INDUSTRIAL PRODUCTIVITY MODELLING AND ANALYSIS

1. INTRODUCTION

Industrial development is one of the most important priorities and concern of the developing nations throughout the world. This is more so in the nineties due to the ushering in of a new era of GATT and WTO. As opportunities widen in the form of a global market, the challenges, as also responsibilities increase equally or more. Especially developing nations have to take this up a little more seriously, concentrating on problems relating to industrial output, investment, expenditure and employment. Productivity and Profitability have become the buzz words of modern industrial production.

Hence planning and organising any industrial unit/sector has to be approached in a more scientific way for a better understanding of the dynamics of the organisational system over a time period. This will pave way for better planning, development and thereby growth. (Cameron, 1999) (Moore, 1973)

1.1 INDUSTRIAL PRODUCTIVITY

Productivity in industries is concerned with the efficient utilization of resources (in puts) in producing goods and/or services, (output), Sumanth, (1990). A formal productivity program in industries begins with productivity measurement (Mark, 1971). To manage productivity in a true sense of the term four formal phases must be recognized viz., measurement, evaluation, planning and improvement. These four phases form a continuous productivity process - the productivity cycle.
The word ‘Productivity’ has become such a buzz word these days that it is almost rare not to find it mentioned in some context or the other - in trade magazines, newspapers, management briefs, share holders' reports, political speeches, TV news, consultants’ advertisements, conference proceedings - just to name a few. Though a very early 18th century literature defined productivity as the faculty to produce, that is, the desire to produce etc., it was not until early twentieth century, however the term acquired a more precise meaning as a relationship between the output and the means (inputs) employed to produce the output.

However, if one closely observes and examines the various interpretations of the term, three types of productivity measures appear to be emerging. They are as follows:

Partial Productivity: It is the ratio of output to one class of input. For example, capital productivity is the ratio of output to the capital input which is a partial productivity measure. (Sumanth, 1990)

Total-factor productivity: It is the ratio of the net output to the sum of associated labour and capital inputs factors. (Nadiri, 1970) (Kalil, 1988)

Total productivity: It is the ratio of the total output to the sum of all input factors. (Mali, 1978) (Cameron, 1998)

The measurement and evaluation are useful in the following ways. These were analysed by many authors over a period.

Economic indicators: At industry level, productivity measurement is useful as an economic indicator in tracing the performance.
Manpower analysis: Trends in manpower utilisation, labour costs, effects of technological advances in industry, employment and unemployment are analysed. (Mali, 1978)

Company performance analysis: This helps in comparing the performance of individual company against that of the particular industry. (Sumanth, 1990)

Firm and trade association forecast: The analysis assist the firms and trade associations to forecast industry growth patterns, performance prediction etc. Venkatesan et al (1977)

1.1.1 Productivity Measurement

Economists use three basic approaches in measuring the productivity of industry.

Index approach

Production function approach

Input - Output approach

Index approach: Many researchers and organisations attempted to develop index based measures for the industry. Some of the significant works are Kendrick and Creamer (1965), Nadiri (1970). In most of the works only labour input is considered. Although labour productivity index is valuable for estimating labour requirements, labour is not the only factor responsible for productivity gains. Productivity measures based on other aspects such as materials, capital and energy may be more relevant.
Production function approach: Measurement of technological changes as well as developing aggregate production function (Adam and Dogramaci, 1980) were some of the works done by certain authors. Aigner and Chu (1968), Griliches (1968), Nadiri (1972) have developed some production functions connecting labour and capital as well as material consumed.

Input - Output analysis: Most of the investigations using input output analysis are, at national and industrial levels. Elliot - Jones (1971) applied this analysis to determine total input and output and developed input - output tables to consider inter industry flows.

In all the above works, either partial productivity or total productivity or total factor productivity were considered and appropriate models developed. But they did have the opinion and commented against using one type of measure alone indiscriminately. Also these studies involved factors like labour hours, machine hours, materials cost, capital etc.

Keeping the above in mind the performance of certain industrial sectors in India were proposed to be analysed in this investigation. Since productivity is the ratio of tangible output to tangible input, the idea of 'Systems Approach' and "Modelling of Industrial Productivity" was mooted.

1.2 PRODUCTIVITY MODELLING - PRODUCTION FUNCTIONS

To evaluate productivity of an industrial sector, systems approach comes in handy. With the industrial sector as a system and a set of input parameters resulting in a certain output, analysed was taken up to correlate these by a mathematical model. A deliberately simplified analytical frame work called an 'Economic model' was arrived at and it elegantly represented the actual system as the industrial sector
(Hodges, 1969). This approach is nothing but the "Production function approach". This analysis is unique in the sense that it can be useful in exhibiting the dynamic characteristics of industrial systems and also simple but at the same time can be an exhaustive economic analysis.

With the above preamble, coming to the present analysis, year wise reported data from different industries culled out from their annual reports starting from 1993 to 1998 were analysed to form the production functions and to establish the correlation.

1.2.1 Chemical Industry

Chemical industries cover almost every spectrum of life in our requirements be it, biotechnology, food, clothing, shelter, pharmaceutical, fuel, defence (missiles) nuclear power and what not! This sector embraces a wide range of industries from the giant petro chemical complexes to small time varnish and paint industries, highly sophisticated bioprocess laboratories to crude mining and metal melting industries, and is also closely linked with other industries in the broad industrial spectrum of the nation. Chemical industries are capital intensive and rank third after iron and steel, among the top industrial sectors of India. Many chemical products can be made by different competitive processes with the result that chemical processes are subject to fast technological obsolescence. The growth of chemical industry is, however, linked with the general growth of the national economy.

The investment in the chemical industries in the last decade was a staggering Rs.20,000 crores and it gives employment to more than 5 million. The value of production according to official sources is around Rs.24,000 crores in which petroleum products alone cut a heavy chunk. The difficulty in accepting this figure as a total
picture is that there is no reliable source to give data on the unorganised sector and small units which may account for a sizable figure.

In the present analysis, a sample of 7 industries are taken for performance evaluation. These industries comprising a good sample of reasonable investment range from medium to large.

1.2.2 Sugar Industry

The sugar industry occupies an important place in the Indian Economy. From a small beginning made just after the turn of the century (20th) it has grown over the last many decades to make this country the 4th largest sugar producer in the world after (Brazil, Cuba and USA) The first sugar mill was set up in UP in 1903 and in the next two decades it grew to more than 30 units. The production of a mere 0.16 million tonnes jumped to 0.95 million in 1935-36. With this began the era of self-sufficiency in sugar.

However there was a set back in 1966-67 when there was widespread drought in the country when all the cane produced withered in all the states which cultivated cane. The number of factories rose to 300 units in the late seventies with an aggregate installed capacity of 6 million tonnes. During the eighties and nineties there were tremendous growth and now there are around 800 factories around the country producing more than 125 lakhs tonnes.

An important feature of this industry is that almost all the factories are located in the rural areas, many of them in relatively underdeveloped regions. The industry has also given a fillip to the growth of distilleries and a large number of downstream units based on the by-products such as bagasse, molasses and pressmud.
But the sugar industry like cotton textiles is a sick industry. According to the survey of Reserve bank of India, the rate or return on capital in the sugar industry is a mere 9.2% as against 14 to 15% for all industries.

Sugar industry has its own problems in the sense that at least certain mills face some peculiar problems as given below. The mills have an optimum cane crushing duration per year and beyond that the juice extraction may go down leading to loss. More over a mill should crush an optimum quantity of cane and beyond which also may incur loss. Some times mills are forced to face this situation by Government agencies leading to loss.

About 10 sugar industries were taken up for the analysis. They also form a good sample and a judicious mix of average to large investment units.

1.2.3 Cement Industry

The cement industry in India in the past ten years has made rapid strides with production now touching around 100 million tonnes a year. It is being exported to many countries also. But to keep pace with the ever increasing demand following the revolutions on the farm, housing and infrastructure building activities, the industry has to draw up a carefully planned expansion programme to provide the future needs.

Cement is one of the few mineral based industries in India which has made a spectacular progress technologically. But the growth in this sector shows some regional imbalances since the industry depends mainly on the raw material availability. The first cement plant in the country was started in 1904 in Tamil Nadu. In 1914, A.C.C set up a plant at Porbandar with an installed capacity of 14,000 tonnes/year. In 1917, there were 3 plants with an annual production capacity of 85,000 tonnes. Then there was very little progress in this sector. At the time of independence there were
only 18 factories. After wards only during 1965-75 cement industry witnessed considerable growth. During eighties the demand for cement rose to 45 million tonnes and now during the mid and late nineties it has crossed 80 million tonnes. With the expected growth of demand in the domestic sector the low per capita consumption base is bound to change, production target may go upto around 110 million tonnes by the terminal year of the Ninth 5 year plan which would necessitate addition of 25 million tons of new capacity at an investment cost of around Rs.10,000 crores in the next 4 years. This additional investment can only come in with adequate profit margin in the industry.

However, the industry is plagued with many problems like poor infrastructure, coal shortage, power, slower growth on consumption, excess capacity etc. The problem of excess capacity and others will find solution only if there is rapid development of the infrastructure sector in India, which is long overdue.

A good sample of 6 cement mills comprising medium to large scale investment range is selected and data has been acquired.

1.2.4 Paper Industry

Paper Industry is a core sector industry and highly capital intensive. As of 1998-99 there were about 500 paper mills in our country and 25 of them are major units. The total capacity of them is about 50 million tonnes. It is principally the large units which have contributed to the present,some what satisfactory supply position.

Though there was a steady increase in demand for paper during the period 1993-94 and also improvement in the price of paper in the international paper market, after a prolonged recession prospects for paper was expected to improve. The same trend was felt in 1995 also. But after september 1995 paper prices in domestic market
and international market have been considerably under pressure. More over during April - May 1995, Central Government made major changes in the news paper input policy and also reduced the custom duty on import of paper to a low of 20%. Both these factors have caused a spurt in imports and weakening of the domestic market. During the year 1996-97 there has been a deep decline in average sales realisation by the paper mills in the country. Despite increase in quantity sales in paper mills, turnover declined slightly. The same trend continued in 1997-98 also. But in the year 1998-99 the recession in the paper industry eased to a certain extent. Paper inventory came down in 1999 and price movement is upwards since early 1999.

A sample of a good cross section of medium to large scale investment range paper mills have been identified and data aquired from these, is being analysed for the paper industry sector.