STUDIES RELATING TO PLANNING FOR
NATIONAL DEVELOPMENT
No. 8

THE APPROACH OF OPERATIONAL RESEARCH TO PLANNING IN INDIA

P. C. MAHALANOBIS

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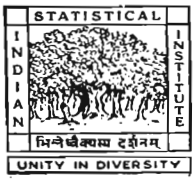

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PREFACE

This paper was originally written to explain the logical and factual basis of the recommendations for the formulation of the Second Five Year Plan which was submitted to Shri Jawaharlal Nehru, Prime Minister of India, on 17 March 1955. The paper was published in *Sankhyā* : The Indian Journal of Statistics, Vol. 16, 1955. The paper is now published in a book form with some editing changes to make it more easily available to persons interested in economic planning in India.

29 June 1963 *P. C. Mahalanobis*

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THE APPROACH OF OPERATIONAL RESEARCH TO PLANNING IN INDIA

Chapter 1

RECENT DEVELOPMENTS IN PLANNING

1. The Draft Plan-frame of 17 March 1955 giving Recommendations for the Formulation of the Second Five Year Plan of India (to be referred to subsequently as the Plan-frame) together with extracts from the associated working paper of 21 March 1955 prepared jointly by the Economic Division of the Ministry of Finance, and the Economic Division of the Planning Commission in consultation with the Central Statistical Organization and the Indian Statistical Institute, and a memorandum giving "Basic Considerations Relating to the Plan-frame" prepared on 10 April 1955 by the Panel of Economists of the Planning Commission are being reproduced as appendices by the courtesy of the Planning Commission.

2. The Plan-frame was addressed to plan-making organisations of the country, and contains only such information as was likely to be useful for preparing plan projects. For readers who are not in direct touch with planning in India the mode of presentation of the Plan-frame is not adequate. Any approach to planning which involves social action has to be judged in its historical context. I shall therefore try to explain briefly my own approach to the problem; the circumstances in which the Plan-frame was drafted; and its logical and statistical basis. I shall discuss in a separate paper what would be the implications of the present approach on the future course of planning in India. I have used a personal form of narration because the views expressed in this paper are my own and are not necessarily shared by other persons or agencies with which I am connected.

Statistical Developments

3. During the greater part of my working life I have been a teacher of physics; but in the early twenties I started using statistical methods to solve problems mostly of practical importance

but also sometimes of theoretical interest. My statistical work increased considerably since the establishment of the Indian Statistical Institute in 1931-32. At the desire of Prime Minister Jawaharlal Nehru, I started working as the Honorary Statistical Adviser to the Cabinet, Government of India, from February 1949. In the same year I agreed somewhat reluctantly to become the Chairman of the National Income Committee with Professor D. R. Gadgil and Dr. V. K. R. V. Rao as members. My colleagues did a great service in laying sound foundations for national income statistics and making a thorough review of the gaps in statistical information in India. In this country many of these gaps can be filled only through the method of sampling, and it was a significant advance when the Government of India decided to initiate the National Sample Survey (NSS) which is operating continually since 1950 in the form of about two complete "rounds" per year covering both rural and urban areas of the whole country. The field staff works under the direct control of the Ministry of Finance ; and the statistical work (sample design, processing and analysis of data) is done in the Indian Statistical Institute. The NSS can supply much information required for planning.

4. A Central Statistical Unit had been started in February 1949 and was converted into the Central Statistical Organization (CSO) two years later. It is now a pivotal agency for general coordination and the development of comparable concepts, definitions, and standards on a country-wide basis. The CSO works in close touch with the statistical offices in the Central Ministries as well as with the Statistical Bureaus in the various States of India. Rapid developments have also taken place in the Indian Statistical Institute (ISI), a non-profit scientific institution, which works in close association with Government. The CSO, the NSS, and the Institute provide a good statistical base for technical work relating to planning.

The Planning Commission

5. The Prime Minister had been keenly interested in planning for a very long time. It was because of this personal interest that he was appointed Chairman of the National Planning Committee which was set up by the Indian National Congress Party in 1938. This Planning Committee published a number of valuable reports most of which, however, became out of date after the war. The Planning Commission, with the Prime Minister as Chairman, was

established in 1950. It prepared the First Five Year Plan of India for the period 1951-52 to 1955-56 ; and is now actively engaged in preparing the Second Five Year Plan.

6. As Statistical Adviser I have been connected with the Planning Commission from the beginning. My contact with Government made me increasingly aware of the poverty of the great masses of people, and the inadequacy of the techniques of production. It has been always my view that statistics is an applied science and its chief object is to help in solving practical problems. Poverty is the most basic problem of the country; and statistics must help in solving this problem.

Some Earlier Work

7. I expressed my views of this period in my presidential address entitled "Why Statistics ?" to the Indian Science Congress held in Poona in 1950. In this paper I used a ratio of the value of product to the capital invested to make preliminary calculations about industrial development; this ratio was subsequently found useful in studies on planning. When the First Five Year Plan was being finalised in 1951 I stressed that a progressive and integrated economic policy, rather than a reliance on a number of useful but unconnected projects or on some parametric marginal rate of saving, would be necessary to achieve a high rate of growth. In 1952, in a lecture delivered at the National Institute of Sciences of India, I put forward certain views on planning; and pointed out that it was necessary to increase the rate of investment from 5 or 6 per cent to 10 or 11 per cent. In a second paper published in *Sankhyā* in 1953, I elaborated these views, and used a model of growth for a planned economy to which reference is made in a later section.

8. Two young colleagues had started working with me from the very beginning. Pitambar Pant, who like me started life as a teacher of physics, has been generally helping me since 1946. He was appointed Private Secretary to the Chairman, Planning Commission, in 1952, and has been actively assisting me in the planning work since then; he is now Deputy Secretary in the Planning Commission. Moni Mukherjee, originally a statistician in the Indian Statistical Institute, who had worked as Secretary, National Income Committee from 1949 to 1953 and is now in charge of the National Income Unit in the CSO, has been closely associated with my work. We went on thinking on our own lines, and I took advantage of my visits abroad to have discussions with

distinguished economists and statisticians. Gradually other workers have joined our group among whom I should like particularly to mention I. G. Patel (of the Economic Division, Ministry of Finance), a young economist, who made significant contributions to our thinking especially on the financial side.

The Approach of Operational Research to Planning

9. I have been all the time using the approach of operational research with a view to getting some broad idea of the strategy of planning. In December 1953 I told Shri Chintaman D. Deshmukh (Minister of Finance and Member of the Planning Commission in charge of its Economic Division) that a small organized group would be useful. He immediately agreed and sanctioned funds to enable an Operational Research Unit (ORU) being established in the Indian Statistical Institute which made it possible to start some preliminary studies on planning. The ORU also gave us the opportunity to invite distinguished foreign economists and specialists to come to India for short visits to participate in our work. The visit of Professor Charles Bettelheim of Paris (Editor of *Planification*) in the winter season of 1953-54 was particularly stimulating and helpful.

10. I may explain why I have been using the phrase 'operational research' in relation to planning in India. Our aim is to solve the problem of poverty, that is, to find a feasible method of bringing about a continuing economic development of the country. It would be necessary to use much scientific and technical knowledge and also to organize continuing research at various levels for this purpose. But research is not our primary objective; the aim is to solve our particular problem. When a practising physician gives medical treatment to a patient he uses much scientific knowledge and may even do some research, but his chief aim is to cure the patient. His observations or experiments on the patient may add to medical knowledge but the treatment given is not primarily for purposes of research. The distinction is important. In my view our studies also have the primary aim of solving a particular problem (and not of doing any theoretical research for its own sake). This is why I have used the phrase operational research in the present connexion. We are speaking of India and suggesting methods which we think are practicable under Indian conditions. I shall be naturally glad if our work is of help to any other country. But it has not been our intention to formulate

any general theory which would be universally applicable to other countries.

11. I have tried to set up a conceptual frame-work which would be of help for practical purposes ; and I have used certain statistical methods to solve our problem. I do not think that the models have any permanent value of their own. I have used them as scaffolding to be dismantled as soon as their purpose has been served. There is, of course, much need of theoretical thinking and researches; but so far we have been primarily concerned with practical issues, that is, with operational (as distinguished from theoretical) research.

Formulation of the Problem by the Planning Commission : September 1954

12. On 14 September 1954 there was a full discussion in the Planning Commission, under the Chairmanship of the Prime Minister, on the basic approach to the formulation of the Second Five Year Plan which was due to begin in 1956-57. At the end of the discussion the Finance Minister asked : "Is it possible to prepare a Plan which would enable unemployment being liquidated in 10 years and which would also provide for a satisfactory increase in national income at the same time ?" This was the problem set to us.

13. One important decision was taken by the Planning Commission at the same meeting, namely, that the Central Statistical Organization (CSO) should be responsible for the statistical work of the Planning Commission ; and that the CSO in collaboration with the Indian Statistical Institute (ISI) should immediately take up studies relating to planning. I had another discussion with the Prime Minister on 17 September 1954 about the basic approach to the Second Plan ; and, at his desire, gave him next day a brief note on this subject. He asked me to prepare working papers on the lines of our discussions.

Inauguration of Studies on Planning : November 1954

14. Prime Minister Jawaharlal Nehru inaugurated studies relating to planning for national development in the Indian Statistical Institute in Calcutta on 3 November 1954. On 8 November 1954 I submitted to the Prime Minister a general note on planning (which was later circulated as Working Paper No. 1 of the Institute series on planning); and at his desire I explained my views at a meeting

of the National Development Council (which consists of the Central Cabinet, the Planning Commission and the Chief Ministers of all the States of India) held in New Delhi on 10 November 1954. From about this time, the Finance Minister made arrangements by which Shri J. J. Anjaria (Chief, Economic Division, Planning Commission) and Shri I. G. Patel (Economic Division of the Ministry of Finance) became closely associated with our work. A number of study groups were quickly organized in the Indian Statistical Institute and a large number of Working Papers were prepared and were circulated in mimeographed form; some of them are being printed.

15. On 20 and 21 December 1954, the Lok Sabha (the Indian Parliament) discussed the economic situation in India and at the end of a long debate adopted a motion that the "objective of our economic policy should be a socialistic pattern of society and towards this end the tempo of economic activity in general and industrial development in particular should be stepped up to the maximum possible extent." One month later, the Prime Minister raised the question of the basic approach to planning in India at the annual session of the Indian National Congress Party at Avadi where a resolution was passed on 21 January 1955 accepting a socialistic pattern of society suited to Indian conditions as the aim of national planning in India. These decisions settled, in principle, the type of economic development of India in future.

16. The Standing Committee of the National Development Council which had met on 7 January 1955 and had agreed that a unified programme should be prepared for the formulation of the Second Five Year Plan, met again on 27 January and decided that a Draft Plan-frame containing recommendations for the formulation of the Second Five Year Plan should be got ready by April 1955. This was followed by several weeks of work at very high pressure by a small group of economists and statisticians in the Economic Division of the Ministry of Finance, the Economic Division of the Planning Commission, the Central Statistical Organization and the Indian Statistical Institute.

17. I should like to mention that in the winter season of 1954-55 a number of distinguished statisticians and economists came to the Institute from different countries of the world. Among those who came in connexion with economic planning may be mentioned Professor Ragnar Frisch of Norway, Professor Oskar Lange of Poland, Professor Charles Bettelheim of France, Dr. Richard Goodwin from the University of Cambridge, and Academician

D. D. Degtyar of the Soviet Gosplan at the head of a Soviet team of economists and statisticians (Professor I. Y. Pisarev, Dr. M. I. Rubinstein and Professor P. M. Moskvin) from the USSR Academy of Sciences. We profited much from our discussions with these distinguished experts. They helped us to think clearly; they made constructive criticisms about the logical basis of our thinking; and they placed at our disposal their own rich experience; but, naturally, they refrained from giving any specific advice on questions of policy. The greatest benefit was that through contacts with such eminent experts from many different countries we gained confidence in our way of thinking. The basic decisions naturally had to be taken by the small group of Indian statisticians and economists who were working on the Plan-frame.

18. I should also mention that a Panel of Economists had been set up in January 1955 by the Planning Commission with Shri C. D. Deshmukh as Chairman, Professor D. R. Gadgil as Vice-Chairman and twenty leading economists of India, as members. This Panel met for the first time on 27 and 28 January 1955; and started preparing working papers on a number of subjects relating to planning.

The Draft Plan-frame of 17 March 1955 and Associated Papers

19. I submitted the Draft Plan-frame on 17 March 1955. There was much joint thinking and joint work behind it, and the Draft Plan-frame was truly a cooperative effort although it was issued in my name. The associated working paper giving detailed technical information was submitted on 21 March 1955 and the two papers were sent to the Panel of Economists and were considered by the Panel on 8, 9 and 10 April 1955. The Panel prepared a memorandum on "Basic considerations relating to the Plan-frame" in which they (with the exception of one member) agreed with the basic approach of the Plan-frame and approved generally its proposals and underlying principles. The strong support of the Panel of Economists at this stage was of decisive importance.

20. The Draft Plan-frame, the Joint Working Paper, and the Memorandum by the Panel of Economists were considered on 5 May 1955 by the Standing Committee of the National Development Council and on 6 May by the Council itself which gave general approval to the approach adopted in these papers and desired that the Draft Plan-frame should be used as the basis for discussions

between the Planning Commission and the Central Ministries and State Governments for the formulation of the Second Plan. It was decided to release all the papers for public information. The approach of the Plan-frame and associated papers was subsequently approved at the meeting of the All-India Congress Committee held at Berhampore on 10 May 1955.

21. On the publication of the Draft Plan-frame there was much discussion in the newspapers and at public and group meetings. There was opposition from certain quarters but public opinion appeared to be generally in favour. The subject was again considered by the National Development Council on 24 July 1955 and it was decided that the physical targets of the Plan-frame should be maintained even if this involved an increase in the financial outlay. After further public discussions the Draft Plan-frame and associated papers were examined by the All-India Congress Committee on 3 and 4 September 1955, and the basic approach and targets were again generally approved. The proposals were approved generally for the third time by the National Development Council on 5 September 1955.

22. I should like to point out, at this stage, that I had called the document of 17 March 1955 a "draft of a draft". My intention was that it would be revised and issued as a draft in the form of a document of the Planning Commission. This, however, was not done ; and the Plan-frame was issued in my name in its original form. Its only aim was to supply a convenient starting point for planning within a flexible but connected frame-work.

CHAPTER 2

PRESENT CONDITIONS IN INDIA

1. India is a vast subcontinent with 12 major language groups[1] and 9 major religious faiths.[2] The country lies between latitudes 8° and 37° north and longitudes 66°20 to 97° east, measuring about 2000 miles from north to south and 1700 miles from east to west with a land area of about 1.27 million square miles or 811 million acres. The Tropic of Cancer roughly divides the country into two halves. India has a land frontier of about 8200 miles and a coast-line of about 3500 miles. Measured by the extent of territory, India is the seventh largest country in the world ; and is approximately thirteen times as large as the United Kingdom and eight times as large as Japan. The Union of India comprises 14 States (including the State of Jammu and Kashmir) and centrally administered territories.

2. The average annual rainfall in India is about 42 inches. But the distribution is very unequal, some areas getting abundant rainfall while some others getting not more than two or three inches per annum. West Bengal, Assam and the coastal strip towards the west of the western ghats get more than 80 inches of rainfall per year and the rest of the area of the country with the exception of desert regions of Rajasthan and Punjab gets varying rainfall ranging between 20 and 80 inches. Indian climate is markedly affected by monsoons, the South West monsoon being instrumental for 85 per cent of rainfall in the country. The temperature has little extremes except in the north where it ranges from 4°.4C to 46°.1C. The rest of the country is generally hot. Calcutta has a mean annual temperature of 26°.1C with a range from 10°C to 29°.4C. The mean temperature for Madras and Bombay are respectively 26°.7C but the annual ranges are of the order of ten degrees. The country has two important crop seasons, *kharif*

[1] Figures in millions (1951 census) of persons speaking : Hindi (105.64), Urdu (35.57), Hindustani (8.16), Telegu (33.00), Marathi (27.05), Tamil (26.55), Bengali (25.12), Gujrati (16.31), Kannada (14.47), Malayalam (13.38), Oriya (13.15), and Assamese (4.99). Three other languages have special recognition : Punjabi (0.27), Kashmiri (0.05) and Sanskrit.

[2] Figures in millions (1951 census) of religious denominations : Hindus (303.19), Sikhs (6.22), Jains (1.62), Buddhists (0.18), Zoroastrians (0.11), Muslims (35.40), Christians (8.16), Jews (0.03), Tribals (1.66) and Others (0.05).

or summer and *rabi* or winter ; as much as 80 per cent of cereal crops are produced in the *kharif* season and the rest in the *rabi* season.

3. India has the second biggest population in the world, 360 million in 1951 out of which roughly five-sixths belong to the rural areas. Roughly 48 per cent of the population is below 14 years while only about 8 per cent of the population is above 54. The crude birth rate is reported to be 4 per cent and the crude death rate is 2.7 per cent. Also there are 95 females to every hundred male in the country. Population has been increasing at a rate of over 1 per cent per year, i.e., with an annual net addition of about 4 or 4.5 million.[1] Compared to population the land area is small, and the share of land is only about 2 acres per head[2] against nearly 6 times this area in the USA and more than 12 times in the USSR. The average density of population in India is 312 per square mile ; it varies considerably from region to region and is as high as 832 per square mile in lower Gangetic plains. Per capita agricultural and arable land is roughly the same in India while the per capita agricultural land is more than twice the arable land in the USA.

4. Agriculture is the chief industry engaging about 70 per cent of working population. Out of every 100 employed Indians, 48 are mainly peasant proprietors including rentiers, 9 mainly tenants, 13 landless labourers, 10 engaged in industries or other non-agricultural production, 6 in commerce, 2 in transport and 12 in services and miscellaneous professions. There are certain difficulties associated with definition of labour force, particularly for the rural population, but roughly the labour force is likely to be between 40 to 45 per cent of the population of the country.

5. Agricultural products form nearly half of the net national output. Besides supplying raw materials to industries like sugar and textiles, it provides the bulk of the country's export. In the total geographical area of 811 million acres, about 300 million acres of net area are cultivated annually in India, the gross cultivated area being of the order of 350 million acres. Besides this, there exists about 60 to 70 million acres of fallow land. Roughly

[1] The recent rate of growth of population in India is not known accurately, but there are reasons to believe that it may be as high as 2 per cent. The rate observed over the period 1941 to 1951 was of the order of 1.2 per cent per year. It is worth noting that the growth of population in the UK between 1881-1951 was somewhat higher than this (i.e., 1.2 per cent). The rate of increase in population (by birth and migration) during the same period was still greater in the USA.

[2] Figures quoted without date indicate the general order of values in recent years.

220 million acres of land are reported to be not available for cultivation while about 130 million acres of land are under forests. The main feature of agricultural production in India is the excess of food crops (which occupy 85 per cent of the area sown) over non-food crops. Cereals (rice, wheat, barley, *jowar*, *ragi*, *bajra* and maize) form the staple food. India grows tea, coffee, sugarcane, oilseeds, jute and cotton, and other tropical crops including fruits and vegetables ; tea and jute are important for export. India is the largest sugarcane producing country of the world and with Pakistan holds virtual monopoly in the production of jute. India follows the USA in cotton and compares favourably with China as a leading producer of rice, millets and tea. The most important oilseed is groundnut. According to official estimates of production, the output of food grains is of the order of 65 million tons of which rice contributes an amount of the order of 25 million tons. The other important grains are wheat and *jowar*, between 8 and 10 million tons and gram and *bajra*, between 3 and 5 million tons. It is not possible to be absolutely sure of these figures, and there is likelihood of some amount of underestimation. The cattle population is very large being about 20 crores[1] in 1956. That is, it is about half the size of the human population. The quality, however, is poor and the supply of milk meagre. The average yield of milk per cow per annum is only a little over 400 lbs., which compares unfavourably with other countries in which the average ranges between 2000 and 7000 lbs. Milk is consumed fluid or converted into products such as *ghee* (clarified butter), *dahi* (curd), *khoa* (dried milk), etc. Bulk of the milk is from buffaloes which comprise a little more than one-fourth of the total population. Dung is the most important manure used in the country and this is one reason why the economic value of the cattle population is more than what it appears on the surface. India's forests cover 280,000 square miles which is nearly 22 per cent of the total geographical area of the country yielding a government revenue worth a little more than Rs. 20 crores annually[2]. Apart from timber and bamboo, forests supply fuel wood, an essential item of domestic use. Fish provides an occasional item of diet for numerous people in India and supplies useful protein. But the output is not large, the total value being of the order of Rs. 50-60 crores. The supply of food in India is adequate when the seasonal rainfall

[1] 1 crore = 100 lakhs = 10 million ; [2] Rs. 100 = 7.5 sterling = 21 US dollars.

is normal. There was, however, shortage of food for about ten years since 1942 which made it necessary to import foodgrains to the extent of 2 to 3 million tons per year for a number of years with the largest import of 4.7 million tons in 1951. The food position became easier from 1952, partly due to two or three years of exceptionally good crop seasons. However, there is still a somewhat precarious balance between the production of food and the requirements of the growing population unless one reckons on import of foodgrains.*

6. Agricultural land in India is basically fertile, though naturally suffering from different degrees of exhaustion from continuous use. This is particularly true of alluvial soil of north India. The black soil of Deccan as well as red and laterite soils found in other parts of India are also fertile and suitable for cultivation. About 45 per cent of the total area is under some kind of cultivation. As has been already mentioned, distribution of rainfall in the country is uneven and even a partial failure of monsoon results in famine conditions in some parts of the country. Irrigation, therefore, is very important for Indian agriculture. Of the total area under cultivation, about 17 per cent is under major and minor irrigation and the rest is dependent on rainfall. Out of the total irrigated area of about 55 million acres in 1954, canals accounted for about 22 million acres, wells 16 million acres, tanks 10 million acres and the rest 6 million acres. There is a large difference between the yield per acre on irrigated and on unirrigated lands; and irrigation normally raises production

* According to the 1951 census the population in the rural areas was roughly 300 million. There is a general impression that there is much surplus population in villages, but this is still an open question. It is possible that although the agricultural population is very large, it is needed to supply labour essential at the period of peak load (at the stage of transplantation of the rice crop, or at the stage of harvesting of rice and other crops). Some direct information on this point has been recently collected which suggests that there is sometimes shortage of agricultural labour at peak loads. This is also indicated by the seasonal movement of factory labour in some cities: a large number of labourers leave their factories to go back to their villages at certain periods of the year (peak load points of agriculture), and come back after finishing agricultural work. If one portion of the agricultural population is drawn away from the villages, there would be some decrease in the outturn of crops. If the decrease in the outturn of foodgrains due to such labour shortage is greater than the net contribution (i.e., total contribution minus consumption of food) of the transferred workers to the national income then obviously it would be economical, in a broad sense, to keep these labour households within the village to supply the peak load of labour required for full agriculture production, even if they do not have other gainful work during the rest of the year. On this view, there would be a biological balance between the size of the agricultural population and the volume of crop production, and it is conceivable that a decrease in agricultural population (without introducing labour saving devices) might diminish the real income per person. This question requires careful study.

from two to four times the original yield. India has a large number of big and small rivers and the quantity of water that annually flows along India's rivers is estimated at nearly 1400 million acre-feet. Of this volume of water only 5.6 per cent is used for irrigation works and power generation and the rest runs to waste. Irrigation schemes are being developed for a long time and recently a few big river valley schemes (irrigation and electricity) have been started and on completion, these are expected to irrigate 17 million acres of new land ; at this stage India will begin to use 13.6 per cent of her total river flow. There are still large possibilities of developing irrigation schemes. Moreover, there is much scope and need of developing minor irrigation works and water lifting devices for areas unsuitable for flow irrigation. In 1955 India produced 11,000 million kwh of electrical energy, giving a per capita figure of the order of 30 kwh. The corresponding figure in the USA is of the order of 2800, UK 1300 and Japan 650. Hydro-electricity accounts for roughly a little more than one-third of the energy generated in 1954, the rest being produced by the thermal stations.

7. India has the largest reserve of high quality iron ore in the world ; there are also fair reserves of coal, bauxite (for aluminium), monazite sand (for thorium), mica, chromite and refractories, some gold and copper and minor minerals. The iron reserves in the country are mostly haematites and magnetites with iron content ranging between 60 and 70 per cent ; India's total reserves have been estimated at 21,000 million metric tons and almost inexhaustible at the current rate of production. India ranks seventh among the coal-producing countries in the world and has an average annual production of about 36 million tons. The country has fairly abundant reserves of manganese ore and the present production is third largest in the world; the country has 15 to 20 million tons of good ore containing 50 per cent of the metal; moreover the Indian ore is non-friable and hence easily transportable. So far as bauxite is concerned, many of the laterites contain 50 to 80 per cent of aluminium ; the total reserve of bauxite in the country is estimated at 250 million tons. India has virtual monopoly of mica mining and produces 70 to 80 per cent of world's supply of mica. Small reserves of petrol have been found, but certain areas likely to bear oil have not yet been properly prospected. Geological surveys have made good progress but there has not been enough prospecting for minerals. In recent years, India

has been producing minerals worth about Rs. 100 crores, coal contributing roughly half of the total value. The other important minerals are manganese ore, mica, gold, salt, building materials and iron ore, the values in descending order ranging between Rs.20 to 30 crores.

8. The net output of organized factories is comparatively small and accounts for less than 10 per cent of net material production. The net value added by factories (employing 10 or more persons with power, or, 20 or more persons without power) is only about 6 or 7 per cent of the national income. The number of factory workers is about 2.7 million which is only about two per cent of the total working force and about three-quarters of one per cent of the total population. The number of factories (in round figures) is about 30,000, of which about 25,000 are small and employ less than 100 persons ; 2500 factories employ more than 200 persons ; and only about a thousand factories are really big. The geographical distribution of factories and factory employment is very uneven. Most of these industries produce consumer goods and the largest single industry, cotton textiles roughly provides one-fourth of the employment in the factory industry sector. The production of basic investment goods (steel, cement, machinery), or of power (coal, electricity) is extremely low compared to the population. Output of producer goods, including coal and other minerals, is of the order of one-sixth of the total fabricated output. During the First Five Year Plan, the factory output increased by about 40 per cent ; of these capital goods exhibited a rise of 70 per cent while both consumer goods and intermediate goods rose by about 35 per cent. Though capital goods production increased more rapidly, the position is yet unsatisfactory because of the very low share of such goods in the base period. Excess capacity is still reported to exist in several of the consumer goods industries. The production of some important commodities in 1953-54 is given in Table 1 of the Plan-frame (reproduced in the Appendix).

9. India is a country of small scale industries ; and only recently attention has been given to the development of large-scale industries. Indian economy is basically one of small household units of production ; and most of the enterprises are run by self-employed persons. Cottage industries offer alternative employment to the agricultural labourers. Very little accurate information is available on small-scale industries, but roughly it can be stated that the value of outupt in the sector is unlikely to be less than that

in the organized factories while the labour force engaged in the sector is somewhat more than four times that engaged in the organized sector. Handloom weaving is by far the most important small-scale industry supplying a sizable part of the need of textiles in the country and providing employment for a large number of artisans. The industries are of varied types, ranging from units specializing in goods of artistic value to units carrying on operations using modern technique to some extent.

10. There is a nationalized system of railways (with about 34,000 miles of tracks) which is the principal means of transport in the country. There is roughly 250,000 miles of extra-municipal roads in India of which the share of surfaced roads is not even 4 per cent. The length of all weather roads is only 9.7 miles per hundred square miles of the area of the country, and is very low compared to the population. The number of registered motor vehicles in 1950-51 was only 308,002. India has a 3500 miles long coast line with five major ports. Indian coastal shipping is at present nearly 300,000 gross rated tons ; and practically the whole of the coastal trade is now carried by Indian ships. Air services have been established to link important cities ; and a nationalized air transport system is in existence. India possesses 800 registered aircrafts of which about 200 hold current certificates of air-worthiness. The country has 78 aerodromes of which three are international. There is an old and well-established system of posts and telegraphs. The total number of post offices is 6000 in urban and nearly 30,000 in rural areas. The expansion of postal network has kept pace with the growth of population in recent years. The telegraph network is inadequate with about 8000 telegraph offices only. India is very backward in the field of telephones ; it is even more backward than China. The total number of telephone lines within the country is even less than that in one city of Australia, viz. Sidney. Thus, transport and communication have a good base but are extremely inadequate.

11. Commerce plays an important part in the Indian economy and the labour force engaged in commercial activities is roughly three times the labour force in organized factories ; the total industrial labour force, however, is about 50 per cent above the labour force in commercial activities, and the net output of commerce is somewhat below the net output of the industries. Bulk of the trading in India is handled by small retailers including hawkers, and small wholesalers ; but organized trading plays an important

role in the Indian economy. Organized traders pay much more income tax than organized industries. Banking also has two sectors : the organized banking with Reserve Bank of India and the State Bank at the apex and the unorganized banking including rural money lenders who play a very important role in production and distribution. There are cooperative banks also, but on the whole the development of cooperation has been inadequate in India ; the most important type of primary institution is the credit society which numbers only about 1.4 lakhs and has a membership of 6.6 million. Insurance in India generally does not cater to the poorest of the classes. Recently, insurance has been nationalized and it may have a wider spread in the future.

12. Educational facilities are meagre compared to the population; there is provision of schools for only 50 per cent of the children of the age group 6-11 ; 17 per cent of the children of the age group 11-14 ; 8 per cent in the age group 14-17 ; and less than one (0.9) per cent of those of the age group 17-23. Only about 17 per cent of the population is literate, about 12 per cent in rural areas and about 35 per cent in urban areas. Moreover, there are great differences in educational facilities in different States or in urban and rural areas. Though nearly 82 per cent of the population live in the rural areas the percentages of total number of students in primary, middle and high schools studying in rural areas are roughly about 60, 67 and 26 respectively in 1949-50. Also, nearly 40 per cent of total number of teachers in primary and middle schools are untrained. Some 380,000 students pass matriculation or an equivalent examination each year, and there has been remarkable growth in this number in recent times. Number of students in some 30 universities and 680 colleges is less than 3 lakhs. There is very little facility for technical and vocational education in the country. There are some 2750 vocational schools, 42 engineering schools and about an equal number of engineering colleges. There are about 20,000 pupils in engineering schools and 16,000 pupils in engineering colleges. Annual outturn is about 2500 engineers from colleges.

13. The average expectation of life is only about 35 years compared to 75 years in the USA and a little over 70 in the UK while infantile mortality per 1000 live births is as high as 130 in India against 30 in the USA and in the UK. Deaths caused by epidemic diseases form nearly 50 per cent of the total mortality. The prevalence of diseases, like malaria and tuberculosis is very

high and cause deaths to more than one million persons every year. The number of medical personnel is extremely low. There are only about 65,000 fully qualified (six-year trained) doctors with an overall share of one doctor for about 6000 persons (against about one per 1000 persons in the UK). But the distribution is extremely uneven, only about one-fourth, that is, 15 or 16 thousand doctors live in rural areas with a share of only one doctor for about 20,000 villagers. In some States the proportion is much less. Nurses, health visitors and other auxiliary health and medical personnel are proportionately even fewer in number. Medical institutions are very few ; one for about 25,000 persons in the urban area and one for 50,000 persons in rural areas. The availability of beds is only one per 3000 persons, but again mostly in urban areas. There are about 40 medical colleges now with an annual admission of about 3500 pupils.

14. Not much statistical data are available on the various other social and public services. The most important of these in the recent past was perhaps the problem of rehabilitation of refugees from Pakistan. The problem is now considered to be under control, though there is still influx of refugees from East Pakistan and this is a case of continual worry of the Central and West Bengal governments. The position of housing in the country, particularly in the urban areas is far from satisfactory and requires regular attention of the government. Other important services which requires attention are welfare of the backward classes and welfare of labourers. Prohibition has been accepted as a policy of the Congress Party, and some of the States have given effect to the policy in spite of its adverse effect on government revenue. Recently, attention is being paid towards reform of government administrative services so as to make the services more suitable for purposes of planning. The press with 330 newspapers and a circulation of dailies totalling only 25 lakhs reaches a small fraction of the population. More than 300 feature films and documentaries are produced each year and there are about 1 million radio receiving sets.

15. The problem of land reform has received considerable attention in recent years ; and measures of land reform have practically eliminated or will soon eliminate intermediate rights on land in most of the States. Except in Jammu and Kashmir, compensation on a sliding scale is being paid to intermediaries who are losing their rights on land. In many cases the maximum rent

to be charged as well as the maximum size of holding have been prescribed ; most of the States have fixed 30 standard acres as the ceiling of holdings. Some attention is being paid to prevent further fragmentation of holding due to operation of laws of inheritance and also to consolidate the holdings on a voluntary and co-operative basis. Most of the States are putting restriction on partition or transfer below specified limits and are adopting legislation for consolidation of holdings. The average size of ownership holdings is very small and less than 5 acres in rural areas. The distribution of rural land is, however, very uneven. About a fifth of rural households have no land. About half either have no land or own less than one or one and a half acre, and their total share is only about two per cent of the total area owned by rural households. At the upper end about 10 per cent of households have more than 10 or 12 acres, and own about 60 per cent of the land.

16. The consideration of various sectors of the economy may be followed by some observations on the aggregates. A rough idea about the general pattern of the total value produced is provided by the following : investment about 5 per cent ; public consumption 4 per cent ; and private consumption 64 per cent ; the rest of the product enters intermediate uses. Investment at the present moment is estimated at a little below 7 per cent of the net national product, but roughly one-fifth of this is in non-monetized activities such as land improvement and construction of huts in rural areas. Public investment (net) in recent times has moved roughly from one third to half of the total investment. In the organized private sector, most of the fixed investment is in industry and mining, the second most important sector being transport. But investment in industry and transport put together is less than the investment in urban construction. Very little is known about investments in inventories in the private sector. There is not much barter but a large part of the economy (may be something like 30 or 35 per cent of the whole) is non-monetory, with a large volume of home consumption of home produced food and other goods. The national income was about Rs. 28 per month per person ; and an expenditure in cash, on an average, probably of only about Rs. 17 or Rs. 18 per month per person. A small number of households are very rich. Only about 5 lakh (half a million) pay income tax with an exemption limit of Rs. 2,500 per year. There is a large number of very poor people ; about one

eighth of the population (or about 50 million) probably have less than 10 rupees (i.e., 15 shillings or about 2 US dollars) per month per person.

17. While agriculture and allied pursuits (animal husbandry, forestry and fishery) roughly contributes a little less than half of the national income, the remaining half is shared more or less equally by mining and industries, commerce and transport, and various services. There has been some rise in national income in recent times ; in particular rises in agriculture, organized industries and in some of the service sectors have been quite pronounced, but a part of the apparent rise may probably be due to statistical adjustments. It is not clearly known how far the estimates of national income from year to year truly reflect the underlying change. But accepting the figures as they are, a large rise in per capita national income is noticed between 1950-51 and 1953-54 ; subsequently the evidence is indicative of just a maintenance of the per capita level reached in 1953-54.

18. Consumption pattern in the country is different in different regions ; also there is marked difference between urban and rural areas. Roughly two-thirds of the consumer expenditure in rural areas are on food ; in urban areas, the percentage is of the order of 55. Again some 40 per cent of rural expenditure is on foodgrains, while the corresponding figure for urban area is a little above 20 per cent. In so far as meat, fish and eggs are concerned, the rural families spend 2 per cent on these items while the urban families spend 3 per cent. Regarding clothing and milk and milk products, the relative share in urban areas is only slightly above that in rural areas and in respect of fuel and light the percentage is more or less the same. The residual group, of course, is considerably higher in urban areas than in the rural areas. The pattern of expenditures also naturally varies with the per capita expenditure level of the household. Thus, both in urban and rural areas, the share of expenditure on food is about 70 per cent in the per capita expenditure class below Rs. 8 per month and of the order of 40 per cent in the per capita expenditure class above Rs. 55 per month.

19. There is a good deal of unemployment. Many persons are without jobs and many self employed persons do not have enough gainful work in hand. During the last two or three years unemployment in the urban areas has been increasing. The visible unemployment in urban areas may have reached two or three million in 1954. The corresponding figure in the rural areas may

be of the same order, that is, the pool of visible unemployment may be something of the order of 4 or 5 million. There are also fresh additions to the labour force every year. The age structure of the population is fairly stable and as the proportion of the working force is between 40 per cent and 45 per cent, and as the population is growing by something like 4 or 4.5 million every year it follows that about 1.8 million persons would enter the working force every year. Unless sufficient new work is created to absorb these new entrants into the labour force the number of unemployed persons would go on increasing continually. Besides visible unemployment in respect of paid jobs there is a great deal of underemployment or disguised unemployment. Many agricultural labourers or artisans and craftsmen do not have enough work and remain idle for a considerable part of the year. There are conceptual difficulties in giving definite figures. Various estimates have been made ranging from 10 or 12 million to over 30 million in terms of equivalent man years. It is beyond dispute that a very large number of people are often obliged to remain idle for lack of work. For both social and political reasons unemployment is the most pressing problem in India today.

20. On the credit side India has a stable Government with wise leadership, a stable currency credit-worthy at the international level; a fairly stable foreign trade, fairly good Government machinery for law and order and for routine administration; a number of universities, scientific institutions and societies; and a nucleus of experienced scientists and technologists.

21. There has been some notable progress during the First Five Year Plan. Some large river valley schemes for irrigation and power have started coming into operation; the area irrigated have gone up by about 6 per cent and power generated has gone up by two thirds. Some completely modern factories in the public sector have started working and mention may be made of Hindustan Shipyards, Hindustan Machine Tools, Sindri Fertilizer Factory, Hindustan Antibiotics, Hindustan Cables, Hindustan Insecticides, Chittaranjan Locomotives, Indian Telephone Industries and Integral Coach Factory in this connection. All the above enterprises are central; some of the State Governments also started new factories. Further, three steel plants are under construction under the auspices of the Central Government. The progress in the private sector has already noted to be satisfactory, the overall index number of industrial production moving up by about 40 per cent

over the plan period. A big scheme of Community Projects and National Extension Service Blocks has been initiated in the rural areas which may develop into an important movement to revolutionize rural economy. Upto 1955-56, work has started in almost a thousand Community Project and National Extension Service Blocks covering a population of a little less than 9 crores. The services are expected to encompass the whole of the rural population during the Second Plan. The area sown has gone up by more than 7 per cent while the index number of agricultural production is roughly 20 per cent above the pre-plan periods. The level of foreign trade has not changed materially over the plan period, but the volume of internal trade has increased. Prices exhibited a declining trend after the post Korean war boom in 1951-52 in spite of some deficit spending by the government towards the end of the plan period ; the rate of decline has not been so large as to cause worry. Inland passenger transport remained steady, but the railway goods transport increased by as much as 35 per cent. Education flourished in so far as quantitative aspect is concerned, about 70 per cent more students graduated or passed higher examinations in 1954-55 in comparison with 1950-51, while the corresponding percentage is about 60 for matriculation and equivalent examinations. Further, 14 National Laboratories for scientific and technological research have been established. The progress in health services has not been so large. Also, employment flagged behind and created difficult situations in urban areas. Industrial employment went up by only 5 per cent, employment in railway by 10 per cent while the Central Government services expanded by 12 per cent over a period in which the national product reportedly increased by 18 per cent. But quite apart from the question of material progress, the greatest achievement of the First Five Year Plan has been that it made the whole country Plan-conscious. Increased interest is being taken by the general public in economic conditions and problems ; and great expectations have been roused about the Second Five Year Plan.

Chapter 3

THE GENERAL APPROACH OF THE PLAN-FRAME

The Problem of Unemployment

1. The chief aim of planning in India, in the first instance, must be to solve the problem of unemployment as quickly as possible. In India we have vast resources of iron ore, coal, and other minerals; large possibilities of developing river valley (hydro-electric and irrigation) projects; raw materials of many kinds; and yet there are millions of people either without jobs, or sitting partly idle. The obvious reason is the great shortage of capital goods. In highly industrialized countries there is full employment (with potential shortage of labour) when the economy is working at full capacity. Unemployment can occur only when means of production remain idle. The situation in India is different. Unemployment is chronic because of lack of capital goods. The only way of eliminating unemployment in India is to build up a sufficiently large stock of capital which will enable all unemployed persons being absorbed into productive activity. Increasing the rate of investment is, therefore, the only fundamental remedy for unemployment in India.

Small scale and Household Industries

2. In the highly industrialized countries, under conditions of full employment, the rate of investment can be increased only by curtailing consumption. In India the general level of consumption is extremely low. Some savings no doubt can be created by reducing consumption in certain sectors but the scope is small. We have, however, idle man-power and raw materials. It is logical, therefore, to think of expanding the production in the small scale and household industries. This sector is capital-light and labour-intensive. We have a long tradition of handicrafts in India. We know how to manufacture the tools and means of production for the small scale and household industries. A comparatively small amount of capital could generate a large volume of employment and could also supply much additional consumer goods for sale. During the war (1940-45) we witnessed a large expansion of small scale and household production in response to the increasing demand

for goods. If we can increase the demand, it should be again possible to increase the production in the small and household industries.

3. How can this be done? In two different ways. Any increase of investment in the heavy industries producing investment goods (which do not compete with the small and household industries) must create new purchasing power and hence generate new demand. The effect will be the same if we increase expenditure on health, education, and other social services (which also do not compete with the small and household industries). It is clear, therefore, that the basic strategy of planning in India should be, on one hand, to increase investments in the heavy industries and also expenditure on services to increase purchasing power and create fresh demand; and, on the other hand, to increase the supply of consumer goods by increasing investment and production as much as possible in the small and household industries to meet the new demand. In India the correct policy is to increase both consumption and investment at the same time.

4. Until unemployment is brought under control there should not be, therefore, any fresh investments to expand factories which compete with the small and household units of production. In addition, in special cases, it may be also necessary to impose a temporary ban on further expansion of factory production which is competitive with small scale or hand production. This may result in some surplus factory capacity remaining idle temporarily. It may be better to allow machines to remain idle rather than to keep human beings unemployed.

5. The price of hand-made goods would be sometimes higher than the price of factory-made goods of comparable quality. A simple remedy is to levy suitable excise duties on factory-made goods to preserve price parity with hand-made goods at any desired level. This would, no doubt, raise prices to some extent but would at the same time supply additional resources for investment and hence for additional employment, increase of income, and national development.

6. Under planning, the whole economy would be continually expanding. Income and consumption would increase. The unemployed would get more and more absorbed in productive activity. The self-employed, the household sector, and the poorer sections would gain relatively more than the richer sections of the population. The poorer people would not mind paying somewhat higher prices (which would flow back into the hands of Government

as additional resources for development), once they realize that this is the inescapable condition for their own prosperity. Any person who has no employment or whose earning is low at present would prefer to have work or to increase his earning even if this means that a part of the increase in income would go back to Government in the form of additional tax or higher prices. It cannot satisfy a person without employment to know that prices will remain low but he would not be able to make any purchases for lack of money. He would prefer the opportunity to earn something with which to purchase what he wants even if this means that he would have to pay somewhat higher prices.

7. It would be wise to give the highest priority to the elimination of unemployment; and to try to decide the basic approach for the Second Five Year Plan with the object of reaching full employment in 10 years or less.* The above formulation of the problem implies, of course, that after getting rid of unemployment it would be necessary to maintain full employment in future. As population in India is growing steadily it is necessary to create enough new work and employment every year to absorb the new entrants into the labour force. That is, in India employment must expand at least as fast as the population which requires that the national economy must also expand, at least, equally fast.

8. We must thus look beyond 5 or 10 years; and have a "perspective" of 20 or 30 years or even more (although the programme or plan would necessarily have to be worked out in the concrete for 5 or 10 years and even year by year in the light of experience). The aim would be to increase the national income as much as possidle while progressing towards full employment, and to continue to increase national income after reaching full employment. This is the logical basis of the two objectives of (a) increasing employment and (b) attaining a satisfactory rate of increase of income which have been adopted in the Plan-frame.

* In a "fully socialized" economy, maximizing national income would be a sufficient condition as this would enable maximizing employment at the same time because a part of the increase in income can be distrialized in a suitable way to create a large volume of employment or provide appropriate benefits to the unemployed. (For example, both children and adults can even be paid for attending schools or clinics). In an "unplanned" economy, maximizing profits or income might lead to an increase in unemployment. In highly industrialized countries such temporary unemployment can be taken care of through unemployment insurance and social services. This is not possible in an under-developed country like India where, under mixed economy, it seems preferable to state the aim of (partial) planning as the attainment of full employment (and not simply the maximization of the rate of growth of income).

9. In the present approach great emphasis has been given to building up quickly the basic heavy industries. This would lay a sound foundation for the manufacture of machinery which would improve the efficiency of industrial production in future. As the problem of unemployment comes under control and as the basic industries are gradually developed, modern machinery would be supplied in increasing quantities to the small and household industries; and factory production of consumer goods would also be expanded as necessary to lead to a continually increasing level of living. In India, the wise policy would be to disperse production as much as possible, physically, in the sense of preference being given to the smallest units of production which are economical from a national point of view, and also geographically.

Basic Heavy Industries

10. I may now consider the question of economic development over a long period of time. Although production can be increased to some extent by utilizing idle capacity, by working double or triple shifts, or by increasing the skill of the worker, the long-term growth of the economy will depend on the rate of increase of the means of production, that is, on the rate of increase of investment.

11. Econometric "models" are particularly useful for the study of long period growth. The art of model building lies in selecting a small number of significant factors (out of the innumerable factors affecting the economy) and putting these simple factors in a definite relationship to constitute a "model" which would serve as a representative substitute for reality. A study of the changes in the model would then supply some idea of the real process of growth. The usefulness of the "model" would, of course, depend on the extent to which the model succeeds in representing reality in the essential features under study.

12. Since 1950 we have been studying simple models of the relation between increase in the national income and amount of new investments over a long period of time in the USA, UK and some other countries. On the basis of these studies (Mahalanobis, 1952) I had reached the conclusion that the rate of investment in India must be increased to 10 or 11 per cent in order to attain a satisfactory rate of expansion of the national economy. Since then further studies were made (to which more detailed reference is made in a later chapter) on the basis of which we found that,

under planning, the ratio of the increase of the national income to new investments may be reasonably expected to be about 0.5 in India. If we aim at an increase of income of about 5 per cent per year (which would double the national income in about 14 years and the per capita income in about 18 years) then it would be necessary to increase the average rate of investment to about 10 or 11 per cent per year. As the national income of India is of the order of ten or eleven thousand crores of rupees, in order to increase the national income by 5 per cent per year or by something like 27 per cent in 5 years, the total capital requirement would be something between, say, five and six thousand crores of rupees spread over 5 years. Besides investments, there would also be some developmental expenditure on training and social programmes. Allowing about one thousand crore for such purposes the "size" of the plan, as measured by the financial outlay, should be something between six and seven thousand crores in 5 years. This is a convenient starting point.

13. The rate of development over a long period is, however, intimately connected with the pattern of investment. For example, if all investments are made in industries producing consumer goods (by importing capital goods from abroad) then there would be, no doubt, a good deal of increase in the immediate supply of consumer goods but there would be no increase in the capacity to manufacture capital goods in India so that we shall have to continue to depend on the import of foreign machinery in future for further expansion of industries. There may also be a glut of consumer goods (as has happened in India from time to time) followed by unemployment.

14. India has plenty of iron ore, coal and other natural resources. The long-term aim should, therefore, be to manufacture capital goods within the country rather than to import them. The proper strategy would be to bring about a rapid development of the industries producing investment goods in the beginning by increasing appreciably the proportion of investment in the basic heavy industries. As the capacity to manufacture both heavy and light machinery and other capital goods increases, the capacity to invest (by using home-produced capital goods) would also increase steadily and India would become more and more independent of the import of foreign machinery and capital goods.

15. Some illustrative figures may be useful. Indian reserves of iron ore have been estimated at about 21,000 million metric tons which is just one-fourth of the total reserves of the whole

world and more than three times bigger than the estimated reserves of the USA (less than 7,000 million metric tons), or more than five times that of the UK (4,000 million metric tons, UN Report, 1955). Indian ore has a high iron content. India also has coal. The production of steel in India in 1954 was about 1.2 million tons for a population of possibly 375 or 380 million persons against about 110 million tons for a population of 165 million in the USA and about 20 million tons for a population of 50 million in the UK. Compared to India, the production of steel per person is more than two hundred times higher in the USA and more than hundred times greater in the UK.

16. More steel per person means more machinery per person; and more machinery means more production per person. The difference in the level of living in these three countries can be easily explained by the differences in the rate of production of steel. For a single factor, the production of steel probably has the highest correlation with national income in different countries.[1]

17. The production of steel must be progressively increased in India. It has been decided that three new million-ton steel plants would be installed during the Second Five Year Plan or as soon as possible. Each new million-ton steel plant involves an investment of about Rs. 100 crores (£75 million sterling or 200 million US dollars) in round numbers. Out of this amount about Rs. 45 crores (£34 million sterling or 90 million US dollars) would have to be spent in foreign currency to import machinery made mostly of steel. It has been proposed in the Plan-frame that a heavy machine building industry should be established in India so that as soon as possible India is able to fabricate machinery for the production of steel (or cement or capital goods) to the value of say Rs. 40 or Rs. 50 crores per year. Once this is done it would be possible to develop steel and other basic industries with the help of our own resources.[2] The ratio of capital to gross

[1] From some preliminary studies it appears that the coefficient of correlation between per capita production of steel and per capita national income is so high as +0.75 for a group of 19 countries in 1953 for which data were available.

[2] It is not necessary that India should manufacture everything required for the installation of a steel plant. In the case of machinery for the production of steel there has been much specialization and even industrially advanced countries (like the USA, the UK, or Germany) make considerable purchases from other countries. But they also sell some of their own specialized products so that they do not have to depend on foreign currency or loans. Furthermore, if there is any difficulty in securing capital goods from abroad, they can start manufacturing such goods to meet their own essential needs. It is most desirable that India should attain a similar position as quickly as possible.

value of product is roughly 3 to 1 or somewhat less for the production of steel. On the same basis, the capital required to manufacture heavy machinery worth, say, Rs. 50 crores per year would be about Rs. 150 crores. Even if the heavy machine building industry is more capital-intensive than steel, the total capital required is not likely to exceed Rs. 200 crores; and the value of imported machinery required for this purpose cannot be higher than, say, Rs. 100 crores or Rs. 120 crores. The saving in foreign currency (in imports) for a single million ton steel factory would be about Rs. 40 or Rs. 45 crores. The foreign currency required to establish a heavy machine building industry would be recovered by the time three new million ton steel plants are installed with the help of home-produced machinery. If it is known that at least three new million ton steel plants would be installed *after* the establishment of the heavy machine building industry then there would be no risk in the decision to establish such an industry. Under planning there cannot be any doubt that India should produce 10 or 20 or 50 million tons or more of steel as soon as possible. Under planning it is, therefore, a safe and wise decision to establish a heavy machine building industry at the earliest opportunity.

18. I may give another example. India is believed to be short of copper but has large reserves of bauxite from which aluminium can be produced. The present consumption of aluminium is only 7 or 8 thousand tons per year, about half of which is produced in India and about half is imported. India is rapidly developing electricity for which large quantities of copper would have to be imported. The Plan-frame has recommended that the production of aluminium should be progressively increased with a view to replacing copper by aluminium to the largest extent possible. This would be a wise decision because it would increase production through the utilization of Indian resources; and would also make India progressively independent of imports of copper in future. This is the kind of thinking which made us give so much emphasis to the rapid development of the basic industries.*

* A rapid development of basic heavy industries which requires a great deal of capital can be brought about in India only through planning at a national level. A heavy machine building industry at a capital cost of Rs. 150 or Rs. 200 crores can be started only if there are reasonable prospects that new factories for the production of steel or other capital goods would continue to be established in sufficient numbers in future. It is Government alone which can make decisions about the rate and pattern of industrialization in future and hence can make the decision to establish the heavy machine building industry on a sufficiently large

19. At the same time we also examined the question from a more aggregative (or macroscopic) point of view. Studies based on a statistical model (discussed later) showed that the larger the share of capital goods industries in the total investment the larger would be the increase in the national income over a long period of time (of the order of 15 or 20 or 30 years) and the smaller will be the immediate rise. From the point of view of long range development it will be desirable to increase, as much as possible, the proportion of investment in the basic industries producing capital goods. There is, however, a physical and/or socially acceptable limit beyond which it is not possible to push up investments in the capital goods industries (because of the shortage of capital goods and technical personnel or because it would involve too great a sacrifice of immediate benefits).

Balance of Demand and Supply

20. There is a second point. We think it would be desirable to avoid inflationary pressures as much as possible so that it would not be necessary to continue indefinitely the rationing of essential goods. The only way to achieve this is by balancing the supply and demand of essential goods. Investments in basic industries must not be pushed above a point beyond which the increase in demand caused by the increase in purchasing power cannot be absorbed by the additional production of consumer goods. This condition has been emphasized in the Plan-frame.

Allocation of Resources

21. What should be the proportion of total investment to be allocated to the industries producing capital goods is the most crucial decision in perspective or long range planning. Once the choice is made of the share of investment in capital goods industries, the availability of capital goods in future years would become more or less determined. The only change which could be made would be through import (or export) of capital goods. From certain studies based on the model of 1953 we reached the conclusion that something between 30 per cent and 35 per cent of the total

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scale to make it possible to instal, say, one new million ton steel plant every year in future. Inspite of the unrivalled natural resources for the production of steel in this country, in the absence of planning, India was producing only about one million ton per year up to 1953 and no action has been taken so far to manufacture heavy machinery. This clearly demonstrates how development was retarded for lack of planning in India.

investment should go to the industries producing capital goods. In India the present proportion is probably less than 10 per cent. In our view this proportion should be increased by three or four times.

22. Having settled the share of investment for the capital goods industries, broadly from considerations of long period development, the next step would be to decide the detailed allocation of investments to individual industries and services. At this stage attention must be given to the need of creating as much employment as possible. We have found it useful to use three sets of contingent parameters in considering different possibilities. We are interested firstly, in the ratio of the increase in output (in physical terms or in money value) to new investment, that is, the output per unit of new investment or the output coefficient of capital; secondly, in the ratio of the increase in net value added to new investment, that is, increase in income per unit of new investment, or the income coefficient of capital (which we have called β); and, thirdly, in the ratio of investment to the number of persons employed, that is, the amount of capital required per worker or the capital coefficient of labour (which we have called θ). Detailed studies are being made about these technological parameters for individual industries and groups of industries.

23. The technical methods used in the Plan-frame can be now briefly explained. The total amount of investment available having been provisionally settled, we may proceed (provisionally, of course) to distribute the investment to groups of industries or to individual industries and services. In each industry (or group of industries) the amount of investment having been (provisionally) settled, it would be possible (with the help of the technological coefficients mentioned above) to estimate the expected output in physical terms and in money value, the expected contribution to national income, and the expected volume of employment generated. Adding these up we can get the total income and employment which may be reasonably expected to be generated by any particular way of allocation of investments.

24. The physical targets of production, investment, income, and employment are thus completely interlocked. Not only this, there are also physical relations between quantities of material and labour required for the production of different commodities. The targets of production are, therefore, directly connected and interlocked among themselves through physical and technological relations.

25. There is also the question of meeting the expected increase in demand for consumer goods. A great deal of material on family budgets has been (and is being continually) collected since 1950 through the National Sample Survey. It is possible, therefore, to study the differences in the pattern of consumption among households at different levels of per capita (or per household) expenditure. Engel coefficients of elasticity are being studied for this purpose; and provisional values have been calculated for food grains, cloth, sugar and some other commodities. If we assume that households, when their income is increased, would incur expenditure (on an average) in the same way as households who at present have higher incomes are actually doing, that is, if we assume that tastes and preferences would remain (on an average) fairly stable, then it is possible to use the Engel coefficients of elasticity to estimate the increase in demand for individual commodities which is likely to occur as income increases. It is, of course, possible to make such estimates separately for different geographical regions, or for different occupational groups. In principle, it is thus possible to take into consideration the effect on demand not only of changes in income but also of changes in the rural and urban or occupational or regional distribution of population, or changes in the distribution by size of income.

26. For any particular allocation of investments to individual (or groups of) industries and services, it is, therefore, possible in principle to estimate the expected output of commodities, the expected increase in income, the expected increase in employment, and also the expected increase in demand. It is then possible to check whether there is a balance between requirements and supply of raw materials and labour at each stage of production; or whether there is a balance of supply and demand of consumer goods and services. If there is any lack of balance, then the targets must be suitably changed remembering that, in principle, a change in any single item may affect the other items. The balances must be then again checked. The whole process will have to be repeated until a set of physical targets with associated investments, income, and employment is reached which is internally consistent and in which the supply and demand is balanced at every stage of production and consumption.*

* It would not be possible to meet the demand for luxury goods and services as large resources cannot be permitted to be diverted to the production of luxury goods. A balance must be brought about through an appropriate price policy

27. It is possible to use some mathematical short cuts in making the above calculations. For example, in principle, it is possible to use advanced methods of linear and convex programming. A number of Working Papers on this subject were prepared under the leadership of Professor Ragnar Frisch of Oslo who worked in the Indian Statistical Institute in the winter season of 1954-55. Some of these papers have been printed. These refined methods are extremely powerful but, unfortunately, it is not possible to use them in the immediate future in India for lack of detailed data which would be required for this purpose. In the meantime the simpler methods described in Chapter 4 have been used for the preparation of the Draft Plan-frame.

Five Limiting Factors

28. The aim of planning in India must be to obtain the maximum possible rate of increase of employment and national income over a given time period. Planning must, therefore, maintain a wide perspective of the growth of the national economy over 10, 20 or 30 years or more; and, at the same time, give adequate attention to the urgent need of eliminating unemployment as quickly as possible.

29. In the present approach, the strategy is to balance the increase in demand created by investments in the heavy capital-intensive industries and expenditure on services by adequate production of consumer goods at first through small and household industries. The rate of development, if inflation is to be avoided, would be determined by the amount of surplus consumer goods which can be actually produced. The production of enough consumer goods in the small and household industries is, therefore, of strategic importance and may constitute a limiting factor.

30. The capacity to invest (without import of capital goods) in any given year is determined by the pattern and volume of production of capital goods in the previous year. The rate of expansion of the basic industries, therefore, sets a limit to the rate of growth of the economy as a whole and may constitute a second limiting factor.

(through the imposition, for example, of excise duties) or suitable fiscal measures. There is no danger of inflation if the supply and demand can be balanced in the case of essential commodities used by all sections of the people (such as cereals, cloth, sugar).

31. The capacity to increase both production and the flow of services would depend on the rate at which technical personnel of the required type can be trained. Lack of trained personnel may be a serious bottleneck. The rate at which training can be provided would thus constitute a third limiting factor.

32. The possibility of planning on the proposed scale would depend on raising adequate financial resources which may constitute a fourth limiting factor. This, no doubt, involves technical questions of monetary and financial policy; but ultimately the basic decisions must be made on broad social and political considerations.

33. Finally, as pointed out in the Plan-frame, even if adequate financial resources can be raised, implementation may become difficult or impossible owing to rigidities in the existing system of administration. There must be thorough decentralization of administrative and financial powers in the case of public enterprises and institutions; and also active cooperation between official and non-official agencies. Inadequate administrative machinery may form a fifth limiting factor.

34. We are aware of these difficulties. The logical consistency of the Plan-frame is not a sufficient guarantee of its feasibility in practice. Any one (or two or more in combination) of the five limiting factors mentioned above can retard progress. However, so far as plan-making is concerned (as distinguished from plan-implementation) all that can be demanded is internal consistency, valid technical reasoning and a correct appreciation of social needs. If the present plan has these merits then there is only one single issue, namely, whether there is any alternative plan which would eliminate unemployment and poverty more quickly and more effectively; and at the same time, lay the foundations for a continuing increase in the level of living in future. If there is no alternative plan which is more satisfactory, then the proper policy would be to try to implement the present plan.

Chapter 4

THE STATISTICAL BASIS OF THE PLAN-FRAME

1. I shall now explain the statistical basis of the Draft Plan-frame. It will be useful to start with a brief recapitulation of some previous work. In 1949-50, I worked with a simple model covering the whole economy, that is, using one single sector for the national economy.[1] I used the ratio of the gross value of the additional product to the new investment required to generate this product; and adopting a value of unity for this ratio gave some estimates of the investment required per person to increase the level of living under Indian conditions.

Single Sector Model

2. In 1951 and 1952, I worked with another model[2] for the whole economy in which I used the ratio of the increase in net national income per unit of time to the net investment associated with this additional income. I called this ratio β (which is the inverse of the marginal capital coefficient). If α is the rate of *net* investment, that is, the fraction of net national income used for investment, then the rate of growth of the economy is $\alpha\beta$. If ρ is the rate of increase of population (usually less than 2 per cent per annum), then the rate of increase of income per person is $(\alpha\beta - \rho)$ approximately.

3. From direct calculations I had found from the national income data for USA given by S. Kuznets (1946) that the value of β for USA was about one-third. I also found by direct calculations from data of national income and investment for UK given respetively by A. R. Prest (1948) and by J. H. Lenfant (1951) that the value of β for UK was something like one-fourth or a little smaller. I had also made some tentative calculations for Switzerland, Norway and some other countries from which I inferred that the value of β for the USA and some of the West European countries would

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[1] P. C. Mahalanobis: "Why Statistics?" Presidential Address to the Indian Science Congress Association, Poona, 1950.

[2] P. C. Mahalanobis: "National income, investment, and national development" (Lecture, National Institute of Sciences, 1952). The model I used is similar to the models used a little earlier by Harrod and by Domar but I did not know of their work at the time of writing.

probably fall between one-fifth and one-third (that is, the over-all marginal capital coefficient would be something between 5 and 3). Using similar values of β for India I reached the conclusion that it would be necessary to increase the rate of investment in India from about 5 per cent at the time to at least 10 or 11 per cent to attain a reasonably satisfactory rate of increase of national income.

Two-Sector Model

4. I used a two-sector model in 1953 which I shall now briefly describe.[1] The total net investment is divided into two portions. One part (a fraction, say, λ_k) is used to increase the production of basic capital or investment goods (which may be called the K-sector), and the other part (a fraction, say λ_c) is used to increase the production of consumer goods (to be called the C-sector). It should be noted that λ_k and λ_c are fractions of the total investment, so that $\lambda_k + \lambda_c = 1$. I should also explain that appropriate fractions of investments in industries manufacturing intermediate (producer) goods should be allocated to λ_k and to λ_c in proportion to the value of such intermediate goods used in the capital goods (K-sector) and the consumer goods (C-sector) industries respectively. The two fractions λ_k and λ_c can be settled at the choice of the planners. However, once the value of λ_k is settled, the supply of investment goods produced within the country would become fixed. A change can be brought about only through imports or exports of investment goods. In India I have assumed that, with the progress of planning, the domestic supply of investment goods would become more and more important. That is, although in the beginning India will, no doubt, have to depend on imports of capital goods, the policy would be to make India *independent* of such imports as soon as possible.[2] In the present model I have, therefore, assumed that there would be no imports or exports of investment goods.

5. Let Y_t = national income, C_t = consumption, and K_t = investment at time t; with Y_0, C_0, K_0 as the corresponding values at the initial period. As already mentioned, λ_k and λ_c

[1] P. C. Mahalanobis: "Some observations on the process of growth of national income". *Sankhyā*, 12(4), 1953.

[2] This does not mean that India would not purchase capital goods from other countries. India would make such purchases but India would also manufacture and export capital goods. Secondly, if for any reason (such as lack of foreign currency, shortage of supply or high prices in the world market, state of blockade or war, etc.) there is difficulty in securing essential investment goods from abroad, India should be able to manufacture such goods within the country.

(with $\lambda_k+\lambda_c = 1$) are fractions of investment allocated to industries producing capital goods (K-sector) and consumer goods (C-sector) respectively. We shall write β_k= ratio of increment of income to investment in industries producing investment goods; β_c= ratio of increment of income to investment in industries producing consumer goods; and define β as the ratio of increment of income generated to total net investment in the economy as a whole, with

$$\beta = \lambda_k\beta_k+\lambda_c\beta_c, \quad \text{necessarily.}$$

We also have $$K_{t+1}-K_t = \lambda_k\beta_kK_t, \qquad \ldots \quad (4.1)$$

$$C_{t+1}-C_t = \lambda_c\beta_cK_t. \qquad \ldots \quad (4.2)$$

We then get $$K_t = (1+\lambda_k\beta_k)^tK_0, \qquad \ldots \quad (4.3)$$

$$Y_t = Y_0\left[1+\alpha_0\frac{\lambda_k\beta_k+\lambda_c\beta_c}{\lambda_k\beta_k}\left\{(1+\lambda_k\beta_k)^t-1.\right\}\right] \qquad \ldots \quad (4.4)$$

giving national income in terms of the initial income Y_0, the initial rate of investment α_0, and the allocation parameters λ_k and λ_c (which are at our choice), and the contingent coefficients β_k and β_c (which, however, are determined by the pattern of investment and conditions of production).

A Four-Sector Model

6. More recently I found it of great help to use a four-sector model. The two-sector model described above is first used to decide the allocation λ_k to the industries producing capital or investment goods. The industries producing consumer goods and services are divided into three different sectors, namely, factory production of consumer goods (sector $C.1$); the production of consumer goods (including agricultural products) in small and household industries (sector $C.2$); and services such as health, education etc., (sector $C.3$).

7. As creating new employment is an important aim of planning in India, we introduce another set of parameters, θ's, the net investment required per engaged person. The number of jobs created in any sector, which we may call n, is then simply λ/θ per unit investment where λ is the fraction of investment allocated to

the sector under consideration. We shall use the subscript k for industries producing investment goods (K-sector); subscripts 1, 2, and 3 respectively for the industries producing consumer goods and services in the three sectors $C.1$, $C.2$ and $C.3$ respectively. We shall then have λ_k, λ_1, λ_2 and λ_3 as fractions of investment allocated to the K-sector, sector $C.1$, sector $C.2$ and sector $C.3$ respectively; with, of course,

$$\lambda_k+\lambda_1+\lambda_2+\lambda_3 = 1. \quad \ldots \quad (4.5)$$

We also have β_k, β_1, β_2 and β_3 as the ratio of increment of income to investment; and θ_k, θ_1, θ_2 and θ_3 as the net investment required per engaged person respectively in the four sectors. We now consider a total plan-period of, say, 5 years, and regard the above parameters as average values appropriate to the plan-period as a whole. Also, if n_k, n_1, n_2 and n_3 are the number of additional persons engaged respectively in the four sectors over the plan-period, and A is the total investment over the whole plan-period, then

$$n_k = \lambda_k A/\theta_k,\ n_1 = \lambda_1 A/\theta_1,\ n_2 = \lambda_2 A/\theta_2, \text{ and } n_3 = \lambda_3 A/\theta_3. \quad \ldots \quad (4.6)$$

If N is the total number of additional persons engaged over the plan-period, and E is the total increase in income over the whole plan-period, then we have

$$N = n_k+n_1+n_2+n_3, \quad \ldots \quad (4.7)$$

$$A = n_k\theta_k+n_1\theta_1+n_2\theta_2+n_3\theta_3$$

$$= \lambda_k A+n_1\theta_1+n_2\theta_2+n_3\theta_3, \text{ since } n_k\theta_k = \lambda_k A \text{ from (4.6)} \quad \ldots \quad (4.8)$$

$$\text{Also, } E = \beta_k\theta_k n_k+\beta_1\theta_1 n_1+\beta_2\theta_2 n_2+\beta_3\theta_3 n_3$$

$$\equiv Y_0[(1+\eta)^5-1], \text{ say.} \quad \ldots \quad (4.9)$$

If we assume a constant annual rate of growth of income of, say, η per cent per year, then E can be derived from the initial income per year Y_0 by applying the η rate to Y_0. For our calculations we have taken η as given and equal to 5 per cent per year.

8. In order to use the above model we must substitute statistical estimates for the different algebraic symbols in the equations. It

is possible to treat as 'variables' the increase in national income E, the investment A, and the employment N. But the ratio of net income generated to capital investment $\beta_k, \beta_1, \beta_2$ and β_3, and the net investment required per engaged person θ_k, θ_1, θ_2, θ_3 respectively for each of the four sectors behave as parameters; and are given in the sense that their respective values are assumed to remain more or less constant and are not sought to be influenced by planning during the period under consideration. Besides these, we have the allocation ratios λ_k, λ_1, λ_2, λ_3 which also are parametric in the sense that they do not change during the period of time under consideration. There is however an important distinction. The income-investment ratios β's are determined by the conditions of production (and the pattern of investments within each of the four sectors) and are not influenced by planning,[1] during the period under consideration. The allocation ratios λ's, on the other hand, are at the choice of the planner within certain limits. The proportion of total investment allocated to investment goods industries λ_k must be decided from considerations of long period changes; and the allocation ratios for the other sectors λ_1, λ_2, λ_3 must then be obtained as solutions of the set of simultaneous equations given above. For example, the rate of increase of income or the employment generated may be treated as 'variables' to which desired values may be assigned. The model would then enable us, with the help of numerical estimates of the various parameters, to study how the allocation ratios λ's, that is, the proportions of total investment going into the different sectors should be chosen so that the desired aims can be realized.

Concepts and Definitions

9. We have been using so far terms like 'national income', 'investment' etc., without giving any definitions. In order to make valid statistical estimates of the magnitudes of the different variables or parameters it is necessary to have operational definitions which can be used for statistical purposes in practice without ambiguity. There are different concepts of *national income*. We have used here the definition adopted in the United Nations publication 'A System of National Accounts and Supporting Tables' [23].[2] It

[1] The pattern of investment itself is, of course, determined by the programme of investments which results from planning. In this sense, the β-coefficients are also indirectly amenable to planning but only in an implicit or indirect way. In contrast, the λ-coefficients are subject to direct planning.

[2] Figures in square brackets indicate serial number of references on p. 84.

is possible to use other concepts, for example, the USSR definition of national income as the total net material product. Another possibility is to define national income as the sum of the net material product and the value of the directly consumed services; this concept may be particularly useful under planning in a country with a mixed economy like India. What is needed is a concept which would be most suitable for the purpose in view. Some tentative work has been started but no definite conclusions have been yet reached. In this situation I shall use United Nations definition which has wide acceptance. The latest available estimates of domestic product of India (according to UN definition) is for 1953-54 which has been used in our calculations [2]. Provisional estimates for 1954-55 and 1955-56 have been also prepared for our work by the Central Statistical Organization.

10. *Investment* is the net addition to capital stock within the country in the form of plant, machinery, buildings and other capital goods. There are considerable conceptual and estimational difficulties in calculating the net investment. Standards also vary from one country to another in the proportion of maintenance and repair expenses charged to the operating account. In highly industrialized countries like the USA, the UK, Sweden and Switzerland, during the last decade or two, the rate of investment appears to have been between 10 per cent and 13 per cent of the national product. In the UK, during the period 1870-1913, the average rate of net investment was about 11 per cent per year. In the USA the average rate was 12 per cent or 13 per cent over several decades and exceeded 16 per cent over a decennial period only on two occasions during 1879-1948. In Sweden the rate was about 11 per cent over a long period before the war and about 13 per cent after the war; and in Switzerland it was of the order of 10 or 11 per cent in recent years. In socialized countries the rate of net investment is higher and is roughly of the order of 15 or 16 per cent or 20 per cent or even more as seen from the available information about Poland, Czechoslovakia, Hungary, East Germany and USSR. The current rate of investment in India is estimated as being of the order of 7 per cent of the net national product. For rapid industrial development the rate of investment must be increased appreciably.* We have suggested that it should be

* Simon Kuznets (1952) has shown that the rate of savings out of disposable personal income was remarkably steady and did not rise with the increase of national income in the USA over a long period (1869–1938). This is likely to be

increased from about 7 per cent to about 10 or 11 per cent by the end of the Second Five Year Plan or should be about 9 per cent on an average during the plan-period.

11. *Employment*, as considered in the present model, is the equivalent number of new jobs that would be created as a result of planned investment and production. In a country like India there are a very large number of persons working on their own account. They do not hold paid posts, and cannot lose their jobs. Many of them, however, do not have enough work and remain idle a part of the time. In their case if the volume of gainful work increases it may not lead to the creation of new jobs but usually some additional members of the household (who used to be partly or wholly idle) would be absorbed (partly or wholly) in the household enterprises. The concept of employment in the present context is, therefore, much wider than that used in the highly industrialized countries. We shall include under employment the increase in the gainful work in the household sector and also part time employment so that the total new employment would represent the increase in terms of something like equivalent man-years.

Allocation to Capital Goods Industries

12. I shall now consider the proportion of investment that should be allocated to industries producing investment goods (λ_k) through planning. We found from available data that $\beta_{\bar{k}}$ is usually much smaller than β_c (that is, the marginal increase of income per unit of investment is much less in basic industries producing capital goods than in industries producing consumer goods). This being so, the larger the value of λ_k, the smaller is the increase of income in the short run; but, after a critical period of several years, income begins to rise very steeply. Using the initial rate of investment, $\alpha_0 = 7$ per cent, $\beta_k = 0.2$ and different plausible values of β_c we found that to attain a fairly rapid increase of income over, say, about 30 years, it would be desirable that λ_k should have a value between 0.3 and 0.5. We adopted the value $\lambda_k = 1/3$, as we felt

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true in India also. Investments apparently can be increased in India in any appreciable manner either (a) by ploughing back undistributed profits in private enterprises or (b) through Government planning. To encourage large-scale ploughing back of undistributed profits (which would be practicable only in the case of the big private enterprises) would lead to progressive concentration of capital and financial power. This would be inconsistent with a socialistic pattern of economy. In India investments must be increased in the public sector through national planning.

it would not be possible to go beyond this value under present conditions. (See Technical Note at the end of this chapter.)

Statistical Estimates of the Parameters

13. The next step is to obtain reasonable estimates of the parameters which occur in the model under study. In principle, it is possible to use time-series data provided prices and the pattern of production had remained fairly steady, and also provided production was up to full capacity. This method, however, cannot be used in India for lack of suitable time-series data. We shall have to rely a great deal, therefore, on short period or technological data.[1]

Current or Replacement Value of Capital

14. Investment is a basic item in the present model. It is desirable to express the value of investment at current (rather than historic) prices. For this purpose it is necessary to know the relation between the book value and the replacement value of capital. Consider a steady state in which the stock of capital goods is being maintained without any increase or decrease. Every type of capital goods has a certain life after which it must be replaced. Consider any particular type of capital goods, and let its average life be T years. Also consider any particular item of the given type; it must already have been in use for a certain period, say, t years; it then has $(T-t)$ years of useful life still left. If the stock of capital goods includes a large number of items of the given type then there would be one item which still has a useful life of t years left. We may pair these two items (of the same given type), one with useful life of $(T-t)$ years still left and the other with a balance of useful life of t years; then the combined useful life of the two items taken together is $(T-t)+t$ or equal to T years for two items. The average life is thus $\frac{1}{2}(T)$ for each item. This argument would be valid for all items (under the simplifying conditions mentioned above). Hence, the average useful life still left at any time is half of the total life, so that as a first approximation, the current book-value should be half of the replacement value. The replacement value of capital can be, therefore, taken as double the book value.[2]

[1] Estimates of β based on data for annual increment of income and investment are not strictly appropriate. I have not entered into refinements because subsequent calculations are of a very rough nature. (It is worth noting, however, that β-coefficients appear to be fairly stable over long periods.)

[2] This question has been discussed in detail under more general conditions by D. G. Champernowne and R. F. Kahn in *Review of Economic Studies*, vol. XXI (2), 1953-54.

A rough check was made in the following way. If we assume that the paid-up capital is numerically equivalent to net block assets, and inflate the annual increase in the paid-up capital by an index of cost of capital construction (compiled from an index of construction cost and an index of import prices of machinery) for the last few years, for India, then on aggregation the estimate of replacement value is actually found to be about double the present value of the total paid-up capital (which is assumed to be the same as the present book value of net block capital).

15. In a recent survey of 8 small-scale industries in the Calcutta area (1952-53) the replacement value of plant and machinery was found to vary from 2 to 6 times the book value. Also, data on the relation between the output and investment are available for a number of projects. If these relations are used to estimate (on the basis of current output) the capital stock in existing enterprises, it is found in most cases that the estimates of replacement value are 2 to 4 times the corresponding book values of capital. It is necessary to remember that in these cases much of the plant and machinery was purchased many years ago when prices were very low compared to current prices. In addition to adjustments for depreciation, it is, therefore, also necessary to make reasonable allowances for changes in the level of prices. These adjustments are particularly important in the case of plant and machinery but are not necessary in the case of stocks which are usually valued roughly at current prices. Depreciation in the case of buildings would be comparatively small, but adjustments for cost of construction would be necessary. On the basis of studies on the lines explained above it was decided generally to use double the book value as a reasonable estimate of the current replacement value.

Income-Coefficient of Capital (β)

16. One most useful parameter is the general (over-all average) ratio of increment in income to investment defined by

$$\beta = \lambda_k\beta_k+\lambda_1\beta_1+\lambda_2\beta_2+\lambda_3\beta_3. \quad \ldots \quad (4.10)$$

I may first consider briefly the value of this parameter in foreign countries. In the USA, during the period 1861-1938, the average income coefficient of investment (β) was of the order of 30 per cent. In the UK on the basis of data given by A. R. Prest (1948) and by J. H. Lenfant (1951) over the period 1870-1913, I found by direct

calculation that it was about 25 per cent. However, much larger values of β are obtained over short periods. Thus, if all available statistics on increment of income and net investment recently released in various United Nations publications are utilised, we get an average estimate of the ratio of the order of 40 per cent for 19 countries. For Japan over the periods 1930-36 and 1947-52, the ratio is as high as 50 per cent. In the latest 'Economic Survey of Asia and the Far East for 1954' by ECAFE [25], the value of this ratio for a number of countries in South-East Asia is quoted (on page xiii) as varying between 40 per cent and 50 per cent.

17. I should also note in the present connexion that in a capitalistic country, when the study covers a fairly long period of time, usually there would be periods of both rising and falling national income. The income coefficient of investment (β) over the whole period would be an average of values of the coefficient during periods of both booms and depressions. The observed ratio would be high when income and investment are both increasing. On the other hand, whenever a part of the capital remains idle (during periods of depression) the observed value of β must necessarily fall.[1] This is fully corroborated, for example, for the USA, for the period 1929-52; the general average is of the order of 0.28 while the average of the positive values only is as high as 0.76 [10].

18. Under planning, the aim is to maintain a continually expanding economy with production at full capacity. In a socialized economy, production is deliberately planned to make the fullest use of all resources and by-products.[2] That is, attempt is made to attain the maximum external economies through planning with the result that values of β are large. In socialized countries the addition to the national product per unit of net new investment appears to be generally much higher than in private enterprise economy and is of the order of 0.6 or 0.7 or even higher.[3]

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[1] If the trade cycle in capitalist economies is considered as a sum of harmonic fluctuations, then the average value (calculated with reference to the trend line) would be about half of the value of β taken over periods of production *above* the trend-line. If production to full or nearly full capacity can be maintained through planning then the value of β would seem to be doubled to a first approximation. That is, the capital coefficient would be roughly halved under planning.

[2] In a highly industrialized country like the USA, external economies become progressively more important and there is greater utilization of all by-products with the consequence that, during periods of increasing production, the value of β would tend to increase and approximate to the value attained in a planned economy. This may be at least a partial explanation of the observed increase in the value of β in the USA, in recent years.

[3] In discussions with Soviet economists I gathered the impression that the value of β can be as high as one hundred per cent or even more in certain

19. In India, for the First Five Year Plan, this β-coefficient was assumed to be of the order of 0.33 but the actual growth of income seems to have been higher than that envisaged in the plan. Over the six year period 1948-49 to 1953-54, the ratio of increment of income to investment was only slightly lower than 0.5 as revealed by the recent national income statistics. Under conditions of planning the overall income coefficient of investment β in India may therefore be taken to be of the order of 0.5.

Sectoral Values of Income-Coefficients

20. We may now consider the sectoral ratios β_k, β_1, β_2, β_3 bearing in mind that the overall ratio for the economy should be of the order of 0.5. In the sector of capital goods industry, the observed average value of the income-coefficient, based on the Sample Survey of Manufacturing Industries (SSMI) relating to five successive years 1949-1953, comes out as 0.43, which when adjusted for replacement value gives a value of $\beta_k = 0.21$.

21. The Census of Manufactures [3] gives an overall average of $\beta = 0.6$ for the five years 1946 to 1950. This includes some investment goods industries, excluding which the income-coefficient for factory production of consumer goods would be somewhat higher and of the order of 0.7. This figure, however, refers to the book value of capital; adjusting by the factor of $\frac{1}{2}$ for replacement value, we get a corresponding income-coefficient for replacement value of $\beta_1 = 0.35$.

22. For agriculture, very little direct data are available for estimation of the parameter. We have to use, therefore, the national income data on income and investment which yield a figure of about 1.5 for both agriculture and household enterprises combined. There was, however, a large and somewhat sudden increase in agricultural production which has pushed up the national income figures since 1951-52; a part of this increase is usually ascribed to exceptionally good monsoons, and a part may be due to a statistical correction of previous under-estimation in official figures of crop production. We have thought it advisable to scale down the figure slightly and have adopted $\beta_2 = 1.25$ as a reasonable value.

23. Some fragmentary data are available on the income-coefficient in the small and household industries which we may call

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transitional phases of planned economy, that is, the new net income generated may be equal to or even higher than the new investment which is associated with this income.

β_h. The National Sample Survey, fourth round (April-September, 1952) gave a value of $\beta_h = 2.1$. From an earlier survey at Aligarh-Harduaganj in 1948, the income-coefficient was found to be about 2 in rural areas and 1.7 in urban areas. The material supplied by the All-India Khadi and Village Industries Board leads to a value of 2.8. A Survey of Small Scale Industries in Calcutta in 1952-53* had given a much smaller value of 0.94. It had been, however, noted in the report that the small enterprises were passing through a depression and that there was much idle capacity. The value at full capacity would be, therefore, much higher. On the basis of the above material, we have adopted a value of $\beta_h = 2$ (for use in paragraph 28, below).

24. The estimate of income-coefficient of investment for services was obtained as a straight average of figures obtained from balance sheet data released by the Reserve Bank of India [20]. It was found that $\beta_3 = 0.45$ approximately.

Numerical Values of Capital Required per Engaged Person (θ)

25. We must next consider estimates of θ, the capital needed per employed person in the individual sectors under study. In the industries producing investment goods (K-sector) the average capital needed per person in the five successive rounds of SSMI (1949-1953) was about Rs. 6,200 only while the figure relating to 1953 alone was about Rs. 8,500 (both figures at book value). Adjusting for replacement value, the average value of θ_k would come to something between Rs. 12,000 and Rs. 17,000 per engaged person.

26. It must be remembered, however, that India is greatly lacking in the basic heavy industries (metals, machinery, heavy chemicals, etc.), on which emphasis will have to be given in the near future. We therefore, made some calculations on the basis of new projects which are being prepared for the Second Five Year Plan. We find that the capital needed per worker ranges from Rs. 35,000 to Rs. 60,000 for industries like iron and steel or machine tools while it is about Rs. 12,000 or somewhat less for industries like cement, aluminium, coal and electricity. The appropriate average for the sector has to be chosen in accordance with the pattern of development of the capital goods industry in the Second Plan. As our intention is to expand rapidly the basic heavy investment

* Bureau of Industrial Statistics, Calcutta, 1953.

goods industries, we have adopted Rs. 20,000 per person as a reasonable figure for the capital coefficient of employment θ_k in this sector.

27. Large scale industries for the production of consumer goods which are included in the Programmes of Industrial Development published by the Planning Commission [7] yield an average value of θ_1 of about Rs. 10,000 per person. The adjusted figure from the Census of Manufactures for the year 1950 is Rs. 7,528. We have adopted Rs. 8,750 as a reasonable estimate of the capital needed per engaged person in the large scale factory production of consumer goods.

28. For small scale and household industries the following material is available on the capital requirement per person, θ_2. The National Sample Survey, third round and fourth round figures are Rs. 430 and Rs. 360 respectively. A survey of small scale industries at Aligarh-Harduaganj, conducted by the Ministry of Industry in 1948, gave Rs. 114 for rural areas and Rs. 465 for urban areas. These figures all refer to what are usually called cottage or household industries of a traditional type. According to the Survey of Small Scale Industries of Calcutta in 1952-53[9], which covered mostly the production of components for large engineering enterprises, the amount of capital needed per worker was much higher and about Rs. 1,200 per person. The unweighted average of the above estimates is Rs. 620. For agriculture, some data on the cultivation of reclaimed lands and of lands brought under major irrigation schemes give the capital per person as about Rs. 6,250. Using approximate weights for the small scale industries and agriculture, we got Rs. 2,500 per engaged person as a reasonable estimate for the sector of agriculture and small scale and household industries combined (θ_2).

29. For the services sector, the capital coefficient of employment (θ_3) was calculated on the basis of outlay and employment in education and health schemes, transport services, etc., yielding a figure of about Rs. 3,750.

A Numerical Solution of the Four-Sector Model

30. We can now get a solution for our four-sector model. On the basis of an average rate of investment of 9 per cent (as indicated in paragraph 10 above) and from considerations of financial resources we adopted, in consultation with the Economic Divisions of the Planning Commission and of the Ministry of Finance, Rs. 5,600 crores as the target of total asset formation during the plan-period

of 5 years. We accept $\eta = 5$ per cent as the assigned rate of increase of national income per year; and $N = 110$ lakhs or 11 million as the number of jobs to be created during the plan period of 5 years. We thus start with :

Y_0= initial national income = Rs. 10,800 crores.
A = total asset formation = Rs. 5,600 crores.
η = rate of increase of national income = 5 per cent per year.
N = total new employment to be created = 110 lakhs(= 11 million).
λ_k = proportion of investment in industries producing investment goods = 0.33 (settled from considerations of growth over a long period).

We can also write down the sectoral coefficient :

sector	description	parameters	
		β	θ
K	basic investment goods	$\beta_k = 0.20$,	θ_k = Rs. 20,000
$C.1$	factory consumer goods	$\beta_1 = 0.35$,	θ_1 = Rs. 8,750
$C.2$	household industries (including agriculture)	$\beta_2 = 1.25$,	θ_2 = Rs. 2,500
$C.3$	services	$\beta_3 = 0.45$,	θ_3 = Rs. 3,750

For a plan-period of 5 years, we then get the following results in rounded figures :

sectors	investment (A) (Rs. crores)	increase in	
		income (E) (Rs. crores)	employment (N) (million)
K	1850	370	0.9
$C.1$	980	340	1.1
$C.2$	1180	1470	4.7
$C.3$	1600	720	4.3
	5610	2900	11.0

We have, therefore, obtained the allocation of the total investment and the total man-power between the four broad sectors of the economy.

31. We shall next split up the estimates relating to the combined sector of agriculture and small and household industries into two sub-sectors: (1) agriculture, and (2) small and household enterprises. For this, we can use a subsidiary system of simultaneous equations similar to the one cited earlier. Using the subscript a for the sector of agriculture and h for the sector of household enterprises we may write the employment created in the two sectors respectively as n_a and n_h and the corresponding parameters as β_a, θ_a and β_h, θ_h. Using the numerical values for the combined sector given in the previous paragraph, we then have the following equations

$n_a + n_h = n_2$ = combined employment = 4.7 million,

$n_a \theta_a + n_h \theta_h$ = combined investment = Rs. 1,180 crores,

$\beta_a n_a \theta_a + \beta_h n_h \theta_h$ = combined increase in income = Rs. 1,470 crores.

We can now substitute the value of β_h from paragraph 23, and of θ_a and θ_h from paragraph 28.

$$\beta_h = 2, \quad \theta_a = \text{Rs. } 6{,}250, \quad \text{and} \quad \theta_h = \text{Rs. } 620.$$

On solution, we get the ratio of increment of income to investment for agriculture β_a as 1.10; and the allocation of increase in income, employment generated, and investment as shown below.

	sector	investment (Rs. crores)	increment in income (Rs. crores)	increment in employment (million)
a	agriculture	986	1083	1.58
h	household enterprises	194	387	3.12
		1180	1470	4.70

COMPARISON WITH FIGURES GIVEN IN THE PLAN-FRAME

32. In the Draft Plan-frame, we have retained the above broad sector allocations and have adjusted allocations within sectors to some extent from considerations which are explained later. The figures given in the Draft Plan-frame are compared in the following table with the figures obtained from the numerical solution given above. The allocation of investment and employment in the Planframe is found to be in line with the solution.

sector	investment (Rs. crores)		increment in income (Rs. crores)		increment in employment (million)	
	plan-frame	this paper	plan-frame	this paper	plan-frame	this paper
$K+C.1$	2800	2830	710	710	2.1	2.0
$C.2$	1150	1180	1470	1470	4.5	4.7
agriculture	950	986	1060	1083	1.5	1.6
household enterprises	200	194	410	387	3.0	3.1
$C.3$	1650	1600	720	720	4.4	4.3
total	5600	5610	2900	2900	11.0	11.0

33. I shall now consider certain definitional questions which arise in splitting up the figures of investment relating to the sector of large scale enterprises, that is, between sector K (industries producing investment goods) and the sector $C.1$ (factories producing consumer goods). It has been already pointed out that the intermediate products should be allocated to the two sectors in such a way as to obtain the net outputs of both the sectors as final products. Since by choice, 33 per cent of Rs. 5,600 crores, that is, Rs. 1,850 crores of the total investment is allocated to investment goods industries, it follows that the remaining Rs. 950 crores must go to large scale industries producing consumer goods ($C.1$). The two above amounts of investment in the two sectors (Rs. 1,850 crores and Rs. 950 crores respectively) should conceptually include the investments on intermediate goods which are used in respective sectors. Further, it is necessary to allocate the investment on stocks. For this, we have taken three-fifths of the stocks as trading stocks (Rs. 300 crores) and the rest (Rs. 200 crores) as inventories of large scale industries. Thus, the investment pattern presented in the Plan-frame now works out as follows.

sector		industry		investment (Rs. crores)
K		basic investment goods		1850
$C.1$		factory consumer goods		950
$C.2 = (a)+(h)$		household industries		1150
	(a)	agriculture	950	
	(h)	household enterprises	200	
$C.3$		services		1650
				5600

34. In the next table the above figures are reconciled with the investment figures actually given in Chapter Three, Table (2) of the Draft Plan-frame.* The allocation of investments was shown there as Rs. 500 crores for electricity (including hydro-electric projects combined with irrigation schemes); Rs. 1,400 crores for large scale industries; and Rs. 900 crores for transport (railways, roads etc). The total of these three heads comes to Rs. 2,800 crores which may be identified with the total of Rs. 2,830 crores for the K-sector and the sector $C.1$ taken together (as shown in lines 1, 2 and 3 of the following Table). This total can be also broken down into an investment of Rs. 1,850 crores in industries producing investment goods (line 4) and an investment of Rs. 980 crores in this paper or Rs. 950 crores in the Plan-frame (line 5). Agriculture and irrigation (line 6) have been alloted Rs. 950 crores in the Plan-frame corresponding to Rs. 985 crores in this paper; and household enterprises Rs. 200 crores (line 7 of the following Table). The services sector with an allocation of investment of Rs. 1,600 crores has been treated as covering all construction work (buildings for schools, hospitals, residences, roads, etc.) and also trading stocks of Rs. 300 crores.

	sector	plan-frame			this paper (Rs. crores)
		public	private (Rs. crores)	total	
1.	electricity	450	50	500	
2.	industry (large-scale)	1000	400	1400	
3.	transport (railways, etc.)	850	50	900	
				2800	2830
4.	of which investment goods			1850	1850
5.	,, consumer goods			950	980
6.	agriculture & irrigation	950	—	950	986
7.	household enterprises	—	200	200	194
				1150	1180
8.	construction, etc.	250	1100	1350	
9.	stocks	—	300	300	
				1650	1600
10.	grand total			5600	5610

* Out of total stocks of Rs. 500 crores given in Chapter Three, Table (2) of the Plan-frame, Rs. 200 crores have been transferred to industry (large scale) in the present table; at the same time Rs. 200 crores included under the head industry in the Plan-frame have been separated under household enterprises (Rs. 200 crores) in the present table.

35. This is as far as our simple model can take us. Further details must be settled from supplementary considerations. For example, the four-sector model cannot give any guidance to decide the share of investments in the public and the private sectors respectively. The allocation shown above is based partly on historical trends and partly on social policy. Large scale expansion of power plants (often in combination with irrigation schemes in river valley projects) in recent years has occurred mostly in the public sector and railways in India have been mainly State concerns for a long time. In the case of electricity and transport most of the investments would, therefore, take place in the public sector and has been shown in this way. On the other hand, there was very little of large scale industries in the public sector during the First Five Year Plan. The bigger share has been, however, reserved for the public sector in the Plan-frame because it is considered desirable to develop the basic industries (minerals, steel, heavy machines, heavy chemicals etc.) as quickly as possible which would be facilitated if such basic industries are State enterprises.

TECHNICAL NOTE ON THE PATTERN OF THE GROWTH OF THE ECONOMY

TWO-SECTOR MODEL

1. In the two-sector model the pattern of the growth of the economy depends on the initial rate of investment (which is given), the values of β_k and β_c, the income-coefficients respectively in the industries producing capital goods (K-sector) and in the industries producing consumer goods (C-sector) which are determined by technological factors and conditions of production and are not at the choice of the planner, and on λ_k, the fraction of the total investment allocated to industries producing capital goods (K-sector) with the remaining share of investments $\lambda_c(\equiv 1-\lambda_k)$ going to industries producing consumer goods.

2. The value $\lambda_k = 1/3$ was adopted on the basis of the pattern of growth emerging from certain values of β_k and β_c which were considered to be reasonable estimates of these parameters under Indian conditions. If the real values of β_k and β_c happen to be different from the values used in the model then the actual pattern of growth would be different from the pattern assumed to be true in the Plan-frame. The effect of a change in β_k or β_c can be studied numerically without any difficulty. I am giving four specimen tables to indicate the differences in the pattern of growth of the economy. Tables (A-1), (A-2) and (A-3) are appropriate to values of $\beta_k = 0.15,\ 0.20,\ 0.25$ respectively; and Table (A-4) gives some extreme values to illustrate boundary conditions.

3. It is seen from Tables (A-1) and (A-2) that for any value of β_c (with given β_k) the growth of the economy is slower for larger values of λ_k upto a *critical period*. Once the critical period is passed the higher the value of λ_k or β_k (or of both) the quicker is the growth of the income over a long period of 20 or 30 years.

4. It is not necessary to go into the details of the present tables but I may illustrate their use in one particular case. Columns (2) and (3) of Table (A-2) may be taken to represent what is likely to happen if the Indian economy continues without planning. Using $\beta_c=0.25$, income will increase by about 42 per cent in 20 years. On the other hand, columns (7) and (8) may represent growth under planning. Firstly, the value of λ_k can be deliberately

TABLE (A-1): VALUES OF Y_t (= INCOME AT TIME t) FOR TWO-SECTOR MODEL

$Y_0 = 1{,}000$, $\alpha_0 = 7$ per cent, $\beta_k = 0.15$, $\beta_c = 0.25, 0.50, 0.75$ and 1.00 (for each value of $\lambda_k = 0.1, 0.3, 0.5, 0.7$)

	$\lambda_k = 0.1$				$\lambda_k = 0.3$				$\lambda_k = 0.5$				$\lambda_k = 0.7$			
β_c / year	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	1017	1033	1048	1064	1015	1028	1040	1052	1014	1023	1032	1040	1013	1018	1023	1028
2	1034	1066	1097	1129	1031	1057	1082	1107	1029	1047	1065	1084	1027	1038	1049	1060
3	1051	1099	1147	1195	1048	1087	1125	1164	1045	1073	1102	1130	1042	1059	1077	1094
4	1069	1133	1198	1262	1066	1118	1171	1223	1063	1102	1141	1180	1059	1083	1108	1133
5	1087	1168	1249	1330	1084	1151	1218	1285	1081	1132	1183	1234	1078	1110	1142	1175
6	1105	1203	1301	1399	1103	1186	1268	1350	1101	1165	1228	1292	1098	1139	1180	1222
7	1123	1238	1354	1469	1123	1222	1320	1418	1123	1200	1277	1354	1121	1172	1223	1273
8	1142	1274	1407	1540	1144	1259	1374	1489	1146	1238	1329	1420	1147	1208	1269	1330
9	1161	1311	1462	1612	1166	1299	1431	1563	1171	1278	1385	1492	1175	1248	1320	1393
10	1180	1348	1517	1686	1189	1340	1490	1641	1198	1322	1446	1569	1206	1291	1377	1463
20	1388	1753	2117	2481	1483	1867	2252	2636	1606	1985	2364	2743	1764	2082	2401	2719
30	1630	2222	2813	3404	1939	2687	3434	4182	2448	3352	4257	5162	3399	4399	5398	6398

TABLE (A-2): VALUES OF Y_t (= INCOME AT TIME t) FOR TWO-SECTOR MODEL

$Y_0 = 1{,}000$, $\alpha_0 = 7$ per cent, $\beta_k = 0.20$, $\beta_c = 0.25, 0.50, 0.75, 1.00$ (for each value of $\lambda_k = 0.1, 0.3, 0.5$ and 0.7)

	$\lambda_k = 0.1$				$\lambda_k = 0.3$				$\lambda_k = 0.5$				$\lambda_k = 0.7$			
year \ βc	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	1017	1033	1049	1064	1016	1029	1041	1053	1016	1024	1033	1042	1015	1020	1026	1031
2	1035	1066	1098	1130	1034	1059	1084	1110	1033	1051	1070	1088	1032	1043	1055	1066
3	1052	1101	1149	1197	1052	1091	1130	1169	1052	1081	1110	1139	1052	1070	1088	1106
4	1071	1136	1201	1265	1072	1126	1179	1233	1073	1114	1154	1195	1074	1100	1126	1152
5	1089	1171	1253	1335	1093	1162	1231	1300	1096	1150	1203	1256	1099	1134	1169	1204
6	1108	1208	1307	1406	1115	1200	1286	1371	1122	1189	1257	1324	1128	1173	1218	1263
7	1127	1245	1362	1479	1138	1241	1344	1447	1149	1232	1315	1398	1161	1218	1274	1330
8	1147	1282	1418	1553	1163	1284	1405	1527	1180	1280	1380	1480	1199	1269	1338	1408
9	1167	1321	1475	1628	1189	1330	1471	1611	1214	1333	1452	1570	1242	1327	1411	1495
10	1188	1360	1533	1705	1217	1378	1540	1701	1251	1390	1530	1669	1291	1393	1494	1596
20	1417	1799	2182	2565	1605	2056	2506	2957	1902	2403	2904	3406	2370	2848	3326	3804
30	1696	2335	2974	3613	2301	3269	4237	5206	3591	5030	6469	7909	6370	8243	10116	11989

TABLE (A-3). VALUES OF Y_t (=INCOME AT TIME t) FOR TWO-SECTOR MODEL

Y_0=1,000 α_0 = 7 per cent, β_k=0.25 β_c=0.25, 0.50, 0.75, 1.00 (for each value of λ_k=0.1, 0.3, 0.5 and 0.7)

	λ_k=0.1				λ_k=0.3				λ_k=0.5				λ_k=0.7			
year \ β_c	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00	0.25	0.50	0.75	1.00
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
1	1018	1033	1049	1065	1017	1030	1042	1054	1018	1026	1035	1044	1018	1023	1028	1033
2	1035	1067	1099	1131	1036	1062	1087	1113	1037	1056	1074	1093	1038	1049	1061	1072
3	1054	1102	1151	1199	1057	1096	1136	1175	1059	1089	1119	1148	1062	1081	1100	1118
4	1073	1138	1203	1269	1078	1133	1188	1243	1084	1126	1169	1211	1091	1118	1145	1172
5	1092	1175	1258	1340	1102	1173	1244	1315	1112	1168	1225	1281	1124	1161	1198	1236
6	1112	1212	1313	1414	1127	1216	1304	1393	1144	1216	1288	1360	1163	1212	1261	1310
7	1132	1251	1370	1489	1154	1261	1369	1477	1179	1269	1359	1448	1209	1272	1335	1398
8	1153	1290	1428	1566	1183	1311	1439	1567	1219	1329	1438	1548	1263	1342	1421	1500
9	1174	1331	1488	1645	1214	1364	1514	1663	1264	1396	1528	1660	1327	1425	1523	1621
10	1196	1373	1549	1725	1248	1421	1594	1767	1315	1472	1629	1787	1402	1522	1643	1763
20	1447	1849	2252	2654	1758	2288	2829	3349	2336	3004	3673	4341	3416	4141	4866	5591
30	1768	2460	3151	3843	2809	4076	5343	6609	5654	7981	10308	12635	13522	17279	21036	24792

TABLE (A-4): VALUE OF Y_t (= INCOME AT t) FOR TWO-SECTOR MODEL

Y_o = 1,000, a_o = 7 per cent, β_k = 0.1, 0.2, 0.4, β_c = 0.25, 0.75, 1.25, λ_k = 0.1, 0.3, 0.7,

		$\lambda_k = 0.1$			$\lambda_k = 0.3$			$\lambda_k = 0.7$		
	β_c	0.25	0.75	1.25	0.25	0.75	1.25	0.25	0.75	1.25
year (1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
β_k =0.1	5	1084	1245	1405	1076	1206	1336	1058	1119	1179
	10	1172	1502	1831	1165	1445	1726	1140	1285	1430
	20	1362	2056	2749	1386	2044	2702	1416	1847	2277
	30	1572	2668	3764	1683	2848	4014	1959	2951	3942
	50	2060	4091	6122	2618	5382	8146	5126	9395	13663
β_k =0.2	5	1089	1253	1417	1093	1231	1369	1099	1169	1238
	10	1188	1533	1878	1217	1540	1863	1291	1494	1697
	20	1417	2182	2947	1605	2506	3408	2370	3326	4281
	30	1696	2974	4252	2301	4237	6174	6370	10116	13862
	50	2451	5115	7779	5776	12889	20003	76168	128611	181053
β_k =0.4	5	1100	1271	1442	1131	1287	1442	1216	1308	1399
	10	1223	1601	1979	1362	1792	2222	1959	2364	2769
	20	1552	2490	3428	2488	4253	6018	13281	18470	23660
	30	2040	3807	5574	5983	11896	17809	146949	208619	270289
	50	3832	8641	13450	50560	109361	168161	20355669	28956374	37557079

increased from 0.1 to 0.3. Secondly, the value of β_c is bound to be higher and may be safely taken as 0.5 in which case the income will easily double in 20 years. If β_c increases under planning to 0.75, income would increase two and a half times in 20 years.

5. Professor J. B. S. Haldane considered the question of maximization of national income in the above model in a paper received in March 1954 which was printed in *Sankhyā*, Vol. 16, Parts 1 & 2.

Four-Sector Model

6. In the Plan-frame it is estimated that the volume of new employment would be about 11 million consisting of about 2.1 million in the large-scale (capital-intensive) industries, 4.5 million in agriculture and small and household (capital-light) industries and 4.4 million in the services. These estimates are based on the following values of the income-coefficients of investment (β's) and the capital required per engaged person (θ's) for the different sectors.

sector of the economy		sectoral income-coefficient of investment (β)	sectoral value of capital per engaged person (θ)
symbol	description		
(1)	(2)	(3)	(4)
K	large-scale industries producing investment goods	0.20	Rs. 20,000
$C.1$	large-scale industries producing consumer goods	0.35	,, 8,750
$C.2$	agriculture and small and household industries	1.25	,, 2,500
$C.3$	services (health, education etc.)	0.45	,, 3,750

7. If the targets of employment are changed from those given in the Plan-frame then the estimates of investment and income would also have to be changed in an appropriate manner. However, the accuracy of all such calculations depends on the accuracy of the adopted values of β's and θ's. If the actual values of β's and θ's (which are contingent parameters determined by technological factors and conditions of production and cannot be settled at the choice of the planners) happen to be different from those used in the Plan-frame then the derived estimates of employment, investment, and income would all have to be changed in an appropriate way. It is possible to study the effect of using different sets of values of β's and θ's. Numerical solutions to the model

used in the Plan-frame have been obtained; and calculated values of employment, investment, and income are given in columns (5), (6) and (7) respectively of Table (A-5) (*vide* p. 60) based on the respective values of β's and θ's given in columns (3) and (4) of the same table.

8. Let us suppose that the values of all θ's are doubled but β's remain the same, and the total fund to be invested also remains the same, namely, Rs. 5,600 crores. From lines 1-5 of Table (A-5), it is seen that the rise in national income can be large, about 6 per cent per year if we are satisfied with a low target of employment of 6 million (with a very high figure of 4.3 million in agriculture and small and household industries and a very low one of about half a million in the services).

9. Keeping the β's the same, if the θ's are changed to Rs. 30,000, Rs. 13,125, Rs. 3,750 and Rs. 5,625 for the 4 sectors respectively (lines 6-10), it is still possible to have an increase of income of 6 per cent per year together with new employment of 8 million out of which 1.5 million would be in large scale factories, 5.8 million in agriculture and household production and 0.7 in services. With the above values of β's and θ's it is also possible to achieve 6 per cent rise in income per year and new employment of 9 million over 5 years with, however, only 0.67 million in large scale factories together with 5.4 million in agriculture and household enterprises, and 2.9 million in services (lines 11-15). Employment can be increased to 10 million only if θ's can be lowered to Rs. 26,600, Rs. 11,638, Rs. 3,325 and Rs. 4,988 as shown in lines 16-20 of Table (A-5).

10. Let us next consider a case in which β's have lower values, namely, 0.15, 0.25, 0.75, 0.30 respectively, and θ's have higher values, namely, Rs. 40,000, Rs. 20,000, Rs. 5,000 and Rs. 10,000 respectively (lines 21-25) but the total investment is the same, Rs. 5,600 crores as in the Plan-frame. This represents a more unfavourable situation than that assumed in the Plan-frame. It is possible to attain a rate of increase of income of 5 per cent per year with, however, a low target of employment of 7 million with heavy concentration of 5.7 million in agriculture and household industries, only 0.54 million in large scale factories, and 0.72 million in services. Using the same values of β's and θ's as above, the same total employment of 7 million can be reached with, however, a much better distribution (1.4 million in factories and 2 million in services) if the increase in income can be lowered to about 4 per cent per year

(lines 26-30). Using the same values of β's but with another set of values of θ's (lines 31-35) it is still possible to have new employment of 7 million.

11. In more favourable cases with higher values of β's and lower values of θ's (lines 36-40) it is possible to have an increase of income of about 6 per cent per year with new employment of 13 million out of which 2.3 million would be in large scale factories. If the total employment is reduced to 12 million then a much larger number, 3 million, can be absorbed in factory industries (lines 41-45). With somewhat higher values of β's but the same values of θ's and the same investment of Rs. 5,600 (lines 46-50) it is possible to attain a 6 per cent increase in income per year and new employment of 12 million out of which 2.6 million would be in large factories.

12. If the income and investment figures are the same as in the Plan-frame and β's also have the same values but 20 per cent *less* employment needs to be created then it is possible to work with higher values of θ's (lines 51-55). On the other hand, in the same situation, if 20 per cent *more* employment has to be created, then the values of θ's must be much lower than those assumed in the Plan-frame (lines 56-60).

13. If β's and θ's retain the same values as in the Plan-frame but 20 per cent *less* employment has to be created then a much lower investment of Rs. 4,500 would be sufficient with, however, a smaller rate of rise of income of 4 per cent per year (lines 61-65). If in the same situation 20 per cent *more* men require to be employed then the investment would have to be increased to Rs. 6,700 crores with an increase of income at the rate of a little over 6 per cent per year (lines 66-70). It is possible in the same way to work out appropriate numerical solutions to study the effect of other values of the parameters or of the variables.

Change in the Value of β-Coefficients

14. It has been already pointed out (Chapter 4, para 18, p. 43) that the average value of β is likely to be appreciably higher in a planned economy as production would continue, in principle, at full capacity. One aim of planning would be to chose λ_i's in such a way as to make β as large as possible over a long period. Although the λ_i's are not independent, (being connected through inter-industry relations), some improvement in the overall pattern of production would be usually possible by an optimum utilization of resources at the given level of investment. For example,

TABLE (A-5): EXPECTED VALUES OF EMPLOYMENT AND INCOME : FOUR-SECTOR MODEL

serial no.	sector of economy (i)	sectoral income coefficient (β_i)	capital per engaged person (in Rs.) (θ_i)	employment (in million)	investment (in Rs. crores)	income (in Rs. crores)	remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	*K*	0.20	40,000	0.46	1,848	370	
2	*C*.1	0.35	17,500	0.68	1,193	418	34 p.c. increase in
3	*C*.2	1.25	5,000	4.34	2,167	2,708	income
4	*C*.3	0.45	7,500	0.52	392	176	
5	*total*	....	....	6.00	5,600	3,672	
6	*K*	0.20	30,000	0.62	1,848	370	
7	*C*.1	0.35	13,125	0.91	1,193	418	34 p.c. increase in
8	*C*.2	1.25	3,750	5.77	2,167	2,708	income
9	*C*.3	0.45	5,625	0.70	392	176	
10	*total*	....	....	8.00	5,600	3,672	
11	*K*	0.20	30,000	0.62	1,848	370	
12	*C*.1	0.35	13,125	0.07	88	31	34 p.c. increase in
13	*C*.2	1.25	3,750	5.40	2,028	2,535	income
14	*C*.3	0.45	5,625	2.91	1,636	736	
15	*total*	....	....	9.00	5,600	3,672	
16	*K*	0.20	26,600	0.69	1,848	370	
17	*C*.1	0.35	11,638	0.20	235	82	34 p.c. increase in
18	*C*.2	1.25	3,325	6.16	2,047	2,558	income
19	*C*.3	0.45	4,988	2.95	1,470	662	
20	*total*	....	....	10.00	5,600	3,672	
21	*K*	0.15	40,000	0.46	1,848	277	
22	*C*.1	0.25	20,000	0.12	249	62	25 p.c. increase in
23	*C*.2	0.75	5,000	5.83	2,910	2,183	income
24	*C*.3	0.30	10,000	0.59	593	178	
25	*total*	...	...	7.00	5,600	2,700	
26	*K*	0.15	40,000	0.46	1,848	277	
27	*C*.1	0.25	10,000	0.97	966	242	20 p.c. increase in
28	*C*.2	0.75	5,000	3.58	1,790	1,342	income
29	*C*.3	0.30	5,000	1.99	996	299	
30	*total*	...	...	7.00	5,600	2,160	
31	*K*	0.15	30,000	0.62	1,848	277	
32	*C*.1	0.25	10,000	0.19	192	48	20 p.c. increase in
33	*C*.2	0.75	5,000	4.33	2,168	1,626	income
34	*C*.3	0.15	7,500	1.86	1,392	209	
35	*total*	...	...	7.00	5,600	2,160	

TABLE (A-5) EXPECTED VALUES OF EMPLOYMENT AND INCOME : FOUR-SECTOR MODEL (*contd.*)

serial no.	sector of economy (i)	sector income coeffi-cient (β_i)	capital per engaged person (in Rs.) (θ_i)	employ-ment (in million)	invest-ment (in Rs. crores)	income (in Rs. crores)	remarks.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
36	*K*	0.25	20,000	0.92	1,848	462	
37	*C*.1	0.40	7,500	1.41	1,055	422	30 p.c. increase in
38	*C*.2	1.50	2,000	5.04	1,008	1,511	income
39	*C*.3	0.50	3,000	5.63	1,689	845	
40	*total*	...	...	13.00	5,600	3,240	
41	*K*	0.20	20,000	0.92	1,848	370	
42	*C*.1	0.35	7,500	2.06	1,545	541	25 p.c. increase in
43	*C*.2	1.25	2,000	4.98	996	1,244	income
44	*C*.3	0.45	3,000	4.04	1,211	545	
45	*total*	...	...	12.00	5,600	2,700	
46	*K*	0.25	20,000	0.92	1,848	462	
47	*C*.1	0.40	7,500	1.72	1,288	515	30 p.c. increase in
48	*C*.2	2.00	2,000	3.44	687	1,375	income
49	*C*.3	0.50	3,000	5.92	1,777	888	
50	*total*	...	...	12.00	5,600	3,240	
51	*K*	0.20	25,000	0.74	1,848	370	investment and in-
52	*C*.1	0.35	11,000	0.85	935	327	come as in plan-
53	*C*.2	1.25	3,125	3.74	1,169	1,462	frame; 20 p.c. *less*
54	*C*.3	0.45	4,750	3.47	1,648	741	employment.
55	*total*	...	...	8.80	5,600	2,900	
56	*K*	0.20	16,667	1.11	1,848	370	investment and in-
57	*C*.1	0.35	7,300	1.31	955	334	come as in plan-
58	*C*.2	1.25	2,090	5.60	1,172	1,465	frame; 20 p.c. *more*
59	*C*.3	0.45	3,140	5.18	1,625	731	employment.
60	*total*	...	...	13.20	5,600	2,900	
61	*K*	0.20	20,000	0.74	1,479	296	β's and θ's as in plan-
62	*C*.1	0.35	8,750	0.90	785	275	frame; 20 p.c. *less*
63	*C*.2	1.25	2,500	3.76	940	1,175	employment, invest-
64	*C*.3	0.45	3,750	3.40	1,276	574	ment and income.
65	*total*	...		8.80	4,480	2,320	
66	*K*	0.20	20,000	1.11	2,218	444	β's and θ's as in
67	*C*.1	0.35	8,750	1.35	1,178	412	plan-frame; 20 p.c.
68	*C*.2	1.25	2,500	5.64	1,411	1,763	*more* of employment,
69	*C*.3	0.45	3,750	5.10	1,913	861	investment and in-
70	*total*			13.20	6,720	3,480	come.

appreciable savings in transport may accrue through a properly planned location of units of production.

15. The value of β would also depend on the rate of investment and on the stock of capital already accumulated. With a low rate of investment and a small stock of capital it would not be possible to utilize the resources in a complementary way to the fullest extent owing to indivisibilities in the scale of production. The higher the rate of investment and the greater the stock of available capital the greater is the possibility of making the fullest use of the resources mobilized in the plan. As already pointed out (Chapter 4, footnote 2, p. 43) in a country (like U S A) with a very high stock of capital it may become progressively easier to secure external economies and hence to have higher values of β. In India an important object of planning must be to increase the rate of investment and to build up quickly a large stock of capital which may, in its turn, lead to an increase in the value of β. Technological improvements in methods of production would also increase the value of β. When any technological improvement occurs either in a research institution or in a particular enterprise it would be possible to introduce the improved method quickly on an extensive scale in a planned economy. At any given rate of investment and with a given stock of capital, for reasons explained above, the value of β is likely to be higher under planning.

16. The value of the β-coefficients may, therefore, be expected to rise in India with the progress of planning in future. With any given amount of total assets formation (for example, Rs. 5,600 crores) and with any given set of values of the β-coefficients (for example, those used in this paper) there would be, in principle, an optimum allocation of resources in relation to the basic objectives (such as an increase of employment of 11 million and a long range rate of increase of income of 5 per cent per year). If the values of the β-coefficients turn out in practice to be somewhat different then the solution used in the plan would not be a true optimum but may still serve as quite an efficient solution. The illustrative tables given above show that the broad type of allocation used in the Draft Plan-frame is likely to be fairly efficient. That is, the general approach of the Plan-frame is likely to be suitable for the purpose in view, and would have a good deal of scope for adjustments in details.

Chapter 5

SUPPLEMENTARY CONSIDERATIONS

1. The estimates of production, employment, income, and investment are given in the Draft Plan-frame by much finer categories than we have considered so far. Certain supplementary considerations have been used to derive these figures (which cannot be obtained from my theoretical model but are consistent with it). One basic step was to calculate the increase in demand of important consumer goods (cereals, cloth, sugar, etc.), which would be generated as a result of the (assigned) increase of 27 per cent in the national income in 5 years. This was done with the help of appropriate Engel elasticities* calculated on the basis of the National Sample Survey data. With the knowledge of the figures obtained from the solution described above, the targets of production were then fixed for the investment goods on partly *a priori* grounds, and for consumer goods on considerations of the anticipated additional demand. For some services, like transport, the targets were derived on the basis of targets of other sectors.

2. On the basis of this trial set of targets, the required investment and the employment generated were computed for individual targets by making use of appropriate technological coefficients. Also, the national income in 1952-53 was carried forward to 1955-56 and 1960-61 by making use of the physical production targets (the income arising from individual targets having been computed separately). For certain major commodities like cement, steel, coal, electricity, and heavy chemicals, the consistency of the trial set was then checked; for example, it was examined whether the production target for cement was equal to the demand for cement implicit in the levels of other targets. Then the trial targets were aggregated by sectors; and the calculated values of employment, income, and investment were checked against the solution. Naturally, a number of discrepancies were found in the beginning which necessitated changes in the targets. But gradually, by the method of repeated trial and error, a set of targets was obtained which was

* Some tentative values of Engel elasticities have been given in a Working Paper No. 8 of the Institute series on Plannng which was circulated in a mimeographed form in December 1954 and is now in the press.

consistent with the solution. Speaking broadly, this set of targets has been reproduced in the Plan-frame. Also, the figures of national income, employment, and investment as given in the Plan-frame were computed on the basis of the given set of targets in the manner described earlier.

3. To get the initial set of trial targets, a good deal of consideration was given to the physical resources and scarcities, existing economic conditions, and the opinion of various authorities on the desirable or possible increase of production during the plan period. For example, I have already mentioned that to instal a million ton steel plant at a cost of about Rs. 100 crores (Rs. 1000 million) it is necessary to import at present machinery to the value of about Rs. 45 or Rs. 50 crores. I have proposed in the Plan-frame that high priority should be given to establishing a heavy machine building industry to fabricate machinery required-to produce steel and other investment goods. Once the heavy machine building industry is established it would be possible to increase investments progressively without depending on imports. Again, the supply of copper is short but India has large reserves of bauxite. It is logical to increase the production of aluminium to a sufficient extent to enable copper being replaced by aluminium in the electricity industry. I have suggested that production of aluminium should be increased from 4,000 tons to 40,000 tons per year in the Second Plan to supply a base for the development of electricity and for other purposes. In the field of agriculture and animal husbandry it was considered more important to improve the nutritional quality of the diet than to increase the total intake of calories. Similar considerations prevailed in deciding many other targets. It is neither possible nor necessary to describe them in detail.

4. There were also supplementary considerations of a much broader type. I am using the phrase "supplementary considerations" as a concise term for all those different arguments or reasons which we recognize to have some bearing on the methods or targets of planning which should be adopted to attain our objectives. That is, we are working within a general frame work of social, political, economic, and cultural values with some (clearly or vaguely) recognized aims and objectives. Once we accept this frame work as given, it becomes necessary to incorporate in the plan all considerations which are likely to help in attaining the desired objectives.

5. The theoretical model which I have used does not, and cannot obviously, incorporate all these supplementary considerations.

In our view, the proper function of the theoretical model is to supply some broad general guidance leaving the details to be settled from supplementary considerations.* This gives flexibility to the approach, and the scope to adjust the details in accordance with priorities to be reached by agreement through discussions. It is also clear that the theoretical model (being purely technological in character) is necessarily neutral to questions of social or administrative policy. Here also we must give proper attention to methods which are likely to be of help in attaining the desired objectives. That is, it is necessary continually to refer to what I have called the "supplementary considerations" in making decisions about the Plan-frame.

6. Some of these wider considerations have been indicated in the Plan-frame and some others are given in the Joint Secretariat paper or the memorandum prepared by the Panel of Economists. It is not necessary to repeat them here. In view of the importance of industries, I have made certain observations on the future programme of industrial development in the next chapter. Here I may give some other examples.

7. Consider health services. There are at present about 65,000 fully qualified (six-year trained) doctors in India. Most of the doctors reside in urban areas; and it is believed that in the rural areas there is, on an average, only one qualified doctor for twenty thousand persons. Even this distribution is not uniform. In some States the proportion is probably much smaller. About two thousand six-year trained doctors are turned out in India every year, and the cost of training each doctor is about forty or fifty thousand rupees. Under existing conditions it may take 60 or 70 years to provide one doctor for every two thousand persons in the rural areas on an average (a modest target compared to one doctor for 700 or 800 or 1000 persons in USSR, or UK, or USA).

* I find simple models useful in planning (just as the thermo-dynamical approach is useful in physics) in revealing the broad characteristics of the system under consideration without getting lost in the details It is clearly out of question to use any complicated model in India in the near future. Statistical data and other factual material are much too meagre. However, when reliable information in great detail becomes available for a very large number of industries or sectors, and also when a great deal of experience has been gathered about the effect of various actions taken in a planned economy, it may become possible to reach quite good solutions to practical problems of planning without any recourse to mathematical models. This is what seems to have happened in the USSR where planning problems are solved with the help of a vast amount of detailed and up-to-date statistics and the use of "balances" (basically something like input-output analysis), but without any mathematical models.

I have thought it desirable, therefore, to include in the Draft Plan-frame a proposal to bring some health service to every home in the country within a reasonable time, possibly in 10 or 15 years (instead of providing an exclusively high quality service to a very small fraction of the population), by establishing two new cadres of 2-year and 4-year trained health assistants as a first step to a national health service throughout the country. In addition to public health duties these health assistants would be given training to provide routine treatment in minor ailments. One 6-year trained physician would be in charge of a group of 5 or 6 health assistants; the latter would be provided with bicycles and would be instructed to contact the physician in difficult cases. The cost of training the health assistants would be much less. Also, it would be possible to turn out twelve or fifteen thousand health assistants per year so that one health assistant could be placed in charge of, say, every five villages in the course of about 10 or 12 or 15 years. At the same time, the number of 6-year trained should, of course, continue to be increased as fast as possible.

8. Let us consider another example: improvement in the efficiency of Government machinery. Our theoretical model is neutral because it does not include any variable or parameter corresponding to the type or the efficiency of the administrative machinery. It is our knowledge of the defects and delays of the existing system, and our general appreciation of the level of efficiency which would have to be attained in the management of large Government enterprises that make us think that proper implementation of the plan would be practically impossible without a thorough decentralization of administrative and financial powers. In future the efficiency of public enterprises must be judged on results; and suitable incentives must be offered to increase efficiency. Our appreciation of future possibilities is based partly on the experience of other countries; but obviously, a good deal of experimentation will have to be done to evolve a system suited to Indian conditions and requirements.

9. The recommendations in the Plan-frame on the training programme is very general. There is urgent need of much detailed work being done, on the basis of technical coefficients, to formulate the requirements of technicians at various levels and to formulate appropriate training programmes to meet the demand.

10. Also consider the important question of the respective shares of the public and the private sectors in the new enterprises which

would be started during the Second Plan. Our theoretical model does not and cannot say that a particular industry should be included in the public sector, while some other industry should be included in the private sector. Our basic recommendations in this matter are guided by the need of general Government control over the entire economy of the country. This is also in keeping with the Industrial Policy Resolution of the Government of India of 1948, reaffirmed in December 1954, and is in keeping with the resolution of the Lok Sabha of December 1954 and the Avadi resolution on socialistic pattern adopted by the Congress Party in January 1955.

11. Again, consider the question of raising adequate financial resources for investment. Our theoretical model cannot give any specific guidance. Our recommendations are based on preliminary studies made by experts in public finance; but it is only proper to admit that much detailed studies would have to be undertaken in this field in the immediate future.* At this stage, our main task has been to work out a tentative solution in real terms, leaving it to the financial experts to work out the details of the monetary counterpart. We have taken our stand on the obviously true proposition that if something can be shown to be feasible in physical terms, then the financial and fiscal machinery can always be adjusted to supply a satisfactory monetary counterpart (provided there is no difficulty in making necessary institutional changes). I agree that models should be elaborated to include the monetary counterpart. This would enable us to set targets not only of production but also of the price level. Until this is done other *ad hoc* methods have to be used.

12. I would like to recapitulate the basic features of the Plan-frame. We start with a given total investment over the plan period (Rs. 5,600 crores), a given rise of national income (5 per cent per year), and an assigned large volume of new employment to be created (110 lakhs) during the plan period together with a steady improvement of income in future. Our solution indicates a large increase in investment in industries producing investment goods, a small rise in investment in factory industries producing consumer goods, considerable activation of all capital-light small and

* It is necessary, in my view, to broaden the base of taxation by introducing taxes on capital gains, wealth, and expenditure and by extending and increasing customs and excise duties. The two objectives should be first, to raise adequate financial resources; and, secondly, to remove disparities of opportunities and of level of living.

household enterprises, and a fairly large increase in various services. This solution is not intuitively obvious, and depends both on the validity of the analytical methods used as well as on the approximate accuracy of the values of the parameters adopted. The advantage of putting the whole thing in this form is that the reader can check the validity of the solution.

Chapter 6

INDUSTRIAL DEVELOPMENT

Basic Heavy Industries

1. India has very little of heavy industries for the production of investment goods; this sector contributes something like perhaps one per cent to national income. The Plan-frame has stressed the need of establishing and expanding the basic industries to manufacture heavy machinery with all possible speed. This would enable India to instal new plants for the production of steel, cement, and other investment goods with the help of machinery manufactured in India out of domestic resources and to produce in increasing quantities machiery required for mineral prospecting and mining, hydro-electric projects, electrical appliances, railways and other forms of transport, and for the production of consumer goods generally. India has bigger reserves of high quality iron ore than any other country of the world (three times more than either the USA or the USSR) and also coal and large possibilities of increasing the production of electricity. The object of expanding the basic heavy industries would be the continuing expansion in future of the production of both investment and consumer goods with the help of modern machinery driven by power.

2. This would require a large amount of capital goods much of which will have to be imported in the beginning. India's present dependence on imports of capital goods is a fundamental structural weakness which must be corrected as quickly as possible. It would be obviously more economical from the national point of view to produce in India as much heavy machinery as possible because this would ensure a supply of capital goods which would make India increasingly independent of imports and would strengthen India's position in the world market. In my opinion, the development of the heavy machine building industry is so important that, if necessary, targets of even steel, coal, or transport should be reduced to give higher priority to heavy machines because this would facilitate a much quicker rate of industrialization after four or five years.

3. The heavy machinery industry should be in the public sector. For rapid industrialization of an under-developed country it would

be desirable to keep the cost of capital goods as low as possible. The further removed the type of capital goods under consideration is from the production of final consumer goods, the greater is the need of keeping the price low. Heavy machinery which would manufacture machinery to produce investment goods is the furthest removed from the consumption end. It is essential, therefore, that Government should have complete control over the heavy machinery industry so as to be able to fix prices to suit national needs. Such control would enable Government to shape the future pattern of industrialization through a properly planned programme of production of heavy machinery. If imports are properly regulated, it would be also possible to influence the pattern of investment in the private sector through Government policy in respect of the production and price of heavy machinery for that sector.

4. It is neither necessary nor desirable that India should try to become completely self-sufficient in the production of machinery. India should, however, acquire both the means of production and technical knowledge to be able, if and when necessary, to manufacture essential investment goods within the country. This is necessary for economic independence. But under normal conditions India should continue to purchase abroad such machinery and capital goods as it would not be economic from a national point of view to manufacture in India. On the other hand, India should also develop in the course of time the production of specialized machinery for which there would be an external market. The policy should be to encourage both imports and exports of machinery and capital goods which would be of mutual benefit to India and other countries.

5. In the field of mechanized production India should encourage automation, that is, the use of automatic and electronically controlled machines, to the fullest extent possible. There would be many advantages. The requirements of highly trained and experienced technical personnel would be appreciably reduced which would save much expense on training and, what is more important, would also save a good deal of time. The high quality of the product would be automatically maintained and would reduce rejections and waste. Production would proceed at a uniform rate which would facilitate working out integrated programmes. The capital cost of automation would be, of course, much higher which may, however, be partly or wholly offset by savings on account of training and elimination of wastage. One serious disadvantage would

be the greater rigidity of an automatized system of production in which it would be difficult to introduce improvements of technique in a piecemeal fashion. The automatized system, even if only obsolete in parts, would have to be either scrapped or continued without any change. In spite of such difficulties India may benefit much by the use of automation from an early date, and possibilities in this direction should be continually explored.

Small-Scale and Household Production

6. The long-term aim would be to use as quickly as possible the most technologically advanced machinery for the production of both investment and consumer goods. This is not immediately possible because of the lack of a sufficiently broad base of heavy industries. It is, therefore, necessary to plan for a transition phase, in which preference would be given to capital-light and labour-intensive small scale and household industries to create as much employment as possible in the immediate future and, at the same time, to release capital resources for the heavy industries. However, as the economy expands and employment increases the need of giving preference to labour-intensive but low-efficiency production would decrease. As the supply of power, machinery and other capital goods increases, a gradual and steady change-over would be made to more efficient forms of production by the increasing use of machinery driven by power.

Policy of Greatest Dispersal of Production

7. It is, however, neither necessary nor desirable to copy the developments in the more advanced countries of America and Europe and concentrate production in large factories. On the contrary, the wise policy in India, in my opinion, would be to adopt a policy of the greatest dispersal of industrial production.

8. This would, of course, include geographical dispersal, that is, locating units of production in such a way that the different regions of India can share equitably in the programme of production. Specialized regional resources and economy of transport must receive proper consideration; but planning should be deliberately aimed at achieving a broad parity in the level of production and of living in the different regions of India and preventing the formation of depressed areas.

9. But this is not all. It would be desirable to try to classify all industries into two broad groups. One, in which the physical

scale of production would have to be large; for example, steel, cement, railway rolling stock, fertilizers, heavy machinery, motor cars, antibiotics, etc. In such cases large factories must be established. It would be desirable to do this in well-planned new industrial towns with adequate housing, schools, medical clinics, hospitals, and facilities for sports and cultural activities not only for the workers employed directly in the planned factories but also for other people who would come to live in the new town for subsidiary occupations. The capital cost of large and medium factories established in this way would be high but the additional expenditure would be a social obligation.

10. The second type of industries would be that in which production is technologically possible in small units. In the case of these industries preference should be given to the smallest units which are economical from the point of view of the nation as a whole. Consider, for example, the traditional highly skilled artistic handicrafts of India such as, Banaras or Patola textiles, Kashmir shawls, silver and gold work, metal work of Moradabad or Bidri, ivory and wood carving, Midnapore and Masalipatam mats, artistic leather work, etc.; every one would agree that India should try to preserve and encourage these handicrafts. There is a good deal of scope and need of improving efficiency of production by developing specialized small tools driven by power which would lighten the manual labour. There is no reason, for example, why a metal box should not be pressed out by machinery and the artistic part of the work done by hand. Efforts should be made to improve the design from a functional point of view and to introduce standards of quality.

11. I have much more in view. I believe it would be possible to produce economically in small units many articles which are now manufactured in large factories. The large factories at present enjoy certain facilities which are not available to small scale and household enterprises. The most important advantage is the use of machinery driven by power. If a policy of dispersal is deliberately adopted then arrangements would be made to supply modern machinery driven by power to the small scale and household enterprises. There is no inherent reason why all efficient machines should be large. With the growth of capitalism, as big factories began to be established in large numbers, the mind of the inventor was more and more directed to large units of production which would suit the big factories because such factories (and not small producers)

were in a position to offer large financial incentives for new inventions which would increase their efficiency of production. Under capitalism the trend of inventions was, therefore, towards large units. The increasing use of electronic technology has, however, already changed the direction of invention towards smaller machines in many fields. Also, in large factories in many cases, machines are comparatively small in size and are looked after by one or two persons. In such cases it is even now possible to set up small independent units of production. Under planning incentives can be offered for the invention of small but efficient machines.

12. Secondly, large factories are usually able to raise capital or borrow money at low rates of interest, purchase raw materials at competitive prices, and enjoy good facilities for marketing which are often under their direct control. The small scale and household enterprises are greatly handicapped in this respect. They have difficulty in securing credit and even when they are able to borrow money, they are obliged to pay high rates of interest. Their supply of raw materials and tools is uncertain; also they are sometimes obliged to pay unreasonably high prices. They have very little marketing facilities; and are usually exploited by middlemen. If Government can arrange to supply credit, raw materials, and marketing facilities to the small scale and household industries then their efficiency of production would be much improved, and they would be able to compete with large factories in many cases.

13. The large factories also enjoy many external economies the cost of which is borne by the tax-payer. Most of the large factories are located in or near large towns and cities; and the factory owners usually do not offer housing, education, medical care and other amenities for their workers. There are, of course, exceptions; but by and large most of the privately owned factories depend on the public authorities for such facilities. The cost of roads, water, electricity, drainage, transport are not charged to the factories. If the large investments required for such purposes as well as maintenance expenses are taken into consideration then it may be found in many cases that the social cost of factory production is much higher than the cost as it appears in the factory accounts. In addition there are intangible costs which cannot be expressed in terms of money such as the misery of slum life, evils arising from the workers having to live away from their families, and other adverse social repercussions. If all economic, social and human costs of large factories are properly taken into account,

in many cases it would be preferable, from the point of view of the nation as a whole, to substitute production in small scale and household enterprises.

14. As electricity begins to reach the villages (or with the help of small steam or diesel engines) it would be also possible gradually to convert the small and household enterprises in the villages into high efficiency and low cost mechanized units of production. This would avoid the heavy expenses which would be incurred for urbanization if the same production had to be arranged in large factories. There would be also large savings in transport and other overheads.

15. In small cooperatives or in self-employed household enterprises the workers would be able to work much longer hours than in factories; also, some of the members of the household would do part-time work so that there would be practically double shift operation. Working at home or very near home in the villages would be less fatiguing than in factories because the workers would be able to take some rest as and when necessary. Household activities and family life would not be disrupted.

16. Dispersal of production in small units in villages or small towns would be particularly suited to social and economic conditions in this country. India has many geographical, linguistic and ethnic regions with large differences in climate, food habits and social customs. It is difficult to transfer surplus labour from one part of the country to another. There is practically no migration from villages in one region to villages in other regions. Labourers come from villages to work in towns and cities; but a good number is seasonal who go back to their villages at the time of peak loads of agriculture. If mechanized industrial occupations can be established in the country, many of the labourers would stay in or near villages which would ensure an adequate supply of agricultural labour at peak-loads. This would be of great help in the transition phase. The policy of dispersal would tend to raise the level of living in villages and remove the present large disparities between rural and urban areas. For all these reasons it is desirable to adopt a deliberate policy of "back to the village" in, however, a new form in which electricity (or small steam or diesel engines) and modern machinery would be supplied to the village for industrial production.

17. The future policy, in my opinion, should be to establish and bring all large units of production under direct Government control; to develop enterprises of a medium size on a cooperative

basis; and leave small units of production to household enterprises. Such a policy of dispersal would have political advantages. It would tend to create a large number of household or small scale enterprises which would be organized more and more in the form of cooperatives and would supply a sound foundation for a democratic society. It would avoid, on one hand, the disadvantages of heavy concentration of financial power in the hands of a small number of monopoly capitalists; and, on the other hand, would also avoid the rigidities of a highly centralized, bureaucratic administration. Through a policy of industrial dispersal it would be possible to combine the advantages of both economic and political democracy in an effective manner. This would be a solution entirely in keeping with Indian social and cultural traditions.

Chapter 7

CONCLUDING REMARKS

The first draft of this paper was written in June 1955 and was revised in short intervals between frequent journeys both in India and abroad. Originally it was my intention to give a much fuller account of the implications of the approach to planning adopted in the Plan-frame. I prepared drafts of a number of other chapters but I have not had time to complete them. In the meantime I am making some brief observations on different aspects of planning in India.

2. In the Plan-frame we started with the allocation of investments with a view to realizing the given targets of production. A programme of production which is consistent internally in respect of requirements of men, machinery and materials and is also capable of realizing the desired targets of income and employment is, however, not enough. The raising of financial resources required for this purpose is equally important. It is, therefore, necessary to work out a programme of public finance. The present system of taxes and public finance is based on the model of industrially advanced capitalist societies.. Much fresh thinking would be needed to develop a scheme of taxation and monetary measures which would be suitable for an under-developed country like India, from the point of view of both economic growth and social justice. In India less than half a million (five lakhs) persons pay income-tax. Assuming an average size of a family of seven for each person paying income-tax, the total number of persons directly affected would be about three and a half million (35 lakhs) or less than one per cent of the total population. This one per cent owns a disproportionately large share of the wealth of the whole country. It would be desirable, from the point of view of social justice, to raise financial resources for the plan by taxation rather than by borrowings or deficit financing which, under existing conditions in India, are likely to increase the profits of those who are already rich. The direct tax can be appreciably increased by suitable changes in the structure of the income tax, and by imposing taxes on capital gains and wealth. It is also possible to introduce a progressive direct tax on personal expenditure at low rates and with a high exemption

limit.* Even this is not likely to be enough to supply the large resources needed for a rapid growth of the economy. Additional resources can be secured through indirect taxes by raising customs and excise duties in a selective manner. The tax on luxuries can be increased very considerably so as to reduce disparities in the level of living. Essential commodities may also have to be taxed to raise adequate resources; but this should not be a hardship as the income of the majority of the population, who are poor, would increase rapidly with the increase of employment and work. All this would require a good deal of careful study.

3. It is comparatively easy to prepare plans on paper; the real difficulty lies in implementing them. Suitable instruments and techniques of implementation must be devised to realize the targets. It will be necessary to formulate and give effect to a vast programme of training of personnel at all levels. There will be urgent and continuing need of scientific and technological research oriented towards solving problems of national planning. This is essentially a long range task and it would be necessary to think in terms of 15 or 20 years and more.

4. The present system of education aims at providing very detailed teaching and instructions spread over a long period for a very small number of persons who are rich enough to pay for such education or who have the ability to win scholarships. The need for this type of education would continue; and educational facilities of the conventional type will have to be increased as rapidly as possible. But this would not be enough. A new approach will be necessary. Here the aim would be to give very quick training to a very large number of persons to enable them to start functioning as junior or auxiliary technicians in engineering and technology, agriculture, survey of natural resources, education, and health services. Suitable packaged and highly specialized courses would have to be developed for this purpose; and the training would have to be given not only in training schools and institutions but also, in an increasing measure, in factories, mines, irrigation and power projects, farms, and in hospitals and clinics all over the country. The selection of students for different types of training would require careful planning. Appropriate tests and examinations would have to be developed for this purpose. Much study and experimentation would be required to prepare the highly specialized short courses. It would be also useful to provide facilities

* N. Kaldor: *An Expenditure Tax* (Allen and Unwin, London, 1955).

for training through correspondence courses which can be made available to remote villages.

5. Much thought will have to be given to improve the efficiency of public enterprises. Government administration has been so far concerned primarily with work of a quasi-judicial type in which decisions may affect a large number of people. It is important to avoid wrong decisions. It is also important to reconcile conflicting views among different Government agencies. There is no special hurry as there is no productive activity in the economic sense. All these call for much consultation and it is safe to have checks and cross-checks at different levels. The emphasis is on "control" in the sense of preventing mistakes or wilful deviations from prescribed rules and "coordination" in the sense of eliminating duplications or adjudicating between conflicting points of view of different agencies. The basic assumption is that the purpose in view would be fulfilled if there is no deviation from the rules.

6. In Government enterprises, on the other hand, the sole purpose is to manufacture specified products or to provide specified services (as in trading). In this case the real test of efficiency is an objective appraisal of the output of the final product or services. Mere adherence to rules cannot guarantee the fulfilment of the targets of production. The public enterprises must be given sufficient autonomy to realize their production targets on businesslike lines. Much study and experimentation would be needed to evolve a suitable system of decentralization of the administrative and financial powers of public enterprises within the general frame work of a planned economy. This would naturally involve important questions of recruitment, control and promotion of personnel; incentives to promote efficiency; relationships between Government, management, labour, and consumer, etc. Competence of government officials must be judged on results, literally, on the ability to deliver the goods, and must be suitably recognized.

7. The Government of India had carried on trading in grains on a large scale for about ten years (1943-1952). It is likely that Government would have to take up trading again and gradually to increase the scale of operations. The State Bank is being expanded with a view to providing credit to rural areas on a large scale. Suitable institutions will have to be organized for the further expansion of Government trading and banking. Thought will have to be given to the expansion of foreign trade and the earning of foreign exchange for which a good deal of planning will be needed.

8. Attention will have to be given to land policy. Most of the States have acquired from the landlords the large holdings of land through legislation but very little has been done for the redistribution of the acquired land. One view is that a maximum size of the holding (depending on local conditions) should be fixed and land in excess of the ceiling should be distributed among villagers who do not own or have very little land. Such redistribution would not necessarily lead to an increase in productivity but it may still be worthwhile because of the social and political benefits which would accrue from it. However, if such a redistribution be not immediately feasible then attempts should be made for a gradual consolidation of holdings with some kind of joint ownership. The success of the *Bhoodan* movement of Acharya Vinoba Bhave, who is advocating joint cultivation of the village as a whole, may be of great help in this connexion. The introduction of mechanized production in agriculture would probably have to come at a later stage when an adequate supply of power and of agricultural machinery manufactured within the country becomes available. With an increase in income the demand for food of better quality (vegetables, eggs, fish, meat, milk and milk-products, fruits etc.) would steadily increase. The pattern of agricultural production would have to be changed for this purpose which would require planning over a period of 20 or 30 years and more.

9. Other aspects of implementation would require attention. However well thought out a plan-programme may be, it is inevitable that shortfalls and deviations would occur in practice. The original programme itself would be based, in many respects, on inadequate or even incorrect information. Changes would also continually occur through the impact of the private sector (which is very large in India) and economic conditions outside India. There would be delays in the process of production which would lead to shortages of machinery, raw materials and labour or of consumer goods from time to time. A most important task of planning must be to introduce controls and take corrective measures at the earliest opportunity. A great deal of advance thinking and preparation is necessary for this purpose. For example, it would be wise to have a fully worked out scheme (and also, preferably, a nucleus organization) for the rationing of commodities like grains, cloth, sugar etc., so that, if any emergency arises, there would be no delay in introducing physical controls. Similar preparatory work would have to be done in other fields like finance, foreign trade, supply

of machinery, raw materials and labour, training programmes, and administrative arrangements.

10. A good system of statistical services is essential for the preparation of plan-programmes as well as for an objective appraisal of the results achieved. There must be a continuing flow of statistical information from all sectors of the economy and from all over the country to enable a proper assessment being made of the progress of the plant not only in terms of expenditure but in terms of fulfilment of physical targets and of increase in the volume of employment and of the rise in the level of living. On the basis of such assessment it would be possible to introduce controls and corrective measures at appropriate points and to make necessary adjustments in the future programme.

11. The type of planning visualized above would be necessarily a continuing process and would have two broad aspects. One would be the current planning directed to projects included in the annual plans within the frame work of a five year plan. The successive five-year plans themselves would have to be fitted into a larger frame work of perspective planning with a wide time horizon of 10 or 20 or 30 years or even more. Perspective planning would be primarily concerned with the technical and scientific aspects of the long-term growth of the economy. Studies and researches would be directed to solving practical problems and would be broadly of the type of "operational research" (although some problems of basic research would no doubt arise from time to time). This would call for the active cooperation of a large number of engineers, technologists, economists, statisticians, and workers in practically all fields of both natural and social sciences.

Acknowledgements

12. I have already mentioned that the "Draft Plan-frame" was prepared for issue, after revision, as a document of the Planning Commission but it was actually published in my name. The Draft Plan-frame is, in fact, a cooperative effort and is based on studies on planning conducted in the Indian Statistical Institute in collaboration with the Economic Division of the Planning Commission, the Economic Division of the Finance Ministry, and the Central Statistical Organization. A large number of persons participated in these studies and a number of working papers were produced. A part of this material has been used in the Plan-frame and this paper; other studies have no direct relation with the Plan-frame.