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Growth and
Human Development in
North-East India

edited by **P. NAYAK**

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Preface

It took centuries to realize that people are the real wealth of a nation. They produce goods and services for their own welfare. The development and growth of a nation depends upon the proper utilization of natural and cultural endowments available to it. To utilize these endowments, human participation is required. Human participation, on a sustained and autonomous basis, cannot be expected without enhancement in the capability of the population. Thus, self-sustained growth cannot be ensured without human development. Further, since the basic objective of development of a nation is to improve the well-being of the people, every nation strives hard, not only to increase her wealth and productive resources, but also to ensure a better standard of living for its citizens by providing them with adequate food, clothing, housing, medical facilities, education, etc. In fact, governments of various nations, at different levels, take the initiative to create an enabling environment for their people to enjoy healthy, long, and creative lives. However, technical considerations of the means to achieve human development and the use of statistical aggregates to measure national income and its growth have, at times, obscured the fact that the primary objective of development is to benefit the people. Of course, people want higher incomes as one of their options, but income is not the aggregate of human life and, hence, not an end in itself.

The human development approach of looking at development differs from conventional approaches to economic growth, human capital formation, human resource development, human welfare, and basic human needs. Gross National Product (GNP) growth is treated as being necessary but not sufficient for human development. Human

progress may be lacking in some societies despite rapid GNP growth unless some additional steps are undertaken to improve the same. Human welfare approaches look at human beings more as beneficiaries of development processes than as participants in it. They emphasize only the distributive policies rather than production structures. Recent development experience has once again underlined the need for paying close attention to the link between economic growth and human development for a variety of reasons. Many fast-growing developing countries are discovering that their high GNP growth rates have failed to reduce the socio-economic deprivation of substantial sections of their population. Even industrial nations are realizing that high income is no protection against the rapid spread of such problems as drugs, alcoholism, AIDS, homelessness, violence, and the breakdown of family relations. At the same time, some low-income countries have demonstrated that it is possible to achieve high levels of human development if they skillfully use available means to expand basic human capabilities.

Human development also encompasses elements that constitute the critical issues of gender and development. There are four major elements in the concept of human development—productivity, equity, sustainability, and empowerment. People must be enabled to increase their productivity and to participate fully in the process of income generation and remunerative employment to achieve higher economic growth, which is a subset of human development models. Productivity is not the only means to achieve welfare in a society. People must have access to equal opportunities. All barriers to economic and political opportunities must be eliminated so that people can participate in and benefit from these opportunities. These benefits also need to be distributed over generations. Access to opportunities must be ensured, not only for the present generation but for future generations as well. All forms of capital such as physical, human, and environmental should be replenished. Besides, empowerment is a necessity. People must participate fully in the decision-making process that can shape their lives. Human development is impossible without gender equality. As long as women are excluded from the development process, development will remain weak and lopsided (UNDP 1995).

Development should increase peoples' choices. While enhancing the choices of one individual or a section of a society, it should not restrict the choices of another. It calls for equity in human relationships. It should not mortgage the choices of future generations while

improving the lives of the present generation (UNDP 1991). In other words, the development process must be sustainable.

Literature in this regard is vast and varied. It reveals that a large number of studies have been undertaken in India and abroad on various aspects of human development. While some literature dealt with concepts of human development, some have dealt with methods of measurement, construction of Human Development Index (HDI) for various states and sub-states, and for different sections of society. There have been numerous efforts over time to remedy the defects of traditional measures of development, and to create composite indicators that could serve either as complements or alternatives to this. There are studies relating to debates on the selection of variables to be included in HDI and weights to be assigned to different variables under consideration. While some studies dealt with disparities in human development between rural and urban areas and between males and females, some others concentrated on trends of human development. There are some studies that concentrated on finding the two-way relation between human development and economic growth of nations. Available evidence reveals interesting insights relating to the impact of economic growth on human development, and vice versa, with different time lags. Some scholars have also tried to examine the link between poverty and human development. The factors responsible for low levels of human development are also identified in some studies. While some authors prescribed increased allocation of resources on social sectors for improving human development, some others put emphasis on the aspects of implementation of programmes relating to social sector development. There are some authors who believe that high growth could lead to high human development, while some others opine for achieving high growth through the achievement of high human development. There are also some studies that argue in favour of a balanced path of development that combines the strategies of growth and human development with appropriate weights.

Since 1990, United Nations Development Programme (UNDP) has been publishing *Human Development Reports (HDRs)* at the global level for various nations and every year a report is published to this effect with emphasis on a different theme. The Planning Commission of India has also undertaken a similar exercise and has published the *National Human Development Report (NHDR)* for the years 1981, 1991, and 2001. The reports for the years 1981 and 1991 include data on HDI for all the states and union territories of India. But in the 2001

report, the index has been constructed only for fifteen major states due to non-availability of required data for smaller states, including the states in the North-East.

If we take a look at the *NHDR 2002*, we get some idea on the status of human development in the North-East, though data is somewhat dated. The report reveals that the region comprising the eight states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim (the last to be included in the region), and Tripura constitutes a land surface of 262,230 square kilometers with a population of 38.9 million belonging to different ethnic and cultural groups. Topographically, the region is a mixture of hills and plains. While Arunachal Pradesh, Meghalaya, Mizoram, Nagaland, and Sikkim are almost entirely hilly, about four-fifths of Assam is plains. Manipur and Tripura have both plains and hilly tracts. The hills account for about 70 per cent of the area and accommodate about 30 per cent of the population of the region while the plains, constituting the remaining 30 per cent area, hold about 70 per cent of its population. A wide variation in altitude coupled with abundance of rainfall has given rise to a wide variation in climatic conditions within the region, which in turn has endowed the region with rich biodiversity. The richness of biodiversity of the region is almost matched by its ethnic diversity. The region is a meeting place of large number of races, creeds, cultures, and languages. The impingement of the diversity of physical and cultural environment is naturally found in the organization of economic life of the people of the region.

Keeping all this in view, it was thought to bring out a volume on growth and human development for the region by inviting papers from academicians from within and outside the region. The present book is an outcome towards achieving that end. While every effort has been made to bring analysis and discussion on the issues of human development, touching upon various states in the region, the study is constrained due to non-inclusion of the newly included state, Sikkim. It must be borne in mind that although Sikkim has been included in the north-eastern region for administrative and developmental considerations, it is geographically non-contiguous to the rest of the states in the region. Its cultural background is much different from the other states. This sociological, cultural, and geographical difference gives a different character to Sikkim.

The book has been broadly divided into three sections on three different themes:

1. Concept and measurement issues;
2. The national scenario; and
3. The issues at the level of the north-eastern region.

The first section deals with the concept and measurement, and has three chapters. The first chapter titled 'Human Development: Concept and Measurement' contributed by the editor discusses in detail not only the evolution of the concept of human development but also its measurement. The author provides an account of change in the methods of measurement of human development proposed by UNDP, the Government of India, and individual academics.

The second chapter 'Concept of Human Development: A Critique' contributed by P.K. Chaubey, critically examines the literature on the concept of human development and its measurement. He points out that the motivation for UNDP, under the advice of Mahbub-ul-Haq, to bring out a report on human outcomes of economic, social, development, and welfare activities in the public, private, and other spheres in different countries emanated from the fact that wide failures were noticed in terms of reduction in poverty and infant mortality, enhancement in longevity, education, improvement in health, and the like. Contributions from economists like Amartya Sen, on capability approach as against the commodity approach, provided the right kind of theoretical support to define 'human development' in terms of enlarging people's choice through enhancement of capabilities. However, everything is not hunky dory with the idea of human development as it is too individualistic in approach, and shorn of communitarian ethos. Again, when it comes to measuring human development, it is not in terms of capabilities but in terms of attainment and performance, which is possible only when capability space interacts with commodity space. The author, in this connection, tries to delineate the history of evolution of the idea of human development and its contribution in shifting the focus of the development debate, and the weakness it inheres.

The third chapter 'Construction of an Index: A New Method' has been contributed by Sudhanshu K. Mishra. In this paper the author argues that composite indices are often constructed by a linear combination or weighted sum of indicator variables. While constructing indices, weights are either subjectively determined on the basis of expert opinion, or mathematically determined by the Principal

Components Analysis (PCA). By its very logic, such composite indices are elitist—assigning large weights to highly correlated variables and negligible weights to poorly correlated variables. The author proposes to construct a composite index by maximizing the sum of absolute correlation between the composite index and the indicator variables. In the first part of this chapter, the author shows that such a composite index is inclusive—duly weighting the poorly correlated variables. Thus, composite index does not undermine the importance of an indicator variable merely because it is not well correlated with others. In the later part of the paper, the author, by adopting the proposed method, has constructed HDI with equality in income distribution for 125 countries. The study reveals that while the traditional PCA assigns poor weight to the measure of income inequality, the proposed method ameliorates its position by assigning reasonable weight to it.

The second section of the book which deals with growth, human development, and other related issues at the all India level, has seven chapters. In this section, Saundarjya Borbora in the chapter titled 'Economic Growth and Human Development: Chain Relationship' discusses the relationship between economic growth and human development, and opines that they reinforce each other. He argues that development of social sectors, such as education, health, and good governance, is a major precondition for achieving economic growth with the help of effective government policy and appropriate public expenditure. This in turn would help the states to move above the threshold level in human development. He also admits that it is necessary to identify the weak links between growth and human development, and that appropriate policies are required to be formulated and implemented to strengthen the links; and that such policies must be dynamic in nature with changes in the development process. He suggests that in the early stages, priorities might be given to education and health, and at a later stage higher education, technology, and better health facilities might assume a greater role. He concludes by reiterating that the view of *grow first and worry about human development later* is not supported by evidence and, hence, focus on human development must be targeted at the beginning of the growth process.

Santanu Ray, in his chapter 'Transformation of Economic Growth to Human Development: A Long-Run Study of Indian States' states that the role of income growth in determining the level of human

well-being has become a topical issue in recent literature. Indian performance in this regard has been far from satisfactory. Using disaggregated data for the country over a long period of time, Ray examines the relationship between growth and human development. He also addresses the question whether the economic growth achieved by Indian states in the last three decades has any significant influence in determining the level of human development. Using the latest formulation of UNDP, he not only computes HDI for each of the major states of India, but also makes an analysis of HDI over time and across states. His study reveals that per capita income levels of Indian states play a positive role in determining the non-income component of human development in the long-run. He expresses his concern over huge regional variation in income levels and disparity in human development indicators across states.

The chapter titled 'Effect of Structural and Conditional Rigidities: A Case Study of a Poverty Reduction Programme' has been contributed jointly by Arindam Banik and Pradip K. Bhaumik. In their paper, the authors are very critical about the previous studies conducted on poverty reduction programmes, most of which concentrated on evaluation of the effectiveness of government interventions in meeting the stated programme objectives and targets, gaps between desired and actual targeting of beneficiaries, and adherence to programme guidelines. In their paper the authors have made an attempt to analyse the effect of structural and conditional rigidities, on moving a beneficiary of poverty reduction programme from passive to active state, with the help of micro-level field data comprising a fairly large sample of poor beneficiary artisans collected under SITRA programme. Using ordered logistic analysis, they have provided an analytical characterization of the beneficiaries in a situation of structural and conditional rigidity, where all beneficiaries do not move from a passive state to an active state and are able to take advantage of the government intervention despite their having access to the benefit. The authors view that identification of ageing artisans as beneficiaries of the programme might not bear much fruit as they are unlikely to become economically active due to their conditional rigidities. Therefore, they opine that a thorough understanding of the conditional and structural rigidities and their impact on economic behaviour of beneficiary artisans is required, which perhaps would go a long way in helping to design and implement poverty reduction programmes.

The chapter titled 'Public Distribution System: An Instrument for Improving Human Development' has been contributed by R. Gopinath. The author states that the PDS is a major component of public delivery system in India that started functioning during the 1930s and, subsequently, was replaced by the Targeted Public Distribution System (TPDS) in the 1990s. The programmes were mainly designed to play an important role in improving human development, particularly among the rural masses and the poor people. The paper revolves around the discussion on the loopholes in operational mechanism of both PDS and TPDS, and strongly argues for addressing the problems associated with their implementation.

Taking a careful look at the HDI estimates for the various districts in Orissa, P.K. Tripathy and Bhabagrahi Mishra, in the chapter 'Status of Human Development in Orissa', make a few intriguing observations. They point out that the districts of Kalahandi and Deogarh, two of the least developed districts by conventional yardsticks, turn out to be ranked as high HDI districts in the *HDR* of Orissa. Keeping this paradoxical result in mind, they raise some important questions on the suitability of the concept of HDI while assessing the economic status of a region. They observe that the implication of high literacy in developed economies is not the same as that in backward economies. In backward economies, mere literacy without employment opportunities neither turns out meaningful educational attainment nor estimated higher life expectancy, and that lower infant mortality reflects sound health conditions of the majority of the population in general, and agricultural labourers, marginal and small farmers, and poor artisans, in particular. In the light of the above observations, they argue that there is a need for inclusion of alternative variables for health, education, and standard of living in the index that can lead to a more realistic ranking of a region based on such indices. For example, a composite index of property ownership (land and other resources), per capita income obtained on the basis of income accrual method, and the average man days employed for the working population shall capture the standard of living index more accurately than mere per capita income. Similarly, education index could be a composite index of literacy as well as its linkage with employment opportunities and the health index as a composite index of anthropometric measurements and pattern of mortality.

The chapter 'Good Governance: The Force behind Human Development', contributed jointly by Ashutosh Dash and Paohulen

Kipgen, reveals that human development cannot just automatically happen without economic development. The authors argue that growth oriented economic progress alone cannot bring progressive human development without good governance which demands greater transparency. That is why social activists are increasingly paying attention to governance, both at the macro and micro level. The authors conclude by laying stress on the importance of governance in the process of human development.

The last chapter in the section, titled 'Politics of Human Development', has been contributed by Apurba K. Baruah. The author brings out the politics involved in the issues concerning human development. Citing the example of poverty, he explains that in Contemporary Development Theory, poverty has been basically reduced to an issue of measurement, and the important issue of the mechanism of its generation is often overlooked. He also pleads that the economic efficiency is in its top gear only when the state takes control. Whether the state controls or leaves the market in private hands is a matter of politics to which the nature of human development is inalienably connected.

The third section deals with the issues of human development in the context of North-East India and has fifteen chapters. M.P. Bezbaruah, in his chapter 'Socio-political Transition, Growth Trends, and Development Attainment in the North-East in the Post-Independence Period', reviews the development experience of the region in the context of its political-administrative transformation in the post-Independence period. He points out that development experience in the region has been mixed and uneven. While there are periods of high growth for individual states, the region as a whole has been increasingly lagging behind the country in terms of per capita income. He believes that the rapid post-liberalization growth of the country is a far cry for the region. While the recent service sector led growth of the country is propelled by expansion of frontier areas like information technology, public administration and other services are the faster growing services in the region. He argues for enhancement of the rate of economic growth in the region based on its inherent strength and endowed resource base. Though funds required for building up the necessary infrastructure to activate the inherent growth potential of the region are no longer a constraint, disruptions caused by insurgency and the *bundh* culture make deployment of such investments difficult and add to the cost of any business venture, reducing the competi-

tiveness and economic viability. However, he is optimistic about the future of the region in the globalized era.

The editor of the book, in the chapter titled 'Human Development in North-East India' highlights that India, in spite of pursuing the policy of liberalization and globalization since the early eighties and witnessing higher growth rates, has not been able to achieve much on account of human development and welfare in comparison to many countries at the global level. Human Development Index in the country was as low as 0.56 in 2001. While some states in the region have performed better than the national level, some others have lagged behind. Rural-urban disparity, gender disparity, and uneven human development across the states in the region are quite significant. The disturbing trend of increasing gender disparity in Nagaland and the escalating rural-urban gap, particularly in the states of Assam and Meghalaya, is a matter of concern. The author, while highlighting some of these issues, stresses on the urgent need for taking appropriate action in this regard.

Nirankar Srivastav analyses the poverty status in the region using three conventional measures of poverty in the chapter titled 'Severity of Poverty and Status of Public Services in North-Eastern States'. His study reveals that poverty, in most of the states in the region, has declined. It has declined more in the hill states and in urban areas. The access to public services is observed to be very poor in the poverty-stricken states. The author states that there is a positive and strong relationship between poverty levels and access to public services in the region and recommends a target-oriented and region-specific poverty reduction programme.

Bhagirathi Panda, in the chapter 'Economic Growth, Exclusion, and Human Development', studies the mismatch between economic growth and human development in the region using empirical data. He observes and apprehends that the region, which is witnessing continuous low economic growth accompanied by relatively high human development, is susceptible to social tension. This has to be overcome by promoting a policy of high economic growth by taking some concrete measures. He prescribes accelerating industrialization and putting emphasis on greater value addition. The author also identifies some of the obstacles to industrialization, such as poor physical infrastructure, lack of culture of genuine entrepreneurship, security deficit, and poor governance. He suggests that in order to overcome these hurdles the governments in the region should play a proactive

role along with developmental Non-Governmental Organizations (NGOs) and promote Self Help Groups (SHGs), their movement, and effective participation in development programmes. He also emphasizes the role of civil society, academia, and peer groups towards reorientation in the value-systems for inculcating a culture of entrepreneurship.

Biswambara Panda, in the chapter 'Non-Governmental Organizations and Participatory Development' analyses the approaches of the grassroot NGOs and their role in contributing towards participatory development in addressing issues relating to human development, with special reference to the North-East. The author argues that participatory development can ensure integrated development, where all sections of society would be involved and benefited. This would not only bring about economic growth but would also dissipate social inequality. The micro approaches along with people-centred development objectives can bring considerable dividend by resolving conflicts, avoiding programme uncertainties, and evolving synergy among the key actors of society. He further argues that though participatory development may not ensure development for all the people but it certainly creates confidence among them, and most importantly provides them opportunities to share their ideas and knowledge. He believes that a development plan, armed with indigenous practices and native wisdom, can accelerate the developmental process at the grassroots level. Though NGOs are not the only force within the civil society to work towards inclusive growth, they are certainly a force to reckon with in the development domain. They can inch towards this objective through (various) people-centred approaches and strategies despite so much of apprehensions on their accountability and sustainability.

The chapter 'Inter-District Disparities in Meghalaya: A Human Development Approach' contributed jointly by Purusottam Nayak and Santanu Ray highlights widespread variations in the magnitude of human development across all the seven districts and three hills regions representing three different ethnic tribal groups in the state, between rural and urban areas, and between male and female groups of population. The authors also show that there exists a significant level of disparity, both in income consumption and in non-income attainments, among these districts. The inequality in economic attainment (income, as well as consumption expenditure) happens to be very high. However, both measures of variation and inequality indices suggest that few non-

income indicators, namely intensity of formal education and infant mortality rates, have disparities over economic indicators, which, according to the authors, are indeed a cause of considerable concern. In addition, they observe that economic inequality is much higher than inequality in overall HDI. Keeping in view a huge shortfall in HDI, accompanied by the existing level of variation and disabilities, the authors feel the need for a redesign of public policies that directly affect the welfare of the people. The study also reveals that the improvement of human development in Meghalaya, on account of better performance in respect of some socio-economic indicators, has been neutralized because of its laggardness in respect of some other indicators over time.

The next chapter titled 'Does Micro Finance Bring Human Development?' contributed by A.P. Pati, explains the success stories of micro-finance through SHGs in different parts of the country and abroad. The author suggests ways for economic empowerment of women through micro finance in the region. However, he concludes by stating that micro finance endeavour in Meghalaya is still at the nascent stage to make any visible impact at the macro level, so as to measure its contribution in attaining higher human development.

P.S. Suresh and Biswambhara Mishra, in their chapter 'Public Expenditure and Human Development in North-East India: A Case Study of Meghalaya', point out that Meghalaya, in the last few decades, has been witnessing a paradoxical and explosive economic growth because of the mismatch between growth rates of state domestic product and public expenditure. Disproportionate growth of the social sector over the years has not only eaten up most of the public investment in the state, but also given rise to a weaker linkage among different sectors. The study explores the nature, extent, and the degree of interdependence between the level of public expenditure and human development with the aim of understanding the cause and effect relationship and the extent to which the public expenditure on social services gets transformed to the end result of a better level of human development. The study reveals that at the regional level there is a positive functional relationship between public expenditure on social sectors and human development. The authors conclude that per capita spending on education and health has a relatively stronger impact on human development than per capita income growth.

Kishor Singh Rajput in the chapter 'Antenatal Care, Institutional Delivery, and Human Development in Meghalaya' highlights some

of the facts and figures on mothers' health with special reference to institutional deliveries of the child. Further, using logistic regression, he examines the role of certain background variables of women like her education and the spouse, work status, place of residence, etc., along with the role of antenatal care on institutional delivery.

E. Bijoykumar Singh in 'Human Development in Manipur' states that in spite of having a low per capita income, the HDI of Manipur for 1981 and 1991 has been higher than most of the major Indian states. In his chapter, he makes an attempt to examine the change in HDI for the state in the post (economic) reform period with available indicators of development like Infant Mortality Rate (IMR), sex ratio, life expectancy at birth, and literacy rate. He also examines the quality of development through an analysis of data on structural change, occupational distribution of work force, employment, and productivity of workers. He argues that though performance of Manipur in terms of IMR, sex ratio, literacy rate, and life expectancy at birth has been positive, low per capita income and continued dominance of low productivity activities in the occupational structure has weakened the link between employment creation and poverty reduction.

A.K. Agarwal in the chapter 'Human Development in Mizoram: An Overview' not only analyses the status of human development in Mizoram, its strengths and weaknesses, but also suggests a strategy for improvement. Through empirical analysis he claims that Mizoram has shown excellent performance not only in the field of education and health but also on Gross State Domestic Product (GSDP) in which the tertiary sector has been playing a dominant role. He also states that one might not notice the relative inadequacy of the state in terms of HDI, Human Poverty Index (HPI), and gender disparity as compared to other states in the region and the country as a whole, but in-depth analysis points towards the need for better services and for evolving an appropriate delivery mechanism with close interaction of various components of human development in the state.

The chapter 'Facets and Factors of Human Development in Tripura', contributed jointly by Sudhanshu K. Mishra and Purusottam Nayak, synoptically presents an account of different facets and factors relating to human development in Tripura which suffered a brutal blow during partition of the country in the form of maimed infrastructure, severed connectivity, and a debilitating burden of immigrants, with all the needs and no resources. They have also systematically presented the geographical and historical forces that have shaped the resource

base, infrastructure, connectivity, socio-economic milieu, and, consequently, the economy of the state, determining the level of human development. Their study reveals that in spite of a great population burden on her fragile economy, the state has secured an appreciable score in matters of education and health. The authors opine that human development of the state needs to be harnessed to promote economic growth in terms of increased productivity and higher per capita income.

The next chapter, 'Human Development in Assam: An Analysis', is jointly contributed by Hiranmoy Roy and Kingshuk Adhikari. The authors report that the state is lagging far behind other major Indian states in terms of various socio-economic indicators, including the measures of HDI, HPI, and poverty. Their findings also reveal an inverse relationship between human development and poverty on the one hand, and widespread variation of human development across districts, on the other.

Debasis Neogi, in 'Development and Deprivations in Arunachal Pradesh', highlights the extent of development and deprivations in the state of Arunachal Pradesh. While presenting his findings, he states that while some parts of the state are well ahead in terms of socio-economic development, the other parts are lagging behind. He opines that uneven development, across districts and among tribal groups, has given rise to inter-tribe disputes. The large chunk of Net State Domestic Product (NSDP) in the state is observed to be contributed by the tertiary sector, of which public administration constitutes the major component. This type of development trend, as observed by the author, seems to be untenable in the long run. The author also analyses the role of basic education in bringing empowerment to the society and explains how such capacity building can lead to redressal of deprivation of human beings. Besides, he investigates the aspect of gender discrimination and prescribes mass education in order to remove such discrimination from the society.

The last chapter of the book, 'Human Development and its Correlates in Nagaland', has been contributed by Sudhanshu K. Mishra and Purusottam Nayak. The authors have presented a large amount of data relating to human development in Nagaland, and made an attempt to observe regularities in the same that may be meaningful for devising development policies. Their findings indicate that PCI, HDI, and gender-related development index are poorly correlated with health indicators, but appreciably correlate with educational

attainment. The authors conclude that the reliability of data reported by a socio-economic system is dependent on the level of development of the system. Underdeveloped socio-economic systems report highly unreliable data. This is not only regarding the figures of income but also the measures of attainment in matters of health and education. Official data on these variables is thrown up by a system that is administratively motivated and unsupervised with regard to their economic and developmental meaning. Use of such data, whether it pertains to income or any other measure of development, is not dependable for policy decisions meaningful to fostering development.

An overall analysis of various issues discussed in the present volume reveal the following:

1. There is a need to rethink, not only the choice of variables but also the method of construction of HDI. The proposed alternative method, by maximizing the sum of absolute correlation between the composite index and the indicator variables, might be of some use while overcoming the problems associated with construction of composite indices by PCA.
2. In the recent past, the entire region has been experiencing good human development but poor economic growth. There exist widespread variations in the levels of human development across states, regions (rural-urban), among ethnic and other social groups, and between genders. This mismatch probably has given rise to increased disputes among various social groups and tribal populations leading to social tensions reflected in the form of extortions and other secessionist activities. To overcome this, a determined effort is required to harness human development towards achievement of higher economic growth through increased productivity. There is also a need for specific intervention strategies on the basis of sector/group/class/gender/region/state.
3. Human development is positively associated with the quality of governance. Governance, from the human development perspective, demands greater transparency, accountability, participation, and stringent rules and laws. Judged on these parameters, the quality of governance in the region is not satisfactory and, hence, requires improvement. Besides, local democratic institutions like Autonomous District Councils need to be strengthened and their functioning be made more effective.

4. Revolution of SHGs has not made much headway in the region. SHG as a movement and institution ensures, at the micro level, both economic growth and human development. Further, both these objectives are realized through the method of participation, especially of the poor and the marginalized. There is a need to make this movement more widespread in the region.
5. Besides increased inequality, the quality of public services on the basis of access, use, reliability, and satisfaction are worst in the poverty stricken states in the region. To overcome this, the extremely poor households need up-front intervention through measures such as TPDS.
6. Reproductive health care happens to be an important component of human development. The goal to attain satisfactory human development will remain unfulfilled if the reproductive health needs of married women and children are not properly attended. The situation of reproductive health care in some states of the region is worse than many other in the country. Therefore, immediate efforts are to be made to improve this situation.
7. Higher level of human development is a product of the accumulated benefits that accrue to the society from public investments on social service. Per capita spending on education and health has a relatively stronger impact on human development than growth in per capita income. Hence, public expenditure on social services needs to be continued till the time economic growth itself takes care of it substantially.
8. The country, in general, and the north-eastern region in particular, suffer from the politics of human development. The approach of development theory and practice to poverty has been mechanical. It never goes into the question of the mechanism of generation of poverty. Hence, it is suggested that institutions engaged in development practice should analyse the mechanism of generation of poverty, and based on such analysis should come up with programmes to overcome it.

PURUSOTTAM NAYAK

I

Concept and Measurement Issues

3

Construction of an Index A New Method

SUDHANSHU K. MISHRA

INTRODUCTION

On many occasions we need to construct an index that represents a number of variables (indicators). Cost of living index, general price index, Human Development Index (HDI), index of level of development, etc., are some of the examples that are constructed by a weighted (linear) aggregation of a host of variables. The general formula of construction of such an index (OECD 2003) may be given as:

$$I_i = \sum_{j=1}^m w_j x_{ij} \equiv w_1 x_{i1} + w_2 x_{i2} + \dots + w_m x_{im}; \quad i = 1, 2, \dots, n$$

where, w_j being the weight assigned to the j^{th} variable, x_j and remains constant over all observations of $x_j = (x_{1j}, x_{2j}, \dots, x_{nj})$.

The weights $w = (w_1, w_2, \dots, w_m)$ are determined by the importance assigned to the variables $x_j; j = 1, 2, \dots, m$. The criterion on which importance of a variable (vis-à-vis other variables) is determined may be varied and usually has its own logic (Munda and Nardo 2005). For example, in constructing a cost of living index, importance of a commodity is determined by the proportion of consumption expenditure allocated to that particular commodity, and in constructing the HDI, variables such as literacy, life expectancy, or income are weighted according to the importance assigned to them in accordance with their perceived roles in determining human development status.

In many cases, however, the analyst does not have any preferred means or logic to determine the relative importance of different variables. In such cases, weights are assigned mathematically. One of the methods to determine such mathematical weights is the Principal Components Analysis (PCA) [McCracken 2000].

In the PCA (Kendall and Stuart 1968: 285-99), weights are determined such that the sum of the squared correlation coefficients of the index with the constituent variables (used to construct the index) is maximized. In other words, weights in $I = \sum_j^m w_j x_j$ are determined such that $\sum_{j=1}^m r^2(I, x_j)$ is maximized. Here, $r(I, x_j)$ is the coefficient of correlation between the index I and the variable (x_j).

The PCA is a very well-established statistical method that has excellent mathematical properties. From $x = (x_1, x_2, \dots, x_m)$, one may obtain m (or fewer) indices that are orthogonal with each other. These indices together explain cent per cent variation in the original variables $x = (x_1, x_2, \dots, x_m)$. Moreover, the first Principal Component (often used to make a single index) explains the largest proportion of variation in the variables $x = (x_1, x_2, \dots, x_m)$.

SOME PRACTICAL PROBLEMS WITH THE PRINCIPAL COMPONENTS ANALYSIS

Although the PCA has excellent mathematical properties, one may face some difficulties in using it if one desires to construct a single index of the variables that are not very highly correlated among themselves. The method has a tendency to pick up the subset of highly correlated variables to make the first component, assign marginal weights to relatively poorly correlated subset of variables, and/or relegate the latter subset to construction of the subsequent principal components. Now, if one has to construct a single index, such an index undermines the poorly correlated set of variables. As a result, practically speaking, the index so constructed is the weighted aggregation of only the preferred (highly correlated) set of variables. In this sense, the index, so constructed, is elitist in nature that has a preference to the highly correlated subset over the poorly correlated subset of variables. Further, since there is no dependable method available to obtain a composite index by merging two or more principal components, the deferred set of variables never finds its representation in further analysis.

A WIDER VIEW OF CONSTRUCTING AN INDEX

Let us now investigate the possibilities of maximizing $\left(\sum_{j=1}^m |r(I, x_j)|^L \right)^{1/L}$ to obtain weights to construct $I = \sum_j^m w_j x_j$. This is only a Minkowsky

generalization of maximization of $\sum_j^m r^2(I, x_j)$, or (equivalently) $\left(\sum_{j=1}^m |r(I, x_j)|^2\right)^{1/2}$. It can be shown that as $L \rightarrow -(\infty)$, the index becomes more and more egalitarian, with an ever stronger tendency to assign weights, such that all or most of the variables, are equally correlated with the index. In so doing, it maximizes the minimal correlation of the index with its constituent variables, or in other words, it gives us the maximin index. However, for $L = 1$, the index is inclusive in nature that assigns reasonable (although smaller) weights to the members of less correlated subset of variables, but has no tendency to undermine the less correlated variables and their representation. This property of the index obtained by maximizing $\sum_{j=1}^m |r(I, x_j)|$, or maximizing the minimal correlation, is attractive and useful. The objective of this chapter is to illustrate this fact.

THE METHOD OF OPTIMIZATION

The method of constructing indices by the Principal Components is available in many software packages such as STATISTICA or SPSS. However, the method to construct indices by maximin correlation, or maximization of the sum of absolute correlations, is not available. We have obtained all indices (I-2, I-M and I-1) by solving $\max \left(\sum_{j=1}^m |r(I, x_j)|^L\right)^{1/L}$ such that $I = \sum_j^m w_j x_j$, where w_j are the decision variables. It is an intricate non-linear optimization problem. Any powerful non-linear programming software may possibly be used for optimization (see Kuester and Mize 1973 for classical methods and FORTRAN programs). However, we have used the Differential Evolution (DE) method of Global Optimization (which is in the broader family of the genetic algorithms). The optimization may also be done by the Particle Swarm method often used in Artificial Intelligence (see Mishra 2006). We have found that the Repulsive Particle Swarm (RPS) method performs as effectively as the Differential Evolution method. We have not presented the results of the RPS optimization to avoid duplication of results. The FORTRAN codes of the programs (Mishra 2007) may also be obtained from the author on request.

WORKING ON REAL LIFE DATA

Sarker *et al.* (2006), in their paper argued that HDI should include income equality measures (EQ) also in addition to the three measures of life expectancy (LE), education (ED), and per capita gross domestic product at the purchasing power parity with the US \$ per capita income (PCI), conventionally incorporated into it. They computed the per capita income distribution-adjusted composite index (DAPCHDI) of human development and showed that the ranking of countries on the basis of this type of HDI (that includes income distribution as one of the component indices) differed substantially from the ranking calculated in the *Human Development Reports (HDR)* of United Nations Development Programme (UNDP, published annually). They suggested, therefore, that within-country income distribution should be given its due importance in international comparison of countries.

Sarker *et al.* 2006 used data on life expectancy, educational index, and per capita income from the *Human Development Report* of UNDP for 2004. From the information on Gini coefficients of income distribution available in the *HDR* for various years, they also constructed an index to measure equality in distribution of per capita income. They used the Gini coefficients data over a span of 13 years (1990–2002). Under the constraints of data availability on income distribution, they chose 125 countries for construction of distribution-augmented HDI. The indices were subjected to the PCA and two composite indices of human development, one (PCHDI), without incorporating equality index, and the other (DAPCHDI), with its inclusion were obtained.

Haq (2003) noted that there is no a priori rationale for assigning different weights to different constituent indices. Each dimension of development is important, but the importance of each dimension may be different for developed and developing countries. Hence, he pleaded for equal weights on the principle of insufficient reason to discriminate among the constituent indices. On the other hand, as we have already mentioned, the PCA, a blindly empiricist method, has a tendency to undermine poorly correlated variables and instead favours highly correlated variables to make a composite index. The inclusive index (obtained by minimizing the sum of absolute correlation) gives due weights to poorly correlated variables too (by the proposed method), while the principal component index is largely elitist, favouring highly correlated variables and undermining the poorly correlated ones.

With this background, we re-computed the *DAPCHDI* with the data given by Sarker *et al.* (2006) in their paper to compare our composite index with theirs. As per the UNDP method *HDR 2005* or the *HDR 2006* adds little to the *HDR 2004* (as shown in Figure 3.1) database. We computed DAPCHDI by our new method, which maximizes the sum of absolute coefficients of correlation between the composite index and the constituent variables. We call them $NHDI_2$ (which is an I-2 type index) and $NHDI_1$ (I-1 type of index), respectively.

We have re-computed the DAPCHDI from the four indices, namely LE, ED, PCI, and equality index (EQ). The data for 125 countries, given by Sarker *et al.* (2006) in their paper, is reproduced in Table 3.1 below. We also reproduce the *HDR 2004* ranks (R_1), PCHDI ranks (R_2), and values, as well as the DAPCHDI ranks (R_3) and values obtained by Sarker *et al.* 2006. It may further be noted that computation of *I* (PCA) by the traditional method gives the same correlation coefficients (loadings) to variables (LE, ED, PCI, and EQ) as does the direct optimization method.

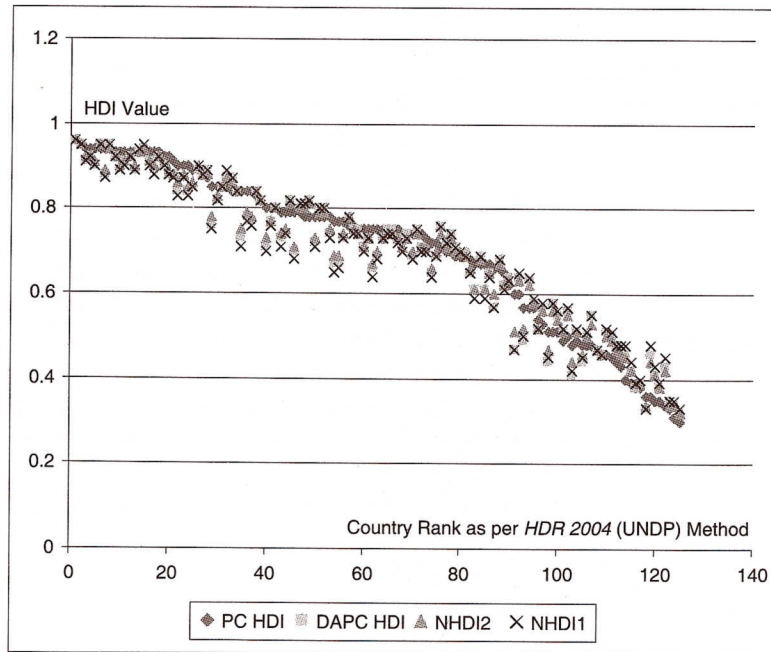


Figure 3.1: HDI Values of 125 Countries Obtained by Different Methods

Table 3.1: Composite Indices of Human Development in Select Countries Obtained by Different Methods

Select Countries	Ranks by Different Methods					Human Development Indices: Different Aspects				Composite Indices of HDI			
	R_1	R_2	R_3	R_4	R_5	LE	ED	PCI	EQ	PC HDI	DAPC HDI	New Indices $NHDI_2$	$NHDI_1$
Norway	1	1	1	1	1	0.90	0.99	0.99	0.96	0.96	0.96	0.96	0.96
Sweden	2	2	2	2	2	0.92	0.99	0.93	0.98	0.95	0.95	0.95	0.95
Canada	3	3	11	11	11	0.90	0.98	0.95	0.81	0.94	0.91	0.92	0.91
Netherlands	4	6	10	8	10	0.89	0.99	0.95	0.82	0.94	0.92	0.92	0.92
Australia	5	4	14	13	14	0.90	0.99	0.94	0.76	0.94	0.90	0.91	0.90
Belgium	6	5	3	3	3	0.90	0.99	0.94	0.98	0.94	0.95	0.95	0.95
USA	7	7	23	20	26	0.87	0.97	0.98	0.64	0.94	0.88	0.89	0.87
Japan	8	8	4	4	5	0.94	0.94	0.93	0.98	0.94	0.95	0.94	0.95
Luxembourg	9	10	9	10	9	0.89	0.91	1.00	0.86	0.93	0.92	0.92	0.92
Ireland	10	14	18	16	17	0.86	0.96	0.98	0.75	0.93	0.89	0.90	0.89
Switzerland	11	9	12	12	12	0.90	0.95	0.95	0.81	0.93	0.91	0.91	0.90
Austria	12	11	8	9	8	0.89	0.96	0.95	0.87	0.93	0.92	0.92	0.92
UK	13	12	17	17	19	0.88	0.99	0.93	0.74	0.93	0.89	0.90	0.89
Finland	14	13	6	6	6	0.88	0.99	0.93	0.94	0.93	0.93	0.93	0.94
Denmark	15	15	5	5	4	0.86	0.98	0.96	0.99	0.93	0.94	0.94	0.95
France	16	16	13	14	13	0.90	0.96	0.93	0.81	0.93	0.91	0.91	0.90
New Zealand	17	17	19	19	21	0.89	0.99	0.90	0.74	0.93	0.89	0.90	0.88
Germany	18	18	7	7	7	0.89	0.95	0.94	0.91	0.93	0.92	0.92	0.92
Spain	19	19	15	15	15	0.90	0.97	0.90	0.82	0.92	0.90	0.91	0.90
Italy	20	20	21	21	23	0.89	0.93	0.93	0.74	0.92	0.88	0.89	0.88
Israel	21	21	24	23	24	0.90	0.94	0.88	0.76	0.91	0.88	0.88	0.87
Singapore	22	23	30	29	32	0.88	0.91	0.92	0.61	0.90	0.84	0.86	0.83
Greece	23	22	26	25	27	0.89	0.95	0.87	0.76	0.90	0.87	0.88	0.87
Hong Kong China (SAR)	24	24	32	30	33	0.91	0.86	0.93	0.59	0.90	0.84	0.85	0.83
Portugal	25	25	28	27	28	0.85	0.97	0.87	0.69	0.89	0.85	0.86	0.85
Slovenia	26	26	16	18	16	0.85	0.96	0.87	0.91	0.89	0.89	0.90	0.90
Korea Rep.	27	27	22	24	22	0.84	0.97	0.86	0.84	0.89	0.88	0.88	0.88
Czech. Rep.	28	28	20	22	18	0.84	0.92	0.84	0.97	0.87	0.89	0.88	0.89
Argentina	29	29	47	45	49	0.82	0.96	0.78	0.40	0.85	0.76	0.78	0.75
Estonia	30	30	34	34	34	0.78	0.98	0.80	0.72	0.85	0.82	0.83	0.82
Poland	31	31	29	31	29	0.81	0.96	0.78	0.84	0.85	0.85	0.85	0.85
Hungary	32	32	25	26	20	0.78	0.95	0.82	1.00	0.85	0.87	0.87	0.89
Slovakia	33	33	27	28	25	0.81	0.91	0.81	0.96	0.84	0.87	0.86	0.87
Lithuania	34	35	33	33	31	0.79	0.96	0.77	0.83	0.84	0.84	0.84	0.84
Chile	35	34	60	49	64	0.85	0.90	0.77	0.30	0.84	0.73	0.75	0.71

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Table 3.1 (Contd)

Select Countries	Ranks by Different Methods					Human Development Indices: Different Aspects				Composite Indices of HDI			
	R_1	R_2	R_3	R_4	R_5	LE	ED	PCI	EQ	PC HDI	DAPC HDI	New Indices NHD ₁	NHD ₂
Uruguay	36	36	43	43	44	0.84	0.94	0.73	0.56	0.84	0.78	0.79	0.77
Costa Rica	37	37	45	44	47	0.88	0.87	0.75	0.52	0.84	0.77	0.78	0.76
Croatia	38	38	31	32	30	0.82	0.90	0.77	0.89	0.83	0.84	0.84	0.84
Latvia	39	39	36	35	35	0.76	0.95	0.75	0.82	0.82	0.82	0.82	0.82
Mexico	40	40	66	63	72	0.81	0.85	0.75	0.35	0.80	0.71	0.73	0.70
Trinidad & Tobago	41	41	46	47	45	0.77	0.87	0.76	0.65	0.80	0.77	0.77	0.76
Bulgaria	42	42	40	39	40	0.77	0.91	0.71	0.83	0.80	0.80	0.80	0.80
Malaysia	43	45	63	58	63	0.80	0.83	0.75	0.46	0.79	0.73	0.74	0.71
Russian Fed.	44	46	57	48	55	0.69	0.95	0.74	0.54	0.79	0.74	0.75	0.74
Macedonia	45	44	35	36	36	0.81	0.87	0.70	0.91	0.79	0.82	0.81	0.82
Panama	46	43	73	67	79	0.83	0.86	0.69	0.31	0.79	0.70	0.71	0.68
Belarus	47	47	39	40	39	0.75	0.95	0.67	0.86	0.79	0.80	0.80	0.81
Albania	48	48	38	38	38	0.81	0.89	0.65	0.91	0.78	0.81	0.80	0.81
Bosnia & Herzegovina	49	49	37	37	37	0.82	0.84	0.68	0.95	0.78	0.82	0.81	0.82
Venezuela	50	50	64	65	66	0.81	0.86	0.67	0.47	0.78	0.72	0.73	0.71
Romania	51	51	42	41	42	0.76	0.88	0.70	0.87	0.78	0.80	0.79	0.80
Ukraine	52	53	41	42	41	0.74	0.94	0.65	0.89	0.78	0.80	0.79	0.80
Saint Lucia	53	52	54	51	57	0.79	0.88	0.66	0.60	0.78	0.74	0.75	0.73
Brazil	54	54	81	78	81	0.72	0.88	0.73	0.25	0.77	0.67	0.69	0.65
Colombia	55	55	80	77	80	0.78	0.84	0.69	0.29	0.77	0.67	0.69	0.66
Thailand	56	56	58	57	59	0.74	0.86	0.71	0.59	0.77	0.73	0.74	0.73
Kazakhstan	57	57	44	46	43	0.69	0.93	0.68	0.84	0.76	0.78	0.78	0.78
Jamaica	58	58	49	50	51	0.84	0.83	0.61	0.70	0.76	0.75	0.75	0.74
Armenia	59	59	52	54	54	0.79	0.90	0.57	0.70	0.75	0.75	0.74	0.74
Philippines	60	60	67	66	68	0.75	0.89	0.62	0.53	0.75	0.71	0.71	0.70
Turkmenistan	61	61	62	61	60	0.70	0.93	0.63	0.64	0.75	0.73	0.73	0.73
Paraguay	62	62	82	81	85	0.76	0.85	0.64	0.30	0.75	0.66	0.67	0.64
Peru	63	64	78	74	78	0.74	0.86	0.65	0.45	0.75	0.69	0.70	0.68
Turkey	64	63	59	60	58	0.76	0.80	0.69	0.66	0.75	0.73	0.73	0.73
Azerbaijan	65	65	51	56	53	0.78	0.88	0.58	0.73	0.75	0.75	0.74	0.74
Jordan	66	66	53	53	50	0.76	0.86	0.62	0.74	0.75	0.75	0.74	0.74
Tunisia	67	67	61	62	61	0.79	0.74	0.70	0.66	0.75	0.73	0.73	0.72
China	68	68	69	69	69	0.76	0.83	0.64	0.56	0.74	0.71	0.71	0.70
Georgia	69	69	55	59	56	0.81	0.89	0.52	0.73	0.74	0.74	0.73	0.73
Dominican Rep.	70	71	76	73	76	0.70	0.82	0.70	0.50	0.74	0.69	0.70	0.68

Sri Lanka	71	70	50	52	48	0.79	0.83	0.60	0.78	0.74	0.75	0.74	0.75
Ecuador	72	72	70	70	71	0.76	0.85	0.60	0.58	0.74	0.71	0.71	0.70
Iran	73	73	71	71	70	0.75	0.74	0.70	0.60	0.73	0.70	0.71	0.70
El Salvador	74	74	83	83	87	0.76	0.75	0.65	0.38	0.72	0.65	0.66	0.64
Guyana	75	75	77	75	75	0.64	0.89	0.63	0.59	0.72	0.69	0.70	0.69
Uzbekistan	76	76	48	55	46	0.74	0.91	0.47	0.94	0.71	0.76	0.74	0.76
Algeria	77	77	65	68	62	0.74	0.69	0.68	0.76	0.70	0.72	0.71	0.72
Kyrgyzstan	78	78	56	64	52	0.72	0.92	0.46	0.89	0.70	0.74	0.73	0.74
Indonesia	79	80	68	72	65	0.69	0.80	0.58	0.78	0.69	0.71	0.70	0.71
Vietnam	80	79	72	76	67	0.73	0.82	0.52	0.74	0.69	0.70	0.70	0.70
Moldova	81	81	74	79	73	0.73	0.87	0.45	0.74	0.69	0.70	0.69	0.69
Bolivia	82	82	84	84	82	0.64	0.86	0.53	0.56	0.68	0.65	0.66	0.65
Honduras	83	84	91	90	90	0.73	0.74	0.54	0.34	0.67	0.61	0.61	0.59
Tajikistan	84	85	75	80	74	0.73	0.90	0.38	0.77	0.67	0.69	0.68	0.69
Nicaragua	85	83	90	91	91	0.74	0.73	0.54	0.34	0.67	0.61	0.61	0.59
Mongolia	86	86	85	85	84	0.64	0.89	0.47	0.57	0.67	0.65	0.65	0.64
South Africa	87	88	94	92	95	0.40	0.83	0.77	0.25	0.66	0.57	0.60	0.57
Egypt	88	87	79	82	77	0.73	0.62	0.61	0.78	0.66	0.68	0.67	0.68
Guatemala	89	89	89	88	89	0.68	0.65	0.62	0.48	0.65	0.62	0.62	0.61
Morocco	90	90	87	87	88	0.72	0.53	0.61	0.67	0.62	0.64	0.63	0.63
Namibia	91	91	108	103	111	0.34	0.79	0.69	0.00	0.60	0.47	0.51	0.47
India	92	92	86	86	83	0.64	0.59	0.55	0.82	0.60	0.64	0.63	0.65
Botswana	93	93	105	100	105	0.27	0.76	0.73	0.17	0.57	0.49	0.52	0.50
Ghana	94	94	88	89	86	0.55	0.65	0.51	0.87	0.57	0.63	0.62	0.64
Cambodia	95	95	92	93	92	0.54	0.66	0.50	0.65	0.57	0.58	0.58	0.59
Papua New Guinea	96	96	99	99	101	0.54	0.57	0.52	0.43	0.54	0.52	0.52	0.52
Laos	97	97	95	94	94	0.49	0.64	0.47	0.72	0.53	0.57	0.56	0.58
Swaziland	98	100	113	107	113	0.18	0.74	0.64	0.21	0.51	0.44	0.47	0.45
Bangladesh	99	98	93	95	93	0.60	0.45	0.47	0.83	0.51	0.58	0.56	0.58
Nepal	100	99	97	97	97	0.58	0.50	0.44	0.73	0.51	0.55	0.54	0.56
Cameroon	101	102	102	102	100	0.36	0.64	0.50	0.56	0.49	0.51	0.51	0.52
Pakistan	102	101	96	96	96	0.60	0.40	0.49	0.81	0.50	0.56	0.55	0.57
Lesotho	103	106	117	114	118	0.19	0.76	0.53	0.17	0.48	0.41	0.44	0.42
Uganda	104	103	101	101	99	0.34	0.70	0.44	0.60	0.49	0.51	0.51	0.52
Zimbabwe	105	107	114	111	114	0.15	0.79	0.53	0.30	0.48	0.44	0.46	0.45
Kenya	106	104	104	104	103	0.34	0.74	0.39	0.56	0.48	0.50	0.50	0.51
Yemen	107	105	98	98	98	0.58	0.50	0.36	0.80	0.48	0.55	0.53	0.55
Madagascar	108	108	107	108	110	0.47	0.60	0.33	0.50	0.47	0.47	0.47	0.47
Nigeria	109	110	112	112	112	0.44	0.59	0.36	0.43	0.46	0.46	0.46	0.46
Mauritania	110	109	100	105	102	0.45	0.42	0.52	0.68	0.46	0.51	0.50	0.52
Gambia	111	111	103	106	104	0.48	0.40	0.47	0.70	0.45	0.50	0.49	0.51

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Table 3.1 (Contd)

Select Countries	Ranks by Different Methods					Human Development Indices: Different Aspects				Composite Indices of HDI			
	R ₁	R ₂	R ₃	R ₄	R ₅	LE	ED	PCI	EQ	PC HDI	DAPC HDI	New Indices NHD ₁	NHD ₂
Senegal	112	112	106	109	106	0.46	0.39	0.46	0.63	0.44	0.48	0.47	0.48
Guinea	113	113	109	110	107	0.40	0.37	0.51	0.65	0.43	0.47	0.46	0.48
Tanzania	114	114	110	113	109	0.31	0.62	0.29	0.70	0.40	0.46	0.45	0.48
Cote d'Ivoire	115	115	116	116	116	0.27	0.47	0.45	0.55	0.39	0.42	0.42	0.44
Zambia	116	116	121	120	120	0.13	0.68	0.36	0.39	0.38	0.38	0.39	0.39
Malawi	117	117	119	119	119	0.21	0.66	0.29	0.44	0.38	0.39	0.39	0.40
Central African Rep.	118	118	124	123	124	0.25	0.43	0.41	0.21	0.36	0.33	0.34	0.33
Ethiopia	119	119	111	115	108	0.34	0.39	0.34	0.87	0.36	0.46	0.44	0.48
Mozambique	120	121	118	118	117	0.22	0.45	0.39	0.67	0.35	0.41	0.41	0.43
Guinea Bissau	121	120	120	121	121	0.34	0.39	0.33	0.51	0.35	0.38	0.38	0.39
Burundi	122	122	115	117	115	0.26	0.45	0.31	0.80	0.34	0.43	0.42	0.45
Mali	123	123	122	122	122	0.39	0.21	0.37	0.44	0.33	0.35	0.34	0.35
Burkina Faso	124	124	123	124	123	0.35	0.16	0.40	0.49	0.31	0.34	0.34	0.35
Niger	125	125	125	125	125	0.35	0.18	0.35	0.44	0.30	0.32	0.32	0.33

Source: Sarker et al. 2006 (adapted from HDRs of UNDP); PCI is named as GDP in HDR/ Sarker et al. 2006.

The HDI indices computed by us are NHD₂ (principal component) and NHD₁ (that minimizes the sum of absolute correlation coefficients), and the ranks obtained by different countries are R₄ and R₅, respectively. These HDI indices too are presented in Table 3.1. Note that ranks, as computed by us, are based on more accurate NHD₂ and NHD₁ figures.

In our analysis, the constituent indices of HDI obtain different weights and are differently correlated with their composite HDI indices. These weights and correlation coefficients are given in Table 3.2 and Table 3.3, respectively.

Table 3.2: Weights Assigned to the Constituent Indices by Different Methods

Indices	LE	ED	PCI	EQ
DAPCHDI	0.30	0.25	0.25	0.20
NHD ₂	0.270909751	0.275588551	0.289481714	0.164019853
NHD ₁	0.239643184	0.258695275	0.265657700	0.236003815

Table 3.3: Correlation of Composite HD Indices with Different Constituent Indices

Index	LE	ED	PCI	EQ	SAR	SSR
NHD ₂	0.923635411	0.870389039	0.890306269	0.567829911	3.25216063	2.72575551
NHD ₁	0.914036295	0.845974366	0.865869176	0.639601336	3.26548117	2.70995428

SAR=Sum of Absolute correlation coefficients; SSR=Sum of Squared correlation coefficients

Table 3.4: Correlation Matrix of Different Ranks and HD Indices Obtained by Different Methods

Ranks/ HD Indices	Ranks obtained by Different Methods					HD Indices obtained by Different Methods				
	R1	R2	R3	R4	R5	PCHDI	DA PCHDI	NHD ₁	NHD ₂	NHD ₁
R1	1.00000	0.99969	0.96199	0.97512	0.95372	-0.97103	-0.95206	-0.96446	-0.96446	-0.94855
R2	0.99969	1.00000	0.96289	0.97568	0.95443	-0.97105	-0.95320	-0.96515	-0.96515	-0.94960
R3	0.96199	0.96289	1.00000	0.99736	0.99878	-0.94587	-0.98259	-0.98089	-0.98089	-0.98573
R4	0.97512	0.97568	0.99736	1.00000	0.99478	-0.95589	-0.98075	-0.98235	-0.98235	-0.98284
R5	0.95372	0.95443	0.99878	0.99478	1.00000	-0.93923	-0.98202	-0.97900	-0.97900	-0.98633
PCHDI	-0.97103	-0.97105	-0.94587	-0.95589	-0.93923	1.00000	0.97141	0.98302	0.98302	0.96251
DAPCHDI	-0.95206	-0.95320	-0.98259	-0.98075	-0.98202	0.97141	1.00000	0.99783	0.99783	0.99865
NHD ₁	-0.96446	-0.96515	-0.98089	-0.98235	-0.97900	0.98302	0.99783	1.00000	1.00000	0.99569
NHD ₂	-0.94855	-0.94960	-0.98573	-0.98284	-0.98633	0.96251	0.99865	0.99865	0.99865	1.00000

It may be noted that $NHDI_1$ trades off SSR only slightly to assign higher weights to EQ index. In exchange, the weights of LE, ED, and PCI are reduced. Overall, $NHDI_1$ weights are more egalitarian than the $NHDI_2$ weights. Finally, in the Table 3.4 we present the matrix of correlation coefficients (based on figures in Table 3.1) among and across different ranks, and composite *HDI* measures.

The *HDRs* assign subjective (or arbitrary) weights to indices of life expectancy, education, and income. Inclusion of equality index to *HDI* naturally raises the question as to the weight to be assigned to it. It is also required to reduce the weights assigned to other indices. An attempt may be made to obtain weights by the Principal Component Analysis. However, the Principal Component Analysis has a tendency to undermine the variables with weaker correlation coefficients. It may be elitist in favouring the highly correlated indices. Variance, or explanatory power of a composite index, cannot be the sole guide to assign weights. Representation of individual indices in the composite *HDI* also matters. The *HDR* has taken an extreme stand of assigning equal weights to all indices and suffers from an excessive bias to pragmatism. However, the new method of obtaining weights and constructing an *HDI* suggested by us is inclusive in nature, and takes care of weakly correlated indices and, also, gives them proper representation in the composite *HDI*.

CONCLUDING REMARKS

In this exercise, we have shown that the principal component indices are elitist and they have a tendency to undermine the importance of poorly correlated variables. On the other hand, I-1 is more inclusive and has a tendency to represent even the poorly correlated variables. The I-M indices are egalitarian in nature. Conventionally, the *HD* index is constructed by assigning equal weights to all the constituent measures (such as literacy, income, life expectancy, etc.). The I-M index does almost the same, but with an added mathematically-oriented methodological justification. The I-1 (inclusive) type of index is a compromise between I-2 (elitist) and I-M (egalitarian) types of indices.

It would depend on the analyst, whether he is interested in egalitarian, inclusive, or elitist method of constructing indices when the constituent variables are not very highly correlated among themselves. This chapter has opened up the option to choose the method of constructing a desired type of index.

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