“Growth is one aspect of the process of economic development.” (Sen, 1983, p. 748).
Development is multi-dimensional process, involving re-organization and re-orientation of entire economic and social system. It is the most important challenge, and every nation strives for it. During 1950s and 1960s, development was taken as an increase in output, based on the economic efficiency; diverted to distribution aspect of income in the early 1970s and, then, to the sustainable development during 1980s. Sustainable development refers to the process, whereby a nation is enabled to utilize the available resources in a more productive manner, so as not only to ensure a continual increase in the output of goods and services, but also to that the future generations do not remain deprived of the resources (Hogendorn, 1987).

For the developing countries, the practice of development has become much more a complex phenomenon. It is the process of securing a higher level of productivity in all sectors of the economy, which primarily depends upon technological advances the community is able to make (Najundapa and Sinha, 1982). It is not purely an economic phenomenon, but is evaluated with reference to a host of qualitative factors, apart from quantifiable aspects. Improvement in literacy, education and training levels, improvement in health and nutrition of people resulting in reduction in mortality and increase in longevity, high levels of living on all norms, optimum use of all types of resources, etc., are indicators of development. Thus, economic development involves structural changes in composition of output, employment, consumption, trade and other related aspects. This internal process of structural changes is necessary for generating and sustaining the process of rapid economic development (Todaro, 1989).

Generally, economic development and structural changes are mutually reinforcing as development leads to structural transformation in demand, trade, production and factor use which, in turn, affect the growth rate of national income (Chenery et al., 1974). Viewed in this manner, economic development is the advancement of an economy, along with evolving new and better methods of production and acquisition
of capital resources. It brings in its wake various important social, institutional and structural changes, such as industrialization, changes in production techniques, etc. Moreover, the record of history demonstrates that in order to eliminate a country’s techno-economic backwardness, it is obligatory to diversify the pattern of economy by equipping it with the latest machinery and utilizing modern technologies & techniques of production.

Composition of domestic product is likely to undergo a change with economic development. In low per capita income countries (i.e., less-developed economies), the largest portion of income is derived from agriculture and a smaller proportion from industry and the smallest from services sector. With economic development, the share of agriculture falls, of industry firstly increase at a higher rate and then at a slower rate, while that of services firstly at a slower rate and then at a faster rate. It has been realized by many less-developed economies that there is no alternative to remove poverty, unemployment and inflation, etc., except rapid economic development. However, a country cannot develop without growing.

Growth is said to take place when a country’s output expands because of expansion in factors of production, such as land, labour, capital, etc., and is generally measured in terms of an increase in domestic product in real terms. Classical economists described economic growth as a process, whereby a nation tranforms its economic surplus into capital accumulation (Dholakia, 1974). According to Kuznets (1959), economic growth of a firm, an industry, a nation, or a region means a sustained increase in the output of the goods that satisfy human wants. Moreover, the increase must be sustained over a long period of time. Output can be increased by increasing the quantum of physical inputs deployed in the production process. However, every nation has constraints on the availability of physical inputs. For example, advanced countries like USA and Japan face severe shortages of labour. The problem of physical inputs constraint is more severe in developing countries. In India, capital inputs are scarce and are, therefore costlier due to lower per capita income, lower savings rate and income inequalities. Although labour is in abundance, yet there are even labour input limitations because of structural deficiencies, such as an imbalance between skill availability and skill requirements (because of low productivity). Accelerating the rate at which output is generated from the employed
resources is imperative for India, i.e., productivity growth must occur (Saxena, 2006). The steady process by which the productive capacity of the economy is increased over time to bring about rising level of national output and income is referred to as economic growth (Meier, 1973).

Since the days of Adam Smith, economists have been concerned with the theme of economic growth. However, it was only during the post-war period when special attention was drawn towards a detailed analysis of the sources of the economic growth. The growth of an economy is, broadly, governed by two distinct sources \textit{viz., factor inputs} and \textit{productivity} or, in other words, quantity and quality of resources. Presently, with the increasing role of markets in the era of globalization and liberalization in conjunction with the restricted role of government, the Indian economy, in general, and manufacturing sector, in particular, has been facing a stiff competition from the outside world. Therefore, it becomes pertinent to put more emphasis on productivity growth, not only to increase output but also to improve the competitiveness of an industry, both in the domestic and international markets. The \textit{productivity driven growth} (or inspiration component), which is one of the distinct and critical sources for development of an economy, refers to the growth in output that cannot be explained by the growth in total inputs. It is normally attributed to the advancement in knowledge, technological progress, efficient use of resources, improvement in organizational & human resource management, enhancement of information technology, \textit{etc.} The \textit{input driven growth} (or perspiration component), another mode of growth of an economy, is achieved through an increase in factors of production, which is inevitably subjected to diminishing returns and is not sustainable in the long run, as suggested by Young (1992) and Krugman (1994). Therefore, the only sustained manner to increase per capita income in the long run, is by increasing the amount of output produced by a given quantity of inputs, that is raising \textit{Total Factor Productivity} (TFP) of the production process. In order to study as to whether factor accumulation or factor productivity primarily drives the output growth in a particular economy, the analysis of growth accounting becomes imperative.

Growth accounting is a procedure, originally introduced by Robert Solow way back in 1957, to measure the contribution of different factors to economic growth and to
indirectly compute the rate of technological progress, measured as a *residual* in an economy. According to Cororation and Caparas (1999), however, the growth accounting approach of estimating total factor productivity was first ventured by Stigler (1947) and then popularized by Kendrick (1961) and Denison (1962). Whereas according to Mahony and Timmer (2009), this methodology was theoretically motivated by seminal contribution of Jorgenson and Griliches (1967) and then put in a more general input-output framework by Jorgenson *et al.* (1987).

The growth accounting framework provides an important tool with which growth experience of a country or region can be examined. It summarizes and gives adequate weights to different elements that should be identified as directly responsible for the observed growth. It, then, decomposes the growth rate of economy’s total output into: (a) the component resulting from an increase in amount of factors used – usually the increase in the amount of capital and labour, and (b) the component which cannot be accounted for by observable changes in factor utilization. The unobservable part of growth in output is then taken to represent increase in productivity or, equivalently, a measure of what is known as *technological progress*. In the language of Barro (1999), growth accounting breaks down economic growth into components associated with changes in factor inputs and *Solow residual*, which reflects technological progress and other elements.

Therefore growth accounting provides a framework for allocating changes in a region’s observed output into the contributions from changes in its factor inputs – capital and labour – and a *residual*, typically called *total factor productivity*, as is shown in Figure 1. The latter is best interpreted as a measure of gains in the efficiency with which factor inputs are used (Bosworth and Collins, 2008).

The key issue of growth accounting is to study the role of total factor productivity (TFP) in economic growth. Growth in TFP, being obtained as a residual; its estimation crucially depends on the assumptions of growth accounting framework and the quality of data on outputs and inputs. Basically, land, labour and capital stock are considered to represent factor inputs. Land and other natural resources are, rather, inelastic in the sense that there cannot be a continuous increase in their availability in quantitative and qualitative terms. Therefore, in labour surplus region
or economy like ours, where the human population has been growing at an alarming rate, the desired rate of growth in the national product may be realized, either through a rapid accumulation of capital stock or through improvement in productivity (Sethi, 1997). The former approach may, however, not be practically feasible in relatively poor countries like ours because a rapid increase in capital stock means requirement of an increasing propensity to save which, consequently, may result in growing hardships to the people belonging particularly to weaker sections of the society. Therefore, the plausible channel left before us to meet the requirement of growth in output, is through productivity improvement sustained over a long period of time. Productivity improvement is not merely ‘caused by’ but also ‘affects’ the capital stock. As Bhattacharya (1972) puts it, “both technological progress and capital accumulation, by helping each other in their growth, make the total process of economic growth a self perpetuating one”.

Figure 1: Growth Accounting Framework Source: Saari (2006)
In the analysis of technological change, we distinguish between four basic elements (Yotopoulos and Nugent, 1976), viz.:

1. The Technical Efficiency of Production: An increase in technical efficiency of production refers to the usage of lesser quantities of factor inputs in producing the unit output. Alternatively, it can be seen as a reduction in the unit cost of all factors of production, attributable to the application of better techniques. This is reflected by a homothetic shift in the isoquant or by the shift in the constant term of the production function.

2. The Scale of Operation of Production: The second characteristic of technology is the scale of the operation of the production process. While technical efficiency is defined in the terms of the maximum quantity of output with inputs held constant, returns to scale refer to the change in output that results from an equi-proportional change in all inputs.

3. The Bias of Technological Change: Factor intensity, of course, may change as a result of changes in factor prices. The bias in technological change may, therefore, be measured in terms of the rate at which the ratio of marginal products changes.

4. Elasticity of Substitution: The fourth characteristic of technology is the elasticity of substitution between the factors of production. It refers to the ease with which one input can be substituted for another.

Productivity is a technical concept, measuring efficiency. When only a single input, say labour, is considered, one simply needs to get the ratio between the output and that single input so as to obtain the productivity of that factor input. It may be termed as \textit{partial factor productivity}. However, when there are more than one factors of production, say labour, capital and energy, the relevant concept is \textit{total factor productivity} (TFP). The concept of TFP originated way back in the early 1950s, with the work of Tinbergen, a German economist. Many others followed the suit, but TFP started to become popular concept only through the growth model of Solow in 1957 (Cororation and Caparas, 1999). The rate of productivity increase is a
sort of catch-all; it covers a wide range of different factors, such as improvement in quality of labour, non-constant returns to scale, non-neutral technical change, inter-industry shifts of resources, aggregation and measurement biases, and so on, besides, of course, the effects of advances in knowledge. It is perhaps for this reason that the names given to this factor have ranged all the way from (a) “Technical Change” and (b) “Efficiency Index” to (c) “Total Factor Productivity”, (d) “Output per unit of Input”, (e) “The Residual”, and (f) “Measure of our Ignorance” (Dholakia, 1974).

Now, an obvious question that arises is: Why there is an increased focus on growth in factor productivity rather than factor accumulation, to achieve a desired level of growth? The likely reason is: There is a broad consensus among economists and policy makers that the presence of positive trends in productivity growth can lead to sustainable output growth, since it ensures efficient utilization of key resources. On the contrary, the output growth generated by increasing factor inputs (commonly called as factor accumulation) will not be sustainable in the long-run, because the expansion of inputs generally is associated with diminishing returns to scale. Therefore, the growth in output merely due to factor accumulation will eventually taper off, making the growth process unsustainable in the long run. However, the growth in factor productivity has increasing returns characteristics, i.e., there is no limit to growth in output due to productivity (Cororation and Caparas, 1999; Mahadevan, 2007; Sosa et al., 2013). Thus, due to the presence of decreasing returns to scale, sustained growth of income is not possible merely by increasing investments in labour and capital stock. It is, therefore, argued that for sustained growth of per capita income, investment has to be accompanied by technological change. A number of studies, viz., such as due to Grossman and Helpman (1991); Mankiw et al. (1992); Romer (1994); Helpman (1998), etc., have emphasised the crucial role of productivity, technology and innovations in promoting growth.

Productivity changes as production continues. It improves under favourable circumstances and deteriorates when unfavourable changes occur. The changes that lead to higher productivity are technological improvements, improvement in efficiency, increased education of labour, improvement in the quality of labour via training, etc. Since such changes simultaneously affect different physical inputs
favourably or unfavourably; therefore, the resultant change in output cannot be attributed to the individual physical inputs. Productivity improvements arising from such changes are collectively termed as TFP growth (Saxena, 2006).

In conventional growth accounting approach, the indicator for the growth of total factor productivity is computed residually, *i.e.*, if the indicator of output growth is the growth of real domestic product, then total factor productivity growth is calculated as the difference between the growth in real output and the weighted sum of the growth of the primary factor inputs, say labour and capital. Since TFP growth is the difference between two growth rates; therefore, it is not derived in monetary units or in levels. It is rather calculated as a usual growth rate.

The TFP growth is, further, decomposable into two mutually exclusive components *viz.*, technological progress and technical efficiency. In other words, TFP is viewed as a composite measure of technological progress and technical efficiency. Technological progress is associated with the best practice production frontier, while technical efficiency change is related to learning by doing, improved managerial practice and changes in efficiency when a known technology is applied (Kalirajan and Obwona, 1994). Technological progress measures the shift in the frontier over time and can be interpreted as an evidence of innovation. Technological progress (or change) can be classified as:

- **Embodied Technological Change**, which is embodied in the factor inputs. In other words, it means the improvements in factors of production, like the stock of knowledge (*i.e.*, technically qualified workers, installation of better machinery and use of improved quality of raw materials, intermediates, *etc*). These are assumed to be properly specified and accounted for in the production functions;

- **Disembodied Technological Change**, which is not embodied in the factor inputs. In other words, it refers to an increase in productivity due to external factors, such as through better methods and organization that improve the efficiency of both new and old factors inputs. It is the average index of technology common to all types of old and new firms. Such a change is an indicator of better use of resources, managerial efficiency, and other factors.
which are not visible, even though they contribute to the improvement of the efficiency of both old and new inputs (labour, capital, etc.);

- **Exogeneous Technological Change**, meaning that change whose occurrence is independent from other factors of production. This implies that time is the only contributing factor. This type of technological change is influenced by diffusion of technology, research and development (R & D), experience, education, investment activities, etc.;

- **Endogeneous Technological Change, which means** the change in output due to trade, human capital and endogeneous technology. In other words, this component attributes technical progress to systematic efforts by economic agents;

- **Hicks Neutral Technological Change**, which means that technology is increasing the efficiency of both capital and labour inputs to the same extent;

- **Harrod Neutral Technological Change**, which means that the change is labour augmenting. In other words, the efficiency of labour increases through an extent larger than that of capital; and

- **Solow Neutral Technological Change**, which means that the change is capital augmenting. That is to say, the efficiency of capital increases through an extent larger than that of labour.

Normally, in the estimation of various productivity indices, the assumption of Hicks-neutral disembodied technical change is made. The second component of TFP, *i.e.*, efficiency change, is further decomposable into two components *viz.*, (a) *pure efficiency change* (PECH), and (b) *scale efficiency change* (SECH). Pure efficiency change indicates the managerial efficiency change, whereas scale efficiency change refers to the changes in efficiency due to changes in the scale of operations.

In recent years, *economics of growth* has been one of the most fascinating research topics. Since independence, Indian economy has been growing steadily, though at differential pace. In the second half of the twentieth century, Indian economy grew
by about 4.5% per annum on long-term basis. It propagated at Hindu rate of growth of nearly 3.5% per annum from 1951 till mid-1970s, and growth picked up to about 5.5 percent, thereafter, till early 1990s. After the wide ranging reforms initiated in 1991, country’s GDP (which measures the aggregate income in the economy) grew by above 7.5% for the three years in succession during fiscal years 1994-95 to 1996-97, giving rise to hopes of a higher growth path for the economy (India Development Report, 1999-2000). Thus, Indian economy has come a long way since independence. But, where does the consensus end? How is this growth happening? A simple question, like “How much of the growth can be attributed to various factors?” gets different answers.

It was Abramovitz (1956) who first observed the growth of output occurring due to factors, other than increase in inputs. Later on, Solow (1957) measured total factor productivity as a shift in the production function. Since then, a large number of studies have been conducted on total factor productivity growth in both developed and developing economies. The effectiveness of a country’s economic policies can be gauged through total factor productivity, as it indicates the economy’s ability to produce more output with limited resources, or to produce the same amount of output with fewer inputs. The question as to whether TFP improves, when economies move on a higher growth trajectory has been controversial. Some researchers have attributed the success of countries like South Korea, Taiwan, Hong Kong and Singapore due to high rate of growth accompanied by high productivity growth (World Bank, 1993; Chen, 1997). But others, like Krugman (1994) and Young (1993, 1995) have opined that this resulted from high investment rates, rather than from total factor productivity growth.

Growth accounting is, thus, an indispensable tool, which helps us in ascertaining the various factors affecting the output growth of an economy, i.e., it provides an insight into relative contribution of different sources of growth of an economy. A study of growth accounting becomes all the more important in view of the limited availability of factors of production, particularly, in developing economies. Productivity growth is a crucial factor in determining growth of an economy. If productivity is increasing in an economy, it means its factors of production are manifesting an increase in their output efficiency. The productivity improvements
along with the increase in quantity of factors will also be contributing an additional source of output increase (Brahmananda, 1982).

Recent years have witnessed a growing optimism about the potential for Indian economic growth. However, the optimism also reflects the fact that India’s growth has accelerated over the past two decades. Now the questions arise: “Where among agriculture, industry, and the service producing sectors has the growth been concentrated? And, what are the major contributors to that growth: increased employment, capital per worker, educational attainment, or improvements in the basic efficiency of resource use (total factor productivity)?” Denison (1962) made a path-breaking contribution about sources and rates of economic growth in U.S. economy by identifying more than 20 independent sources, and observed that different sources of growth varied in importance from time-to-time and from place-to-place. In the Indian context, Dholakia (1974) made a pioneering study about various sources of economic growth, measured their contribution, and concluded that different sources varied considerably during different sub-periods. Sethi (1997) carried out a growth accounting analysis to examine the sources of economic growth in India, the results of which showed that the major contributors to the growth rate of primary, secondary and tertiary sector were labour, capital and TFP, respectively. And for the whole economy, the highest contribution was made by labour input.

**Orientation of the Present Study**

During the last decade or so, issues relating to the growth of Indian economy have been the subject matter of debate and discussion at home as well as abroad. India has undergone a multiplicity of economic reforms right since it opened up its economy during June, 1991. The major thrust driving the reform process was to achieve macroeconomic stability, accompanied by faster growth and efficiency. Certain policy measures were adopted to reinforce structural reforms in order to impart competitive strength to the economy. Structural reforms mainly focused at the reorientation of the economy from a controlled economy to market oriented in order to foster higher efficiency and growth (Mallikarjun, 2012). During this period, the economy has witnessed growth at a much faster rate.
Analysis of economic growth is, of course, a fairly complex phenomenon. This issue includes as to why certain economies grow faster and why certain others grow slower; how the developing economies reach the balanced growth path by increasing the productivity of inputs. After the process of liberalization, there has been a significant acceleration in the growth rate of the Indian economy. The long standing barrier of so-called Hindu Rate of Growth of around 3.5% has been comprehensively broken and the Indian economy started showing growth at a rate of as high as 9% per annum or so. Lately, however, the economy has been cruising along at a rate to the tune of 5-6 percent per annum. Moreover, its per capita income has more than doubled since early nineties. With population growth slowing down to about 1.6 percent per annum, such a growth of the economy, according to Gupta (2004), would be sufficient to quadruple the per capita income by 2020. Therefore, it would be interesting to examine the sources of such a pattern in India’s growth path.

Punjab has, historically, been one of the most progressive and the fastest-growing Indian state, with one of the lowest poverty rates. It experienced accelerated growth and steadily rising per capita income compared to the growth experience of the Indian economy, in general, and other states, in particular, during the early green revolution period (viz., from the year 1966 of its formation uptill mid-80s). As a result, Punjab continued to occupy the first rank (on per capita income) among the major Indian states. Since its phenomenal growth during mid-1960s (thanks to the green revolution!), Punjab is now facing economic crisis of unprecedented scale, and is now termed as one of the slowest growing states. The state has altogether lost its sheen and has been continuously slipping in its relative rankings. At present (i.e., 2009-10), of the 28 odd states, Punjab occupies 8th position from the top (with per capita GSDP at 2004-05 prices equaling Rs 42831/-; next to Haryana, Maharashtra, Gujarat, Tamil Nadu, Kerala, Uttrakhand and Himachal Pradesh; Government of Punjab, 2012). It was a widely held belief that after the introduction of reforms in India, Punjab would get a big-push towards the road to economic prosperity. However, the trends in post-reforms period portrayed a reversal for the state; performance of the Indian economy, in general, and a number of other states have overtaken Punjab, so far as per capita income is concerned (Singh and Singh, 2002). The agrarian economy seems to have attained a plateau and has registered a
significantly poor growth on agriculture front as well. This drives home the overall story of Punjab’s steady relative decline, even though in absolute terms its performance may not be that bad. On the other hand, the Haryana state, which was originally carved out of the Punjab state, and used to be known as Punjab’s poor cousin, has edged past the latter state on most of the economic parameters of development (Ahuja, 2007). With Haryana’s growth rate even crossing national growth rate, the state has left behind its big brother – Punjab.

Now, an obvious question arises: Why Punjab has suffered a long, steady decline in its relative ranking? In order to bring out the constraining factors in the growth process, the present in-depth study was, therefore, carried out (covering the period 1980-81 to 2009-10), which concentrated on the quantitative analysis of different sources of economic growth in Punjab vis-à-vis the Indian economy, in general, and the neighbouring Haryana state, in particular.

**Objectives of the Study:**

Specifically speaking, the study was carried out with the following objectives:

1. To examine long-term growth behaviour of output (at aggregated/ disaggregated levels) in Punjab and Haryana states vis-à-vis the overall Indian economy;

2. To analyze nature and speed of structural changes in output of the three economies;

3. To detect presence and direction of inter-sectoral linkages in output from major sectors of the three economies;

4. To generate (time series) estimates on capital stock at aggregated/ disaggregated levels for both Punjab and Haryana states, and to study growth behaviour therein;

5. To estimate partial factor productivities and total factor productivity (TFP) in each of the three economies;
6. To perform growth accounting analysis, and to examine differentials, if any, in relative contribution of different factors of production and TFP in output growth; and

7. To examine the relationships, if any, between total factor productivity of different sectors and public expenditure on developmental activities in the three economies.

**Hypotheses Tested:**

The study was directed to validate, or otherwise, the following set of hypotheses:

1. Income in each of Punjab, Haryana and the Indian economy has grown in an accelerated manner during the study span;

2. Total factor productivity has improved over the study span in each of the three economies;

3. Relative contributions of factor inputs and TFP in the Punjab and Haryana states are comparable, and are in consonance with those in the overall Indian economy;

4. Technological change in each of the three economies is Hicks-neutral;

5. Rate of technological progress among the three economies is comparable; and

6. Expenditure on developmental activities, in general, and social services, in particular, induces a significant effect on TFP growth in each of the major sectors of the three economies.

Since an achievement of rapid economic growth has continued to remain a national goal in India; therefore, the present study pertaining to growth and productivity performance in the Indian economy assumes special significance, not only because it would help us to identify as to what has and what has not been important in the growth which has already occurred, but also because of the implications it will have for the conducive strategies required to be adopted for ensuring optimal growth. Thus, our attempt which was made to analyse and understand the constellation of forces which determine the growth performance of the state economies of Punjab and Haryana *vis-à-vis* the Indian economy as a whole would expectedly be fruitful.
“However, growth tends to beget growth; of course, missteps can bring it to a halt. Our understanding of an economy’s rapid growth has to focus on what causes the first stirrings.” (Basu and Maertens, 2007, p.143). Furthermore, analytical comparisons of the sources and rates of growth in the three economies considered in the study might pave a way to provide a systematic explanation of the question so often raised: ‘why growth rates differ?’

**Chapter Scheme**

To pursue the aforementioned objectives, the study has been organised into eleven chapters in all. The first chapter (i.e., the present one) is introductory in nature, highlighting need, objectives of the study, and hypotheses to be tested. The second chapter presents a detailed review of the related literature. Chapter-III is devoted to the description of data sources and various analytical tools/ techniques used for analysis. Growth performance, structural transformations and inter-sectoral linkages with respect to income in Punjab and Haryana States *vis-à-vis* the Indian economy have been analysed in Chapter-IV. In Chapter-V, an attempt has been made to estimate capital stock for Punjab and Haryana states and also to study its growth performance in the two states *vis-à-vis* that in the overall Indian Economy. Chapter-VI is devoted to an investigation of partial factor productivities and employment elasticity of output in Punjab, Haryana and the Indian Economy. Chapter-VII, VIII and IX deal, respectively, with *growth accounting analysis* using *Factor Share Approach*, *Production Function Approach* and the *Non-parametric DEA-based Malmquist Index Approach*. An examination of relationship, if any, between Total Factor Productivity of each major sector and social-sector expenditure has been dealt with in Chapter-X. And, finally, Chapter-XI summarises the findings and brings out useful policy implications derived from the study.