Special Integrated Assessment Issues for Developing Countries

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Abstract

Integrated assessment frameworks face a number of formidable challenges when they are applied to reflect the existing socio-economic structures of the developing countries. The main challenge is to overcome two broad groups of weaknesses of most of the current integrated assessment models as applied to conditions in developing countries. The main weakness is connected to the nature of climate change, namely, that the impacts are likely to be among the highest in the developing countries and that this is precisely the most uncertain part of these models. Most of them capture only the so-called market damages of climate change, while it is generally assumed that the largest share of expected damages cannot be valuated in a market place in monetary terms, at least not for the time being. The second weakness is related to the fact that most of these models were developed for the current conditions prevailing in the industrialized countries and thus do not reflect the actual socio-economic structures of the developing countries. We will briefly address the second category of challenges and weaknesses of the current integrated assessment models, and not the first one which is more generic, as it also applies to the assessment of damages in industrialized countries.

Before we discuss these challenges and weaknesses, it might be useful to state that they relate more to the current and transition states and not to the long-term future. Figure 1 illustrates the fact that economic growth rates in the range of historical experience, say, about two to three percent per year, would lead to a high degree of affluence throughout the world, sufficient for most of the current developing countries to become industrialized over this period. In other words, assuming positive development in the world, and not a global disaster or general failure of development, the difference between the developing and developed countries would disappear as we know it today. Figure 1 is based on the findings of the joint IIASA and WEC study on *Global Energy Perspectives to 2050 and Beyond* (IIASA/WEC, 1995) and represents a ten-fold economic growth in the world during the next century, from some $20 trillion in 1990 to about $200 trillion by 2100. The area of each continent is proportional to the economic activity rather than to its geographical area. The fact that this economic map of the world looks quite like the geographic map in 2100 indicates how the continuous development can eradicate some of the grave inequities and differences between the so-called North and South as they exist today. This means that many of the inadequacies and weaknesses of the integrated

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assessment models, with respect to the situations of developing countries, apply less and less the further one looks into the future. Nevertheless, the crucial issue is to what extent do these approaches give a misleading characterization of the transition period from now into the longer-term future, because they inadequately capture the current socio-economic structures of the developed countries.

One of the problems is that developing countries, and to a lesser extent many developed ones, have large shares of informal or gray economic activities. This part of these economies is consequently not accounted for in the official statistics. A related problem is that national accounts generally do not include any form of unpaid work either. Thus, the historical and base year statistics generally represent only the formal part of the economy, ignoring a substantial part of the economic activities. As these economies develop, it can be expected that informal and unpaid work would be substituted by formal and paid (and thus accounted for) economic activities. This changes the nature of development dynamics. The actual economic growth rate (including estimates of informal and unpaid activities) would be substantially lower than that which only includes formally accounted activities. The consequence is that not only economic activities are grossly underestimated (and growth rate overestimated) but also that the implications, such as environmental and other impacts, are also underestimated as they usually depend on the activity levels in most of these models.

For example, in most of the industrialized countries, agriculture accounts for only a few percent of GDP and overall employment. This does not mean that all of the activities related to what used to be known as traditional agriculture are so small as well. It actually also means that they have been incorporated into other sectors of the economy. Food processing is a part of the industrial activities. Marketing sales is a part of the service sector, and distribution and transport are part of the transport sector. In contrast, in many of the developing countries, agricultural activities are still the major part of the whole economy and in addition, many of them, such as subsistence farming, are not even included in the national accounts. The main point is that this inadequate representation of socio-economic structures prevailing in the developing countries can lead to misleading dynamics in the integrated assessment modeling. Figure 2 illustrates the historical transitions in sectorial shares of the economy for a number of countries, indicating the strong tendency of, first, a transition from agriculture to industrial activities, and then toward services in a clock-wise direction on this graph. These structural changes can be grossly misrepresented through this inadequacy of the integrated assessments.

Another related weakness with respect to the developing countries is that most of them valuate economic activities based on the international market exchange rates. This is clearly inappropriate, especially for the economies with low incomes and low share of formal economic activities. There have been a number of attempts to alleviate this deficiency by the use of estimates for the purchasing power parities among countries. The actual purchasing power is generally higher than that based on market exchange rates in low-income countries, while almost the opposite can be the case in some countries with very high incomes. Unfortunately, there are only a few integrated assessment models using purchasing power parity estimates. One of the reasons might be that this is not unproblematic either. The economic growth rates tend to be generally lower for developing countries when compared with those measured at market exchange rates. This also

means that, for example, the rates of energy intensity improvement would be lower as well. There are now a number of groups that use both methods in parallel in order to avoid misunderstandings that might come up.

And the third, also related, weakness concerns the inadequate account of actual energy needs in most of the developing countries. It is generally claimed that about four billion people in the world do not have access to commercial energy. This means that they have inadequate energy services hindering development, but it does not mean that they do not consume any energy at all. The non-commercial energy use is not represented in energy statistics because it is locally collected and locally used. This is analogous to the exclusion of informal and unpaid work in the economic statistics. The resulting problem is, however, quite severe for the integrated assessment models. Figure 3 illustrates the nature of the problem and indicates some of the adverse consequences. It shows historical energy intensities for a number of countries, including and excluding, estimates of non-commercial energy use, such as locally collected wood, dung, and agricultural wastes. Without non-commercial energy use, commercial energy intensity increases during the early industrialization phase and then proceeds to decline along a long-term trend. Adding non-commercial energy consumption shows that the total energy intensity portrays a generally declining trend from the beginning. Especially interesting is the situation for India, which shows that the total energy intensity is declining quite rapidly (while commercial energy appears to increase at a high pace), albeit starting at an alarmingly high level. This is due to the rather low efficiencies of non-commercial energy use (e.g. cooking over an open fire), similar to those that prevailed in now industrialized countries before the onset of rapid industrialization. Here again, the dynamics of future replacement of non-commercial (and generally unsustainable) by commercial energy sources is grossly misrepresented by most integrated assessment models. This leads to inappropriate treatment of energy-related environmental impacts as well, especially during the transition phase in energy that is likely to occur during the next few decades in most of the now developing countries.

These three examples of some of the inadequacies and weaknesses of current integrated assessment models imply that future emissions of the developing countries and consequently their contribution to global emissions, might also be deficient. Figure 4 shows both the historical and the range of future global carbon dioxide emissions. Three of the six IPCC IS92 scenarios are shown, plus the five IIASA-WEC scenarios and the four emissions trajectories consistent with eventual stabilization of atmospheric concentrations. The range of emissions is indeed very large indicating large uncertainties surrounding the major driving forces and their dynamics. However, better specification of integrated assessment models for developing countries could lead to a big difference in the global emissions as the share of these countries in the global total increases dramatically. Wrong and inadequate representation of the dynamics of the trajectories for the developing countries leads to inappropriate base cases and thus also to inappropriate policy scenarios.

Integrated assessment frameworks therefore face formidable challenges to be resolved in the coming years should they become more important tools in the analysis of future anthropogenic emissions, impacts and possible mitigation and adaptation policies and measures. Suffice to say here that six areas of improvements would make integrated assessment more relevant for capturing the current and future developments in the devel-

oping countries.

1. The base year situation and structure need to be captured much more adequately, and perhaps most important is to include historical dynamics in the assessments.

2. The key driving forces and their relationships need to be captured both empirically and theoretically.

3. The assessments need to capture explicitly the fact that current developing countries will no longer be characterized as such in a century from now, they are future developed countries, but lifestyles, culture and many other salient socio-economic characteristics are likely to be quite different compared to developed countries today.

4. Mitigation costs are generally lower in the developing countries today and the impacts are generally higher today (especially when non-market damages are included), but this distinction is likely to disappear as these countries undergo a rapid phase of development.

5. Technological and institutional change needs to be captured better with sufficient attention given to the RD&D phase of new technologies and subsequent technological learning associated with successful diffusion and transfer of new technologies.

And sixth, the resulting energy efficiency improvements and reduction of emissions intensities, such as the decarbonization of energy, are important consequences of socio-economic development observed historically for the now developed countries and possibly also in the future for the now developing countries.

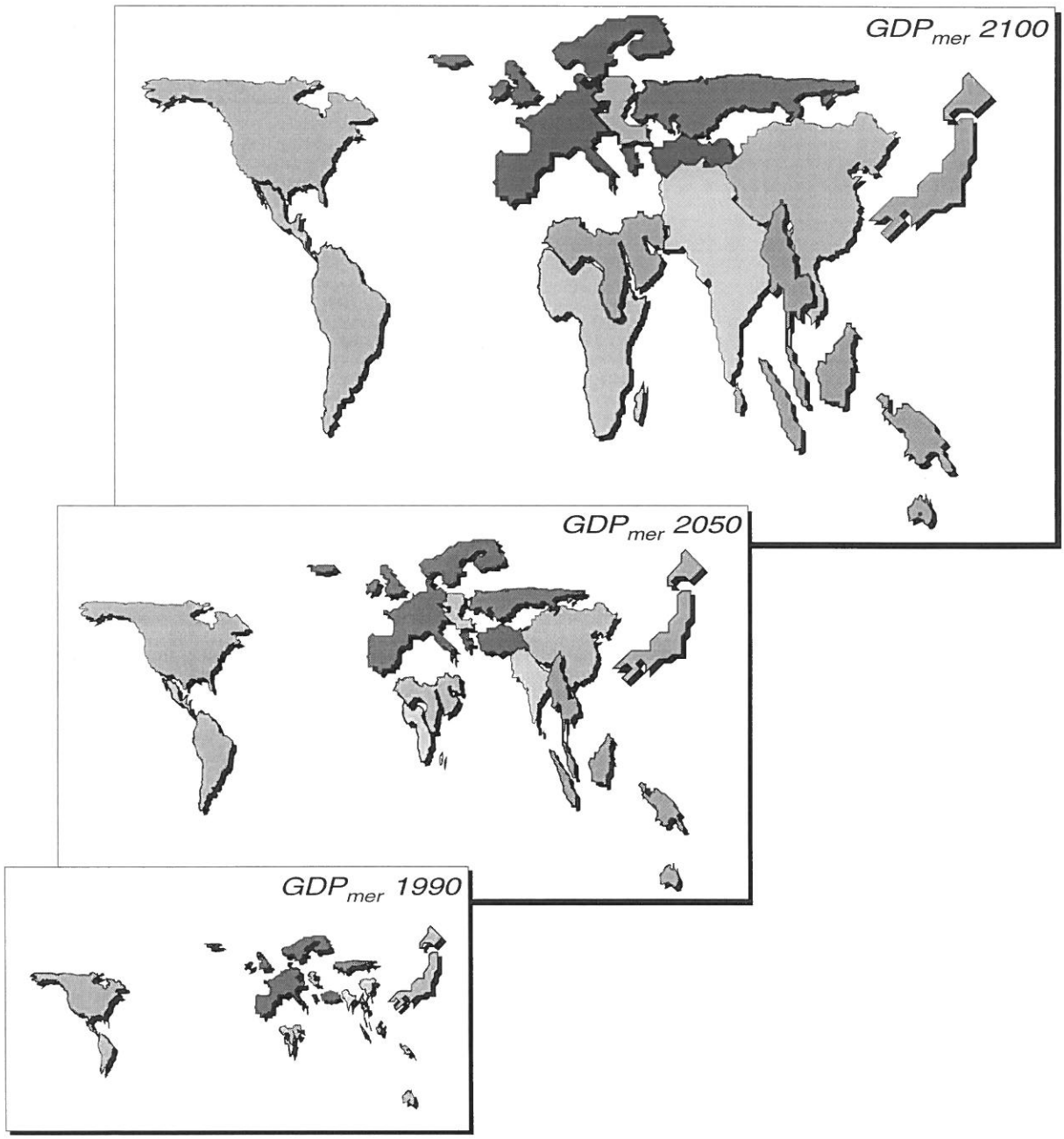

Figure 1: The changing geography of economic wealth, Case B, 1990, 2050, and 2100. The areas of world regions are proportional to their respective 1990 levels of GDP, expressed at market exchange rates.

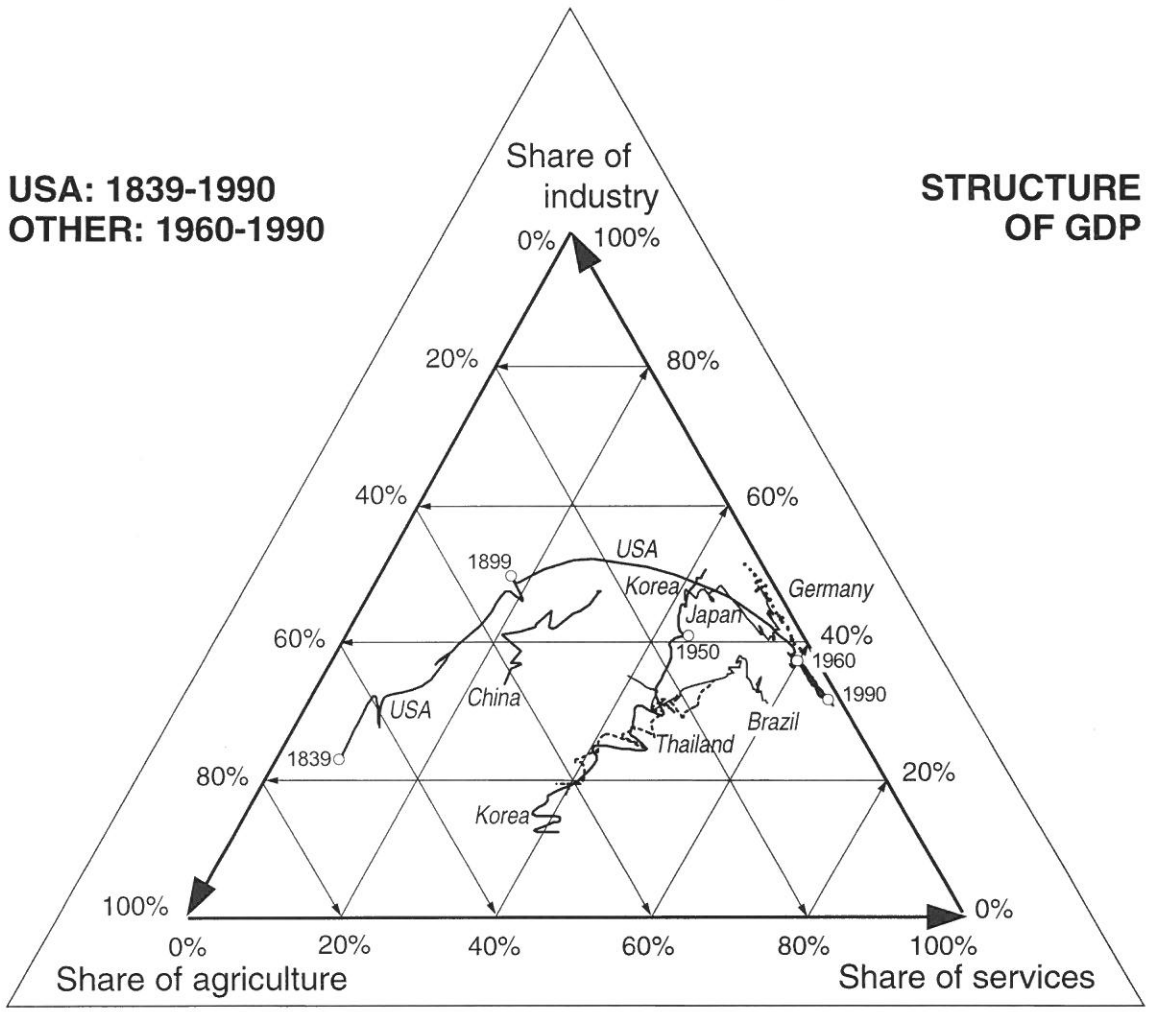

Figure 2: Divergence in the contributions of industry, agriculture and services to GDP (in percent).

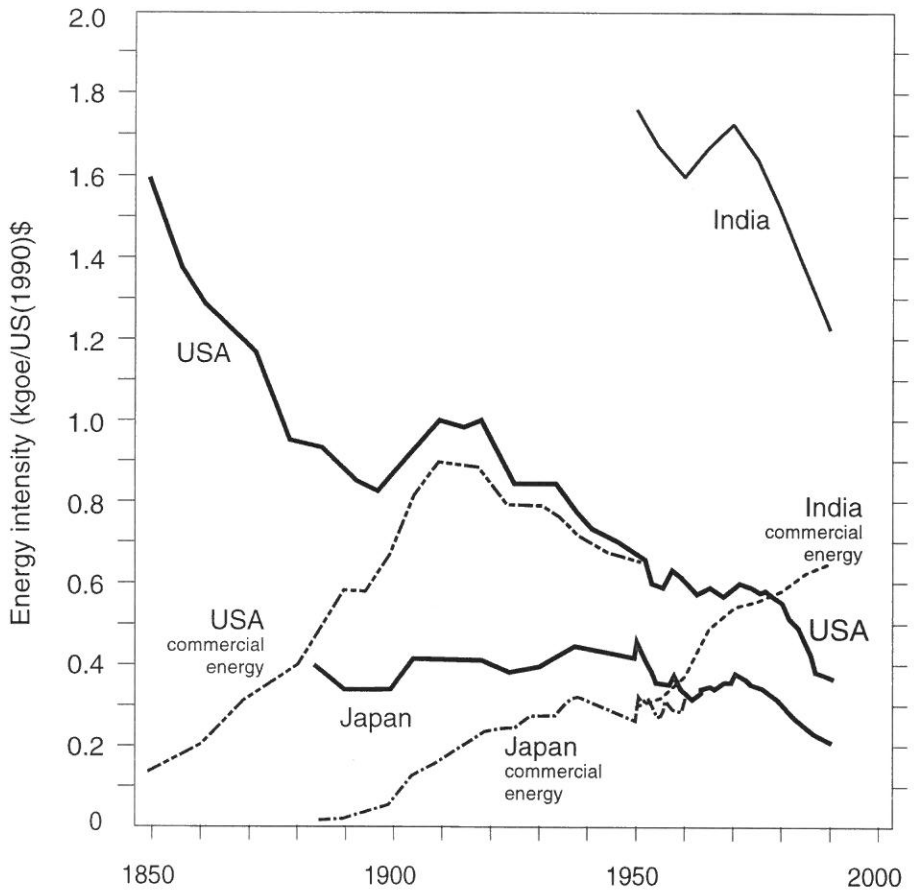

Figure 3: Primary energy intensity of economic activities in the USA and selected countries, expressed in kilograms of oil equivalent per unit GDP at constant 1990 prices [kgoe/US(1990)$].

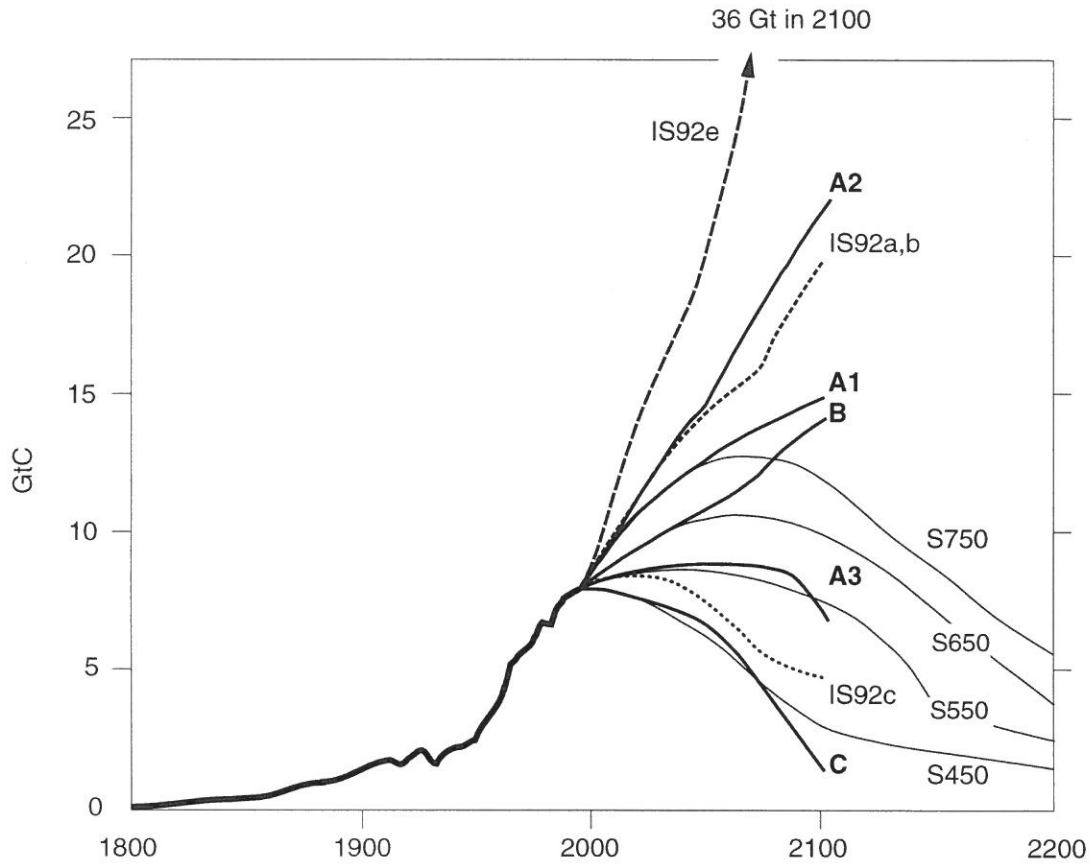

Figure 4: Global energy-related carbon emissions, 1800 to 2200, for IIASA-WEC scenarios and IS92 ranges.

References

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IPCC (Intergovernmental Panel on Climate Change) (1995), J.T. Houghton, L.G. Meira Filho, J. Bruce, H. Lee, B.A. Callander, E. Haites, N. Harris and K. Maskell (eds)., *Climate Change 1994: Radiative Forcing of Climate Change and An Evaluation of the IPCC IS92 Emission Scenarios*, Cambridge University Press, Cambridge, UK, 339 p.