity of energy consumption in Indian agriculture in the last ten years, the
regional disparity persists across the Indian states. The authors’ intensive analytical discourse concludes that there is a greater need for introducing technological change involving energy-efficient farm machinery, electricity and human labour. Additionally, initiatives must be taken for promoting alternative renewable sources of energy involving technologies, institutions and policy measures.

Kaushik Ranjan Bandyopadhyay analyses with qualitative acumen the impact of the novel coronavirus disease on the global oil market in the chapter titled “COVID-19 and the Big Oil Price Crash: Exploring the Anatomy”. COVID-19 has affected the world in several ways ranging from ecology and environment to multiple sectors of the economy. The oil market is one such area that witnessed a big price crash during the periods of worldwide lockdown. Crude oil prices have fallen drastically since the beginning of 2020 driven by the lethal economic contraction caused by the pandemic. The suspension of an OPEC-NOPEC (OPEC+) deal due to the defection of the Russians and the eventual price war waged by Saudi Arabia led to a protracted disequilibrium and volatility in the world oil market. Several energy companies turned bankrupt, and the so-called American energy dominance got battered. This resulted in huge job losses and weakening of the financial institutions that have been backing these industries. The coupling of unprecedented demand and supply shocks tested the oil market and its storage capacity to the limits. The current chapter offers scrutiny of such issues and imbalances that have been building in the system dynamics of oil markets. There was a serious crisis of physical storage capacity to park the excess global oil supply, leading to upward pressure on land storage costs worldwide and raising the rate of crude oil maritime shipping. The escalating glut of oil made global storage capacity (onshore plus offshore) gradually reach its limits and created more volatility in the market. Bandyopadhyay, in his discourse on this topical issue, is apprehensive about the possibility of a return to “normal” for the energy sector that has been bruised by the historically steepest slide in crude prices. With the emerging trends of “work from home” under the “new normal”, the oil demand from the transport sector and energy demand from the offices for cooling and heating purposes may remain low. As a result, the volatility of the oil sector may continue for a long time.

3.3 Sustainability Cross-Cuts: Developmental Aspects

One of the central themes in the pursuit of sustainable development is to ensure the co-evolution of the human systems and the natural systems over time and space while promoting resilience, stability and diversity. In the context of economic systems, this implies fulfilling development objectives while maintaining social cohesion. On the environmental front, it involves putting in place an efficient governance system facilitating the sustenance of the productive capacity of the economy (inclusive of its natural capital base) while addressing the conflicts between the ecological and economic sectors.
Ecological limits threatening human existence and economic prosperity are the reality of the twenty-first century. With the growing realisation of the possible limits to growth, Sustainable Development Goal 12 spells out a target of ensuring sustainable consumption and production patterns, thereby laying down the path towards a sustainable economy. Globally, the concept of circular economy (CE) is being propounded as an effective means of ensuring sustainable consumption, production and waste management patterns for the future. This can potentially foster the preservation of the natural resource base by ensuring optimum resource utilisation, waste management and minimisation of the negative environmental externalities caused by anthropogenic action. In this context, Robin Singhal presents an in-depth review of the conceptual foundations of the CE as a “Recourse to the Circular Economy: The Path Ahead”. This is based on the idea that the economy is a closed and circular system, subject to natural boundaries and circular interlinkages. It becomes a sustainable system, wherein wastes generated get recycled, just as in the case of the natural systems. He further analyses the scope and methodological framework of CE in terms of its interlinkages with other fields such as industrial ecology and ecological economics. However, Singhal feels that the critical third dimension of sustainable development, namely social sustainability, remains lacking in these integrations while economic and environmental dimensions are resorted to in terms of linkages. Finally, the author has critically evaluated the recent initiatives taken by the Government of India towards the adoption of resource efficiency and circular economy. Putting forth an economic perspective towards CE, he has highlighted some thought-provoking potential hindrances in its mainstreaming from the point of view of the economic methodology followed in the neoclassical tradition of environmental and resource economics. The author concludes that there is an urgent need to move beyond the techno-centric and business-oriented understanding of CE to a framework that attempts to integrate the socio-economic realities and development priorities of the developing nations. The governments will have to carefully handle the trade-offs involved in public policy interventions, business environment and social acceptance during the intervening transition phase.

While coal has great economic significance, it has major environmental externalities and adverse health impacts. Ambient air pollution originating in the coal mining areas impacts the environment and economy severely in the form of health externalities. Longer exposure to air pollution leads to high morbidity, increased respiratory illness, asthma, high blood pressure, reduced lung functions, heart diseases and many more. The global economic cost of air pollution has been estimated to be approximately 3.3% of the world’s GDP and the estimated costs of ambient air pollution alone accounted for 5.4% of India’s GDP in 2018. In the chapter titled “Ambient Air Pollution and Respiratory Illness: A Study in Opencast Coal Mining Region of Odisha”, Indrani Roy Chowdhury, along with her co-authors, Anushree Paul and Tapaswini Nayak argue convincingly that the economic cost is underestimated, as pollution hazards in many mining infested remote corners of India are left unaccounted in the estimation. The mining regions of India, mostly located in the vast tracts of remote forests inhabited by the marginalised tribal people, face the greatest environmental externalities and adverse health impacts. The authors have studied the
pattern of concentration of ambient air pollution in the open cast coal mining region of Mahanadi Coal Fields (MCL), Angul-Talcher in Odisha and the associated vulnerability of the people living in the proximity of the mining region towards respiratory illness (RI). It has been observed that the probability of self-reported RI episodes is negatively affected by the distance to mine, and is positively affected by seasonality, socio-economic parameters, health indicators and demographic determinants. The study further examines the determinants of the mitigating expenditure on RI undertaken by the people in the vicinity of the mining region. Health expenditure incurred on RI was found to be determined by the incidence and/or severity of RI, proximity to healthcare facilities and the overall health status. These findings provide some policy relevant insights into the adverse health externalities of open cast mining that are often ignored behind the obvious positive economic impacts of mining in developing countries characterised by laxer environmental regulations, weak institutions and disorganised civil societies.

K. S. Kavi Kumar in the chapter “Rice Production Systems and Drought Resilience in India” investigates the resilience of the rice production system in India with respect to the derived stressors of climate change such as drought. Using a district-level data set covering more than 300 districts spread across 20 Indian states over five decades, the study empirically investigates the extent of the impact of different drought conditions on rice yield and assesses the role of irrigation facilities in reducing such vulnerabilities. One of the deleterious effects of climate change is expected to unfold in the case of the agricultural sector having far-reaching implications for the human economy. Despite a declining trend in the contribution of the agriculture sector to the nation’s gross domestic product, the vulnerabilities of food systems in the context of developing economies such as India are bound to have adverse socio-economic implications. A large percentage of the total workforce still depends upon this sector for their livelihood, and the resilience of this sector in the wake of climate change holds critical importance for several of the public programmes aimed at the attainment of the Sustainable Development Goals such as eradicating poverty (SDG 1), ensuring food security (SDG 2) and reducing inequalities (SDG 10). With his substantial expertise and experience in climate change-related policy issues in agriculture, Kavi Kumar finds that the rice yield has shown resilience to drought conditions across India but observes significant regional disparities. Also, the role of irrigation in ameliorating the adverse effects remains limited to the low and moderate drought conditions compared to severe droughts. It further underscores the need for augmenting farm management strategies as an effective means for dealing with severe droughts and emphasises the promotion of technology adoption through concerted efforts in the times ahead.

In the chapter titled “Water Disputes in the Cauvery and the Teesta Basins: Confictual Federalism, Food Security, and Reductionist Hydrology”, Nilanjan Ghosh and Sayanangshu Modak postulate that the water conflicts in India are essentially the results of three major policy-driven factors. These include the federal structure of the nation where water has been made part of the state list, the wrong delineation of the food security policy with food security being viewed through the lens of production and procurement of high water-consuming crops like rice and wheat, and
finally the lack of an integrated ecosystem approach to understand the land–water–food nexus in the water policy of the nation. Management of natural resources is a major exercise in governance and that of the “fugitive” resource water is particularly complex because of its transboundary nature. The recent definition of transboundary waters incorporates waters crossing boundaries of any form, ranging from the international level to the most micro-level of the society including the sectoral boundaries. In fact, the most recent form of transboundary water conflicts occurs between the economic sector and the ecosystem sector, as human interventions over flow regimes for meeting short-term economic needs result in substantial losses for downstream ecosystems. Despite the imminent rationale and the traditional understanding that river basins are the ideal natural units for planning and management of surface water resources, there has been an equally dominant idea and evidence of fragmenting the basins for governance based on jurisdictions that were human-centric and solely focussed on the reductionist view of water as a stock of resource. The arguments have been elaborated in this paper with expositions from two transboundary water conflicts, namely the interstate water conflicts over River Cauvery involving Tamil Nadu, Karnataka, Kerala and Puducherry and the conflicts over River Teesta at various levels, such as Bangladesh–India, centre–state and economy-ecosystem. Nilanjan Ghosh partners with his co-author, to bring to bear his substantial experience with water governance and policy in arguing for a paradigm change from the reductionist approach to a holistic approach towards water governance, embedded in the emerging thinking of Integrated Water Resource Governance at a basin scale.

Meeta Keswani Mehra, Saptarshi Mukherjee, Gaurav Bhattacharya and Sk. Md. Azharuddin in their chapter “Renewable Energy in India: What It Means for the Economy and Jobs” conduct a very relevant and contextual empirical investigation of the linkages between important macroeconomic and demographic variables with renewable energy deployment in India covering the period from 1990 to 2016. The transformation and adaptation of energy system is one of the essential prerequisites in realising sustainable development goals. It is believed that the mainstreaming of renewable energy sources and technologies would not only yield environmental benefits but also their increased deployment would have stronger backward and forward linkages comparable to fossil energy for an economy. The purpose of the study is to explore both the long-run association between renewable energy deployment and major macroeconomic variables and developing an understanding of the potential short- to medium-term economic implications of the ongoing COVID-19 pandemic, along with capturing the overall energy transitions in India. The future projections of renewable energy generation and associated capacity and job creation are made for the period up to 2042 under three different scenarios, namely business-as-usual (i.e. continuation of the past trends and policies with no significant structural breaks), pessimistic scenario (a situation wherein all the key driving macroeconomic variables move in a manner in future years such that they adversely affect renewable energy diffusion) and an optimistic scenario (wherein the movement of the driving variables is such that these encourage a higher growth of renewable energy than the business-as-usual scenario). The analytical framing leads them to some interesting and policy relevant findings. The authors suggest that on the one hand factors such as a higher
economic growth rate, a higher return on investment and a more remunerative tariff
structure for renewable energy would expedite the deployment of renewable energy,
while on the other hand, factors such as a higher fiscal deficit, higher subsidies to
fossil energy and energy imports will retard the pace of its diffusion in the country.
Given that a higher population level or higher energy access could imply greater
reliance on fossil energy vis-à-vis renewable energy, there arises a need for a greater
policy push for switching to renewable energy.

3.4 Externality Empirics: Knowledge and Practice

One way of considering economic growth and its resultant ecological threats is to
adjust the estimates of the standard economic indicators for the impact on the natural
environment given its role as a source and a sink. The true macroeconomic scenario
can be understood only with adequate knowledge about the country’s resource base
and the condition of the associated ecosystem services. There is also a definite need
for pro-environmental behaviour at the community level with regard to their decisions
on production and consumption. Individual behaviour and community action must
be based on the requisite knowledge about the concerned environmental issues, often
supported by beliefs, instincts and sensitivity. In a world ridden with the uncertainty of
outcomes, particularly in cases of environmental shocks and health issues, people rely
on causal inferences for taking decisions about their actions. Everyday environmental
problems, such as pollution, need to be analysed in a larger framework where socio-
economic parameters indicate the true nature of people’s short-term concerns and
long-lasting impacts on health and overall existence on the planet. Appropriate poli-
cies for enhancing people’s awareness, changing lifestyles and encouraging collective
action can help combat environmental challenges and show the pathway towards a
sustainable world. Science, state and society need to play a coordinated role in this
regard.

In the chapter titled “Embracing Natural Resource Accounting in India: Some
Reflections”, Shalini Saksena discusses the limited scope and coverage of national
accounts based on SNA and the conceptual framework and scope of the System of
Integrated Environmental and Economic Accounting (SEEA). With the rising levels
of production and consumption, recent economic growth is pushing the ecosystems
towards their critical limits set by the availability of natural resources and environ-
mental services. There is a growing realisation in the global community about the
need to undertake prompt and effective measures to offset resource depletion and
environmental degradation in order to sustain long-term growth. This has led to the
search for appropriate indicators and accounting measures beyond the conventional
macroeconomic indicators of economic growth such as GDP or GDP per capita.
The conventional approach to the preparation of national accounts in most countries
is primarily based on the System of National Accounts (SNA). Over the years, the
accounting framework and methodology of SNA have been comprehensively updated
in view of the evolving environment–economy interactions and occurrence of new
phenomena in the world. However, SNA is conceptually based on the neoclassical market theory and it focusses on the key indicators that are based mostly on short-run Keynesian macro-models and not on any long-run growth theory and/or models. The SNA seems to be inadequate for obtaining information on the various determinants of growth and for measuring a country’s sustainable development appropriately. Sustainability analyses require mainstreaming of a system of natural resource accounting that integrates information on the environment–economy interactions. The SEEA, adopted by the UNSD in 2012, provides the conceptual framework for understanding such interactions. This first international statistical standard for environmental–economic accounting framework along with its standardised methodology serves as a ready reckoner for countries trying to mainstream natural resource accounting. In this comprehensive and well-researched chapter, Saksena argues that widespread adoption of SEEA has the potential to support critical global initiatives such as the monitoring of SDG indicators, the post-2020 biodiversity agenda and the international climate policy. The Indian narrative on the initiatives by the government towards mainstreaming of natural resource accounting has also been critically evaluated by the author which she feels has been sporadic, albeit noteworthy and encouraging.

Anindita Roy Saha and Nawin Kumar Tiwary in their chapter “Environment and People: Reflections on Perception, Education and Behaviour” bring in fresh thinking on emphasising the need for incorporating social norms, competitions, group dynamics and other key insights from behavioural economics within the framework of environmental policy for raising people’s environmental consciousness. In general, the pursuit of the goals of sustainable development calls for fundamental changes in the lifestyles and adopting pro-environmental behaviour in economic decision-making for affecting the much imperative transformation in the consumption patterns and production systems. Despite wide-ranging differences in the socio-economic indicators of well-being across countries and stark disparities in the standard of living within nations, the progress in traversing a path to sustainability as an international development agenda requires a reorientation of the people’s value system to live in harmony with nature and curb their tendencies for wealth accumulation and consumerism at the expense of the natural environment. This necessitates concerted efforts towards raising environmental consciousness in general and imparting environmental education in particular. The authors argue that environmental consciousness is an outcome of specific psychological parameters or constructs related to an individual’s inclination to participate in pro-environmental behaviour. An individual’s pro-environmental behaviour can be strengthened in turn by general beliefs, certain attitudinal instincts and sensitivity that may be enriched by information, knowledge and training. In this regard, they convincingly highlight the role and importance of environmental education in ensuring both the enhancement of the discipline-specific environmental knowledge of students and facilitating the development of environmental thinking for realising sustainable development. Further, they carefully underscore the critical role played by major institutions such as educational institutions, family and public forums (such as media, non-governmental agencies and civil society organisations) in building a sustainable and resilient community
through the promotion of environmentally responsible behaviour on the one hand and enhancing the awareness and preparedness for disasters on the other. Against this backdrop, they also discuss interesting findings in the Indian context from a set of three studies carried out in the National Capital Territory (NCT) of Delhi to provide relevant insights into the perception, education and connectedness of the members of the civil society through curriculum, training and information.

In a captivating discussion on “Uncertainty and Causality in Public Policy: The Cases of Heart Disease and Climate Change”, Vikram Dayal uses the analytical framework of uncertainty and causality to examine cases of health issues, such as heart disease and climate change. Uncertainty is a key feature of the current world, and probability is the natural language of uncertainty. While considering the courses of action, uncertainty is faced along with some issues of causality. Causal inferences can provide the necessary information required for undertaking action. While causality is a law-like necessity, probability connotes exceptionality, doubt and lack of regularity. Expected utility in human action depends on both utility and probability, although the latter may be hard to assess. An economic framework that considers well-being over time points to the importance of an assessment of the physical impacts and the importance of the uncertainty of such impacts. Decisions about treatment for disease and combating climate change involve a deep structural uncertainty about what may go wrong and what potential damages are possible for the patient and the planet, respectively. Causal inference may inform us about both and thus help in making calculations that precede our actions. The author skilfully weaves into the narrative that while causality has a key role to play, there may be other factors, such as beliefs, communications and literacy that are crucial behind personal assessment and action. People may have good intuitive knowledge, beliefs and opinions instead of clear evidence and information. All these may be instrumental in creating a knowledge base, necessary for policy design, people’s action and collective response to the uncertain events. Conditional probability, availability of knowledge, effective communication and people’s perception can help take action in cases such as heart disease as well as climate change. Decisions to change lifestyle, prevent damage, reduce risk and delay action depend on the understanding of the complex issues pertaining to health threats and environmental challenges.

The study titled “Unbundling Air Pollution Concerns: A Closer Look at Socio-economic Factors” by Purnamita Dasgupta and Kavitha Srikanth examines the importance of considering socio-economic characteristics in managing air pollution. Air pollution has several adverse impacts on human health, labour productivity and agricultural yield and reduces profits to employers and businesses. It is a matter of great concern in India as it has increased in severity and spread over the last couple of decades, with several cities experiencing poor air quality for several months in the year. Particulate matter concentrations frequently exceed the National Ambient Air Quality Standards. Pollutant concentrations vary substantially in terms of the type of pollutant, geographical topography, meteorological conditions, natural capital endowments, transboundary conditions, demographic features and socio-economic characteristics. Consequently, states and cities in India are not similarly positioned
to handle mitigation of air pollution. The authors examine the empirical relationship between air pollution and variables such as income, urbanisation, industrialisation, energy consumption, social development and green cover. Tackling pollution effectively depends on a host of interdependent factors, and engaging with both the supply and demand sides is critical. The drivers of change could be technological, social or economic in nature. The findings suggest that socio-economic determinants need to be explicitly accounted for and demand-side measures derived thereby tailored to deal with specific underlying economic causes at the state (or city) level, where decisions on economic activities and public sector resource allocations are taken. The authors also indicate that there is huge potential to tap into the synergies between air pollution reduction and climate mitigation, which holds across the spectrum of states covered in the analysis. The insights drawn from the paper make an important contribution to widen the analytical framework of the climate change discourse as well as in putting forth a more nuanced understanding to the current measures being considered to tackle pollution such as the National Clean Air Programme.

Given the laws of thermodynamics, it is argued that the negative externalities are not an exception rather in fact an inherent and general part of the production and consumption process. Consequently, the internalisation of such external costs remains fundamental to the realisation of sustainable production. The conventional production modelling approach, however, assumes free disposability of bad outputs similar to the free disposability of desired outputs and inputs. This assumption is untenable in the scenario where the scale and nature of anthropogenic activities across the world are being held accountable for the climate disturbances and threatening ecological order. Surender Kumar in the chapter “Modelling Production of Bad Outputs: Theory and Empirics” focusses on the issue of modelling bad or unintended outputs from the production process within the domain of applied production analysis and questions the conventional modelling approach given their assumption of free disposability of bad outputs and consequently the treatment of bad outputs as conventional inputs in the production modelling. He presents a salient discussion around the notion of weak disposability and costly disposability that has served as the basis of different production modelling approaches to account for bad outputs—joint production approach and by-production approach, respectively. Besides providing a comprehensive review of empirical techniques for the estimation of technology functions, this chapter further presents an insightful discussion on the estimation of shadow prices of bad outputs (such as carbon emissions) along with the productivity and efficiency estimates for the Indian thermal power sector. Such empirical applications of the modelling of bad output framework in turn reflect that it not only provides reliable estimates of the production processes but can also provides useful information on various public policy parameters for designing incentive-compatible environmental policy.
4 Concluding Remarks

The present collection of essays brings together central themes and key issues in the sustainable development discourse, of special significance in the developing country context. While no single book on the topic of sustainability can hope to be exhaustive in its coverage, the chapters in this collection present a fair mix of diversity and inclusivity of subjects. Sustainability will perhaps remain one of the largest challenges for humankind, and many attempts to push the boundaries of knowledge will continue. Scholarly contributions, practitioners’ experiences and behavioural change from stakeholders will chart the path towards our common sustainable future. In this context, the discussions put forth are a combination of certain theoretical aspects and empirical findings on sustainable development for the Indian economy. This volume is a contribution to the ongoing and enduring journey of academic debate in sustainability and economic development with an understanding that the twenty-first century dawned on India with the highest growth rate being experienced since independence. However, there is an urgent need for her to adhere to the goals of attaining economic efficiency and equity while subscribing to the notions of sustainability. At the times, when the world is coming to terms with the increasing episodes of feedback impacts from the natural environment on the human systems, it becomes necessary to traverse a path of economic progress and prosperity in a sustainable manner. The contributions in this volume, thus, are a humble attempt to put forth thoughtful considerations deeply rooted in the socio-economic complexities and understanding embedded in the institutional environment of the world’s largest democracy that conditions her pursuit of the sustainable development agenda.

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