# How much progress has been recently made in India? Finding out with the use of a Genuine Progress Indicator

Philip Lawn

Flinders Business School, Flinders University
GPO Box 2100, Adelaide,
SA 5001, Australia
Phone: 61 8 8201 2838
Fax: 61 8 8201 2644
E-mail: phil.lawn@flinders.edu.au

**Abstract:** Gross Domestic Product (GDP) is an economic indicator that fails to fully account for the major benefits and costs of economic activity. As a consequence, it is an inadequate indicator of sustainable economic welfare. To overcome the deficiencies of GDP, a Genuine Progress Indicator (GPI) was devised in the 1990s. The GPI has since undergone significant modification and improvement. Calculation of the GPI for India for the period 1987-2003 reveals two important pieces of information. Firstly, the per capita GPI remained consistently lower than per capita GDP over the entire study period. Secondly, the rate of India's genuine progress between 1987 and 2003 was less spectacular than that indicated by India's per capita GDP. To facilitate a greater rate of genuine progress over the coming decades, India needs a new phase of GDP growth based on distributional equity, production excellence, increased resource use efficiency, and minimal natural capital depletion. Eventually, however, India will need to make the transition to a steady-state economy — something which ought not to preclude further progress — or face the prospect of having to endure a declining per capita GPI caused largely by an economy growing beyond its maximum sustainable scale.

**Keywords:** sustainable economic welfare; GPI; genuine progress indicator; India.

**Reference** to this paper should be made as follows: Lawn, P. (2008) 'How much progress has been recently made in India? Finding out with the use of a genuine progress indicator', *Int. J. Environment and Sustainable Development*, Vol. 7, No. 3, pp.311–331.

**Biographical notes:** Philip Lawn is a senior lecturer in environmental and ecological economics at Flinders University. Over the past ten years Philip has published a number of papers and books on ecological economics issues, including Toward Sustainable Development (2001), Sustainable Development Indicators in Ecological Economics (2006), and Frontier Issues in Ecological Economics (2007). Philip's latest book (co-edited with Matthew Clarke from Deakin University), is entitled Sustainable Welfare in the Asia-Pacific (2008). Philip is currently working on environmental macroeconomic models and a comprehensive set of sustainable development indicators to assess Australia's sustainable development performance.

## 1 Introduction

There is little doubt that considerable advances have been made in India over the past two decades. Examples include a dramatic decline in India's poverty rate, a rise in adult literacy levels, and a ten year increase in average life expectancy since the mid-1980s (World Bank, 2007). This aside, it is customary to use measures of per capita Gross Domestic Product (GDP) as evidence of the extent to which a nation is progressing. Despite this, a number of observers have questioned whether GDP accurately reflects a nation's sustainable economic welfare. Many have argued that GDP overlooks important social and environmental factors (e.g., Leipert, 1986; Cobb and Cobb, 1994; and Easterlin, 2001), while others simply question whether GDP constitutes a true measure of national income (e.g., Repetto et al., 1989; Daly, 1996; and Cairns, 2000).

In this paper, it will be argued that an alternative measure of sustainable economic welfare — a Genuine Progress Indicator (GPI) — can provide a better indication of the progress India has made over the past two decades. The GPI, which was first devised in the 1990s, is a composite indicator that comprehensively accounts for the major benefits and costs of economic activity at the macro level. The case for the GPI is put forward firstly by explaining why GDP does not serve as an adequate indicator of sustainable economic welfare. Secondly, the rationale for the GPI is outlined as well as the choice of the various items included its calculation. The results of a GPI study of India are then revealed for the period 1987-2003. The results section is followed by a brief analysis of the factors impacting most on India's rate of genuine progress. The final section of the paper outlines some of the policy areas requiring attention in order to promote India's genuine progress over coming decades.

## 2 Why is GDP an inadequate indicator of sustainable economic welfare?

Although GDP was never devised as a measure of sustainable economic welfare, it is often explicitly used for this purpose. This would be of little consequence if the use of GDP was confined to academic fascination. But it is not. Indeed, the desire to increase GDP constitutes the basis for most macroeconomic policies. It is therefore instructive to consider whether GDP serves as a reliable estimate of a nation's sustainable economic welfare. Should it fail in this regard, policies designed to augment GDP may prove less beneficial than first thought or even be counterproductive.

One of the best ways to ascertain the value of GDP as a macroeconomic policy indicator is to determine how well it constitutes a measure of national income. Income is best defined as the maximum amount that can be consumed today without undermining the capacity to consume at least the same amount in the future (Hicks, 1946). A key aspect of this definition is the need to keep income-generating capital intact.

With this definition of income in mind, one might ask the following question: Could a nation consume its entire GDP and be in a position to consume at least the same national product in the following year and beyond? The answer is a resounding no. Some of the annual product must be set aside to replace the worn out human-made capital needed to maintain the productive capacity of a nation's economy. Secondly, many economic activities are ecologically damaging. These activities consequently reduce the flow of natural resources needed for future production. Thus, even if one was to subtract from GDP the depreciation value of all existing human-made capital, the resultant value would still overestimate the maximum net product that a nation could sustainably produce and consume. Finally, the output of many economic activities is not directly consumed but specifically set aside to defend a nation's citizens from the side-effects of past and present economic activities. Clearly, the various defensive and rehabilitative expenditures incurred each year also contribute to the maintenance of a nation's productive capacity. They should not, therefore, be counted as income.

In all, a better measure of national income — sometimes referred to as Sustainable Net Domestic Product (SNDP) — can be calculated by adhering to the following basic formula (Daly, 1996):

$$SNDP = GDP - DHK - DNK - DRE \quad (1)$$

where

- SNDP = Sustainable Net Domestic Product (Hicksian national income)
- GDP = Gross Domestic Product
- DHK = depreciation of human-made capital (plant, machinery, and equipment)
- DNK = depletion of natural capital (minerals, forests, fisheries, waste sinks, etc.)
- DRE = defensive and rehabilitative expenditures.

Although the above adjustments to GDP reflect the need to avoid long-term impoverishment, there is still one aspect of concern. It relates to whether a combined stock of human-made capital and natural capital should be kept intact or whether the two forms of capital are sufficiently unique to necessitate their individual maintenance. The answer to this dilemma boils down to whether human-made capital and natural capital are substitutable. If the former is able to serve as an adequate substitute for declining natural capital, there is only a need to keep intact a combined stock of both forms of capital. In this situation, the SNDP constitutes a measure of 'sustainable' income provided enough producer goods have been manufactured to offset the depletion of natural capital. The final measure of the SNDP in this instance is often referred to as a *weak sustainability* measure of national income.

Should, on the other hand, natural capital and human-made capital be complements, merely subtracting the depreciation of human-made capital and the depletion of natural capital from GDP cannot give rise to a measure of 'sustainable' income unless the estimated depletion value of natural capital reflects the cost of whatever is required to keep natural resource stocks intact. To do this, it is necessary to determine the portion of the proceeds from resource exploitation that must be set aside to cultivate additional renewable resource stocks or, in the case of non-renewable resources, to cultivate a renewable resource substitute. A simple but ingenious formula has been put forward by El Serafy (1989) to calculate the set aside amount. This set aside amount constitutes the 'user cost' or the replacement cost of resource depletion. The remainder constitutes legitimate income. To calculate the SNDP, the former is subtracted from GDP but the latter is not. So long as the user cost subtracted from GDP approximates the amount that must be invested to keep the stock of natural capital intact, this second measure of SNDP is equivalent to a *strong sustainability* measure of national income.

Growing evidence from ecological economists indicates that natural and human-made capital are complements for the very reason that natural capital provides a range of services that human-made capital cannot. For instance, natural capital is the sole source of low entropy resources (the availability of which is necessary for human-made capital to exist); is the sole repository and assimilator of high entropy wastes; and is the sole generator of critical life-support services.[1]

There are claims that there is adequate substitutability between the two forms of capital because the technological progress embodied in human-made capital can reduce the natural capital needed to fuel the economic process. For three good reasons, it is wrong to call this substitution. Firstly, the technological progress embodied in human-made capital merely reduces the high entropy waste that is generated in the transformation of natural capital to human-made capital. Crucially, because of the first and second laws of thermodynamics, there is a limit to how much production waste can be reduced — i.e., there is no 100% production efficiency; there can never be 100% recycling of matter; and there is no way to recycle energy at all. Hence, the production of a given quantity of human-made capital will always require a minimum resource flow and, therefore, a minimum amount of resource-providing natural capital (Lawn, 2003).

Secondly, when a production function adhering to the first and second laws of thermodynamics is used to derive the elasticity of substitution between human-made capital and natural capital, the value is less than one for all relevant values of the human-made capital/natural capital ratio (Lawn, 2007).[2] Furthermore, the elasticity of substitution tends towards zero as attempts are made to augment human-made capital to offset the impact of declining natural capital.

Thirdly, the quantity of natural capital required to maintain the life-support services it provides far exceeds the quantity needed to sustain the economic process alone. For these reasons, ecological economists believe the calculation of the SNDP should be based on the strong sustainability measure of national income.

## 3 The shortcomings of Sustainable Net Domestic Product

Whilst SNDP is a better measure of Hicksian income than GDP, there are still many problems associated with its use. To begin with, SNDP overlooks a number of welfare-related aspects. These include the value of volunteer and non-paid household work, the cost of crime, unemployment, and family breakdown, and the welfare effect of a change in the distribution of income. Often overlooked, the redistribution of income from the low marginal benefit uses of the rich to the higher marginal benefit uses of the poor can lead to an overall increase in the economic welfare enjoyed by society as a whole (Robinson, 1962). Thus, while the SNDP of a nation can increase over time, it will not accurately reflect the increase in a nation's economic welfare if the rise in the SNDP is accompanied by a growing income disparity between rich and the poor.

Secondly, there is the issue of whether the SNDP is in fact a good measure of national income. Very early on in the consideration of national income, Fisher (1906) argued that the national dividend consists not of the goods produced in a particular year, but of the services enjoyed by the ultimate consumers of human-made goods. Fisher called the services enjoyed by the ultimate consumers as 'psychic income'. Most economists refer to psychic income as 'utility satisfaction'. Because the economic process involves many irksome activities, the concept of psychic income can be extended to include the 'psychic outgo' of the economic process (e.g., the cost of crime and family breakdown). This allows one to obtain the theoretical notion of 'net psychic income' — the sum total of all the psychic income-yielding aspects of the economic process less the sum total of its irksome or psychic outgo-related aspects.

The implications of adopting Fisher's view of income are significant. To begin with, any durable producer or consumer good manufactured during the current year is not part of this year's income. It simply constitutes an addition to the stock of human-made capital. Only the services rendered this year by non-durable consumer goods and durable producer and consumer goods manufactured in previous years are part of this year's income. Unfortunately, since the calculation of the SNDP counts all additions to human-made capital as current income, it wrongly conflates the services rendered by capital (income) and the capital that renders them. It is therefore questionable whether the SNDP is a true measure of income, although one's view on this boils down to their preference for the Hicksian or Fisherian definition of income. The Fisherian view of income is superior in that the former wrongly associates economic welfare with the rate of production and consumption. The Fisherian perspective is different in that it takes the view that economic welfare depends on the psychic enjoyment of life — a view that is strongly supported elsewhere (e.g., Georgescu-Roegen, 1971; Daly, 1979; Easterlin, 1974 and 2001). While it is true that the psychic enjoyment of life cannot be experienced without the existence of physical goods, it is certainly not determined by the rate at which goods are produced and consumed. It is determined primarily by the quantity of human-made capital (at least up to a certain amount), the quality of the stock, and its ownership distribution — all of which can be favourably adjusted without the need for an increased rate of production and consumption.

Fisher's concept of income and capital has one further implication. By keeping capital and income separate, it forces one to recognise that since the stock of human-made capital depreciates and wears out through use, its continual maintenance is a cost not a benefit. It constitutes a cost because the maintenance of human-made capital requires the production of new goods and production itself can only occur if there is an ongoing throughput of matter-energy (the input of low entropy resources and the output of high entropy wastes). To obtain the throughput, it is necessary to exploit natural capital which, in turn, results in the inevitable loss of some of the source, sink, and life-support services provided by natural capital (Perrings, 1986). As equation (1) showed, the calculation of the SNDP overcomes the problem of counting lost natural capital services as income by subtracting from GDP the cost of natural capital depletion. However, it is because Fisher's concept of income and capital treats the production of replacement goods as the cost of keeping human-made capital intact that the SNDP effectively stands as an index of sustainable cost. While an index of sustainable cost is preferable to an index of unsustainable cost, such as GDP, it scarcely serves as an index of sustainable economic welfare.

The final key weakness of Hicksian income relates to investment expenditure — that is, the accumulation of producer goods such as plant, machinery, and equipment. It has already been pointed out that, in order to calculate a nation's SNDP, one must subtract from GDP the value of the output required to keep human-made capital intact. However, unlike investment in most forms of natural capital, the level of investment in human-made capital invariably exceeds this requisite amount. That is, net capital investment — which equals gross investment in human-made capital minus its depreciation — is usually positive. Since Hicksian income measures the quantity of producer goods as well as consumer goods that can be sustainably produced over time, it is entirely legitimate to include net capital investment in a more appropriate measure of national income. But this is not so with sustainable welfare since, in this case, what is desired is an indicator that reflects the *welfare* experienced during a specific financial year.

If one considers investment more closely, it effectively amounts to deprived or sacrificed consumption that is undertaken to provide the means required to generate a particular level of future consumption. In a sense, current consumption and current net capital investment are the antithesis of each other. The first involves a form of conduct that generates welfare in the present; the second involves a deliberative action in the present that is designed to generate future welfare. To count current net capital investment as welfare-enhancing in the present is logically erroneous.

Does this mean that net capital investment will be overlooked in a measure of sustainable welfare? No, because the benefit of net capital investment is captured in future years in terms of the future consumption-related welfare it generates. It can also be captured in terms of any increase in resource-use efficiency that reduces the natural capital depletion costs incurred per unit of consumption. Similarly, so long as the indicator used to measure the sustainable welfare experienced during a particular financial year includes the expenditure on non-durable consumption goods during that year, the welfare benefits generated by previous investment — that is, by past sacrificed consumption — will be also captured by the indicator. Better still, it will be captured during the period in which the consumption-related welfare is experienced.

Having said this, not all investment expenditure is directed towards the replacement or accumulation of producer goods. Nor is it ultimately reflected in consumption expenditure over subsequent years. For example, a large percentage of publicly-funded investment expenditure (e.g., capital works) involves the construction of roads, bridges, and highways, of schools and hospitals, and of museums, galleries, and libraries. The benefits of this investment spending flow to the general public in a similar way that services flow to the possessors of consumer durables — i.e., in future years as publicly-provided infrastructure depreciates through use. Unfortunately, Hicksian income: (a) treats the full amount of this form of *current* investment expenditure as if the benefits are experienced during the current financial year (which is not the case); and (b) ignores the welfare benefits that *previous* expenditure on publicly-provided infrastructure generates in the present financial year.

## 4 The Genuine Progress Indicator

The GPI is a recently established indicator specifically designed to ascertain the impact of a growing economy on sustainable welfare. Usually comprised of around twenty individual benefit and cost items, the GPI integrates the wide-ranging impacts of GDP growth into a single monetary-based index. As such, the GPI includes benefits and costs of the social and environmental kind as well as those of the standard economic variety. Whilst the GPI embraces some of the national accounting values used in the computation of GDP, its calculation accounts for a number of benefits and costs that normally escape market valuation.

Since the aim of the GPI is to provide a more appropriate measure of sustainable welfare, its construction is primarily based on overcoming the shortcomings associated with GDP and Hicksian income discussed in sections 2 and 3. Table 1 lists the items included in the GPI calculated for India. The rationale for the inclusion of each item will now be given.

**Table 1** Items used to calculate the GPI for India, 1987–2003

| *Item* | *Welfare contribution* |
|---|---|
| Consumption expenditure (CON) | + |
| Defensive and rehabilitatve expenditures (DRE) | – |
| Expenditure on consumer durables (ECD) | – |
| Service from consumer durables (SCD) | + |
| Adjusted consumption = CON – DRE – ECD + SCD | (+) |
| Distribution Index (DI) | +/– |
| Adjusted consumption (weighted) (**) | (+) |
| Welfare generated by publicly-provided infrastructure (WPPI) (**) | + |
| Value of non-paid household labour (**) | + |
| Cost of unemployment (**) | – |
| Cost of crime (**) | – |
| Change in foreign debt position (**) | +/– |
| Cost of non-renewable resource depletion (*) | – |
| Cost of lost agricultural land (*) | – |
| Cost of timber depletion (*) | – |
| Cost of air pollution (*) | – |
| Cost of urban waste-water pollution (*) | – |
| Cost of long-term environmental damage (*) | – |
| Lost natural capital services (LNCS) (**) = sum of (*) items | (–) |
| **Genuine Progress Indicator (GPI)** = sum of (**) items | **(+)** |

### *4.1 Consumption expenditure (private and public)*

Although it will soon become evident that the GPI begins with consumption expenditure as its foundation item, the rationale for the items used to calculate the GPI is best explained by focusing again on GDP. Employing the standard national accounting framework, GDP can be calculated by using either the ‘expenditure’ or ‘income’ approach. If the expenditure approach is adopted, GDP is denoted by the following:

$$GDP = CON + INV + G + X - M \qquad (2)$$

where

- GDP = Gross Domestic Product
- INV = private sector investment expenditure (i.e., expenditure on human-made capital)

- G = public sector consumption and investment expenditure
- X = exports (foreign expenditure on domestically produced goods)
- M = imports (domestic expenditure on foreign produced goods).

Since we need to estimate the welfare that a nation's citizens derive directly from economic activity, an adjustment to equation (2) is required on the basis that the welfare benefits of exported goods are enjoyed by foreigners, not by locals, while the welfare benefits of imported goods are enjoyed domestically. That is, we must subtract export spending from GDP and retain import spending that is conventionally subtracted from the categories of CON, INV, and G.

To simplify matters, we can also include public sector consumption and investment expenditure in the categories of CON and INV given that the conventional isolation of G in the national accounts is undertaken merely to differentiate private and public sector spending. This now leaves us with Stage 1 of the GPI:

$$GPI_{Stage1} = CON\ (private + public) + INV\ (private + public) \qquad (3)$$

Because, as explained above, current investment expenditure constitutes deprived consumption that is undertaken to generate welfare benefits in the future, we must subtract INV (private and public) from equation (3). We therefore obtain the following, thus rendering consumption expenditure as the foundation item of the GPI:

$$GPI_{Stage2} = CON\ (private + public) \qquad (4)$$

### *4.2 Defensive and rehabilitative expenditures (DRE)*

It was pointed out in section 2 that defensive and rehabilitative expenditures should not be considered welfare-enhancing for the reason that they serve to maintain and restore the productive capacity of the economy. Although a clear benefit emerges from such expenditure, it is not felt in the present but in later years by way of future consumption. To include current consumption expenditure along with defensive and rehabilitative spending would amount to double-counting. Since a great deal of consumption expenditure includes spending of a defensive and rehabilitative nature, it is necessary to identify and subtract this form of spending. The subtraction of defensive and rehabilitative expenditures (DRE) yields the following welfare adjustment:

$$GPI_{Stage3} = CON - DRE \qquad (5)$$

### *4.3 Expenditure on consumer durables (ECD)*

The third item used in the calculation of the GPI relates to the expenditure on consumer durables. Because it is incorrect to count the spending on consumer durables as a consumption-related benefit during the financial year in which the expenditure took place, all such expenditure must be subtracted from the base consumption item. This results in the following adjustment to equation (5):

$$GPI_{Stage4} = CON - DRE - ECD \qquad (6)$$

### 4.4 Service from consumer durables (SCD)

This fourth item is included because existing consumer durables provide an annual benefit or service as they depreciate through use. To determine the level of service enjoyed, it was assumed that the stock of consumer durables will, on average, endure for seven years. The annual service generated by the existing stock of consumer durables was then calculated by multiplying the capitalised value of the stock by a 14.3% depreciation rate.

### 4.5 Adjusted consumption

The next item listed in Table 1 is not an individual benefit or cost item but a sub-total to indicate the pre-weighted welfare contribution of all consumption expenditure. The adjusted consumption value — Stage 5 in the construction of the GPI — was calculated by applying the following basic formula:

$$GPI_{Stage5} = \text{Adjusted CON} = CON - DRE - ECD + SCD \tag{7}$$

### 4.6 Distribution Index (DI)

In order to incorporate the welfare impact of a changing distribution of income, a Distribution Index (DI) was applied. The DI was constructed on the basis of the change in India's Gini coefficient over time. The DI for the first year of the study period was assigned a value of 100.0. Any subsequent rise/fall in the index value signifies a growing/diminishing disparity between the income of the rich and the poor.

### 4.7 Adjusted consumption (weighted)

This particular item is calculated by weighting the adjusted consumption measure in line with changes in the DI over the study period. Given the manner in which the DI was constructed, the weighting of adjusted consumption was made as per the following basic formula:

$$\begin{aligned} GPI_{Stage6} &= GPI_{Stage5}\ \text{(weighted)} \\ &= \text{Adjusted CON (weighted)} \\ &= \frac{(CON - DRE - ECD + SCD)}{Distribution\ \ Index} \times 100 \end{aligned} \tag{8}$$

### 4.8 Welfare from publicly-provided infrastructure (WPPI)

This next item is incorporated into the calculation of the GPI because a large percentage of publicly-funded investment expenditure is not, as mentioned earlier, directed towards the accumulation of producer goods (e.g., plant, machinery, and equipment). It is instead directed towards the provision of infrastructural capital which generates a flow of services in the years following their initial provision.

The level of welfare generated by publicly-provided infrastructure was estimated firstly by assuming that 75% of all government investment spending is devoted to infrastructural capital rather than producer goods. Secondly, it was assumed that this welfare is equal to the public sector consumption of fixed capital (depreciation of existing capital goods) multiplied by the 75% share of government investment expenditure allocated to the accumulation of infrastructural capital. The annual value was then added as per equation (9) to obtain the following:

$$GPI_{Stage7} = \text{Adjusted CON (weighted)} + \text{WPPI} \quad (9)$$

### *4.9 Value of non-paid household labour*

Despite the enormous benefits provided by market-based economic activity, a great deal of welfare-enhancing activity occurs outside the market domain. One such category of non-market activity is non-paid household labour.

To derive the value of non-paid labour, it was first necessary to estimate the number of non-paid household labour hours occurring in a country each year. Secondly, a wage or opportunity cost was assigned to each non-paid working hour. The former was then multiplied by the latter to obtain the total annual value of non-paid household labour. This was then added in the following manner to obtain equation (10):

$$GPI_{Stage8} = \text{Adjusted CON (weighted)} + \text{WPPI} + \text{non-paid} \quad (10)$$

### *4.10 Social cost of unemployment and crime*

Perhaps one of the most significant yet recently tolerated social costs is the cost of unemployment. The modern predilection that national governments have for a low-inflation, low-interest rate economic environment has led to the widespread adoption of a ‘fight inflation first’ stance to macroeconomic policy. The unfortunate feature of this policy is obvious — its success relies on the existence of an unemployed pool of labour which has a significant impact on society as well as the unemployed individuals. Crime also impacts on society in the sense that it reflects the degradational impact that economic activity has on human relations, social institutions, and the self-esteem of some individual citizens.

In all, unemployment and crime constitutes the social cost associated with the operation of a modern, complex, and imperfect modern economy. Failure to subtract these social costs would clearly overstate the welfare contributed by economic activity. As such, Stage 9 of the GPI involves the following welfare adjustment to equation (10):

$$GPI_{Stage9} = \text{Adjusted CON (weighted)} + \text{WPPI} + \text{non-paid labour} - \text{social costs} \quad (11)$$

### *4.11 Change in net foreign debt*

This item is included in the calculation of the GPI because a nation’s long-term capacity to sustain the welfare generated by its economic activity depends very much on whether natural capital and human-made capital is domestically or foreign owned. Evidence indicates that many countries with large foreign debts have difficulty maintaining the investment levels needed to keep their stock of human-made capital intact. Furthermore, they are often forced to deplete natural capital stocks to repay debt (George, 1988).

The value for this item is not represented by the total debt position at the end of each financial year but by the change in the net foreign debt position from year to year. As equation (12) reveals, the change in net foreign debt can be either positive or negative.

$$GPI_{Stage10} = \text{Adjusted CON (weighted)} + \text{WPPI} + \text{non-paid labour} - \text{social costs} \\ +/- \text{change in net foreign debt} \quad (12)$$

## *4.12 Cost of non-renewable resource depletion*

The items so far discussed from Table 1 relate to the economic and social benefits and costs of economic activity. This next particular item — the cost of non-renewable resource depletion — relates to the first of the environmental costs used to calculate the GPI.

Non-renewable resources differ from their renewable counterparts in the sense that they cannot be sustainably exploited. They must be replaced by renewable resource substitutes. To determine what proportion of depletion profits must be set aside to establish suitable resource replacements, the El Serafy (1989) user cost formula was employed. The user cost was deducted in the calculation of the GPI. As for the remainder (i.e., the difference between depletion profits and the user cost), it effectively constitutes the income component of resource depletion profits. The income component can be safely used to finance current consumption expenditure because spending of this kind ought not to undermine a nation's capacity to sustain the same level of consumption over time.

## *4.13 Cost of lost agricultural land*

Unlike many non-renewable resources, there is essentially no substitute for fertile agricultural land. Indeed, agricultural land is not only used to produce a nation's sustenance-based commodities, it is required to establish renewable resource assets to replace depleted non-renewable resources. The unique nature of agricultural land demands that a different approach be taken to calculate its loss compared to non-renewable resource assets. In particular, the cost of lost agricultural land for any given year should reflect the amount required to compensate a nation's citizens — in a sense, a compensatory fund — for the cumulative impact of past and present agricultural endeavours.

## *4.14 Cost of timber depletion*

As a renewable resource, timber stocks can be sustainably exploited so long as the rate at which they are harvested does not exceed their ability to regenerate. Timber stocks can also be increased through plantation establishment. However, should timber stocks decline, the impact is not unlike the exhaustion of a non-renewable resource. As such, the cost of timber depletion was calculated by employing the previously explained 'user cost' method.

## *4.15 Cost of air and water pollution*

The costs of air and water pollution are both associated with the loss of the natural environment's waste-assimilative or sink capacity. In simple terms, the environment's sink capacity diminishes each time the quantity and the quality of the waste generated by economic activity exceeds the innate capacity of the natural environment to safely absorb it. It was assumed that a decline in the environment's sink capacity occurs whenever the emission of various forms of pollution imposes discernible environmental costs.

### *4.16 Cost of long-term environmental damage*

To account in some way for the loss of the natural environment's life-support function, this particular item was included to reflect the long-term environmental impact of increasing energy consumption. Why energy consumption? Firstly, energy consumption is a major contributing factor to greenhouse gas emissions and the projected change in global climate patterns. Secondly, eons of evolution have resulted in the biosphere being able to deal adequately with a particular rate of energy throughput (Blum, 1962; Daly, 1979; Capra, 1982; Norgaard, 1984). An increasing rate of human-induced energy consumption means, inevitably, the degradation of natural capital and the subsequent diminution of the life-support services it provides.

### *4.17 Cost of Lost Natural Capital Services (LNCS)*

The penultimate item involved in the calculation of the GPI is a sub-total indicating the environmental costs of economic activity. Equalling the sum of the items marked by a single asterisk (*) in Table 1, or by Equation (13) below, this item reflects the source, sink, and life-support services provided by natural capital that are lost as a consequence of converting natural capital to human-made capital.

$$\begin{aligned}\text{LNCS} = {} & \text{cost of non-renewable resource depletion} + \text{cost of lost agricultural land} \\ & + \text{cost of timber depletion cost of air and water pollution} \\ & + \text{cost of long-term environmental damage}\end{aligned} \tag{13}$$

### *4.18 Genuine Progress Indicator (GPI)*

The GPI can finally be calculated by summing (subtracting) the double-asterisked (**) items appearing in Table 1. This involves an adherence to the following equation:

$$\begin{aligned}\text{GPI}_{\text{Final}} = {} & \text{Adjusted CON (weighted)} + \text{WPPI} + \text{non-paid labour} - \text{social costs} \\ & +/- \text{ change in net foreign debt} - \text{LNCS}\end{aligned} \tag{14}$$

## 5 The GPI for India, 1987-2003

The results of the GPI study on India are summarised in Table 2 (valued at 1993 prices). Columns *a*-*s* reveal the annual values of the items that make up the GPI. The aggregate value of India's GPI is shown in column *t* which can be compared with India's real GDP in column *u*. Columns *w* and *x* reveal the per capita values India's GPI and real GDP, while the per capita values are also provided in indexed form in columns *y* and *z* (1987 = 100.0).

**Table 2** GPI and real GDP for India, 1987–2003

| | *CON* | *DRE* | *ECD* | *SCD* | *Adjusted CON* | *Distribution index* | *Weighted Adj CON* | *WPPI* | *Unpaid labour* | *Cost of unempl.* | *Cost of crime* | *Foreign debt* | *Non-ren. res. dep.* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *a* | *b* | *c* | *d* | *e* | *f* | *g* | *h* | *i* | *j* | *k* | *l* | *m* |
| *Year* | | | | | *(a + b + c + d)* | *1987 = 100.0* | *(f/g) × 100* | | | | | | |
| 1987 | 5159.3 | −1024.7 | −416.3 | 462.0 | 4180.2 | 100.0 | 4180.2 | 377.2 | 2172.1 | −358.2 | −251.6 | −264.4 | −122.9 |
| 1988 | 5471.0 | −1085.9 | −444.2 | 481.5 | 4422.5 | 101.5 | 4357.0 | 371.1 | 2200.7 | −351.7 | −249.7 | −214.1 | −141.3 |
| 1989 | 5738.2 | −1136.8 | −468.2 | 503.5 | 4636.7 | 103.0 | 4501.5 | 342.6 | 2228.8 | −384.4 | −247.8 | −461.7 | −151.6 |
| 1990 | 5983.1 | −1184.6 | −491.1 | 529.1 | 4836.5 | 104.5 | 4628.0 | 336.0 | 2256.1 | −405.3 | −246.0 | −117.4 | −167.8 |
| 1991 | 6084.8 | −1207.0 | −503.8 | 553.8 | 4927.7 | 106.0 | 4648.5 | 394.0 | 2282.9 | −425.8 | −244.1 | −562.3 | −174.0 |
| 1992 | 6244.4 | −1234.9 | −518.9 | 578.7 | 5069.2 | 107.5 | 4715.2 | 337.4 | 2309.1 | −430.2 | −238.6 | 33.7 | −176.0 |
| 1993 | 6587.0 | −1297.8 | −549.0 | 603.3 | 5343.4 | 108.0 | 4947.8 | 372.9 | 2339.9 | −425.5 | −177.5 | −372.6 | −178.4 |
| 1994 | 6812.5 | −1344.3 | −572.5 | 630.8 | 5526.6 | 108.5 | 5094.4 | 452.0 | 2364.8 | −428.6 | −172.3 | 28.6 | −195.0 |
| 1995 | 7243.9 | −1422.4 | −609.8 | 659.9 | 5871.6 | 109.0 | 5388.2 | 344.3 | 2391.8 | −418.3 | −194.5 | 151.5 | −206.6 |
| 1996 | 7768.8 | −1528.9 | −659.9 | 690.7 | 6270.6 | 109.5 | 5728.7 | 348.8 | 2420.6 | −428.0 | −180.4 | 160.4 | −207.5 |
| 1997 | 8088.1 | −1570.5 | −682.4 | 726.4 | 6561.6 | 109.9 | 5968.0 | 358.4 | 2446.3 | −445.6 | −219.2 | −93.7 | −227.9 |
| 1998 | 8690.2 | −1668.3 | −729.7 | 761.9 | 7054.1 | 110.4 | 6387.7 | 392.8 | 2471.4 | −454.5 | −240.3 | −102.3 | −234.4 |
| 1999 | 9311.4 | −1764.2 | −776.8 | 803.9 | 7574.3 | 110.9 | 6828.5 | 386.5 | 2495.9 | −473.5 | −233.5 | 20.6 | −242.2 |
| 2000 | 9485.8 | −1798.3 | −797.1 | 851.9 | 7742.3 | 111.4 | 6949.5 | 386.2 | 2539.4 | −477.8 | −250.8 | −122.9 | 247.9 |
| 2001 | 10,036.7 | −1908.4 | −851.5 | 898.0 | 8174.9 | 111.9 | 7305.7 | 387.7 | 2576.6 | −480.2 | −229.8 | 69.0 | −254.0 |
| 2002 | 10,233.9 | −1957.7 | −879.3 | 949.9 | 8346.7 | 112.4 | 7427.0 | 377.0 | 2613.4 | −472.8 | −238.9 | −143.8 | −276.9 |
| 2003 | 10,987.5 | −2110.5 | −954.2 | 1000.1 | 8922.8 | 112.9 | 7905.2 | 418.0 | 2647.4 | −476.3 | −252.1 | 68.0 | −294.8 |

**Table 2** GPI and real GDP for India, 1987–2003 (continued)

| | *Lost agric. land* | *Timber depletion* | *Air pollution* | *Urban w/w pollution* | *L-T env damage* | *LNCS* | *GPI* | *GDP* | *Indian Pop. (millions)* | *Per capita GPI* | *Per capita GDP* | *Per capita GPI* | *Per capita GDP* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* | *o* | *p* | *q* | *r* | *s* | *t* | *u* | *v* | *w* | *x* | *y* | *z* |
| *Year* | | | | | | *m to r* | | | | *(t/v)* | *(u/v)* | *1987 = 100.0* | *1987 = 100.0* |
| 1987 | −128.0 | −6.2 | −155.8 | −155.8 | −167.3 | −736.1 | 5119.3 | 6233.7 | 784.0 | 6529.7 | 7951.2 | 100.0 | 100.0 |
| 1988 | −147.8 | −6.2 | −167.9 | −173.2 | −173.7 | −810.0 | 5303.3 | 6848.3 | 801.0 | 6620.9 | 8549.7 | 101.4 | 107.5 |
| 1989 | −150.0 | −6.2 | −175.2 | −186.3 | −180.0 | −849.3 | 5129.6 | 7289.5 | 818.0 | 6270.9 | 8911.4 | 96.0 | 112.1 |
| 1990 | −156.2 | −9.1 | −181.7 | −199.1 | −186.3 | −900.2 | 5551.1 | 7713.0 | 835.0 | 6648.0 | 9237.1 | 101.8 | 116.2 |
| 1991 | −153.8 | 14.1 | −179.8 | −202.7 | −195.8 | −891.9 | 5201.3 | 7782.9 | 852.0 | 6104.8 | 9134.8 | 93.5 | 114.9 |
| 1992 | −162.7 | 0.1 | −185.5 | −215.1 | −205.3 | −944.6 | 5781.9 | 8193.2 | 869.0 | 6653.5 | 9428.3 | 101.9 | 118.6 |
| 1993 | −169.4 | 0.1 | −190.7 | −227.3 | −214.8 | −980.6 | 5704.5 | 8592.2 | 888.0 | 6424.0 | 9675.9 | 98.4 | 121.7 |
| 1994 | −177.9 | −1.6 | −201.0 | −245.9 | −224.3 | −1045.6 | 6293.4 | 9233.5 | 905.0 | 6954.1 | 10,202.8 | 106.5 | 128.3 |
| 1995 | −176.3 | −1.6 | −212.1 | −266.3 | −233.8 | −1096.6 | 6566.3 | 9939.5 | 923.0 | 7114.1 | 10,768.6 | 108.9 | 135.4 |
| 1996 | −193.3 | −16.8 | −223.3 | −287.5 | −237.0 | −1165.4 | 6884.8 | 10,674.4 | 942.0 | 7308.7 | 11,331.7 | 111.9 | 142.5 |
| 1997 | −188.6 | −16.8 | −228.7 | −301.8 | −240.2 | −1204.0 | 6810.2 | 11,152.5 | 960.0 | 7093.9 | 11,617.2 | 108.6 | 146.1 |
| 1998 | −200.3 | 13.4 | −237.7 | −321.2 | −243.3 | −1223.4 | 7231.4 | 11,820.2 | 978.0 | 7394.0 | 12,086.1 | 113.2 | 152.0 |
| 1999 | −200.9 | 13.4 | −249.6 | −345.3 | −246.5 | −1271.0 | 7753.5 | 12,662.8 | 996.0 | 7784.6 | 12,713.7 | 119.2 | 159.9 |
| 2000 | −200.7 | 26.5 | −254.4 | −360.0 | −268.6 | −1305.1 | 7718.4 | 13,162.0 | 1015.0 | 7604.4 | 12,967.5 | 116.5 | 163.1 |
| 2001 | −213.7 | 26.5 | −262.2 | −379.4 | −272.7 | −1355.5 | 8273.5 | 13,837.1 | 1033.0 | 8009.2 | 13,395.0 | 122.7 | 168.5 |
| 2002 | −198.4 | 26.5 | −267.6 | −395.8 | −278.3 | −1390.6 | 8171.3 | 14,406.3 | 1051.0 | 7774.8 | 13,707.3 | 119.1 | 172.4 |
| 2003 | −217.4 | 26.5 | −284.9 | −430.6 | −283.9 | −1485.2 | 8825.0 | 15,646.2 | 1068.0 | 8263.1 | 14,650.0 | 126.5 | 184.2 |

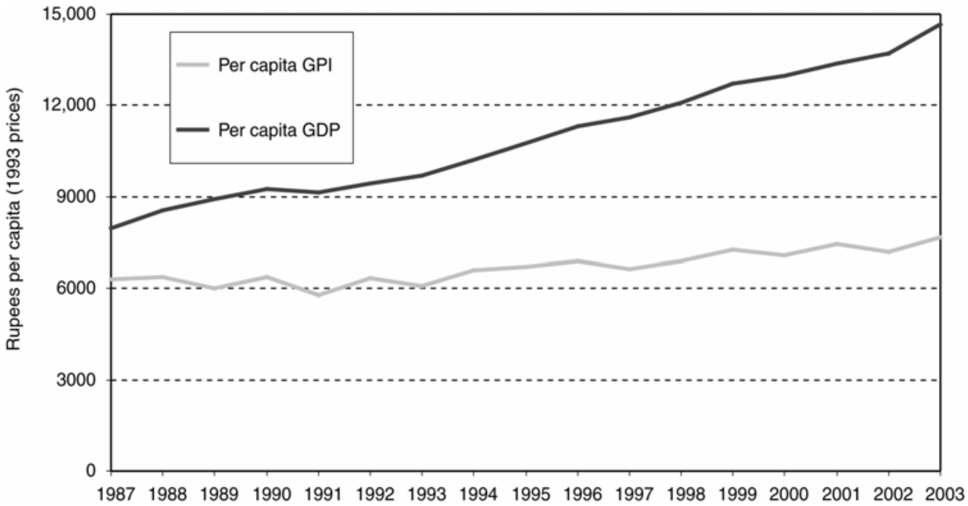
*Note*: All values are in billion of 1993 Rupees except where indicated.

## 5.1 GPI versus real GDP for India, 1987-2003

As can be seen from Table 2, India's GPI increased from 4,930.9 billion Rupees in 1987 to 8,195.6 billion Rupees in 2003. This constitutes a 66.2% rise between 1987 and 2003 or an average rate of increase of 3.0% per annum. Despite the rise, India's GPI declined in six of the seventeen years during the study period. The most significant fall occurred in 1991 which, together with the 1989 decline, resulted in India's GPI being only marginally higher in 1991 than in 1987. Notwithstanding small decreases in 1993, 1997, 2000, and 2002, India's GPI effectively rose between 1991 and 2003. Also of note when comparing columns *t* and *u* is the growing disparity between India's GPI and real GDP. In 1987, India's real GDP was just 1,302.8 billion Rupees higher than its GPI. By 2003, the gap between the two indicators had grown to 7,450.6 billion Rupees.

In order to ascertain the sustainable well-being of the average Indian, the per capita values of India's GPI and real GDP are diagrammatically presented in Figure 1. Along with columns *w* and *y*, Figure 1 indicates that India's per capita GPI increased in ten of the seventeen years over the study period. Conversely, India's per capita GDP increased in every year but 1991.

**Figure 1** Per capita GPI versus per capita GDP for India, 1987–2003




Overall, India's per capita GPI grew from 6,289.4 Rupees per Indian in 1987 to 7,673.8 Rupees per Indian by 2003. This equates to modest rise of 22.0% over the entire study period which is significantly lower than the 84.2% increase in per capita GDP over the same period. India's per capita GDP and GPI respectively grew at average rates of 3.9% and 1.2% per annum.

Given that India's per capita GDP increased more rapidly than its per capita GPI and was 6,976.2 Rupees per Indian higher in 2003, one can conclude that the per capita GDP substantially overstated the rate of genuine progress made by India over the study period. However, there is little doubt that progress was made, particularly after 1993 when India's per capita GPI was slightly lower than its 1987 value (6,289.4 Rupees per Indian in 1987 compared to 6,079.1 Rupees per Indian in 1993). Between 1993 and 2003, India's per capita GPI grew at an average rate of 2.4% per annum.

It is interesting to compare the per capita GPI results for India with those of other countries. To date, almost all GPI studies have been confined to wealthy, industrialised nations. In all instances, the per capita GPI of these wealthy nations has followed the same pattern as India but then levelled off or declined at around $US20,000-25,000. This so-called threshold level of per capita GDP occurred in the 1970s for the USA and Australia and in the 1980s for a number of European and Scandinavian countries (Max-Neef, 1995). Closely examining the trend change in India's per capita GPI, it would seem that India is at the same stage as many industrialised nations in 1960s, albeit at a much lower per capita GPI value. This suggests that India's per capita GPI could begin to level off in the next decade or two should it continue to travel along the same development path it finds itself on at present.

### *5.2 Individual GPI items*

If we now turn to the individual GPI items in Table 2, it can be seen that India's weighted consumption (column *g*) increased every year over the study period, rising from 4,180.2 billion Rupees in 1987 to 7,905.2 billion Rupees in 2003. This equates to a rise of 89.1% or an average rate of increase equivalent to 4.1% per annum. On a per capita basis, weighted consumption rose by 38.8% from 5,332 Rupees to 7,402 Rupees per Indian or at an average rate of 2.1% per annum.

Column *h* of Table 2 shows that the contribution made by publicly-provided infrastructural capital (WPPI) to India's well-being was considerably less than the contribution made by durable and non-durable consumption goods. Indeed, at 377.2 billion Rupees in 1987, the services provided by infrastructural capital equated to a mere 9.0% of the welfare contribution made by consumption goods. Between 1987 and 1991, the relative welfare contribution of infrastructural capital remained largely unchanged — a reflection of the infrastructural investment undertaken during the Indian Government's seventh five-year plan of 1985-90. However, the service provided by infrastructural capital fell spectacularly in both absolute and relative terms in 1992 as a consequence of the deep recession and associated debt crisis experienced by India at this point in time.

Fortunately, infrastructural services recovered dramatically between 1992 and 1994 following the implementation of the eighth five-year plan of 1992-97 but declined again in response to the privatisation policy inherent in the ninth development plan (1997-2002). By 2003, the welfare contribution of infrastructural capital had increased to 418.0 billion Rupees but, in relative terms, had fallen to just 5.3% of the contribution generated by consumption goods.

Column *i* in Table 2 reveals the value of India's unpaid labour. As is typically the case in most GPI studies, unpaid labour constituted a major component of India's aggregate GPI value. It also increased throughout the study period, rising from an initial value of 3,229.0 billion Rupees in 1987 to 3,935.5 billion Rupees in 2003. Conversely, the per capita value of unpaid labour fell between 1987 and 2003 from 4,119 Rupees to 3,685 Rupees per Indian.

The social costs of unemployment, crime, and net foreign debt are revealed in columns *j-l*. When aggregated, it can be seen that India's social costs fluctuated over the study period, beginning at 874.2 billion Rupees in 1987, reaching a peak of 1,232.1 billion Rupees in 1991, falling to a low of 448.0 billion Rupees in 1996, before rising once more to 660.4 billion Rupees by 2003.

The variation in social costs can be largely attributed to the variability of the net foreign debt item. Over the study period, India's foreign debt increased in ten of the seventeen years between and including 1987 and 2003. Of the other two social cost items — namely, the cost of unemployment (column *j*) and the cost of crime (column *k*) — the former increased quite steadily over the study period from 358.2 billion Rupees in 1987 to 476.3 billion Rupees in 2003 (33.0% increase). On the other hand, the cost of crime fell between 1987 and 1994 (251.6 billion Rupees to 172.3 billion Rupees) before rising again to 252.1 billion Rupees by 2003 (46.3% increase between 1994 and 2003).

More significant than the social costs arising from a growing Indian economy was the value of India's lost natural capital services (column *s* in Table 2). Beginning at 1,981.3 billion Rupees in 1987, lost natural capital services ballooned to be 3,402.7 billion Rupees by 2003. This constitutes a 71.7% rise over the study period or an average rate of increase of 3.2% per annum. On a per capita basis, the cost of India's lost natural capital services increased from 2,527 Rupees to 3,186 Rupees per Indian, which is equivalent to an average annual rise of 1.4% per annum.

The factors contributing most to the large rise in India's environmental costs were the cost of non-renewable resource depletion (column *m*), land degradation (column *n*), air and urban waste-water pollution (columns *p* and *q*), and the cost of long-term environmental damage (column *r*). Given that a range of environmental costs were overlooked due to the lack of appropriate data, the estimated cost of India's natural capital depletion can be regarded as conservative. In reality, it is likely to have been much higher than that indicated by column *s* in Table 2.

### *5.3 Dominant influences on India's GPI*

Of the three major benefit items (columns *g*-*i*), publicly-provided infrastructure made by far the lowest contribution towards India's per capita GPI. Moreover, since the annual variations in the per capita value of this item were negligible, it had little impact on the trend movement of India's per capita GPI over the study period. This aside, the decline between 1994 and 2003 in the per capita contribution of publicly-provided infrastructure must be a cause for concern, not only because modest annual rises beyond 1994 would have increased India's per capita GPI by around 3-4% by the end of the study period, but because it provides real evidence of a potential infrastructural constraint on India's future economic development.

The gradual decline in the per capita value of unpaid labour had virtually no impact on the annual fluctuations of India's per capita GPI. It did, nevertheless, play some part in narrowing the difference between India's per capita weighted consumption and per capita GPI. What does this suggest? It suggests two possibilities. Firstly, while an increasing proportion of unpaid household tasks infiltrated the market domain over the study period, this was not reflected by an increase in per capita weighted consumption. Clearly, this can only be true for the period up to the mid-1990s since per capita weighted consumption rose sharply in the last ten years of the study period. Secondly, beyond the mid-1990s, the positive impact of the dramatic rise in India's per capita weighted consumption was dampened by the increase in per capita social and environmental costs. Looking at the per capita values for the two major cost categories, this would appear to have been the case, albeit to a much lesser extent with respect to India's per capita social costs. For instance, per capita social costs rose between 1996 and 2003 from 476 to 618 Rupees per Indian, while per capita environmental costs increased from 2,903 to 3,108 Rupees per Indian over the same period.

Notwithstanding the negating influence of India's social and environmental costs, per capita weighted consumption considerably affected the overall trend of India's per capita GPI. For example, between 1987 and 1993, when India's per capita weighted consumption failed to increase, India's per capita GPI made no general advancement. Beyond 1993, both per capita weighted consumption and the per capita GPI grew steadily, except in 1997. That having been said, the impact of India's per capita weighted consumption on the annual fluctuations of its per capita GPI was confined to the period after 1997. In the ten years prior to 1997, per capita weighted consumption and the per capita GPI moved in opposite directions on four occasions. Yet, in each of the six years beyond 1997, per capita weighted consumption and the per capita GPI moved in the same direction, including the years of 2000 and 2002 when both fell marginally.

It would be a mistake, however, to believe that the stronger positive influence of India's per capita weighted consumption on its per capita GPI after the mid-1990s was due to the declining influence of India's per capita social and environmental costs since, as already highlighted, both major cost categories increased over the latter part of the study period. But there is little doubt that the overwhelming beneficial impact of per capita weighted consumption was a fundamental factor behind India's moderate rate of progress after 1993. It should not therefore be regarded as anything other than a positive recent development in India. However, it remains to be seen for how long this positive influence will continue in view of the probable future escalation of India's per capita social and environmental costs. It is certainly something that will need to be closely monitored over coming decades.

Turning specifically to the social and environmental cost categories, the impact of India's social costs on its per capita GPI is particularly interesting. Because the social cost category includes the change in foreign debt which, between 1987 and 1994, fluctuated wildly and at times was very substantial, their was initially a very close association between per capita social costs and the per capita GPI. Indeed, both moved very strongly in opposite directions in each year during this seven-year period.

From 1994 to 1996, India's cost of crime and foreign debt declined — the latter quite significantly. Thus, during the mid-1990s, India's per capita social costs had very little impact on its per capita GPI. Beyond 1996, India's per capita social costs again rose following the increase in foreign debt and resurgence in the cost of crime. As a consequence, the pre-1994 dampening effect of India's social costs on the per capita GPI returned. Moreover, the annual variations in per capita social costs over the final four years of the study period (1999-2003) had a definite albeit minor influence on the fluctuating fortunes of India's per capita GPI.

As for India's environmental costs, it has already been stressed that the steady rise in the per capita weighted value of lost natural capital services constrained the overall rise in India's per capita GPI, particularly after 1993. But the rise in environmental costs played no part whatsoever in the year-to-year fluctuations of India's per capita GPI.

## 6 Policy direction to promote genuine progress in India

In view of the current plight of many Indians, increases in India's real GDP over the next decade or two are needed to deliver further genuine progress in India. But the rate of progress is unlikely to occur at anything like the recent and projected rates of growth in India's real GDP. Worse still, there is no guarantee that India's per capita GPI will grow at the average annual rate of 2.4% experienced between 1993 and 2003.

Given the continuing unequal distribution of income in India and its rapid rate of population growth, India's per capita GPI would almost certainly have been much higher had India managed to stabilise its population, produced better quality goods, and if it had distributed the spoils of its growth in economic output more evenly across the nation. The negating influence of India's rising environmental costs also suggests that India would have been better served by a greater commitment to increased resource use efficiency, especially in relation to energy use and pollution control, and policy measures to reduce the depletion of its natural capital. This would not only have boosted its per capita GPI, it would have greatly increased India's capacity to sustain the progress it has recently made, particularly in view of its recent high rates of non-renewable resource depletion, land degradation, air pollution, and ecosystem destruction.

Given ecological constraints and the fact that India appears to be approaching some kind of threshold level of per capita GDP, India will eventually be forced to make the transition towards a lower rate of GDP growth, probably within the next two to three decades. Assuming this is achieved, India will then need to seriously consider making the full transition to a steady-state economy by around 2050, although the timing will depend largely upon how well India can reign in its population growth.[3] Should it take longer to stabilise its population, more growth will be needed to meet the needs of a larger number of Indian citizens. Since this would delay the consummation of a steady-state economy, it would unavoidably come at the expense of a lower per capita GPI. It would also bequeath future Indians a socio-ecological system considerably less resilient to external shocks and more vulnerable to ecological collapse and social disharmony.

There are many who believe that a steady-state economy precludes the continued development of a nation and its citizens. This is not so. The policy direction recommended in this section of the paper — namely, the production of better quality goods, a more equitable distribution of income, and a reduction in environmental costs through greater resource use efficiency — can lead to a higher per capita GPI without the need for higher levels of per capita GDP. A steady-state economy is not something to be feared and should be considered an inevitable part of a nation's development process once the necessary growth phase has provided the material basis upon which continuing progress can be secured without the need for further, albeit unsustainable, material expansion (Lawn, 2007; Lawn and Clarke, 2008).

## 7 Concluding remarks

Despite enormous recent advances in India, the GPI results revealed in this paper indicate that India's rate of genuine progress has not matched the rise in its per capita GDP. There is one simple explanation for this. While India's economic benefits have increased substantially, as reflected by the rapid rise in the per capita welfare contribution of consumption expenditure, so too have India's social and environmental costs — the latter being the result of an escalation in the cost of non-renewable resource depletion, land degradation, air pollution, and ecosystem destruction.

There is no denying the fact that India requires further growth of its real GDP to alleviate persistent high levels of absolute poverty, especially given the projected rises in

India's population. However, it will need to be growth that is characterised by improved production (better quality goods), a more equitable distribution of income, increased resource use efficiency, and the minimisation of the rate of natural capital depletion. It will also need to be accompanied by effective policies to rapidly stabilise India's population. Even if a 'better' form of growth can be achieved, the rate of increase in India's genuine progress is unlikely to match the recent and projected rises in India's real GDP. Nevertheless, it should at least prevent India's per capita GPI from declining in the immediate future.

Looking beyond the next ten to twenty years is an entirely different matter altogether. India, like all countries, will need to make the transition to a lower rate of GDP growth. Eventually, however, India will need to think seriously about making the full transition to a steady-state economy. It will need to do this if only because a failure to do so will result in any additional benefits generated from production excellence, increased efficiency, and distributional equity being overwhelmed by the rising costs of an economic system that, inevitably and disastrously, would grow beyond its maximum sustainable scale.

The Indian Government faces a monumental task in trying to deliver a lasting and sustainable rate of genuine progress for its citizens. But it can be achieved, even though it is likely to require external assistance from the world's richest countries. For that matter, the world's richest countries have a clear responsibility to provide financial and moral support for India since they should never lose sight of how fortunate they are to have already enjoyed the spoils from past growth.

## References

Blum, H. (1962) *Times Arrow and Evolution*, 3rd edition, Princeton: Harper Torchbook.

Cairns, R. (2000) 'Sustainability accounting and green accounting', *Environment and Development Economics*, Vol. 5, pp.49–54.

Capra, F. (1982) *The Turning Point*, London: Fontana.

Cobb, C. and Cobb, J. (1994) *The Green National Product*, New York: University Press of America.

Daly, H. (1979) 'Entropy, growth, and the political economy of scarcity', in V.K. Smith (Ed). *Scarcity and Growth Reconsidered*, Baltimore: John Hopkins University Press, pp.67–94.

Daly, H. (1991) *Steady-State Economics: Second Edition with New Essays*, Washington, DC: Island Press.

Daly, H. (1996) *Beyond Growth: The Economics of Sustainable Development*, Boston: Beacon Press.

Easterlin, R. (1974) 'Does economic growth improve the human lot?' in P. David and R. Weber (Eds). *Nations and Households in Economic Growth*, New York: Academic Press.

Easterlin, R. (2001) 'Income and happiness: towards a unified theory', *The Economic Journal*, Vol. 111, pp.465–484.

El Serafy, S. (1989) 'The proper calculation of income from depletable natural resources', in Y. Ahmad, S. El Serafy and E. Lutz (Eds). *Environmental Accounting for Sustainable Development*, Washington, DC: World Bank, pp.10–18.

Fisher, I. (1906) *Nature of Capital and Income*, New York: A. M. Kelly.

George, S. (1988) *A Fate Worse Than Debt*, New York: Grove.

Georgescu-Roegen, N. (1971) *The Entropy Law and the Economic Process*, Cambridge: Harvard University Press.

Hicks, J. (1946) *Value and Capital*, 2nd edition, London: Clarendon.

Lawn, P. (2003) 'How important is natural capital in terms of sustaining real output? Revisiting the natural capital/human-made capital substitutability debate', *International Journal of Global Environmental Issues*, Vol. 3, pp.418–435.

Lawn, P. (2007) *Frontier Issues in Ecological Economics*, Cheltenham: Edward Elgar.

Lawn, P. and Clarke, M. (Eds) (2008) *Sustainable Welfare in the Asia-Pacific: Case Studies Using the Genuine Progress Indicator*, Cheltenham: Edward Elgar.

Leipert, C. (1986) 'From gross to adjusted national product', in P. Ekins (Ed). *The Living Economy: A New Economics in the Making*, London: Routledge & Kegan Paul.

Max-Neef, M. (1995), 'Economic growth and quality of life', *Ecological Economics*, Vol. 15, No. 2, pp.115–118.

Norgaard, R. (1984) 'Coevolutionary development potential', *Land Economics*, Vol. 60, pp.160–173.

Perrings, C. (1986) 'Conservation of mass and instability in a dynamic economy-environment system', *Journal of Environmental Economics and Management*, Vol. 13, pp.199–211.

Repetto, R., Magrath, W., Wells, M., Beer, C. and Rossini, F. (1989) *Wasting Assets: Natural Resources in the National Income Accounts*, Washington, DC: World Resources Institute.

Robinson, J. (1962) *Economic Philosophy*, London: C.A.Watts & Co.

World Bank (2007) *World Bank Development Report: Development and the Next Generation*, Washington, DC: World Bank.

## Notes

[1]To understand what is meant by low and high entropy matter-energy, the importance of the first and second laws of thermodynamics needs to be explained. The first law of thermodynamics is the *law of conservation of energy and matter*. It declares that energy and matter can never be created or destroyed. The second law is the *Entropy Law*. It declares that whenever energy is used in physical transformation processes, the amount of usable or 'available' energy always declines. While the first law ensures the maintenance of a given quantity of energy and matter, the Entropy Law determines that which is usable. This is critical since, from a physical viewpoint, it is not the total quantity of matter-energy that is of primary concern, but the amount that exists in a readily available form.

The best way to illustrate the relevance of these two laws is to provide a simple example. Consider a piece of coal. When it is burned, the matter-energy embodied within the coal is transformed into heat and ash. While the first law ensures the total amount of matter-energy in the heat and ashes equals that previously embodied in the piece of coal, the second law ensures the usable quantity of matter-energy does not. In other words, the dispersed heat and ashes can no longer be used in a way similar to the original piece of coal. To make matters worse, any attempt to reconcentrate the dispersed matter-energy, which requires the input of additional energy, results in more usable energy being expended than that reconcentrated. Hence, all physical transformation processes involve an irrevocable loss of available energy or what is sometimes referred to as a 'net entropy deficit'. This enables one to understand the term *low entropy* and to distinguish it from *high entropy*. Low entropy refers to a highly ordered physical structure embodying energy and matter in a readily available form. Conversely, high entropy refers to a highly disordered and degraded physical structure embodying energy and matter that is, by itself, in an unusable or unavailable form. By definition, the matter-energy used in economic processes can be considered a low entropy resource whereas unusable by-products can be considered as high entropy wastes.

[2]A value of at least one is required to demonstrate adequately substitutability.

[3]The concept of a steady-state economy is discussed at length in Daly (1991) and Lawn (2007). In a nutshell, a steady-state economy is one that does not physically grow but qualitatively improves in terms of the content of the physical goods within the economy, the means by which they are produced and maintained, and the purpose for which they are intended.