

WORLD MODELS
A CASE STUDY ON SOCIAL RESPONSABILITY
AND IMPACT

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Only recently have socio-economic world models been developed. This can be explained by two reasons : the world approach is recent although the problem on the international level has been approached quite some time ago; on the other hand, such an approach requires the bringing together of manifold disciplines, which makes the implementation of such projects difficult.

World models, as all Human Science models, have a social aim and function : explanation and/or decision. Some of these models have been privileged by the Club of Rome publications in the "general public". In this case, the social impact is of a different nature, more especially as for the Club of Rome they are the source of proposed choices of Society (1), (2).

The analysis of the methodology used for the construction of these two models will allow us to point out the biases induced by the model-makers themselves, as well as the authors of the publications.

From this analysis, we will show the issueing impact on society.

It will therefore neither be a matter of suggestion an internal criterium of the models themselves nor of setting methodological standarts.

1 - The Methodology Analysis

The first aim of the analysis will be to determine the nature of the methodological biases which show that the model makers are responsible before society.

1 - 1. Publication of information on the model :

One of the main characteristics of large models is their complexity, not so much of the equations themselves but rather of the global understanding of the system and model.

In this case, the close analysis of the model will not guarantee the pointing out of all the hypotheses made as they are not systematically explained. The set of

hypotheses made and the knowledge of the models global structure are fundamental elements for the understanding, on account too of the complexity.

The analysis on a world wide level is an additional element of complexity. As not very developed, elements for comparison are few. Moreover, such an approach referring to various fields of study, does not make the global understanding easy for the specialists of each field taken separately. For these reasons, it is absolutely necessary to easily know the fundamental hypotheses as well as the global structure when reading the documentation supplied by the model-makers.

1 - 1.1. Explanation of the hypotheses : If alone the widely read works are analyzed, the first report (1) allows one to establish an already lengthy list of the hypotheses laid down.

As examples we will quote :

- the five fundamental variables are characterized by an exponential growth
- a certain number of regulation factors exist
- no social upheaval will occur

On the other hand, the second report (2), gives less information in this respect. It is only possible to reconstitute the general approach rather than the hypotheses themselves. Strictly speaking, the only hypotheses expressed are the following :

- regional partitioning in order to render an account of the specificities (organic growth)
- the gap between regions can be reduced with financial help from the most developed regions
- the present and future problems set by raw materials are of the same nature as those set by oil at the present time
- the food problems are the same in the different under-developed regions

1 - 1.2. Global structure of the model : Therefore, already on this point, whether the general public or other model makers are concerned, it is difficult to have an opinion of the model. More determinant, is the availability of the global structure of the model. Working from this, the well informed reader can find out the causal links between variables and furthermore can, from this, reconstitute a certain number of non-expressed hypotheses. After an attentive analysis, it is possible to know, in a concentrated form, the variables kept as elements of the model and system dynamic, their causal relations and of the way in which they set.

On this point too, it cannot but be noticed that the second report gives little information. Only a small part of the global structure is made available to the reader. It is thus impossible to know what the model contains and consequently to make any critical analysis.

One of the MESAROVIC team's contributions was not so much the world regionalisation -the reason for this will be given later- as the use of a modular construction : demographic, economic, energy models... The methodological advantage is obvious, and bears in particular, on the solving of the problem how to cut up the system into blocks. This, of course, is not mentioned in (2) as already the structure diagrams are, according to the authors, too complicated to be shown in their entirety, Cf.(2), p.63. Neither is this mentioned in the various technical reports published at the time of the Club of Rome meetings in Salzburg end 73 (4), or in Vienna in April-May 74 (5). There is no doubt that this problem, if solved, should have formed the subject of a publication, because a solution to this problem should allow progress in modeling.

Moreover, the reading of the technical reports show that the effort to respect the regional disparities has perhaps not been carried very far : for the economic model it appears that 3 distinct models have been elaborated : developed countries, under-developed countries, socialist countries. The contribution towards the first report is certain, but it is not understandable why the distinct regions have been established. In the paragraph 2.2. the consequences of this problem are shown.

On the other hand, D. MEADOWS's team has, also for the general public, expounded the global structure of its model (2)(pp.212-13). With this element alone, it is possible for everyone to see the relative importance given to each of the five key-variables. Furthermore, a specialist, for example an economist, will easily be able to analyze the way in which to consider the problems relating to the "Industrial Capital" variable.

1 - 1.3. Documentation and possibility of critical analysis : from the methodological point of view, it is necessary for the model-maker to supply the information needed for the understanding of this model and for that which he wishes to show. This is essential with respect to the general public, especially if the model is widely distributed, but ever more so in respect to other model makers. It is clear that progress in modeling is possible, particularly world modeling if elements of comparison are available.

With this as aim, D. MEADOWS's team produced a very detailed technical report (3), unfortunately with some delay, as a number of criticisms had already been made before its publication. It has been possible for the first report to be widely discussed more particularly among the economists who gave themselves up to the criticisms of the hypotheses kept.

In 73, a team from the University of Sussex published a critical counter-report (6), which in detail analyses the whole model. Due to the scarce information available, the second one has not been widely discussed. At most, only the results obtained or the scenarios kept are a source of discussion. A rare example is Pr. W. BECKERMAN's article (7).

1 - 2. Reliability of the results

Another methodological bias should be pointed out : the reliability of the results obtained. The statistical data available, as proved by O. MORGENSTERN (8), are generally not reliable. Thereby, the results obtained reflect these errors. When, moreover, the causal relations are not established with certainty, as is the case for the construction of world models, to comment on the figures obtained and therefore to give them a high credibility in order to draw the conclusions necessary to help the decision making, appears dangerous if not illusory. It is desirable to stop at the analysis of the behaviour mode as D. MEADOWS and his team partly did : (1) pp.229-230. This concretely reveals the methodological differences between the two teams.

J.W. FORRESTER, D. MEADOWS have adopted a methodology which can be described as follows : the model is elaborated and then used in order to solve the behaviour mode problems and not for forecasting. Above all the correctness of the model structure is important while the accuracy of the data ranks after.

Solely the reading of the technical reports (5) allows to show that the actual methodology of MESAROVIC's team appears similar to an econometric approach. This is particularly clear in the World Economic Model : it is a Cobb-Douglas type model. These methodologies differ : both are a research in the understanding, but the second, is more a research in the correctness of the results with regard to the statistical series. The first approach, owing to the fact that the knowledge of the problems on a world scale is not yet very wide, is, doubtless, prudent.

1 - 3. Sensitivity tests and scenarios

A last point, concerning the tests realized on the two models, will be analysed. It appears that the first report presents sensitivity tests on the model as application of policies. This shows a misunderstanding which arose between model and system, as O. RADEMAKER pointed out (9) (p.13) : "Sensitivity analyses serve to find out how great is the influence of the choice of certain coefficient values, functional relations, and initial values, and not of finding the effect of particular real-world measures".

MESAROVIC's team has supplied a contribution in so far as scenarios have been really built and used.

The analysis of the methodological biases that we have pointed out will now allow us to show their impact on society.

2 - Models, Ideology and Society

2 - 1. Refusal of the ideology

The field of analysis of Social Sciences, to which the world models belong, includes ideology, i.e. pseudo-explanatory type of approaches.

The limits of ideology are fuzzy particularly in fields of study such as economy. A large number of discussions between economists on the equilibrium models may in fact be brought down to an ideological discussion.

If refusing to admit that the analyses in Social Sciences, including and above all on the basis of models, partly involve ideology, an inevitable bias crops up : results of the model are given as accurate as they have been mathematically "proved".

Were the controversies on the equilibrium models in the 60's not partly provoked by the discussion on more or less explicit hypotheses, and more fundamentally by the real but not expressed aims of the model makers themselves?

The ideology springs from the fact that a model is built for a specific aim, be it one of demonstration or one of decision making. On this sense, a model can therefore be neither neutral nor 'objective'.

Thus, for the model maker there is a responsibility factor, more particularly so when the results obtained are supposed to help political choices. In this case, the social impact takes a 'world-wide' dimension, not because the two models analyse the world system, but because they are widely read. This world dimension was much more perceptible at the time of the first report's publication : almost simultaneously growth problems were tackled in various claims among others :

- UNESCO meeting in Paris
- U.N. Conference on Environment, held in Stockholm
- CNUCED in Santiago

One must admit that the second report neither had the same impact, nor provoked a comparable awareness of the problems tackled, but it possesses as large a social impact by means of its conclusions.

2 - 2. Global approach and consideration of the specificities

The wish for a global approach led to a theoretical contradiction in the realization of the two models : denial of the ideology, but analysis biased by ideology. The approach by which the object analyzed is a system, is doubtless necessary for a better understanding. Here, the problem set is to know what appropriate degree of aggregation is to be kept, and what phenomena belong to this level of analysis.

This global approach has clearly led to convey a same ideology, in spite of divergent methodologies. Whether the approach was deliberate or not on the part of the modelmakers is not the problem.

The stress has been placed on the identity of the nature of the problems for all the countries, be it a question of food, pollution, energy, etc... But, as a matter of fact, the heart of the problem is concealed. Can one admit that the food problems in the Sahel and in South-East Asia are identical? That the provisioning in energy sets the same problems to Europe as it does to the under developed countries?

That pollution in Africa and in North America are the same? The answer is obviously negative, and goes for each crisis factor dealt with in both reports. To set the problem of pollution cannot have the same signification for a western country as for an under developed country. For the former it is a matter of questioning growth which the latter would wish to have. In this respect, the effort to regionalise the world, i.e. to take into consideration the differences, reveals itself as illusory : the regions kept are not as homogenous as the authors would make us believe. As we are not making an internal criticism of the model, let us accept the partitioning suggested. But, why problems of a given region are transposed to others (food problems for ex), if the analysis proved the necessity to explain the differences between regions?

Apparently, the second report has taken into account the existence of under development. Many authors had reproached D. MEADOWS's team with not having done this. 6 of the 10 regions are indeed under developed countries. But, the progression is only apparent. Growth remains expressed in global terms, which is to know it superficially : to ask the question whether the under developed countries will one day realise their economic take-off and follow the growth of the western countries, is once again to analyse growth in terms of stages of growth, as is done by Rostow. C. FURTADO (10) had already showed this up in connection with the first report. The criticisms of the second report remain identical. Basically, the problem is set in the same terms; it is, for example, said p.73 (2) that...."the gap between the world various regions continually increases".

Many tested scenarios show that the authors are looking for solutions in order to diminish the gaps. But, here again it shows a refusal to ask oneself if the developed countries have not reached such a economic growth thanks to the dominating relations which they have imposed.

If the existence of such a bias is accepted, the solutions proposed in the two reports, such as aid towards development by the means of capital, will probably have a large social impact on the economic development and with regards to public opinion. The readers of the two reports will find in them a confirmation, given as strictly accurate, of what they already know, by means of media, on help towards development which has been practised in the form of financial help since the end of WW.II. From this time onwards the general public is strongly influenced given the fact that by definition, it does not have all the information necessary at its disposal in order to have a truly personal opinion and to recognize such biases.

2 - 3. Analysis of growth and crisis

For some time too, the reader of the second report has been made aware of a second point dealing with an aspect of growth : this concerns the problem of the present crisis(es). The diversity of the vocabulary reveals the complexity of the problem : partial crises are spoken such as, for example, the "food crisis", the "energy crisis"

or the crisis at a global level : the world crisis

the crisis of the capitalist system, etc...

The explanations suggested are at least as numerous as the terms employed. Finally, in fact, the uncertainty as to determine when exactly the crisis began is just as great.. As yet, it has not been possible to make a coherent socio-historical analysis, partly as the crisis is at present continuing.

It is therefore very significant to notice the slide performed on the crisis factors between the two reports. According to D. MEADOWS's team, population, pollution and depletion of natural resources are the factors which in the future will stop growth. On the second report, the blockage has already occurred with the development of oil supply and food problems.

It is clear that the explanations proposed are not of the same nature and diverge. The reader will certainly be more satisfied with the second report as problems which concern his every day life (especially energy) are dealt with. But the question of the validity of the theses presented must be put. The most striking example is that of the 1972 famine. The USSR, which had not foreseen a sufficient increase in the cultivated surfaces of wheat, is alone held responsible for this famine according to the authors ((2), pp.39-40). There could have been an error of forecasting by the USSR, but this does not give an explanation of the reason why other regions are, for the past few years, experiencing famine owing to exceptional drought. Moreover in many countries this famine problem is not recent. In the same way, the analysis of the petrol crisis seems biased : the problem is set as that of the transfer of economic power. Inevitably such an analysis leads to the proposing of solutions by means of cooperation. This in plain language means to take care of the producing and consuming countries interests in order to avoid all conflict, through prices or force. In this connection, one can wonder if the analysis is complete. The reader may have been surprised at the fact that, as in the first report, the phenomenon of Multinational Corporations is generally ignored. Owing to the fact that in the analysis things happen as if these oil firms do not exist, the reader does not have at his disposal the information necessary when reading the solutions suggested : MESAROVIC's team demonstrates that nuclear energy will have to act only as a transition before the exploitation of solar energy. The model makers have not taken into consideration the fact that for some time already the oil firms have been investing in the energy sources, particularly nuclear energy, and that this strategy is not applied for a short period of time.

The existence of biases such as those described above lays down a certain number of methodological precautions to the model maker if he wishes to avoid the risk of being considered as a propagator of an ideology and therefore as a technocrat.

2 - 4. Technocratism

The denial of the ideology and the expressed wish of scientificity may appear as a definitive form of technocratism, in so far as the aim decided on is help for the making of decisions. The research made and the results obtained are meant to be indisputable as it is a matter of scientific work.

The methodology adopted by D. MEADOWS's team should be a partial guarantee against this bias. The main aim is firstly to have a better understanding of the system. But, this then presupposes two points : not to fall into the trap of confusing model/system, and above all not to have as only aim help towards decision making.

An approach of econometric inspiration, as the one adopted for the second report, leads to a more or less stated aim of forecasting. This leads to the proposing of a large amount of numerical outputs to the reader. This approach is hazardous as the accusation of technocratism can be even more easily made. It is obvious that the credibility of the conclusions is always greater when numerical outputs are joined to them as they are therefore accurate and therefore as a guarantee for their accuracy.

CONCLUSION

Ideology appears to be difficult to avoid : in so far as the knowledge of the systems analyzed remains uncertain. However, the social impact of the models being a reality, it is desirable to adopt a methodology which allows one to avoid a certain number of biases presented here. In the opposite case it is the appraisal of the very model-makers' contributions which incurs the risk of being altered. The presence of non explicit hypotheses or other elements of information leads to the following problem : was this voluntary on the part of the model-maker? It is clear that the effort to explain the hypotheses made is an element of more complete knowledge on the model for the model makes himself.

J.W. FORRESTER's "Systems Dynamics" is an appreciable contribution towards accessibility and on the methodological level. However, if non computer science specialists are to have access to such works, it is essential to go further in the methodological effort, which is conceived as an aid towards the construction and comprehension of the model built. This therefore parallelly implies the suggestions of more adapted and accessible languages which simultaneously give a methodology adapted to the problems to be dealt with (11).

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