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## Economic Growth

### Club of Rome Study: Limited Prospects

by Dr Wolfgang Michalski, Hamburg \*

**No other scientific publication in recent months has caused more of a stir and stimulated discussion than the Forrester-Meadows Study of the Massachusetts Institute of Technology (MIT) on behalf of the Club of Rome. In the following article the pessimistic assessment of the outlook for mankind in the MIT study is subjected to a critical examination.**

Our time is distinguished from all previous eras by such a vast and variegated array of features that it is difficult to keep them in perspective. Among the most significant are the apparently continual escalation of the dynamics of social processes, the growing complexity of the interrelated effects of the intensification and acceleration of technological, economic, social and political change, the widening scope for systematic planning in regard to a multitude of decisions to be taken amidst spreading uncertainties, and the increasing importance of human decisions for the world as a whole and for our very survival in it. It is against this background that the MIT study on "Limits of Growth" published a few months ago must be judged. It has caused more of a stir on the international scene than any other publication of a scientific description in recent years.

#### **Basic Idea of the Study**

The basic idea underlying the study is relatively simple. Starting from a diagnosis that the earth may be regarded as a spaceship with finite reserves, an attempt is made to establish that continuing exponential population and production growth coincidental with dwindling raw material supplies, increasing scarcity of food and progressive destruction of living space is bound to bring disaster in its wake within the next hundred years.

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This gloomy prevision is based on a mathematical model of the world in which the world's population, its material capital, the tillable land area and indices of available reserves of non-regenerative raw materials and the extent of environmental pollution are the essential parameters.

The authors' claim that theirs is at present the only model with validity for the whole world and a time-horizon of more than thirty years which treats the elements mentioned not in isolation but as dynamically interdependent can be accepted. Whether it is also, as the authors believe, the most useful model at this juncture for a discussion of the problems to be broached and whether, admittedly elementary and incomplete as it is, it lends itself for use as a basis for political decisions is however open to serious doubt.

The question how many people can live on our earth, how long they can do so and at what level of material welfare, cannot be answered in disregard of social facts and data. The determination of the borderline between population growth and material welfare attainable under the natural and technological conditions prevailing at any given time depends at least as much on factors in the social dimension as on the scarcity of certain material resources. In this context the differential in relative prosperity between industrialised and developing countries and the prevention of another world war are quite as relevant as, for instance, the educational and

vocational standards of the population and the propagation of knowledge and, accordingly, the advancement of technical progress.

### **Ignorance of Social Factors**

By confining their work to an attempt at analysing the material foundations of the expansion process which are alleged to set an ultimate limit to growth irrespective of social difficulties which may arise before these limits are reached, the MIT team obviously ignored that social factors are capable not only of curtailing opportunities for development but of adding to them greatly. To exemplify, success in birth control is, even today, a social rather than a material issue. There is agreement among experts that a given amount of money spent on birth control may in a number of developing countries prove a hundredfold more effective for raising the material welfare than expenditure of a similar sum on conventional development aid.

That exponential extrapolation of industrial production is also open to no less serious objections than a long-term extension on similar lines of population trends can be deduced from incipient signs suggesting that economic policy is no longer orientated exclusively by reference to quantitative growth. Moreover, it must be borne in mind that, in the advanced economies at least, the contribution of industry to the total economic effort is already proportionately declining. It may also be asked what point there is in choosing material capital as the yardstick for measuring industrial production when, according to calculations by prominent economists, about three quarters of the past increase in the national product was attributable to technical progress and not to increased use of labour and capital.

### **Untenable Assumptions**

Some of the assumptions concerning the scope for rising food supplies and the scarcity of raw materials are also untenable. The potential supply of food is supposed to depend on a given maximum of tillable land. That there are no definite limits to the tillable area and that food can be obtained from the sea and even by chemical means has been largely overlooked. Similarly, the supply of raw materials is assumed to be inelastic. Technical advances in the methods of production and utilisation which can be foreseen already now have received scant attention. No mention is made of the possibility of new raw materials gaining importance. Little is said of

substitution processes. The directive functions of the price mechanism are not discussed at all.

That the process of environmental pollution was uncritically extrapolated in the MIT study may in view of its manifold long-term repercussions and delays in the application of conservational policies not seem unreasonable to be expected over the next five or ten years. Against a 30-year horizon however there is much evidence to suggest that the absence of any reference to the social dimension is another sign of insufficient flexibility. The growing awareness of environmental problems throughout the world, national policies for the protection of the environment and the development at the same time of technical processes which are not injurious to the environment make it seem relatively unlikely that the long-term trend in this field will follow an exponential line.

### **Questionable Methods of Investigation**

Those who are used to work with mathematical models will be predisposed to a critical attitude to the global model. Not only does this model, said to comprise no more than 165 equations, lack adequate subject-matter, space and time differentiation because it is made up of too large units and based in part on dubious statistical data, but it is difficult to avoid the impression that the inherent fascination of an exponential function has been allowed to obscure the necessary critical detachment from the object and methods of the investigation. One of the questions which spring to mind is what process forecast would have been reached if the alternative hypothesis of logistic saturation functions had been introduced instead of the exponential function.

The verdict of the London "Economist", which is partly due to the strange remedial proposals, that the MIT study has reached a "high-water mark of old-fashioned nonsense" may seem harsh and precipitate, seeing that the volume containing the scientific material has not yet been published. When this has been done it will be seen whether any real benefit can be derived from a scientific discussion opened with so much publicity that is based on this work. But even if the study is confirmed to rest on too simplistic a superaddition exercise, it has merit in having succeeded in drawing the attention of a wide public to some of the most important questions which will occupy mankind in future. For this reason it may perhaps help to advance the work of those who have to approach these problems in a more responsible manner.