Chapter 2

Review of Literature

2.1 Introduction:

This Chapter 2 reviews the literature of studies dealing with Partial and Total Factor Productivity, Factor Intensity, Growth and Regional Concentration and Dispersal of Industries and Inter-relationships between those concepts and measurements in theory and practice of India’s industrialization. Similar studies relating to international comparisons with other countries’ industrialization and micro-level foreign country case studies are also cited in the Review; that provided similar or divergent relationships leading to a few hypotheses for further empirical testing. This Review is also intended to trace research gaps as to fetch requisite hypotheses, or research questions. The Review is neither necessarily a full comprehensive survey nor claims to be a more refined or improved classification of themes based studies survey; but is intended for the cited purpose of examining the studies for causal relationships of growth, productivity and dispersal of the variables to trace research gaps for further works as not done in earlier studies. Hence, the Chapter is divided into following sections: Section 2.2 deals with initially those Studies dealing with International Comparison and Individual Foreign Country Case Studies. Section 2.3 dwells upon a few Major Studies dealing with Indian Industries’ growth, productivity, dispersal performance, etc. Section 2.4 cites Studies focussing on discussion of relevant theoretical/technical and empirical verification issues dealing with Returns to Scale, Capital Intensity (K/L), Partial Productivity of Factors, Total Factor Productivity and Growth during long period and Period Wise Analysis till the Pre Reforms Period. Section 2.5 deals with specifically those studies on Growth, Industrial Development and Regional Dispersal of Indian Industries. Section 2.6 isolates the Research Gaps learnt from the Review of Literature cited above for further investigation of Indian Industries at national and sub-national levels with the experience of Post Reform Phase of Indian Industrialization.
To cite an important Themes-based Review works of Indian industries’ studies, Somayajulu V.V.N. and Jacob George\(^1\) (1983) reviewed earlier, similar Research works on Indian Industries’ economic issues and contribution of the studies to the themes under the current Review quoting authors’ works. They also included production function studies in India because they can be distinguished by distinct objectives/themes, type of production function used, choice of variables, data used, etc. Such an improved classification adopted takes into account: 1- time series, cross section and pooled data studies; 2- state level and all India Industry studies, 3- micro-macro studies, where size and cluster of firms and industries define choice of variables, returns to scale, capital intensity, TFP measurements, sources of growth, etc. Later in 1990s, he estimated production function parameters in a major study of Andhra Pradesh Industries’ development and relevant TFP and actual growth rates to trace inter-relations between sources of growth and development in AP industries, 1956-80.

The Classification undertaken in this Survey of Literature follows a chronological order of publication of studies under the themes in Respective Sections concerned.

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2.2 International Studies:

Ishaq Nadiri\(^2\) (1970) in ‘Some Approaches to the Theory and Measurement of TFP: A Survey’ in - focuses on some basic hypotheses and empirical evidences but refrains from giving any conclusive answers regarding measurement and determinants. His Survey paper is limited to determinants of TFP in USA industry. He shows that Solow’s TFP measure is similar to Kendrick’s TFP proportional to changes in quantities of inputs and output given a production type of Cobb-Douglas type, characterized by Hick’s neutral technological progress. He discusses the usage of value-added data, as to measure output on assumption that ratio of raw materials to total output remains constant\(^3\) (Domar.-1963). Nadiri’s evidence suggests that the cited ratio was neither constant for the whole economy nor for the individual industries. It declined due to improvements in technology, better inventory management, substitution of both raw materials and primary inputs. Gordon (1969)\(^4\) viewed that omission of materials that influence production relations often leads to a positive bias in estimates of returns to scale and affects elasticity of substitution between L and K.

\(^2\)M. Ishaq Nadiri- ‘Some approaches to the Theory and Measurement of TFP’- A Survey-
\(Journal of Economic Literature\), Vol.-VIII-\(American Economic Association\),


\(^4\) - Gordon R J- ‘$45 Billion of US Private Investment has been mis-laid’- \(Amer. Econ. Rev.\) 59 (3), June 1969, pp. 221-238.
Irving Kravis (1976) made a productivity comparison across countries to throw some light on causes of productivity differentials and to explain international differences in per capita GDP. Industry-wise comparisons have been made in terms of labor productivities. He did not pursue the industrial pattern of international differences in productivity as the industrial pattern differences were not significant. But Metals, Machinery and Chemicals revealed large productivity gaps in UK-USA comparative study Food Beverage, Tobacco, Apparel, Nonmetallic showed less gaps in productivity measurements.

Renuka Mahadevan (2002) examined Australian 2-digit manufacturing for 1968-95. It decomposed TFP into technical progress and technical efficiency. And showed that trade liberalization has a positive effect on technical progress but no significant gains in technical efficiency. She found that in textile clothing, footwear and leather, L- intensity was the most but with the lowest wage rates and lowest TP and TFP growth compared to other industries. Further, government protection led to more fall in productivity. Transport showed greater TP than textiles but there was scope for better use of technology. Petroleum, Coal and Chemicals were most K intensive but there were little gain from technical efficiency because these industries faced minimal competitive imports and catered to domestic demand.

Krishna K. L. (1992) estimated a meta-production function as the envelope of all the efficient input-output points, for international comparisons. The difference between the observed and estimated growth rates of output [using the estimated coefficients] was the residual for the measure of TFP growth. It showed that relative sectoral growth rates of productivity were the important determinants of structural transformation in the economy. He reviewed some recent productivity studies with focus on TFPG. He compared TFPG in India versus South Asia and East Asia and assessed contribution of education to output growth. Then he discussed agricultural productivity, railways sector productivity and inter-state productivity differences, reviewed income convergence hypothesis and three sets of productivity measures for Andhra Pradhesh. TFP measurement was undertaken by using flexible functional forms of Production Function (PF) such as translog rather than restrictive types of Cobb-Douglas (CD) and Constant Elasticity of Substitution (CES).

First, Dougherty and Jorgenson (1998) G-7 results are compared with Wolff (1991). In DJ and Wolff there is initial similarity in TFP levels but over time DJ index varies much. This is because p.f. of DJ allowed substitution possibilities at a much finer level along with data differences. In second part, TFP results are presented for 96 countries presented by Hall and Jones and by Islam-1995. As regards 2nd set there are similarities at the bottom of the list than at the top but Islam index is more bottom heavy than H-J index. The difference in conclusion is due to difference in methodology and data.

Macro Studies showed that the TFP measures used to analyze issues of technological diffusion and convergence and the different approaches to TFP comparison have important roles for purposes of formulation of policy guidelines.

Islam Nazrul (1999) \(^{11}\) makes a review of three main approaches to TFP analysis for international comparisons. They are 1- time series growth accounting (absolute and relative) approach of Kendrick, Denison (1967) \(^{12}\), Jorgenson, etc. The absolute has been used by Kravis (1976) \(^{13}\) and Nadiri (972) \(^{14}\). Jorgenson and Nishimizu (1978) initiated the relative form of time series approach to international TFP comparison.

Jorgenson distinguished between quality and quantity of inputs. Christensen, Cummings and Jorgenson (1981) \(^{15}\) extended it to 9 countries and used the translog production function. This function allowed an expression for difference in TFP levels. But before conclusions about technological differences from TFP results can be drawn, it is necessary to decompose TFP into its different components. For Hall and Jones –1996, 1997, differencing is done in direction of cross section of countries but this depends on the way the countries are ordered.

3- Islam’s Panel approach seeks better explanation of cross-country growth differentiation expression in a level equation form of Cobb Douglas Production Function (C-d p. f.) \(^{A_0}\) estimation is controlled well by Panel Approach. There is difference in scope of results produced by time series approach, cross section and panel regression. The results are presented in two formats.


\(^{13}\) Kravis- op.cit.


Blakemore Arthur and Schlagenhauf Don (1983) \(^{16}\) addressed the issue of switching regressions in the context of the USA productivity slowdown since 1950. A comparison of structural stability of these functional forms through Quandt’s (1960) Most Likelihood Estimate (MLE) for testing null hypothesis that no regime switches have occurred was done. This was against the alternative that a change has occurred at unknown observation \(z^*\). In all three trends, when a simple linear time trend is utilized under assumption of single switch, ML occurs in 1973 II. This supports the opinion that a structural break occurred in US in 1973. But test for two switches is not definitive. This article was also important because it could enable comparison of possibly gradual productivity slowdown on global scale.

Power Laura (1998) \(^{17}\) examines the relationship between productivity, investment and plant age for 14000 plants in USA manufacturing of 1972-88. Growth in productivity is systematically correlated with plant size in employment but there is no overall relationship between investment and productivity or productivity growth. In chemical industry, investment age coefficient is significant across plant regression but plant age is not. Fixed effects (accounts for cross plant and within plant variations and effects) and plant heterogeneity are more important determinants of observable productivity patterns than fixed costs of capital reallocation.

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In Singapore, factor endowments accumulation plays a big role in many industries. Whereas in electronics factor productivity is the driving factor, in primary products industry both are equally important. Given nearly 60% of value-added of manufacturing is generated in the electronics industry and primary products industry, the role of productivity is as important as factor endowments in estimations of translog revenue function for a panel of 7 industries in 19 years from 1974-1992. Under assumptions of Constant Returns to Scale (CRS) and perfect competition the growth rate of TFP equals actual productivity growth. Growth of unskilled labor benefits rubber and wood industry. But primary products industry and manufacturing are skilled labor intensive. Rybczynski elasticities measure growth of output due to growth of factor endowments in an economy. Since Capital (K) is intensively used in chemicals, electronics, machinery, petroleum and misc., where land and buildings are used intensively, productivity is a big factor of growth. For contributions of productivity is constructed as ratio of estimated effect of productivity to the total estimated effects of productivity, factor endowments, prices and fixed effect. Thus contributions of productivity, factor endowments prices and fixed effect are normalized such that the sum of the contributions equals to 100%. Thus 46% of the value-added of manufacturing sector derives from an industry that relies most heavily on productivity as a source of growth. 35% of total value-added of sector is originated from industries that are driven from factor endowments.
2.3 Selected Studies of Indian Industries with the Same Inter-Relations Frame:

Padma Desai (1969)\(^{24}\) related study of industrial growth in context of export demand, domestic final demand, import substitution and intermediate demand at current prices. Shares in Gross Value Added and in gross output at market price and factor cost declined over 1951-63 but GVA of investment goods rose and GVA in raw material and intermediate category had constant shares of 35-40%. In 1957-63, metals and chemicals (intermediate category) with large investment had started yielding outputs. Import substitution in 4 periods accounted for 5-9% of additional output.


Trends in technical progress reveal diversity among industries. Labor productivity has increased significantly in most industries but K-productivity has not. K-intensity explains growth in L-productivity in cotton textiles, ceramics, tanning, sewing machines, etc. The rate of technological change in the growth process of Indian industries was not very significant. The components of technological change that seems to have affected the growth process are K-intensity and factor substitution. In 3 year rolling plan period 1966-68, rate of growth in industrial sector decreased to 1.6 \% p.a. which increased slightly in 1969-70.

Vijay Bhasin and Vijay Seth (1980)\(^{26}\) estimated CD and CES production functions for 27 3-digit and 4-digit major Indian manufacturing industries, commensurate with Dadi for 1950-65.


Brahmananda (1982)\textsuperscript{27} deals with the productivity issue for the Indian economy, a sectoral perspective from classical, neoclassical and empirical points of view and presents a theory of productivity change suited to Indian industries considering the relevance of international productivity experience and its relevance to India. He also deals with controversies on development strategies from the productivity angle and so deals with allocation of factor quantities, relevance of CRS/LDR, disparities in wage ratios at sectoral and temporal levels, ratios of K/O, surplus/K, and the performances of private/public sectors.

He notes that the falling productivity trend is reflected in most commodity sectors and it has moved pari passu with the falling surplus/K ratio. No correlation was noticed between index of F-quantity change and index of TFP change. Sectors where K/O ratio was high showed more factor quantity accumulation, so it was no wonder that incremental K/O ratio rose very high in a short time. The productivity experience of developed countries does not show reversal of productivity index, unlike the case of India. Also, vis-à-vis them, India showed less concern with employment growth, the latter being less than population growth.

Goldar (1986)\textsuperscript{28} estimated Cobb Douglas and translog production functions for large scale registered manufacturing from 1959-1979. His estimates indicate a significantly positive but low growth of 1.3\% p.a. in TFP in Indian Industry. This was low compared to rate of growth in industrial output; similarly low in comparison to similar estimates of other underdeveloped countries. The statistical analysis indicates a strong positive relationship between output growth and productivity growth that is consistent with evidence of other countries. TFP in some modern industries like Basic Metals, Chemicals, Petroleum and Rubber is negative while many traditional industries showed positive growth.

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\textsuperscript{27} Brahmananda P.R.- \textit{Productivity of the Indian Economy- Rising Inputs or Falling Outputs} (1982).
\textsuperscript{28} Goldar B.N.-\textit{Growth and Productivity in Indian Industries}-OUP-1995
\end{flushleft}
The objective was whether meaningful estimates could be obtained for returns to scale, substitution, distribution, efficiency parameters. They observed that: 1-there are inter-industry differences in rate of growth of technical change; 2- there is less scope for factor substitution and the elasticity of substitution is less than unity in most of industries 3- CES seems more appropriate specification for most Indian industries4- most industries experienced decreasing returns to scale and 5- there are inter-industry differences in the pattern of income distribution among factors of production. CD is a better method in case of time trend with biscuit making and nonferrous metals. But ceramics, bicycles and electric lamps CD is better without time trend but CES is better with time trend in these cases. Choice between CD and CES varies from industry to industry.

K L Krishna’s article (1987) reviewed the trends in industrial production and productivity since 1950 to 1986. Industrial output grew 6-fold and average annual rate of growth works out to be 5.5% within these 35 years. Within manufacturing, the organized sector grew at a higher rate than unorganized sector. So growth in industrial employment lagged behind output growth. Traditional industries show better performance than new industries in TFP growth. He points out 2 unsettled issues. They are:(1) - Available estimates of TFP growth have to be reconciled. (2) - Sources of TFP growth have to be analyzed.

J. Ahluwalia’s (1995) ‘Productivity and Growth in Indian Manufacturing’ analyzed productivity and “Industrial Growth in India- Stagnation since the mid-sixties’ analyzed the trends in industrial growth and productivity across 20 two-digit industries and identified the factors for persistent industrial stagnation since the mid 60s. It revealed that a slowdown in growth of heavy industries and low growth in other industries. This observation was caused by low productivity performance in industries due to 4 factors that contributed to industrial stagnation.

They are: 1- slow growth in agricultural incomes and their effect in limiting demand for industrial goods, and in limiting supply of materials, power, etc; and 2- slow down in infrastructure investment, 3- poor management of infrastructure sector, 4- industrial policy framework impacting on a high cost industrial framework. She highlights the deleterious effects of industrial policy regime in 1970s and cites beneficial effects of policy liberalization since mid-1980 when there was a break in manufacturing productivity mid-80s followed by New Economic Policies, reforms in industrial and trade policy.

Balakrishnan and Pushpangadan (1994) \(^{31}\) argued in favor of a separate deflation of output and inputs as components of value added by their respective price indices. This method was critical enough to reverse Ahluwalia’s conclusions of a ‘turnaround in productivity growth’.

J. Mohan Rao (1996) \(^{32}\) deals with method of growth accounting and econometric identification of the production function at any level of aggregation in the first article in ‘Special Article Series’. He addresses critical issues of correspondence between theoretical measures and the indicators to measure it. It shows empirical relevance of B-P’s revisions. They argue B-P procedure is also susceptible to bias but can be bias free through an alternative procedure. Secondly, when non-competitive conditions prevail a return to capital formation modifies bias in conventional productivity measure based on output or value added.

Pravin Krishna and Devashish Mitra (1998) \(^{33}\) investigate effects of trade liberalization after 1991 on productivity. They use an extended Hall methodology that corrects estimated TFP for Solow biases. Using firm level data (1986-93-CMIE data) from four industries electrical, non-electrical, electronics (3-6%), and transport and allowing for changing returns to scale they find some evidence of increase in growth rate of productivity-3-6% in first 3 industries.

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This happens through increased competition as seen in significant reductions in price marginal cost markups in post 1991 period. The traditional X-efficiency argument is invoked to justify these increases. Returns to scale got reduced probably because firms may be operating at smaller scale prior to reforms.

2.4 Theoretical and Technical Issues emerging from Productivity Functions, Growth, Productivities and Dispersal of Industries:

2.4.1 Scale Economies and Technical Progress:

Lakhwinder Singh and K C Singhal (1986) 33 investigates economies of scale and technical change and to locate sources of growth of Punjab large manufacturing for the period 1967-80 using ASI Census sector data. Capital (K) coefficient is found to be very small and is not significant for large manufacturing sector. So main source of growth is Labor (L). Basic metals and alloys industry registered high Capital (K) coefficient. But when a time trend as a proxy to Technical Progress (TP) was included, capital coefficient showed negative values. Neutral TP does not hold. While returns to scale was estimated to show increasing to scale. Electricity has a positive but insignificant coefficient. L coefficient is negative and significant in food products showing decreasing returns to scale. In cotton textiles, basic metals and transport, L-coefficient is negative and insignificant. However, only cotton textile, basic metals, transport and electricity reveal constant returns to scale. Final conclusion is large scale manufacturing shows constant returns. So output growth has been achieved through either one of factor inputs and not through returns to scale or TP. If this pattern and trend are repeated, then every increase in output would mean a greater strain in use of factors and resources and a proportionately higher dose of I is required for every additional unit of output.

34-Lakhwinder Singh and K C Singhal -‘Economies of Scale and Technical Change’ in Productivity- 1986- XXVII, 1, 55-60.
What is needed is increasing efficiency of resources as to improve returns to scale and not greater K/L unless the increasing K/L and resources combination improves Technical Progress (TP).

Agarwal A L (1986) estimated output elasticity of inputs, in turn their marginal productivities, (for example $a^\alpha(Q/K))$, shares in total output ($\alpha$/Sum of coefficients $= a + b + c$) where $a+b+c$ indicates returns to scale ($S$) being increasing ($S>1$), decreasing ($S<1$) or constant ($S=1$) with gamma=1 (unitary elasticity of substitution) for estimated CDPF to 20 industries, with 7 industries of 1967-71 and rest 13 of 1975-80. In 1967-71, some estimated coefficients were negative indicating that increase in input use decreases output.

To overcome problems of multi-collinearity and other econometric problems, pooling of cross section and time series data was done. Regression coefficients computed simultaneously and/or due to fitting regression equations separately. In 1967-71 some estimated coefficients were negative that showed that increase in input use decreases output indicating vegetable and animal oil and fat, cement, etc. at 3-digit level. The estimated coefficients were positive for all 7 industries at 3-digit level. The coefficients of raw materials were positive in all industries but relatively the lowest in Repairs activity. Returns to scale was greater than 1 in Chemicals (IN31) and Transport (IN3). The efficiency parameter ‘n’ was 3.4946. In 1975-80, K-coefficient was negative in jewellery (IN38) and Water Supply (IN42) while being positive for 5 industries. In 1975-80, $MP_L$ was positive in 5 industries of 1975-80 period, implying all 20 industries turned out to be raw material oriented.

Edward Wolff (1991) found that K/L converged over long period though the process was much stronger after 1960. Lowering down of productivity convergence was associated with slowing down of K/L growth. The ratio of TFP to L-productivity growth is a rough measure of contribution of technical change to L-productivity growth. This was 0.57 and the remaining portion was attributable to capital deepening.

Results showed that there is a direct correspondence by period between the degree of K/L catch-up and TFP convergence. This was the strongest in 1950-79 but divergent in 1938-50. Secondly, there is a direct correspondence by period between TFP convergence and average growth in K/L. This was the highest in 1950-79.

Wolff’s paper hypothesized that convergence in L-productivity was due to convergence of K/L over time among the 7 industrialized countries. A positive correlation between TFPG and growth rate of K/L is deducible from the arguments of interaction between capital accumulation and technological advance. This is explainable from embodiment effect, vintage effect, learning by doing, potential technological advance and Verdoorn-Kaldor effect whereby investment growth through demand growth leads to a favorable climate for investment and industrialization. In Wolff, results showed a positive correlation of 0.79 between rate of TFPG and K/L over 1880-1979. Results based on regression and vintage model are mixed but support the existence of interaction effect between technological advance and capital accumulation. Many authors like Wolff, showed concern in possible interaction between processes of K-deepening and technological diffusion. Wolff’s hypothesis is that TFP catch up depends on K-intensity catch up. He presents evidence for USA in terms of positive correlation between TFP growth rate and K-intensity growth rate. Also, after controlling for initial differences in TFP level, he regresses TFP growth rate on initial level of TFP and K-intensity growth rate and finds a positive coefficient. This is an indication of positive influence of capital accumulation on TFP catch-up.

Upender M (1996)\textsuperscript{36} estimated elasticity of L-productivity to find out substitution possibilities of L for K for 1973-90. The proportionate change in L-productivity due to unit or small change in wage rate (W/L) is the measure of elasticity of substitution $\sigma = 1/1 + \rho$ (where $\sigma$ can take any value. $\sigma > 1$ means higher substitution possibilities). Returns to scale is 0.8% and that shows Indian factory sector is subject to decreasing returns to scale. Results show that factory sector is K-intensive.

\textsuperscript{36}Upender M-‘Elasticity of L-productivity in Indian Manufacturing’ in \textit{Economic and Political Weekly (EPW)}, 25 May 1996.
Elasticity is >1 and so there is greater possibility of substitution of L for K. The elasticity of L productivity with respect to wage rate is more than one and so substitution possibilities are high.

Krishna Kumar P. (2000) \(^{37}\) undertook a study for selected five industries (Textile products, Leather, Rubber, non-electrical and electrical machinery, Chemical) at two digit level for time period 1973-93. Net fixed capital stock for different years was estimated by making adjustments for new investment and depreciation for respective years. It was found out that majority of industries faced increasing returns to scale. Electrical and non-electrical show Decreasing Returns to Scale (DRS) but significant rate of TP was 3%. Leather faced Constant Returns to Scale (CRS) and TP was low at 0.0018. But for all the five industries rate of technical progress was positive and it had important contributions to value added.

Hasan Rana (2002) \(^{38}\) uses panel data from 1976-87 on Indian manufacturing to determine the extent to which productivity is affected by both embodied (technology embodied in the capital goods that firms use) and disembodied technology (technical knowledge).

The productivity enhancing effects of new domestic capital goods however appear to be more broad-based. They are found to exist in a wide range of industries and not just the scientific or technology intensive ones as tends to be case for imported disembodied technology and imported capital goods. The analysis reveals that the productivity benefits of domestic capital goods appear to stem in least in part from the disembodied technologies imported by domestic capital goods producers.

Capital formation can exert two effects on L productivity. 1- by raising K/L ratio it will raise L-productivity even if there is no advance in technology use. 2- through interactions with technology advance K accumulation may be associated with gains in productivity over and above capital deepening.


Sengupta D. N. (1999) 39 reviewed the process of growth in Indian manufacturing in 1980-90 through 12 three digit industries and examined the inter-linkages between growth and elements of productivity, demand, cost, prices, investment, employment, structural change and balance of commodity trade. Results showed that growth in the decade period was policy induced and that growth in consumer and non-consumer goods industries was demand induced growth that pulled up output of capital and intermediate goods. Productivity increased in response to output. After reaches 3.7%pa, productivity increased by 1.4% for every 1 % additional growth in output similar to I. J. Ahluwalia study (1991-p-131-40).

**Section 2.5 Studies dealing with Industrial Growth and Dispersal:**

V. Nath (1971) 39 reviewed policies relating to regional development in the Five-year Plans especially in relation to state levels of economic development and rates of economic growth. He confined the analysis to states due to almost little availability of data for lower level administrative-economic units. His conclusion was pertaining to agriculture growth and modernization, rather than industrial patterns. However, even there, the west and south states did rather well than the east and north-central states. He throws some light on industrial location and development of backward regions. Demands for additional resource allocations and special measures of relief of backwardness have come from an increasing number of backward regions.

But in the first 3 plans, despite ‘intentional’ roles given to infrastructures and social services, additional funds could not be provided. Financing was to be from state plans. In mineral resource belts, central investments were made. But the backward regions of Bihar and UP, a total of 80 million people were in districts classified as being at the bottom or next level of development. These backward districts had 45% of total all-India population of such districts.

These two states contiguous with MP and Orissa is the ‘backward heart’ of India. UP had the lowest per capita state plan expenditure under the first 3 Plans. Demarcation of backward regions using uniform criteria is essential for objective assessment of the magnitude of the problem of backwardness to remove complaints of differential treatment. The need for transfer of financial responsibility arises from the inability of states to undertake effective action.

In his first article in EPW, Nath showed the ambivalence of planners on locational problems. While advocating industrial dispersal, the planners avoided advocating licensing power to be used for locational purposes (table 1 col-16 Regional development in Indian Planning). He noted that the most rapid development had taken place in the developed states of Maharashtra, West Bengal and Gujarat. This was the case in 3rd and 4th plan periods. The flexibility due to new technological developments had made many industries footloose. It was noted that the large land requirements for assembly line production induced industries to seek locations in peripheral regions. But Maharashtra had sought to prevent concentration of industries in Bombay and direct industrial growth to less developed regions through construction of estates and financial incentives. Need for a comprehensive policy for industrial location was stressed in the study.

M. L. Pandit’s (1974) paper throws a new dimension into the dispersal issue. He divides the growth effect to regional effect and compositional effect and concludes that correlation between regional effect and state’s industrial growth rates show a positive and strong relationship while no relationship emerges in case of compositional effect in relation with states’ growth rates. Out of 17 states taken for study, regional effect is positive for 11 states in all time periods. But one of his policy conclusions that only when full employment is attained in each state was efficient allocation of industries a viable strategy. The reason is industrial dispersal itself must fulfil the goal of full and productive employment.

Kelkar V. L. and Kumar R (1974)\(^{41}\) showed that the sustained period of inward oriented industrialization was associated with high levels of concentration due to lack of medium range enterprises and a poorly developed SSI. The 1980s witnessed changes in industrial structure. Earlier, the metals related industries in north-eastern industrially underdeveloped regions dominated. But in 1980s, chemicals and consumer durables became engines of growth.

Somayajulu, V. V. N. (1980)\(^{42}\) wrote a Resume of India’s Industrialization for a century of 1879-1978 that identified reasons and facts for distribution of industrial trends. Industrial Stagnation and Industrial Recovery were covered during the Pre-Planning and Five-Year Plan Periods including the Rolling Plan Period.

He wrote that industrial output on 1960 base was 5.5% p.a. for a decade ending 1965-66, but later on pulled down to 0.2% in 1966-67, 0.5% in 1967-68 and a recovery of 6.2% in 1968-9. Cotton textiles showed lower growth than all industries taken together. Silk and synthetic fibers increased their output faster. Import substitution of synthetic fibers caused decline in cotton textiles. Bank rates were reduced from 6% to 5% to ease industrial investment.


Industries were allowed to diversify their output up to 25% of their licensed capacity without need to securing license. Tax incentives were provided in Central budget of 1968-69 to promote private investment and exports. But there was no increase in capital formation in private sector. Price index of raw materials rose after 1967 by 20.9%. Steel shortage was a bottleneck to engineering production. Demand for rail wagons decreased. In 1968-70, food manufacture, leather, footwear, made up textile goods, transport equipment faced recession. Supply bottleneck was noticed in oilseeds, raw cotton, steel, non-ferrous metals, coal, cement.

Somayajulu (1974 and 1976) 43 & 44 Structural Changes and growth rates in industrial sectors are reinforcing to each other over plan periods that value added in modern industries received later and greater importance than in traditional industries. Output of tobacco, petroleum, chemical, showed higher growth in Small Scale Sector than those in Large Scale Sector in 1961-65. But textiles, food industries, electricity generation led the resurgence after 1965-67 (Somayajulu, 1974, 1976).

Dinesh Awasthi (1982) 45 used various measures of inequalities such as Standard Deviation of Logarithms, Gini Coefficient, Theil’s Inequality Index and H-H Index for all years between 1961-1978 (except 1972) using ASI data for Fixed Capital, Employment, Value added. 1970-71 was taken as the base year and all the important states were covered. All indices showed reduction in inter-regional inequality though the trend was not smooth as in 1969 and 1978.

Uday Sekhar (1982) examined trends in interstate distribution of industry in India during 1961-75 and determined whether disparities had been increasing over time or not. Comparing the ratios for 1976 he found that Maharashtra, West Bengal, Gujarat, Tamil Nadu had above average manufacturing value added/Net Domestic Product (VAM/NDP). In 1961, these states along with Delhi but not Tamil Nadu were more industrialized. During 1961-76, manufacturing sectors of other states have been growing at a faster pace relative to NDP and so a trend towards equalization of state VAM/NDP is noticed.

Between 1961-1969, decline was manifested in Orissa, Madhya Pradesh, Bihar, Karnataka due to heavy investment in K-intensive public sector. In unorganized sector too, Coefficient of Variation. showed a decline of 84% to 61% between 1969 and 1978.

Another major study of industrially lagging state of Andhra Pradesh during 1956-1970s (nearly two decades of Planning) emerges from an ICSSR sponsored study by V.V.N. Somayajulu.

The study examined technical parameters of industries through estimation of Production functions, TFP and regional dispersal in large through large versus small and recast those findings for testing the explanation of mid-sixties Indian Industrial retrogression. His study shed light on the institutional financing aspects of AP Industrial development. He made an economic evaluation of the role of APSFC, APIDC, APSSIDC, APIIC, All-India Financial Institutions, Role of Central and State Investment Subsidies.

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Small-scale industries contributed better than large industries in AP State and in backward districts of AP to regional dispersal, employment generation and growth after 1970s prior to which period of two decades no industrialization took place. Large-scale industries in Metropolitan cities, hinterland picked up momentum of growth after 1980s. The fundings were supported by role of APSFC, APSIDC, APIIC and APIDC.

The study analyzed the trends in sanctions and disbursements of finances to different industrial activities of small, medium and large-scale industries and to what extent of regional dispersal those lendings and priorities were given by APSFC. Similarly, the role of APIDC in respect of above aspects along with the aspect of entrepreneurial development is discussed. Despite the drawback in data coverage, it discussed plan allocations, production performance and an evaluation of study of joint sector units in equity participation problems of marketing and raw material procurement by APSSIDC and other corporations and financial institutions were analyzed. Performance of APSSIDC depended on tact and alertness in co-ordination and in making the relevant Bodies understand the spirit of co-operation for small industry promotion, lack of co-ordination seems to be the cause of failure of APSSIDC. Despite the paucity of data, Industrial Estates (IE) and Industrial Development Areas (IDAs), their role for regional dispersal, occupancy ratios, voluntary loan contribution by APIIC along with suggestions for locational improvement were analyzed. Role of All India Financial Institutions, the scheme-wise sanction of IDBI and IFCI for AP industries in backward areas, advances on project financing scheme by providing equity, modernization, underwriting guarantees is noted. ICICI’s promotional and investment role and Commercial banks industry-wise and district wise credit allocation to help SSI’s and role of AP non- resident Indian Investment Corporation were also analyzed. Role of central and state investment subsidies for tribal development blocks and backward areas, industry-wise disbursement, was analyzed. A suggestion for all these explanation and studies was to prefer industries with higher regional linkages and its L-intensive-ness for generating employment in backward areas too and industrial capital and material linkages to be preferred for overall growth of industries in AP.
R Nagaraj (1994) \(^{48}\) studied relationship between employment, capital intensity and wage rate for 1973-87 for 42 three-digit registered manufacturing industries. His point of departure was from Isher Ahluwalia’s 1992 study (p-82-3) that identifies consumer non-durables as accounting for bulk of decline in employment with maximum increase in capital intensity and maximum increase in real wage rate in the relevant period.

Nagaraj differs in the explanation offered by Ahluwalia, Lucas and World Bank study. He believed that structural changes in favor of unregistered sector and also movement towards SSU within registered manufacturing were the cause of declining employment in registered factory sector.

Moreover, it postulated a compositional change in output towards L-intensive industries as overhang of employment in 1970s stagnation, restriction on fresh employment in large factories, contracting out and greater use of part time workers. Methodologically, in time series data of 42 three-digit industries, to minimize auto-correlation problems, the first difference in each series is correlated. In 9 of the 42 industries the postulated relationship is statistically valid with the expected sign for estimated coefficients.

But the results across the variants explored show lack of consistency with insignificant coefficient sign. Thus the results suggest that the relationship among the three variables is more complex than postulated.

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Anuradha and AVVSK Rao (1995) showed that the process of industrialization was characterized by an inequality in its spatial distribution. Interstate disparities in relative terms tended to decline during 1971-86. Developed states experienced decline in their share of employment and productive capital while backward states showed increase. in Theil’s index while H-H Index showed a decline in value added, employment and value of output. Per capita productive capital, factory employment per thousand of population weighted and unweighted interstate CV also declined for all 15 states.

Jeemol Unni, N Lalitha and Uma Rani (2001) analyzed trends in growth and efficiency in utilization of resources in Indian manufacturing before and after the reforms during 1978-95 with the break year at 1989-90. They gave a regional dimension to the repercussions of reforms by analyzing organized and unorganized manufacturing in Gujarat during the same period.

They concluded that growth, value added and capital increased after reforms and especially so in the consumer durable goods sub-sector in organized sector. However, Total Factor Productivity Growth (TFPG) in Indian organized and unorganized manufacture showed decline. Growth in unorganized sector peaked in 1978-85 but decreased later. The authors concluded that perhaps large organized sector is better equipped to deal with competitive conditions arising out of the reform process. The pattern of growth in Gujarat’s both sectors were similar. Gujarat did better in terms of value added for both sectors than all India. Employment growth in both sectors at regional and national levels was higher. But employment growth in unorganized sector in Gujarat was higher than India for both periods; though in case of organized sector result was different. Growth in capital intensity (K/L) ratio was relatively high in both sectors at national and regional levels leading to a negative growth in K productivity in the entire period. In the reforms period there was a sharp increase in K intensity in both sectors at All India levels and Gujarat. But in reforms period K/L declined leading to increase in K productivity in Gujarat.

However, TFPG in Gujarat for both sub-sectors was positive. Also basic and intermediate sub sectors grew rapidly in the reforms period. This was attributed to growth of physical infrastructure development in 1980s.

V. Surender (1986)\textsuperscript{51} work on growth and dispersal took two points of time 1961 and 1978-79 and analyzed Location Quotient and Coefficient of Localization. His database is the three digit industries of ASI Census reports. Out of 21 industries, 11 were highly localised. Uneven distribution of industrial activities is ascribed to uneven distribution of productive resources and lack of cheap transportation facilities. Agro-based industries were located mostly in south and non-agro in Bihar, Maharastra, West Bengal and Union Territories. Localization Quotient showed wide dispersal. They are in electric light and power, non-ferrous basic, electrical machinery and industrial machinery. LQ of $>1$ is seen in transport and rubber. Basic and capital goods showed tendency towards backward locations. His hypothesis that the higher the growth of industries, higher the dispersal and vice versa was empirically verified. But cement and petrol also show high dispersion but low growth and so LQ studies are not deemed conclusive. Combined effects of initial concentration and growth of industry is significant at 18 degrees of freedom.

Rohit Desai (1986)\textsuperscript{64} analyzed results over two points of time-1964 and 1980-81 using census level data. He wrote that the process of diversification has gained ground across states. He also related the level of diversification with economic development by estimating rank correlation coefficient between indices of urbanization, infrastructure, investment in mining, manufacturing, small-scale units at state level. State level industrial diversification was studied by analyzing state level coefficient of specialization by using employment data for organized manufacturing. His conclusion was that there was no significant change in spatial industrial diversification in 1981 over 1964. Majority of states showed specialization. But regional development indicators were positively related with spatial diversification.

\textsuperscript{51- V. Surender-‘Indian Industries’- BR Publishing Corporation in Ch-5- 1986.}
\textsuperscript{52-Desai Rohit-Changing Pattern of Regional Industrial Diversification- A comparison over time –Indian Journal of Regional science (IJRS)-Vol.-18, N-1, 1986.}
Jayadevan C M (1995) 53 analyzed interstate variations in the rates of growth of employment in organized industry as a whole and in 17 individual organized manufacturing industries in India during 1976-88 for 15 states and tried to explain causes of interstate variation in employment. He studied 195 three-digit industries. Large employment growth rate differentials across states were noticed due to disparity in the growth of real output. No significant impact of real wages per worker on the employment growth rate was noticed except in cotton textiles for 1976-77 and beverage, tobacco and nonmetallic mineral products for 1987-88. Interstate variations in value added growth rates are significantly explained by varying magnitudes in industrial disputes and consequent number of man-days lost in various states. Employment in organized industry can be promoted by removing labor market distortions.

K. Rana (1988) 54 writes of uneven development at inter-state level. There was centralization or concentration of industries till 1976 when Maharastra, Gujarat, West Bengal and Tamil Nadu contributed 57.37% of value added. ASI 1978-9 revealed the domination of developed states in industrialization. On the criteria of domestic consumption of electricity per capita, Punjab showed 29.8kwh followed by Maharastra at 28.4Kwh and Haryana at 19.9kwh but in HP it was 15.5Kwh in spite of fact that it was used for temperature regulation. In backward states, the most serious constraint on development was constraint of finance.

Vijay Seth (1987) used data on CMI-ASI from 1951-81 to test convergence hypothesis and interstate spatial pattern of industries. He used relative share of the region in total population as proxy for size of states. He used Hoover measure, Zelinsky-Fuch measure, Grossack’s measure and the measure of changes in the significance of regions. These measures showed that process of industrialization was accompanied by inter-state convergence in India. Finally, it was pointed out that institutional and technological spread of agriculture is important for spread of industry.

Sunil Kumar (1999) analyzed productivity variations across states and found that there is no convergence in Indian manufacturing in a regional context in the period 1969-94 using ASI factory sector data. The fall in total factor productivity (TFP) in industrially developed states may be due to obsolete capital aging infrastructure, deteriorating urban environment and failure to upgrade technology. But the deregulatory framework in 1980s helped impart positive effect on TFP growth at aggregate and regional levels except West Bengal and Orissa. Results also suggested that the government policy of balanced regional development has helped the lagging states in raising their manufacturing productivity.

2.6 Research gaps and Post Reform Phase:

Mohan Rao (1996) made many methodological changes. His real productive capital is measured as a sum of working capital deflated by manufacturing WPI at 1960-61 prices and fixed capital at replacement values also at 1960-61 prices. He showed that the trend rate of growth of TFP was 2% for entire period. But it was high at 5.5% in 1973-81 and −2.2% in 1981-93. The contribution of productivity growth to value added growth was 33% for 1973-93 but 52% for 1st period and −96% for the 2nd period.

Thus he differs form Ahluwalia’s conclusions in that there is a turnaround in 1980s in the negative direction. But TFPD for Mohan Rao and Ahluwalia is same. Mohan Rao’s TFPD shows movement from positive to zero growth. In the Indian manufacturing TFPG with double deflation showed less bias though this may not hold true in general.

Mohan Rao uses Gross Value Added to find out total productivity growth (TPG) for 1973-93. The results of aggregated manufacturing differ from earlier studies in that industrial performance in 1980s did not show improvement compared to 15 years before. Real value of output growth based on ASI data show growth rate of 6.9% pa for 1973-93. But real value added growth rates are much different when this period is divided into two sub-periods though this is not the case in real value of output growth rate calculations.

Sandeep Kumar (1999) confines his analysis to intra-state and inter-district analysis of industrial development and dispersal. Over the time period of study (1971-91) in 1988, only chemical product groups exceeded other major industry groups in terms of labor productivity and capital intensity. Agro-based industries showed increase in their share of total factory workers but the share of capital investment and value added declined. Size structure showed shift in favor of small and medium size industries in general (86% in 1988). Analysis of H-H and Theil’s index showed upward trend in the concentration in value added over 1967-68. The author has also shed light on fiscal incentive structure and institutional financing both for backward and non-backward districts.

Sumit Majumdar (1999) 59 analyzed productivity trends in Indian Industry for 1950-93. Productivity is measured using a linear programming based technique called Data envelopment analysis (DEA). His results showed that in 1950s, industrial efficiency was relatively high; in the 1970s there are retrogression and in 1980s, patterns reversed to a great extent. But in 1990s efficiency peaked showing that reforms were working well.

Dhananjaya R. S. and Sasikala Devi, N. (1998) 60 provided and assessed behavioral characteristics of TFPG in an 18 2-digit inter-industrial framework to see how efficient use of technology accounts for rapid growth in certain categories than others. Kendrick, Solow and Divisia indices are estimated for 1973-94. While overall trends in TFP growth rates affect output expansion with lag of 1 or 2 years depending upon nature of policies adopted, Divisia index of TFP has yielded better rates of technical efficiency and so higher rates of output growth.

In 1980s, Divisia did not show better in any group vis a vis other periods. But in 1990s, Divisia showed higher results in two digit industry numbers such as 23—25-26 in traditional sector and 30-31- 32-33-35-36-37 in non-traditional sector. For overall case, Divisia showed higher in 32-38-23—36-25-35-30-31. But generally, TFP contributions to output growth have yielded low magnitudes though during inflationary spurs in mid 70s, late 80s and early 90s TFP showed higher magnitudes. expansion in the rest was higher in early 90s than previous periods. Only in 35 group, Solow indices showed higher than base year’s unitary magnitude. Among 3 estimates, Divisia index recorded values greater than one in most years of study for all non-traditional categories. Kendrick index of TFPG showed higher rate of output expansion (>than base year value of 1) prevailing in 70s, 80s, 90s. w. r. t. 20-21, 25, 26, 38 industry groups. Using Solow, TFP in 70s was higher than 80s and 90s in all traditional categories except 20-21 and 29 groups. Non-traditional groups showed higher values in all except 35, 37.


Kaplinsky Raphael’s (1997) paper reviews changing strategic perspectives from inward orientation towards a liberalized scenario (in two phases) and the consistent performance of the Industrial sector in post 1947 period. It concludes that given poor productivity performance, most studies that have been undertaken of Indian Industrialization have been macroeconomic in nature and that there has been a poor tradition of microeconomic research into the determinants of industrial competitiveness.

Some forms of industrial development especially those based on cheap labor are only sustainable with a depreciating exchange rate as countries engage in a competitive process of devaluation to lower dollar wage rates. This does not lead to income growth. So also is the case when production is performed behind closed doors. The border price value added in industry, i.e. value of industrial output, when calculated at the cost of imported equivalents, can be much lower than when it is computed at domestic prices and then converted into international units of account through exchange rate. Given India’s commitment to distribution concerns that has long been a central objective of industrial development. This poses challenges in balancing needs for sustained income growth, international competitiveness and equity in distribution that led to the policy framework towards 1- Development of heavy industries; 2- State to control monopolies; 3- Import substitution to be a key strategy 4- promotion of SSI. 5- The trend towards opening of industry’s economy that requires change in pace and quality of industrial development. It is seen that competition in product markets is no more based on costs than on a combination of costs and product quality differentiation and innovation.

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The divergent nature of results from Studies of Mohan Rao, Snadeep Kumar, Sumit Majumdar, Dhananjaya and Sasikala is an incentive to probe further into the problem of Industrial Productivity to understand the causes thereof. TFP in Indian Industry in these above cited studies shows a rising trend. To Kaplinsky, lower TFP figures has not enabled researchers to develop a strong micro-economic foundation of productivity studies in India. While the differential TFP figures of many researchers on Indian Industries is an incentive to further probe into nature of TFP figures obtainable in Indian Industries, this thesis probes further into the possible links between productivity, growth and dispersal measures in Indian Industry that can be one of the foundations to develop a tradition of micro-economic research in productivity and growth in Indian Industry for fulfillment of objectives of regional equity in Indian Industry.