

CAPITAL REQUIREMENTS AND CAPACITY GROWTH  
IN MODERN INDIAN INDUSTRY

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I. Introduction

In the various proposals for the Second Five Year Plan the expansion of modern factory industry is a major goal. The National Income Committee estimated the net output of factory establishments in 1950-1951 at less than six per cent of the national income. Various preliminary proposals indicate that it is hoped to increase this proportion to approximately ten per cent of a larger national income by 1960-1961. This more than doubling of the absolute level of factory industry would be achieved by the additional employment of over one million workers (about a 25 per cent rise in factory employment) and the investment of about one thousand crores in factory industry during the second Plan period. The increase in national income arising from the factory sector equals about 20 per cent of the total planned increase in national income during the same period. (Present plans also project a substantial increase in income from the small enterprise sector of industry, i.e., the small factory and cottage industry.)<sup>1</sup>

This expansion of modern factory industry would reverse the trend of the Indian economy during the 1931-1951 period. If it is in fact achieved it would certainly represent a most significant consolidation of the

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1. See Malenbaum, W., "Economic Growth in India, 1955/56-1960/61," Appendix, for a comparison of various Plan proposals.

industrial advances that have occurred since 1951 as well as a lengthy step in the takeoff of the Indian economy into a period of self-sustaining growth. In a provocative article in the 1954 annual issue of Capital,<sup>2</sup> V. K. R. V. Rao has pointed out that in spite of the absolute growth that occurred in the modern industrial sector from 1931, that sector by 1951 had slightly worsened its relative position both as a contributor to national income and as an employer of labor. C. N. Vahil in another significant article in the same issue points out that from 1946-1953 a large proportion of modern industry has been operating continuously at less than 60 per cent of capacity, although in many of the industries operating at this low level growth in capacity had outstripped increases in output over the same period. The experience of the first Five Year Plan supports the general thesis of these two articles. Although the modern industrial sector has expanded output by 35 per cent from 1950-1954, investment lagged behind Plan estimates, and unused capacity remained significant.

This set of facts centering upon the relationship of investment to capacity, and capacity to output, raises the questions with which the Center study of modern Indian industry will deal.

1) What is the relationship between the investment that occurred in the modern industrial sector over the last twenty years, and the increase in capacity during that time?

2) What is the relationship between changes in capacity and changes in output in the different modern Indian industries during this period of time?

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2. Supplement to Capital, December 16, 1954, articles on pp. 15 and 19.

3) What is the relationship between the input patterns which exist in Indian industry, the growth of that industry, and the utilization of its capacity? What is the range of economic combination of the factors that does exist in Indian industry? Within an industry will different capital/labor:output ratios be reflected in different growth patterns and different output:capacity ratios? (While other factors, such as demand, influence growth, they are beyond the scope of this particular project.)

The remainder of the introduction will be devoted to some description of the sources of the project, and a statement of its purpose. Following this certain major problems of this study will be presented in some detail although of necessity briefly and unexhaustively.

The Indian studies that have been made, and which will be major sources of data for this study, focus upon the problem of capital formation. The Reserve Bank of India published recently a study of company finances in India for 1950-1951.<sup>3</sup> This used the balance sheets and income statements of the large public limited companies to determine both the disposition of their incomes, and the sources and use of their funds in 1950-1951. This study is devoted to company financing entirely, rather than to the investment-output relationship of the Center's study. The method used, as well as the care and thoroughness of the work, make it a valuable source of financial data, as well as a guide to and a check for other studies using similar methods or data.

The Taxation Enquiry Commission within the scope of its work studied

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3. Reserve Bank of India Bulletin, August 1954.

the relation of taxation policy to investment. To do this it made a study of capital formation since 1946 in both the public and private limited companies. Balance sheets and income statements were the major sources of data, and these were supplemented by questionnaires. This study is broader than the Reserve Bank study, and also provides some measure of the role of private limited companies.<sup>4</sup> It is also a valuable source of financial data for the Center's study.

Two private groups have also gathered material from company records and used these data for analyses of private capital formation. These studies have explored the relationship between private capital formation and government policies, especially taxation and depreciation allowance policies. S. K. Chaudhuri in his pamphlet, "Company Finances in Indian Industry"<sup>5</sup> has made an admittedly preliminary study of capital formation in a relatively few Indian industries in the postwar period. The Association of Indian Trade and Industry has published two detailed analyses of capital formation in the cement and iron and steel industries from 1938-1951.<sup>6</sup> These studies, like that of Chaudhuri, used balance sheet and income statements as their basic sources. The Association is continuing its studies, and is making the basic information available to the Center. These balance sheets and income statements, together with the public reports already cited, and it is hoped the raw data behind those reports,

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4. Report of the Taxation Enquiry Commission, 1953-1954, Vol I., (1955).

5. Eastern Economist Pamphlet No. 26 (1954).

6. Both were published in 1954.

will provide the basis for the Center's analysis.

These data will be supplemented by additional material which is available. The Census of Manufactures material is an obvious source, although it lacks the desired detail for the Center's study of greater detail, and hence of value, are such recent reports as the Calcutta Small Industry Survey (also performed in other areas), and the unpublished National Sample Surveys of industry. The former does, and it is hoped the latter will, provide detailed data with respect to capital and labor inputs, as well as capacity, for major Indian industries. There are also the regular government reports issued periodically, which present data on capacity and output of Indian industries.

Apart from these government studies there have been several individual projects directed at studying capital stock, making estimates of capital:output ratios, or studying individual industries which will provide either valuable data, or serve as a check upon the Center's results. Divetia and Trivedi published in 1947<sup>7</sup> a pioneer study of the capital stock in Indian industry in 1938-1939. This used modified Canadian analogue data to derive capital:output ratios, because of the lack of Indian data for certain industries. This study may fill in gaps, act as a check upon, or suggest relationships for the Center's study. V. V. Bhatt in a broader article<sup>8</sup> has used Census of Manufactures data to estimate very tentatively,

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7. Divetia, M. V., and Trivedi, H. M., Industrial Capital in India, 1938-1939.

8. Bhatt, V. V., "Capital-Output Ratios of Certain Industries," Review of Economics and Statistics, August 1954, p. 309.

capital:output ratios in Indian industry, and has also presented figures agreeing with those mentioned in the next paragraph on the relation between costs of production and scale of output.

The industry studies of M. M. Mehta<sup>9</sup> and J. C. Eddison<sup>10</sup> have made tentative estimates of intra-industry production relations. The former concluded that there was an inverse relationship between the scale of output of a textile plant and its cost of production; the latter that small-scale plants in the paper industry not only had higher labor costs per unit of output than larger modern plants, but also appeared to have higher capital costs. These studies provide valuable leads as well as a tentative hypothesis for further research into input:output relations in Indian industry.

On the basis of the data as well as the physical capacity and output data available, carefully examined for meaning and methods of computation, as well as visits to some plants within Indian industry to explore the facts behind the figures, the Center expects to derive tentative answers to the questions posed earlier. The approach will be largely aggregative, aiming at an average picture of developments within industry, rather than specific with respect to an industry or firm. The major sources will be financial records of the type previously described. However, these industrial aggregates and average ratios will be broken down in the study of factor proportions. For this it is planned to segregate on the basis of

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9. Mehta, M. M., Structure of the Cotton Mill Industry of India, 1949.

10. Eddison, J. C., "The Growth of the Pulp and Paper Industry in India", (multilithed), 1955.

financial data confirmed by discussion with knowledgeable individuals, either groups of firms, or individual firms, using very different labor and capital combinations to produce similar outputs. These firms will be studied in more detail to compare costs, profits, utilization of capacity, and rates of growth, in order to determine the relative efficiency and growth potential of a range of factor combinations within Indian industries.

The primary purpose of this study is an understanding of India's industrial development, as part of the Center's broad study of comparative economic development. This particular study of capital:output relationships will contribute specifically to comparison of capital:output ratios among various economies with different factor availabilities.

It is also expected that this study will be of value to Indian industrialists considering varying investment possibilities and to Indian planning officials attempting to determine the most efficient utilization of Indian resources. While this study has been narrowed to several specific problems it is not expected that the Center will be able to answer the questions posed earlier in other than a tentative fashion. This is an exploratory study--gaps in the data will probably be discovered, and techniques of measurement will have to be developed. It is hoped that the methods and results will stimulate other industrial studies which will not only fill in the gaps of this one, but also explore in far more detail the problems of specific industries and the institutional framework within which Indian industry functions.

## II. Growth of Investment

On the basis of the balance sheets and income statements available,

as well as the reports previously cited, it is planned to develop a series showing the change in real fixed assets over the last twenty years.<sup>11</sup>

The desired investment growth series to determine a capital:output ratio is one of gross assets, adjusted for actual retirements of plant and equipment. Such a series will include values of plant, etc., fully depreciated but still being used. To determine the relationship of investment to output potential for the next year this is the logical measure of investment ideally superior to a net investment series which subtracts the accounting value of depreciation from the addition to assets.

In estimating changes in real fixed assets over time certain major problems are apparent, and some of these are briefly discussed below.

1) To have a measure of real growth it is necessary to correct for price changes of plant and equipment that have occurred over the period of the study. It is known that there was a large upward price movement in India since 1938, and it will be necessary to construct an index to deflate for this. The Association of Indian Trade and Industry studies of the cement and iron and steel industries made a large and relatively arbitrary assumption concerning the degree of price change, because of the great difficulty in getting price data. It might, however, be possible, by

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11. While recognizing the importance of working capital to industrial growth, it is felt that the relation of working capital to industrial growth and growth is far less determined by technological factors than is the relation of fixed investment to output. The complex nature of the working capital problem would also require far more time for analysis than seems available at present. However, the data gathered may make possible later analysis of working capital requirements, even though it is outside the present scope of this project.



using prices of imported capital goods, or of construction materials, or of wages in Indian industry, to derive an index of annual price change for plant and equipment.

2) Various accounting problems exist which must also be handled in making estimates of fixed asset changes over time. These accounting problems essentially require going behind the balance sheet or income statement figures to determine the method of computation.

a) Unless corrected for writeup or write-down of asset values during the period covered the result will be distorted. (In the United States the steel firms squeezed out water from the original book values of their assets by writing them down. Failure to allow for this would show a different growth pattern than in fact existed.)

b) Asset changes may be concealed within current accounts, without accompanying balance sheet corrections. In a country such as India where much of the capital repair and even building of new capital is done by the equipment-using plant, failure to allow for this on the balance sheet would lead to significant distortion of asset growth.

c) The method of valuing new equipment, for example whether at original cost or otherwise, will of course influence the figures of asset change. It is desired to have the figures for additional plant and equipment in original cost values.

d) It is important to know the method used to estimate depreciation, not only for determining net asset figures (especially if values of scrapped equipment are unavailable) but also to determine capital inputs. Since these estimates include many firms and industries, and are

over a lengthy period of time, it is most important that the estimates be comparable between firms and over time.

e) It is also most important to determine how scrapped machinery is valued, since it must be deducted from the annual addition to assets. It is desirable for the purposes of this study that the original book values of the scrapped equipment be used in making deductions.

3) Estimates of the average life of capital equipment, and the use patterns in India will be important in estimating capital consumption and change in net assets. It would also be desirable to get information concerning practices with respect to obsolescence and the use of fully depreciated plant and equipment in Indian industry.

### III. Capacity Increase

To develop a relationship between investment in plant and increases in capacity it is necessary to develop a series showing capacity change for the various industries for which there is a net asset series. Since 1946 physical capacity figures have been regularly published for many industries by the Development Wing of the Ministry of Commerce and Industry, and other figures are available from industry sources. Once it has been determined what these capacity figures mean and how they have been computed, a series showing capacity changes for each of the industries will be derived, going back to 1946 and if data permit, to the prewar period. (Although this is presented simply, any single physical capacity figure requires consideration of such complex variables as product-mix, etc.) This data will make it possible to derive an average relationship between additions to fixed assets (as a deflated money value) and additions to

capacity in physical terms (for example, for an additional capacity of 1,000 tons of steel an average additional capital investment of 100,000 rupees in 1939 prices has been required).

To express this relationship as a single ratio it is necessary to convert them to common terms, of necessity, value terms. For this it will be necessary to determine the value of the output of the additional capacity. This requires either using a price in a single year for the total output or using changing prices, converted to real terms by constructing a price index. If independent price data were unavailable, it may be possible to do this from the data for sales that is found in income statements. This can be related to output data (see C below) to derive a unit value, which after an adjustment to a value added basis, would be applied to capacity. (From the income statement it would also be possible to estimate the value added component of price. This is the relevant value of capacity for computing capital:output ratios.) This financial conversion of capacity would make possible the expression of a capital:output relationship as a ratio (for example, 3:1). While this conversion of capacity to monetary terms would be desirable, it may not be possible because of lack of price data.

#### IV. Relationship of Output to Capacity

Various regular government reports provide output data by industries over a period of years. Once it is determined that this output data is comparable to the capacity data in terms of scope, it will be possible to develop a series, by industry, of the ratio of output to capacity.

This can be done in physical terms. Using physical terms, however,

will not give a measure of the economic importance of the idle capacity. To do this it would be necessary to get an estimate of the value of output in relation to the value of capacity. The price and value data derived earlier would be usable for this purpose also, of course. This would give a measure both of the extent and importance of underutilization of capacity in the Indian economy.

#### V. Factor Proportion Analysis

The balance sheet, income statement, capacity and output data, broken down, however, by firms or groups of firms, will provide most of the material for analysis of varying capital and labor:output relationships in Indian industry. From the data it is planned to segregate either several firms or groups of firms which appear to use significantly different factor combinations to produce a similar output. For each of these intra-industry groups it is planned to derive relationships between the gross and net value of fixed assets, the addition to working capital, and the labor requirements per unit of value added. These relationships will be expressed for capital both in terms of a capital stock to output ratio and in terms of capital flow input to output ratio (i.e., depreciation plus imputed interest per unit of value added output). For labor the ratio will almost of necessity be expressed as a wage input per unit of output. It is necessary in computing these input:output relationships to deduct abnormally idle capacity, excess holdings of working capital and abnormally idle labor, since what is desired is a range of ratios that will not fluctuate with cyclical changes but will reflect technical and relative price relationships.

For the firms so segregated it is also planned to get capacity and output estimates. From this data it will be possible to derive a relationship between proportion of capacity utilized by various firms, and the degree of capital or labor intensity of those firms.

This balance sheet and income statement approach will, however, conceal many variables that are important if the derived ratios are to be used intelligently. To get behind these and aggregative relationships (mostly in money terms), it is planned to visit various plants or firms within an industry which appear to use different factor proportions. If time permits this will be done within each industry for which the financial data show significant dispersions in factor-use proportions between firms. As far as possible these firms will be chosen in such a way as to insure comparability both in output and in the degree of integration (i.e., its stage in the productive process). Such visits will, it is hoped, make it possible to estimate or know whether varying capital:output ratios are caused not by different amounts of machinery within a plant but by such factors as whether the machinery is second-hand or new; or different intensities of use of the machinery. Within the visited firms the following types of information would be useful, and the visits will, it is hoped, result either in some quantitative figures, or in useful impressions.

- 1) The machinery used in a particular process broken down by type, age, place manufactured and value. It would be valuable to note whether the machine was originally new or second-hand; or whether one machine, compared to another of the same type, had similar attachments, controls, etc., which might be expensive although apparently only slightly different.

2) The length of time each machine is normally used in a particular process; the working speed of the machine; and its average operating time per day or year.

3) The labor skills used within a plant; the wage of each type of labor, the hours worked, and the amount and payment for overtime; the shift employment of labor and machines within the plant.

4) Supervisory, engineering and research personnel employed by a plant or firm; the hours and wages of such personnel; the type, cost, and degree of use of research and testing equipment.

5) Depreciation procedure, scrapping and replacement, and repair and maintenance procedure and costing within a firm.

6) Raw material and finished product stock practices within the plant.

7) Changes in practice that have occurred over time in the plant.

These data groups describe the type of material such plant visits would ideally make available. While it would be desirable to get quantitative material, it is far more probable that the results will be qualitative and impressionistic. Nevertheless this will make it possible to interpret the aggregate and average estimates with far more insight than would be derived if only the financial figures were used.

From the factor-proportion studies within specific industries it is planned to derive an estimate of the range of factor proportion combinations which simultaneously exist within Indian industry. The firms within an industry which use these various factor proportions can then be compared for efficiency of operation, rates of profit, proportionate utilization of capacity, and rates of growth. Making such comparisons over a

time period by using financial data will make it possible to estimate changes in factor-use patterns within Indian industry, and movement (if any) toward a particular factor combination. For Indian industrialists and planners considering whether more or less capital intensive factories are of greatest profit or efficiency the results, even though necessarily tentative, should prove of value.

#### VI. Comparison of Large Factory with Small Factory and Cottage Industry

The study as previously described is directed largely to the modern factory industry as defined in the Census of Manufactures. There is, however, in India a very extensive small factory and cottage industry. It is not the purpose of this study to explore the latter in any detail, largely because of the difficulty in gathering data. It is planned, however, to use already collected data on this sector to compare it with modern industry.

The Calcutta small factory survey has collected and presented a wealth of data on the inputs and outputs used by small factories to produce their respective outputs. Similar studies exist for other areas in India. Various government surveys of handicraft industries provide additional material, largely qualitative, on the same question; and it will be possible to use data in specific industry studies such as those previously cited of Mehta and Eddison. The simultaneous study by the Center of the rural economy may provide additional information on cottage industry in the villages.

Using this material with the data gathered in the study of modern industry, it is planned to make certain tentative comparisons between modern industry and small-scale industry with respect to capital and labor

intensity per unit of output, costs and efficiency, and rates of growth. These results, while necessarily preliminary, will bear on the key problem, within the context of proposed development plans, of the competitiveness of these two sectors, the possibilities for either's survival and growth, and the steps necessary to encourage various parts of each.

#### VII. Conclusion

This is a study of the relation between different combinations of the factors of production and the growth of Indian industry. It will utilize the following types of information--balance sheets and income statements, physical capacity and output series--to measure investment and estimate factor proportions. It will be supplemented by the careful examination of individual firm or plant financial and physical data; and by visits to individual plants, to the degree possible, in order to distinguish between different firms using different factor combinations to produce similar outputs.

The primary purpose of the project is to contribute to the Center's study carried on in several countries, of comparative economic development, and comparative capital:output ratios in industry. In doing this it will also throw some light on the questions raised by the papers of Professors Rao and Vahil. The exploratory nature of this project and its limited time span will necessarily give results that are preliminary and tentative, but for this reason it will inevitably raise a series of still further questions. Nevertheless it is hoped that the results, in the absence of other information, will be of value both to industrialists attempting to determine whether to invest in a single industry, and to



planners laying out a broad investment program for the economy as a whole. The further questions raised will, it is hoped, stimulate additional research by Indian economists; not only to check and fill in the gaps of this project, but to carry the analysis of growth into new areas by studies of specific Indian industries and the institutional framework of Indian industry.