

CHAPTER 1

INTRODUCTION

1.1 Background

Every industrialist is very much concerned about the theory of firm in order to make correct decision regarding what items, how much and how to produce them. All these decisions are directly related with the cost consideration and market situation. Every industrialist tries to produce goods with maximum profits with minimum cost. In this regard, industrialist needs various inputs such as labour, capital, raw material etc and their optimum combination is equally important for maximum profitability.

In this modern era, economy cannot grow without technological improvement. Technology is changing as per second in this era and this has compelled most of the economy to undertake the appropriate strategies and policies to gear up the technological change and to reap its results, benefits for the economic growth which is derived from the productivity growth. Technological progress is the base of many developed economies rather than they don't have abundant in natural resources, Japan is the great example in this context. Scumpter (1911) said that "Innovations are the engine of growth in any economy."

Productivity is an economic measure of output per unit of input like labour and capital. Generally it is measured by the marginal productivity of capital and labour. Labour productivity measures the amount of goods and services produced by one hour of labour. Real GDP by an hour of labour has been measured by labour productivity. Capital productivity means the amount of goods and services produced by per unit of capital. It means that real GDP by a unit of Capital measured by capital productivity. Productivity can be increased by the efficiency improvement in the production. Technology plays an important

role to increase the productivity. Technology allows more to be done in less time and empowering the workers that helps increase productivity of labours. Technique or technology is the method of production which helps to select combination of inputs for better output. But there is problem of choice of technology which type of combination used for production. Amritya Sen said that planning is important and its success is depends on the choice of technique more than the investment size and type of planning. There are mainly two type of technology discussed by the economists, first is labour intensive technique (embodied technique) and second is capital intensive technique (disembodied). Technology would be adopted as per the availability of resources and according to the aims. In the developed countries there is availability of cheap labour so labour intensive technology should be adopted which helps to reduce the unemployment and on the other hand also helps to produce goods with less inputs costs. Generally developed countries adopted capital intensive technology.

Total factor productivity is the part of output which can't be explained by the inputs. It is the impact o output because of technological factors which may be new machines, innovations and new technique. Technology has two parts technological progress and technological change.

In 1956 Abramowitz wrote the first paper followed by Solow and Kendrick is an attempt to measure the contribution of technical change to economic growth. They treated it as disembodied. Disembodied technical change is purely organizational which permits more output to be produced from unchanged inputs, without any new investment. Disembodied technological change refers to any kind of shift in the production function that leaves the balance between capital labours undisturbed in the long-run. Technical progress is organizational in the sense that its effect on the productivity does not require any change in

the quantity of inputs, existing inputs are improved or used more effectively. Embodied technical change improved technology which is exploited by investing new equipments.

What is technical efficiency?

Today, efficiency is a buzzword not only in economics but also in various areas and in daily life. We can take efficiency means as the optimum solution for any problem. Generally it is categorized in two types first is technical efficiency and second is economical efficiency. Technical efficiency happens, inputs used in best way when there is no possibility to increase the output without that how the maximum output is gotten from the input resources. Economic efficiency happens when the production cost output is as low as possible. So we can say that it depends upon the prices of the factors of production.

Technical efficiency is helpful to change the natural resources into goods and services without much waste. And economy can't imagine the economic efficiency in our production without achieved the technical efficiency. Technological change always increases the productivity of labour and capital also, which helps to produce cheaper goods and services. A rational producer always wants to achieve more profit by using less input. In this globalization and technological word which is full of perfect competition, technological efficiency is how much important for a country or producer. Because it helps them to produce goods at cheaper rate and establish them as a good competitor. Last few years economists and many other socialists attract the world mind at the scarcity of resources so the use of these resources should at their best level.

Total factor productivity is told about the unexplained part of output that's not explained by inputs like labour and capital. It's also known as Solow residual then many advanced techniques and definitions put forward by economists and try to explained the technological

effect on output. Further, total factor productivity decomposed in pure technological efficiency change scale efficiency change and managerial efficiency change.

A higher growth path on the account of higher productivity is considered to be preferable alternative as compared to that due to increased application of inputs. But India is a labour abundant economy and increased productivity is always decreased the level of employment in the economy which is a big concern before the policymakers as it is a barrier of social welfare. World has certain natural resources and there is need of sustainable development and Pareto optimality situation is possible only by efficient use of technology.

1.2 Definitions of Technical efficiency

There are several definitions regarding technical efficiency. The two most famous definitions are discussed below:

The first definition is the radial definition given by **Debreu (1951)** and further developed by **Farrell (1957)**. The input reducing radial measure of technical efficiency for a unit is defined as the difference between unity (100% efficiency) and the maximum equi-proportional reduction in inputs (while maintaining the production of originally specified output levels). If this difference is zero then the unit is efficient else it is inefficient. The output-increasing radial measure of technical efficiency is defined as the difference between unity (100% efficiency) and the maximum augmentation of outputs (while still utilizing the originally specified input levels). Again, the unit is efficient if this difference is zero else it is inefficient.

Koopmans (1951) formally defined technical efficiency as “If a producer needs to decrease one of the output or increase one of the inputs in order to increase in output, the situation is technical efficient.” which is also known as the Parato –Koopmans Optimum or Koopmans technical efficiency. It is based upon the Parato optimality situation of welfare economics.

In simple words, the technical efficiency is the effectiveness with which a collection of inputs is used to produce an output. A firm or industry is said to be technically efficient if a firm or industry is producing the maximum output from the minimum quantity of inputs. For example, a firm or industry would be technically inefficient if a firm employed too many workers than was necessary or used outdated capital.

1.3 Need to study the Productivity and Technical Efficiency

Technical progress we mean inventing a new technology and improving it through innovation and diffusion in the society. Total factor productivity is a crucial measure of efficiency and thus an important indicator of policymakers. There will be strong relation between output and technological change in the sugar industry. As output and export increasing day by day, it can be expect that the technology adoption also shows changing pattern in sugar industry.

Technology and Economic growth

Significant fractions of innovation help to increase in the production. Innovations create new demand in the economy and on another innovation increasing the efficiency of production. Demand and profit motivates the investment in the economy. Innovations are necessary for an economy to move at a sustained path of growth.

Economic Fluctuations and Technology

Large portion of TFP growth is recognized by endogenous innovation decisions has significant implications for the business cycle. This study is likely to be an important research topic in future. Comin and Gertler (2006) examines that low-persistence, non-technological shocks generate pro-cyclical fluctuations in the market value of innovations. **Kydland and Prescott (1982)** came with the real business cycle (RBC) concept in their study with the title of ‘Time to Build and Aggregate Fluctuations’. In this standard model (RBC model) which is

based on US labour market, focuses on productivity shocks and explains how they are responsible for fluctuations in economic activity. Existing models of business cycle have been incapable of explaining many of stylized facts that characterize the US labour market. The standard real business cycle model is modified by introducing two sided search in the labour market as an economic mechanism that propagates technology shocks. This new analytical environment can explain many phenomena of the business cycle that the standard model either has resolved in an unsatisfactory manner or has been able to address at all. When a technology advance leads to boom, MPL increases and there is increase in employment and real wages. According to this study the only driving force behind cyclical fluctuations is technological shocks or disturbances.

Barro and King (1982) conducted a study entitled Time-Separable preferences and intertemporal-substitution models of business cycles. And found that an initial shock in the form of a technological advance shifts the production function upwards. And this leads to increase in the resources by their better utilization and its increase in investment and investment followed by more output. To business cycles technology is responsible.

Technological efficiency and international trade

Technological difference is the base of international trade because it is technical difference which helps countries to make cheaper goods rather than other countries. And make their exports cheaper and stable them as efficient producer of international market and make their goods more valuable. And this shows surplus in current account. This study helps to understand the technological difference between countries and adoption of best technology in their production. **Comin, Hobijn and Rovito (2006)** put together direct measures of technology adoption for approximately 75 different technologies. Increase the number of theories regarding the adoption of technologies such as the role of policies (**Holmes and**

Schmitz, 2001). Burnside et al. (1995) and King and Rebelo (1999) has introduced procyclical fluctuations in measured TFP by incorporating unmeasured labour capacity utilization in standard the standard framework. **Kelnow and Rodriguez-Clare (1997) and Hall and Jones (1999)** have confirmed that a majority of the gap in income per capita between rich and poor countries is associated to large cross country differences in TFP. Difference in TFP occurs because of difference in physical technology. **Squires and Reid (2004)** expressed that technological change us the development of the new technologies or new products to improve and shift production frontier upward.

1.4 Industrial sector of India

In an economy there are three basic sectors i.e. primary sector also known as agricultural, secondary sector and which is also known as industrial sector or manufacturing sector and territory or service sector. As economists told about the relationship between development of economy and change the occupation of people. At first stage of economy which is traditional stage, mostly people of economy depend on primary sector and it plays an important role in GDP. With the growth of an economy, the share of manufacturing sector and service sector also increase in GDP. This trend shows that the development in the economy due to transformation of unskilled labour force into skilled labour force. India also passing out from these stages, since independence Indian economy was mainly agro-based economy but as time passes manufacturing and service sector's share in GDP increased. The share of industrial sector in India's real GDP has been risen over the years. But its share is less than as the share of territory sector in GDP. Finally, we show that the mix of skilled and unskilled labor in manufacturing and services is increasingly similar. It is concluded that sustaining economic growth and rising living standards will require shifting labor into both manufacturing and services. Manufacturing sector has more potential to generate the employment rather than territory sector. Manufacturing sector is the path to increase service

sector of an economy. It provides inputs and market for the other sectors of the economy. India is likely to be one of the few countries to witness a disproportionate expansion in its working age population by 2020. In India approximate 60% of the population was within the working age group (20-50 years) in 2007. An abundant supply of people in the working age group has the potential to boost manufacturing growth. It absorbs much of the force there is need to lay large emphasis on building strong human capital. Robust the growth in manufacturing sector can be a potential panacea for providing employment to vast majority of the population. To boost manufacturing sector govt. launched a new scheme 'Make in India' and there is target to increase the share of manufacturing Sector in GDP up to 25% by 2025 and create employment in manufacturing sector. Manufacturing sector of India can be classified into two parts: organized manufacturing sector and unorganized manufacturing sector

1.4.1 Contribution of manufacturing sector in real GDP: The average share of manufacturing sector in real GDP has marginally increased from about 13 per cent during 1970-75 to about 15.6 per cent in 2007-08 etc. approximately by about 2.6 percentage points over a period of almost four decades. In 2008-09 manufacturing sector's share in GDP is just about 16.1%. Share of manufacturing GVA at current prices is 14.8% in 2010-11, 18.1 % in 2011-12, 17.9 % in 2012-13, 17.3 % in 2013-14 and 17.2% in 2014-15.

1.4.2 Contribution of manufacturing sector in employment

Manufacturing sector's contribution was 13.8% in 1983. In 1999-2000 its contribution in employment creation was increased with 16.3% and in 2011-12 manufacturing sector contributed 24% and its contribution is increased with 33% today. The employment and output generation within the manufacturing sector exhibits a major imbalance. According to the latest available data, the unorganized sector accounts for about 80% of employment and

only about 33 % of income of the manufacturing sector. 'Make in India' initiative a lion step to usher in increased manufacturing in the country, which will ultimately generate more employment opportunities for the poor and give greater purchasing power in their hands. The major expectation from this campaign is that it will create around 100 million job opportunities for youths in India over time.

1.5 Overview of world sugar industry regarding India

After Brazil, India is the largest sugar producer in the world and it leads in sugarcane production. However, if alternative sweeteners such as khandsari (sort of raw sugar) and gur (jaggery) are included in the fold, then India would be the largest overall producer of sugar. Brazil accounts for approximately 22 percent of the global sugar production and India contributes almost 14 percent. India stands at first place in consumption of sugar in the world but in per capita consumption India is so far from the highest per capita consumption countries.

1.5.1 Indian sugar industry

India is the world's largest producer of sugarcane and second largest producer of sugar after Cuba. This industry involves a total capital investment of Rs. 1,250 crore and provides employment to 2.86 lakh workers. In addition, 2.50 crore sugarcane growers also get benefit from this industry.

Indian Sugar industry is second biggest industry after cotton industry which is based upon agricultural products. India is the second biggest producer of world after Brazil and in consumption we stand at first place in the world. Sugar industry is basically rural area industry which plays an important role in the development of rural area to create direct and indirect employment. Sugar industry provides direct employment to 3.25lakh workers and

also provides 450 lakh indirect employments to Farmers. India has 22% share in the world sugar production. Even we have enough surplus; our export of sugar is not as per expectations because price of our sugar is very high in world market. Recently in few years' sugar export of our country is increasing but not up to the mark. So there is need to study of their technological change. This study examines the effect of technological change on the output of sugar industry in a time period of 17 years i.e. from 1998-99 to 2014-15.

1.5.2 Background of Indian Sugar Industry

India is the traditional producer of sugar. India has a long tradition of manufacturing sugar from Vedic period. Many References of sugar making by the Indians are found even in the Atharva Veda. India is truly called the homeland of sugar. But in ancient times, only gur and khandsari were made and modern Sugar industry came on the Indian scene only in the middle of the 19th century, when it was introduced by the Dutch East India Company in north Bihar of India. Unfortunately, this mill was not working successfully. The first successful attempt was made by the indigo planters at the initiative of Britishers in 1903. In this attempt, Vaccum pan mills were started at Pursa, Pratabpur, Barachakia and Marhowrah and Rose in north-eastern U.P. and the adjoining Bihar. This happened when demand for indigo ceased to exist due to the introduction of synethic blue in the market. In the early years of the 20th century, the industry grew rather slowly and there were only 18 mills in 1920-21 and 29 mills in 1930-31. The industry got a great fillip after the fiscal protection in 1931 and the number of mills rose to 137 in 1936-37. The production also shot up from 1.58 lakh tonnes to 9.19 lakh tones during the same period. The industry passed through an uncertain phase during and after the World War II and some stability was experienced only after 1950-51. There were 139 mills producing 11.34 lakh tonnes of sugar in 1950-51. After that, the plan period started and the industry made rapid strides. In the year 1994-95, there were 420 mills producing 148 lakh tones of sugar.

1.5.3 Production trend of Indian sugar industry

In 1950-51 its production was 11 lakh ton and increasing year by year in 2007-08 its production was its highest stage with 263 lakh tons and its lowest production was in 2008-09. Then it again increased with 188 lakh tons in 2009-10 and then 274 lakh tons in 2011-12.

1.5.4 Indian sugar industry and international trade

Now, India has been a net exporter of sugar. However, it has been occasional net exporter of sugar depending upon demand and supply situation in the country. In 2005-06 India has been net exporter with 15.039 lakh tons exports and imports of sugar was 0.07 lakh tons. India export of sugar was highest in 2007-08 with 58.23 lakh tons and highest imports was in 2008-09 with 24.47 lakh tons imports. From last three years, India's export of sugar is higher than its import of sugar.

1.5.5 Major contributed states in the production of sugar in India

Sugar industry has two major areas of concentration. One comprises Uttar Pradesh, Bihar, Haryana and Punjab in the north and the other that of Maharashtra, Karnataka, Tamil Nadu and Andhra Pradesh in the south.

Maharashtra

Maharashtra has progressed a lot and comes at first position from U.P. to emerge as the largest producer of sugar in India. Large production of sugarcane, higher rate of recovery and longer crushing period are some of the factors which have helped the state to occupy this enviable position.

The state has one-fourth of the total sugar mills and produces a little more than one third of the total sugar of India. Sugar mills of Maharashtra are much larger as compared to the mills

in other parts of the country. The major numbers of sugar mills is found in the river valleys in the western part of the Maharashtra Plateau.

Uttar Pradesh

Uttar Pradesh is the traditional producer of sugar and has been standing at the first rank among the major sugar producing states of India. However, its relative importance has been reduced during the last few years and the state has conceded the top position to Maharashtra and now occupies the second position. Maharashtra has fewer mills than Uttar Pradesh but they are of comparatively Large in size and yield more production. In Uttar Pradesh traditional techniques used for sugar production rather than Maharashtra. Huge part of sugar is used in the making of gur which is not use the sugarcane at optimum level.

Presently, the state records about 24 % of the total production of sugar in India. There are two distinct regions of sugar production in this state. One region consists of Gorakhpur, Deoria, Basti and Gonda in eastern Uttar Pradesh and the other lies in the upper Ganga Plain consisting of Meerut, Saharanpur, Muzaffar nagar, Bijnore and Moradabad.

Tamil Nadu

Tamil Nadu has shown extraordinary progress regarding to sugar production during the last years. High yield per hectare of sugarcane, higher sucrose content, high recovery rate and long crushing season have enabled Tamil Nadu to obtain highest yield of 9.53 tonnes of sugar per hectare in the whole of India.

As a result of these qualities, the state has emerged as the third largest producer of sugar in India and it contributing more than nine percent of the total sugar production of India. Most of the 32 mills of the state are located near to Coimbatore, North Arcot Ambedkar, South Arcot Vallalur and Tiruchchirapalli.

Karnataka

Karnataka has 30 mills producing 1,151 thousand tonnes or over 6 per cent of the total sugar of India. Belgaum and Mandya districts have the highest concentration of sugar mills. Bijapur, Bellary, Shimoga and Chittradurga are the other districts where sugar mills are scattered.

Andhra Pradesh

Andhra has 35 mills which are more than its neighbouring state Karnataka but it contributes only 6.01 percent in the production of India's Sugar. The reason is that mills are smaller comparatively the mills of Karnataka. Mostly sugar mills are situated in the East and West of Godavari, Krishna Vishakhapatnam, Medak, Vishakhapatnam and Chittoor Districts.

Gujarat

Mills in Gujarat are scattered in Surat, Amreli, Bhavnagar, Junagarh, Rajkot, Banaskantha and Jamnagar districts. With the 16 mills state produced about 5.56 percent sugar of total sugar produced in India.

Haryana

Haryana has only 8 mills but their large size enables the state to contribute 1.91 per cent of the total sugar production. Sugar mills are located in Rohtak, Ambala, Panipat, Sonapat, Kamal, Faridabad and Hissar districts.

Punjab

Punjab has a total of 13 mills which are located in Amritsar, Jalandhar, Gurdaspur, Sangrur, Patiala and Rupnagar districts.

Bihar

Bihar was the second largest sugar producing state next only to Uttar Pradesh till mid- 1960s. Since then the state has been experiencing slow growth and as a result lost its prestigious position to the peninsular states like Maharashtra, Tamil Nadu etc...

Karnataka and Andhra Pradesh

These states have 28 mills and make an insignificant contribution to the production of sugar. The belt of eastern Uttar Pradesh extends further east in Bihar and the districts of Darbhanga, Saran, Champaran and Muzaffarpur are included in this belt.

Other states of India

Among the other producers are Madhya Pradesh has 8 mills in Morena, Gwalior and Shivpuri districts, Rajasthan has 5 mills in Ganganagar, Udaipur, Chittaurgarh and Bundi districts and Kerala, Orissa, West Bengal and Assam also contributed in the production of sugar in India

1.5.6 By-Products of Sugar Industry

Mainly, Sugar industry has two by-products

Baggase

Basic use of baggase continues as a fuel which is a traditional use of baggase. Now it is also used as a raw material for paper industry requirement. Paper prepared by the use of baggase has high quality. However, since the mills are scattered all over the country, collection of surplus baggase becomes problem. Huge garbage collected around the mills and it creates pollution. Now makes paper units uneconomical. Efficient utilization yet to come up which increase the efficiency of the industry and it is used in the electrical. Through the cogeneration processes bagasse and molasses can be utilized to generate electricity for the use of industry itself and to distribute the same in near areas.

Molasses

Molasses can be used in the production of ethyl which can be utilized in the making of chemicals, liquor and ethanol. Ethanol can be used as the energy sources as it is bending with the petrol. . It can be utilized in the manufacturing of feed for cattle. There are total 283 distilleries and 108 sugar mills having distilleries attached total installed capacity is 2700 Mn liters. In india, mostly part of ethyl used as row material in alcohol.

1.6 Area of the study

In the present study overall sugar industry of India has been taken as the study area. Presently there are 763 sugar mills in operation. Details of the required variables have been taken from the ASI annual survey of India. In this site industries' data has been collected with their by products.

1.7 Rationale of the study

Indian sugar industry is third largest agro-based industry in its share in Gross Value Added (GVA) of Indian economy. Importance of the industry is increased as it is employment potential or labour intensive industry and direct linkage with the rural economy. This made essential to analyze the status of the sugar industry of India. The following reasons attract the researchers to select this industry for evaluate the productivity and technical efficiency in this industry.

- India is not only among the largest producers of sugar in the world but it is also stands at first place in overall production of sugar with khandsari and Gur. Sugar industry uses the huge amount of resources of Indian economy. This means the country has huge stake in efficient operation of the industry.

- Indian sugar industry is a great source of income; generate huge employment and great share in tax revenue of country.
- Sugar industry of India is one of the most highly regulating industries by government as it is an essential good of consumption so there is need to fulfill the demand of consumers at reasonable cost. But from the producer's side its partially decontrolled by the govt. as per time needed to improve the health of the sugar industry. So there is need to check the productivity changes in the industry after these decisions of the govt.
- Now India becomes net exporter from last three years but we have more surplus to export. But high cost of Indian sugar becomes barrier to sale it in the international market. To enjoy comparative advantages there must to adopt sufficient efficiency which capable us to compete in the international market.
- Another great issue that sugar industry is the most fluctuating industry of Indian economy. In the present study we use the most advance technique to estimate productivity and technical efficiency which is Malmquist productivity index.

Research on productivity growth is very important because economic growth cannot be sustainable without improvement in the Total Factor Productivity. From a policy point of view, the assessment of TFP growth is important as it serves as a guide for resource allocation and investment decisions.

1.8 Objectives of the study

These are main objectives of present study:-

1. To estimate the Productivity trend in sugar Industry of India.
2. To estimate the Labour Productivity and Capital productivity trend in the sugar industry of India.

3. To estimate the Total Factor Productivity with technical efficiency and technical change in Sugar Industry of India.

1.9 Hypotheses of the study

To fulfill the objectives and aim of the present study two hypotheses were framed. The hypotheses are as follows:

H0: There is no significant change in productivity of Indian sugar industry.

H1: There is significant change in productivity of Indian sugar industry.

H0: There is no significant relation between productivity growth and technological change.

H1: There is significant relation between productivity growth and technological change.