Chapter IX

MACRO-MATHEMATICAL MODEL

9.1 INTRODUCTION

On defining employment as employment for one or more days in the reference year we see that 1277 men and 31 women are employed during the year. But we know that 150 men and 5 women are fully employed outside the villages. So (1277 – 150) or 1127 men and (31 – 5) or 26 women are employed by the household productive activities of the villages, defining employment, in this case, employment for one day or more in the year. Excluding the 150 men and 5 women who are wholly employed outside the villages and converting the whole of the partially employed 1127 men and 26 women into fully employed persons, taking just 150 days of employment as full employment, we find that the productive activities of the villages can fully employ only 303 men and 7 women. Thus, on this basis, (1127 – 303) or 824 men and (26 – 7) or 19 women are now regarded as fully unemployed.

Again, one of the pioneering features of this study is that we have surveyed the opinion of women of all the 600 households. We have found that 815 women seek full employment. Further there are 22 males who seek employment but had no chance to be employed even for a day during the same reference year. So the amount of net additional demand for full employment is calculated to be 1680 person-years. We currently leave out the question of the growth of additional employment seeking population.

The present low level of household productive activities can provide full employment to only 310 persons. So the output of these productive activities as well as the number of newer activities have to increase themselves several times. Fortunately, the almost infinite potential of our land endowments are capable of doing much more.

9.2 ON LEONTIEF'S METHOD

Wassily Leontief is the original innovator of both static and dynamic analysis of the structural interdependence of a national economy. He has also applied his model in testing some theories of international trade as a result of which lights have been thrown on the murky field of the effects of presence or absence of natural advantages. His study on the structural interdependence in Israeli economy has been painstaking. His work on the future of world economy was marred in process by shift in American policy as a result of which structural reforms or what is known as globalisation dispensed with the continuation of development decades.

Despite this immortal creation of the most useful empirical method in Economics, Leontief has an important rival variation. Holis B Chenery a student of Leontief succeeded in building up what we may call the Chenery school of inter-industry economics. Many enterprising researchers under the leadership of Chenery has made wide application of another variation of Leontief model. Leontief would not record the use of the output of a particular sector for that sector. His concept of net output of a sector in question is the sum of the total output of the sector used in all other sectors except itself. But Chenery and his followers do not accept this practice.

Leontief has important contributions in respect of production function analysis. He is never convinced that traditional theoretical methods using rough short-cut methods of partial analysis could achieve right results. The variables do not change if the data remain constant. If the causes of the conditions change, some or all variables change. It is Leontief's finding that the nature of such reactions of the variables depend on the initial structural properties of the empirically given system. This basic aspect of the general equilibrium problem makes up the real issue of Leontief's general equilibrium analysis.

The originator of the method of input-output analysis describes the fundamental set-up first under the assumption of stationary equilibrium – a hypothetical state of simple reproduction with neither saving nor investment. He uses three sets of equations to explain his empirical theory of general structure of inter-dependence of the economy.

Leontief's first set of equations focuses on the observed fact that the total output of each industry, measured in physical terms, is equal to the sum of the amounts of its output consumed by all other industries. The second set of equations focuses another fundamental fact that under conditions of stationary equilibrium of simple reproduction the value (price X quantity) of the product of each industry is equal to the value of all goods and services bought by it.

The third type of equations describes the technical relation between the physical output of an industry and inputs used in production and bought from all other industries. This relation is the relation of industrial production function. Leontief maintains that production function is dependent on all the natural and technical conditions of industrial processes. Therefore, he rules out the question of deriving the shape of such function on a priori basis. Empirical observations always supply the necessary data about the form of technical equations. There is no doubt that empirical studies have been made in agricultural experiments to verify the law of diminishing marginal physical productivity. But to cover the entire field of agricultural, mineral and industrial production for this kind of technological investigation has so far not been possible.

Thus in Leontief's choice the amount of each cost element is proportional to the quantity of output such as

$$x_{i1} = a_{i1}x_i, \qquad x_{i2} = a_{i2}x_i \ldots\ldots\ldots\ldots\ldots x_{in} = a_{in}x_I$$

Common proportionality factors are introduced and in place of a_{i1}, a_{i2}, ... he writes a_{i1}/A_i, a_{i2}/A_i .... The A's are productivity co-efficients. When A_{ii}

doubles, the same amounts of all cost elements can cause industry ; can produce twice as large a product as before.

Leontief then propounds theoretical and practical methods of dealing with dynamic problems of structural interdependence of the economy.

These methods, in one form or the other, will be of invaluable help for the planning of the proportional of occupations among men and women. But before that we must lay out the new scheme of institutional reforms and pose the new institutions as the peoples own planning authority.

9.3 THE MODIFIED CHENERY VARIATION

Before that let us have look at the work of the Chenery school. The workers of the Chenery group follow, in general, the line Chenery took in his work in Italy on the support of the US Mutual Security Agency in Rome and subsequently formalised in his celebrated book entitled "Inter-industry Economics" co-authored by P.G. Clark and published by John Wiley & Sons in 1959. The book covered lively models of activity analysis and linear programming developed by Dantzig, Koopmans and others in America and Kantorovitch in Russia. Both Koopmans and Kantorovitch were awarded Nobel Prize.

In preparing the tableau économique Chenery or his group members never follow Leontief's concept of net output of a sector. They gave out a complete picture of the disposal of the gross output among all sectors including itself. They, however, classify all imports as competitive or perfect substitutes and give them a column sector classification. Under the present conditions of operation of the lagging rural economies we hold the imports for the year in question as non-competitive.

We are here limited by restricted time-budget and, therefore, unable to present the tableau in large details. In terms of the last paragraph of the

preceding section we shall present the input-coefficients and urge that newer activities and expansion of output and employment will require people's own institutions that will assume the full responsibility of carrying out all aspects of planning of the countryside.

The balance equations can be written in a short form following Yuji Kubo, Sherman Robinson and Moshe syrquine of the Chenery school.

$$X_i = W_i + D_i + E_i - M_i$$

Where X_i = gross 0utput of sector I

W_i = intermediate demand for output of sector i

D_i = final demand for the output of sector i

M_i = total imports of products classified in sector i.

Assuming that each sector produces only one output and that intermediate inputs are required in a fixed proportion to output in each sector as a function of its output :

$$W_i = \Sigma_j X_{ij} = \Sigma a_{ij} X_i$$

While X_{ij} is the intermediate use of commodity i by sector j and a_{ij} is the corresponding input coefficient. With this scheme and our modification of taking imports as non-competitive , the tableau economique is, in symbols, as follows :

Table 9.2.1

Modified Chereny Tableau Economique

Buying Sector / Selling Sector		Intermediate Use			Final Use	Total Output
		1	j	n		
Selling Sector	1	X_{11}	X_{1j}	X_{1n}	Y_1	X_1
	i	X_{i1}	X_{ij}	X_{in}	Y_I^*	X_I^*
	n	X_{n1}	X_{nj}	X_{nn}	Y_n	X_n
Primary inputs (Value added)		V_1	V_j	V_n		
Imports		M_1	M_j	M_n		
Total Output		X_1	X_j	X_n		

Table 9.2.2

Modified Chenery Input-Output Table

Selling Sector / Buying Sector	Agriculture	Irrigation	Animal husbandry HYV Cows	Animal husbandry traditional cows	Non-agricultural production	Final demand	Total output
Agriculture	56,657	-	376,000	942,731	100,000	4991,872	6467,260
Irrigation	91,313	-	-	-	-	6,000	97,313
Animal husbandry HYV cows	304,000	-	-	-	-	3665,860	3969,860
Animal husbandry traditional cows	304,293	-	-	-	-	1602,321	1906,614
Non-agricultural production	-	-	-	-	-	951,763	951,763
Primary inputs (Value added)	4951,231	87,313	1253,727	788,471	607,962	-	-
Imports	759,766	10,000	2340,133	175,412	243,801	-	-
Total output	6467,260	97,313	3969,860	1906,614	951763	-	-

Table 9.2.3

Input-Coefficients

Buying Sector / Selling Sector	Agriculture	Irrigation	Animal husbandry HYV cows	Animal husbandry traditional cows	Non-agricultural production
Agriculture	.0087	-	.0947	0.4945	0.1051
Irrigation	.0141	-	-	-	-
Animal husbandry HYV cows	.0470	-	-	-	-
Animal husbandry traditional cows	.0471	-	-	-	-
Non-agricultural production	-	-	-	-	-
Primary inputs	0.7556	.8972	0.3158	0.4135	0.6388
Imports	0.1175	.1028	0.5895	0.0920	0.2561
Total output	1.00	1.00	1.00	1.00	1.00

9.4 MODEL EMPHASIZES PLANNING

Having completed the preparation of the macromathematical model of the simple reproduction scheme. We do extend it in this dissertation for the dynamic model. Because our present objective is merely to recommend setting

up a people's planning authority in the form of Raiffeisen cooperatives and their associations to ensure expansion of output and employment. The present model shows an abundance of import content among the inputs. These imports which are non-competitive can be replaced by divising input contents on the basis of assemblage of existing technology and introducing new producing units in the villages for use being made in the existing and new enterprises. We shall elaborate the scheme in more detail in the concluding chapter in the section on recommendations.