

# The Biggest World Model So Far

from our Special Correspondent

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THE World Employment Programme on which the International Labour Office is likely to have spent \$2 million in the four years to 1975 has had the somewhat unexpected result of having thrown up a dynamic computer model comparable in many ways to the Meadows model, developed for the Club of Rome at MIT, but which is at once much larger and more sophisticated. The model is being used to test the interactions between population growth and employment and is intended to throw light on questions of employment policy in developing countries. It is called *Bachue-1* after the Colombian goddess of love and fertility and harmony between nature and man.

Some idea of how ambitious the simulation model is can be gathered from the fact that even the refined version of it occupies more than 600 K of storage space on the IBM 370 computer installed at the International Computing Centre in Geneva. The first run of the model a few weeks ago occupied no fewer than 796 K of the 1,000 K core, leaving precious little room for the operational programs necessary to allow the computer to function properly. The work at the ILO has been directed by Dr Richard Blandy, an Australian economist who has just returned to Flinders University, Adelaide. Day to day responsibility for the development of the system has been shouldered by Dr René Wéry, with Mr Ray Curnow of the Science Policy Unit, University of Sussex, acting as a consultant.

Everybody concerned with the project is full of admiration for Professor Jay Forrester's DYNAMO Language in which the programs have been written and especially for the flexibility which this permits and for what are called the "debugging facilities" which, among other things, allow the system of programs to make explicit assumptions about the values of particular parameters when these have been incompletely specified. But DYNAMO Language is extravagant in its use of storage space, so that there are plans—or hopes—to rewrite the lot in Fortran.

The simulation model differs from the Meadows model in the degree to which the variables are disaggregated. Population, for example, is represented by separate variables for each interval of five years between birth and old age, and these categories are further subdivided by sex and residence in urban or rural areas. In the version of the

model now functioning, fertility (or, more specifically, the number of births each year to women of different ages and in different categories) is reckoned to be a function of child mortality (and positively correlated with it), the education of adults, the opportunities for women to work in modern jobs, the numbers of unpaid family workers in the labour force, the education of children and the average income of households. The model also makes possible a variety of assumptions about the effectiveness of family planning. One of the innovations built into *Bachue-1* is the possibility of simulating the migration of workers from country to town.

Compared with previous models, the ILO simulation breaks new ground in its detailed description of the labour force, but its authors acknowledge that data from developing countries which purport, for example, to indicate the proportion of the female population in work of various types are probably highly suspect. Data to represent the several categories by which the educational system is described are probably easier to come by but the assumptions which have been made about the social and economic impact of different kinds of education are probably among the most difficult of all to test. The economic parts of the model are impressively disaggregated—with the problems of developing countries in mind, the ILO team has distinguished between modern and traditional agriculture, modern and traditional manufacturing industry and employment in service functions.

It goes without saying that the ILO model differs from the Meadows model in that it makes no allowance for such things as the effect of pollution on mortality nor of the availability of natural resources other than food. For that matter, the model also fails to allow for differences of caste or race within countries.

The immediate objective is to use the model as a means of telling which kinds of development in a developing country are most likely to help shrink the size of the labour force without work or engaged in non-productive tasks. To provide some yardstick of what will happen, the modellers have used data from countries in Latin America between 1960 and 1970 to provide a starting point for a forty year simulation. They acknowledge that a great deal of work remains to be done before the model can be regarded as mathematically self-coherent and stable to transients, and before the assumptions which have been built into them can be tested; some will no doubt be validated,

others will need further refinement.

What is likely to be the value of this computer model? Although the original incentive for its development was the haunting unemployment problem in developing countries, the model is plainly able to throw light on a wide range of problems concerned with development. One possibility, for example, is that the model may throw light on the economic consequences of rural-urban migration. With the assumptions so far made, such demographic movements may have the effect, for all their immediate or at least conspicuous ill-effects, of making possible a more rapid growth of family incomes. With the assumptions so far incorporated, the model also suggests that an immediate reduction of fertility will not bring social and economic benefits within a decade or even two, although it must be acknowledged that the cost of capital investment in education and health care may not be adequately catered for in the model.

This is why one of the most attractive features of this ambitious exercise in computer simulation is that the modelling is supported by a vast programme of field studies in which attempts will be made to gather from developing countries some of the data on which refined assumptions may be formulated. Unlike some others, the ILO's model is a starting point for a programme of social and economic research which is certain to be made more pointed by the preliminary results of the simulations, but which is a sufficient objective in itself.

Those responsible for the computer modelling hope that in the months ahead it will also be possible to use the model as a means of generating hypotheses for other parts of the World Employment Programme. One of the most stimulating of these is the attempt which is being made to assess the impact of new technologies on employment in developing countries. Should a growing nation invest its capital in agriculture, in advanced technology such as nuclear power or in something half way in between? Several field studies have already been commissioned of the operation of modest industrial enterprises, canning factories for example, on the social condition of the communities in which they are placed in countries such as Kenya. In due course it may be possible to develop yardsticks by means of which developing countries may decide what kinds of new developments will be best. Then will come the task of persuading aid-giving countries that they should be backed with hard external currencies.