P: ISSN NO.: 2321-290X RNI : UPBIL/2013/55327 VOL-6* ISSUE-2* October- 2018
E: ISSN NO.: 2349-980X **Shrinkhla Ek Shodhparak Vaicharik Patrika**

Inter Sectoral Linkages and Key Sector Identification in Haryana Economy

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Abstract

In India, the Green Revolution state Haryana by over-specializing in agriculture, have provided the much needed food security to the country and have achieved higher levels of per capita income, but have failed to create pre-condition for effective transition primary to secondary sector to tertiary sector. In this context, the work is an attempt to analyze the structural transformation and inter-sectoral linkage in Haryana economy using input-output analysis based on recent input-output table provided by CSO.

Keywords: Structural Transformation, Input-Output, Inter- Sectoral Linkage, Haryana, Green Revolution.

Introduction

The term economic development is far more comprehensive. It implies progressive changes in the socio-economic structure of a country. Viewed in this way economic development Involves a steady decline in agricultural shares in GNP and continuous increase in shares of industries, trade banking construction and services. Economic development is a complex phenomena; it cannot be explained satisfactorily in terms of labour and capital alone. The modern economists emphasize the catalytic role that technological changes play in the growth of an economy. Technological change in an economy, therefore, refers to change in the input-output relations of production activities. Consequently, as the economy moves from lower to higher stages of development, there occurs a shift from simpler to more modern and complicated techniques of production on the one hand and from primary to secondary and/or to tertiary sectors on the other. The growth of tertiary sector coupled with state-of-the-art technology has got its own implications for the future development patterns of the system.

Structural change in India is indicative of the fact that the share of tertiary sector in the gross domestic product has crossed the fifty five percent marks. This change in Indian economy since independence is not evenly distributed in all geographical regions. The decade of 1990s witnessed major policy changes in the Indian economy and its State/Union territory economies. Each state of the Indian union is different in terms of its natural, social, political and economic features. Therefore, the pattern of growth of each sub-national unit is unique. In India, the Green Revolution state Haryana by over-specializing in agriculture, have provided the much needed food security to the country and have achieved higher levels of per capita income, but have failed to create pre-condition for effective transition to secondary and sector and to tertiary sector. In this context, the work is an attempt to analyze the structural transformation and tertiary

Review of Literature

Review of literature is a powerful tool which provides useful in sight into the subject matter of research. It helps the researcher to know about the aspects of the research problem, which have not been duly covered by earlier researcher. It helps in better understanding of concept, earlier history; empirical review of the research work related to present study and provides detail insights about research gaps.

Gill (2005) showed that structural transformation in Punjab economy during 1960s brought a drastic change in the life of people. Initially the GR technology has raised the productivity of both wheat and rice significantly. Per capita yield of wheat has increased from 2095kg per hectare during 1967-68 to 4530 kg per hectare in 1969-70 and in rice from 1392kg per hectare to 3335kg per hectare.

Gill & Singh (2006) also discussed growth and structural change in Punjab economy during the green revolution period. Study showed that although state-led green revolution in Punjab has increased income of

farmer irrespective of farm size and catapulted it to the status of being called the grain bowl of India. But it was short lived. The growth rate was nearly 5 percent per annum of the NSDP during the period 1966-67 to 1998-99.

Baker & Jewitt (2007) analyzed the experience of 35 years GR technology in the three villages of Bulandshar District western UP. Study showed that in three villages' i.e Sabdalpur, Kurwal Banara and Chirchita that, impact of GR was extremely positive because higher yields brought food security for all area with financial security.

Jodhka (2012) discussed the position of attached labour in two villages of Karnal district of Haryana after green revolution transformation in mid sixty. Study showed that success of green revolution technology confined to some pockets.

Mukherje (2012) showed that services sector emerged as the fastest growing sector of economy after reform era. Rising urbanization, privatization and demand for services provide a boom to growth of sector and contributed 59 per cent in GDP of Indian economy in 2011-12.

Bandral (2014) made an analysis of Indian services sector through its contribution in GDP, employment and FDI inflow for the period 1950-51 to 2009-10. Study explored that Indian economy follow a unique path as services sector has grown at a rapid rate in comparison to industry and agriculture sector since independence. Agriculture sector contributed 56 per cent in GDP and industry and agriculture have a share of 14 per cent and 30 per cent in 1950-51 and agriculture share fell to 14.6 per cent and industry sector share rose to 28.1 and services have share of 57.3 per cent in 2009-10.

Lal (2015) looked into growth pattern of services sector in comparison with agriculture and industry in terms of employment share and GDP share for Indian economy as well as for world for the time period 1950-51 to 2012 using data from ILO, ESCAP, Economic Survey, Various Issues and Government of India. Cross country evidence showed that share of agriculture and industry in national income is declining while services sector is reflecting increasing trend and more people is employed in it.

Tariyal (2016) explored structural change with changing composition of growth of Indian economy during 1981-2012 using data source National Account Statistics, CSO. The main findings of the study were that three sub sectors namely trade, restaurants and hotels, transport, storage and communication is consistently growing sub sectors of services sector. On the other hand agriculture despite failing in growth was major contributor of employment and provided employment to more than half of the work force of the country.

In conclusion review of literature is indicative of the fact that, most of the studies done are too aggregative and lack in tracing the regional specificities of the dynamics of structural change. On the theoretical and empirical plan there is no dearth of studies; but as far as inter-sectoral linkage and key sector identification in the predominantly agrarian economy is concerned, there are very few studies and shows an ample scope of research of particular theme.

Objectives of the Study

The broad objective of the proposed work is to examine structural transformation in green revolution belt with special reference to tertiary sector development. In consonance with the broad objective, the specific objectives are as follow.

1. To delineate the existing broad economic structure of the region at an aggregate level.
2. To identify the key sectors and linkage patterns with regard to tertiary sector in the region.
3. To prescribe a policy framework for proposed transformation.

Research Methodology

The non-survey method could be put into three groups – the quotients approach, the commodity balance approach and the use of iterative procedure, this study attempts to generate regional input-output table for the state of Haryana by following the quotient approach. All these methods make use of the national input output table to arrive at the regional table. By quotients approach is meant the use of location quotients – LQs. The basic assumption in all these models is that the national technical relationships hold good at the regional level. The regional trade coefficients are different from the national technical coefficient to the extent to which goods and services are imported from other regions. This implies that the national technical coefficients $\mathbf{a}_{ij}^{N}$ is equal to regional input coefficient $\mathbf{a}_{ij}^{R}$ plus regional import coefficient $\mathbf{m}_{ij}^{R}$. Thus, the regional trade flows are estimated by assuming that $\mathbf{a}_{ij}^{R} = \mathbf{LQ}_i \, \mathbf{a}_{ij}^{N}$ subject to **LQ**i is less than or equal to unity. The $\mathbf{LQ}_i$ gives a measure, which, reflects the relative importance of regional industry in comparison to its national counterpart and it is calculated as the ratio of regional output to the national output share of each industry/sector. The recent available input-output transaction table (130x130 sectors) at the national level for India pertains to the year 2007-08 prepared by CSO, India. Keeping in view the nature of economy and the availability of data, a 50 sector disaggregating has been finalized for the regional exercise. First step in the formation of regional input-output table is to aggregate the national level 130 sector input-output table in to a 50 sector input-output table. This 50x50 flow table is then converted into an input-coefficient table by dividing the sector-wise columns with their respective output. This coefficient table forms the basis for computation of regional input output table for Haryana using the location quotients. As explained in the above discussion, there are several formulations to arrive at the location quotients but Flegg et al.'s formulation gave the best estimates.

The calculations of location quotients require sector-wise ratio of sect oral output to total output at regional as well as at the national level. This can be computed from Gross State Domestic Product at Factor Cost (GSDP_FC) at current prices but the state level GSDP_FC is not available up to 50 sector level disaggregating. State level, agriculture related disaggregated data has been obtained from the office of Economic and Statistical Organization (ESO),

Haryana respectively. Annual Survey of Industries (ASI) data have been used for arriving at the share of regional manufacturing related sectors in the GSDP_FC at a required level of disaggregating level. The national sect oral shares have been computed using the GDP data from 'National Accounts Statistics', CSO Sector-wise final demand categories are calculated using different data sources. Sector-wise Private Final Consumption Expenditure (PFCE) is calculated by using the monthly per capita consumption expenditure given by NSSO Surveys for 2007-08.

Along with rural and urban population for year 2007-08 calculated from population census statistics of year 2011. Government final consumption expenditure has been derived from 'State Finances' published by RBI and has been allocated at the rate in sect oral shares. First approximation of other final demand categories like gross fixed capital and changes in stocks have been obtained from ASI and allocated to respective.

Results and Discussion

Input-output framework is a convenient way to analyze a huge mass of data and explores the underlying disaggregate structural relationship in an economy. First, the analysis has been carried out at aggregate level and then it has been elaborated to fifty sector desegregation level. At aggregate level, the input-output structure and linkage patterns have been analyzed for three sectors namely primary, secondary and tertiary sector. Same exercise, for finer details of dynamics, has been carried out at the level disaggregation level for fifty sectors.

Table 1: Sectoral Deliveries of Output in Haryana Economy

Economy Sector	Primary Sector	Secondary Sector	Tertiary Sector	Total Intermediate Input	Total Final Use	Gross Value of Output
Primary Sector	8045	7890	1	15936	9204	25140
Secondary Sector	8548	13809	9237	31593	7860	39453
Tertiary Sector	3268	13019	26478	42766	18811	61577

Source: Author Calculation

The sector-wise output structure can be best elaborated by the analysis of transaction coefficient matrices of Haryana and Punjab economy.The economy has been divided into three broad sectors, namely, primary secondary and tertiary to analyze the nature of structural process of economy. Table 1 gives the inter industry utilization of output of different sector of the economy in absolute terms and in terms of technical coefficient matrix. Table represents the interdependence among three broad sectors of economy. All entries in table are in appropriate units, in crores of rupees. Each sector appears in row and column. The row shows the sales called output that each industry output to others and column shows the purchase, called inputs that each industry takes from others. The table reveals that gross value of output of primary sector is R 25140 crore in which primary sector keeps R 8045 crore output for itself to produce next worth and it sells R 7890 crore output to secondary sector and one crore rupees output to tertiary sector and total final-use output is R 9204 crore in the same year.

Secondary sector contributes R 8548 crore and R 9237 crore to primary and tertiary sector, respectively; whereas for itself, it has R 13809 crore output as an input. The final demand output of this sector is R 7860 crore rupees. Tertiary sector, with output of R 61577crore output, supplies R 3268 crore output to primary sector, R 13019 crore output to secondary sector and it keeps R 26478 crore rupees output for itself and it supplies to R 18811 crore worth output to final demand category. Reading down the columns, we can observe that for producing R 25140 crore of output, primary sector used R 8045 crore inputs from itself, R 8548 crore from secondary sector and R 3268 crore from tertiary sector; whereas secondary sector is getting R 7890 crore inputs from primary sector and R 13019 crore input from tertiary sector in year 2007-08. Tertiary sector is purchasing a small amount of inputs that is one crore rupees from primary sector and a large inputs worth that is R 9237 crore rupees from secondary sector economy. *In short figures depict the structure of inter-industry relations in an economy as well as other forms of disposal of the output of each sector. Figures also represent that secondary sector has more backward and forward linkage with both remaining sector primary and tertiary sector whereas tertiary sector has lower linkage relation with primary sector*.

Table2: Input- Output Transaction Coefficient for three Broad Sectors of Economy

Sector	Primary	Secondary	Tertiary
Primary	0.32	0.20	0.001
Secondary	0.34	0.35	0.15
Tertiary	0.13	0.33	0.43

Source: Author Calculation

Table 2 shows the transaction coefficient matrix for economy. As input coefficients show the number of unit of any industry's output needed to be produced one unit of another industry's output. In other words, input coefficients explain the amount of raw material needed by an industry from other industry to produce a one unit of output. Each sector appears in row and column. Here, column represents the purchases of inputs made by a sector from different sector to produce one-rupee worth of output. The breakup of intermediate inputs into three broad sectors represents the structural change in an economy.

Following the row illustration, out of total intermediate inputs of primary sector in economy, primary sector keeps 0.32 as input for itself and it sells 0.20 to secondary sector for output generation and tertiary sector uses a very low share of 0.001

from primary sector. It means secondary sector uses higher share as compared to tertiary sector, as an input, from primary sector in the economy. The analysis of deliveries of the secondary sector shows that secondary sector keeps a lion's share for itself that is 0.35 for further production process and it sells to 0.34 to primary sector as an input to itself and tertiary sector again has a low share of 0.15 from secondary sector. Analysis of tertiary sector deliveries shows that it uses 0.43 of its output for as an input and it sells to 0.33 to secondary sector and 0.13 to primary sector. In short, table shows that it is secondary sector which is playing crucial role for the growth of primary and secondary sector in the economy. Table also depicts purchase share of different sector. The primary sector purchases 0.34 shares, to produce one-rupee worth of output, from secondary sector and 0.13 from tertiary sector. On the other hand, secondary sector is purchasing 0.20 shares from primary sector and 0.33 from tertiary sector for producing one unit of output. Tertiary sector is using 0.43 shares for itself, 0.15 from secondary sector and a very low share of 0.001 from primary sector to generate a unit worth of output.

It can be observed that all the sectors use a lion share of their output as an input whereas small worth output is sold to other sector in both economies. Table also reveals that it is secondary sector which is playing dominating role in both backward and forward direction in the economy. The tertiary sector has a poor backward linkage with the other two sectors. In terms of forward linkage effects tertiary sector has a poor linkage with primary sector which is the backbone of economy in both the states. Tertiary sector is growing more or less like a stand-alone sector as far as input side is concerned and on output side it has significant delivery linkage with secondary sector in the state.

Linkage Analysis and Identification of Key Sectors

The original Keynesian multiplier examines the impact of level of investment on total income. On the contrary the Leontief input-output model enables us to analyze the impact of change in investment in one sector upon the output of the other individual sector. The value of multiplier differs from sector to sector and depends upon where the initial impact is directed (Richardson, 1972). Input-output technique developed by Leontief (1956) is an important analytical tool to understand and grasp the nature and degree of integration of an economy.

The Leontief static open input-output model is represented as,

$A X + C = X$ . .(1)

$(I-A) X = C$ . .(.2)

$X = (I-A)^{-1} C$ (.3)

Where A is a (50x50) technical coefficient matrix or fixed input coefficient matrix. The elements of A, i.e., $a_{ij}=X_{ij}/X_j$ and $(I-A)^{-1}$ is Leontief inverse. The element of the technical coefficient matrix A indicate only the direct requirement per unit of output while the elements of the matrix $(I-A)^{-1}$ give both direct and indirect requirements per unit of output. The forward linkages and backward linkages in Leontief framework measure the degree of integration of a particular sector with the rest of economy. While studying the structure change in Denmark, Rasmussen (1956) developed the measurement of the industrial linkage using Leontief inverse matrix. Hirschman (1958) used Rasmussen's indices for identification of key sectors in his analysis about disequilibrium development strategy.

Backward Linkages (Output Multiplier)

The $(I-A)^{-1}$ is called the "Leontief inverse" or "total requirement" matrix and is used to find the total linkages in the economy. Rasmussen (1956) uses the sum of column of the Leontief inverse matrix to measure the both *direct and indirect backward linkages.* The total backward linkages show the total inputs requirement for a unit increase in the final demand for the j^{th} sector. It is defined as,

$BL_j = \sum K_{ij} = B_j$

Where, BL_j is the backward linkage of sector j as per Rasmussen's Method; K_{ij} is the ij^{th} element of Leontief inverse matrix; and B_j is sum of column elements of sector j and n is number of sector.

Forward Linkages (Income Multiplier)

The effects from supply side of input-output model are called forward linkage. Forward linkage shows the relationship between the total output of a sector and sale of its output as intermediate input to other sectors. The measure of forward linkages in demand led model is defined as the row-sums of the Leontief inverse i.e., forward linkage of a particular sector shows the change in the total output of sector if the final demand of each sector increases by one unit. It can be written as,

$FL_i = \sum g_{ij} = F_i$

Where, FL_j is forward linkage of sector i of Rasmussen's Method; g_{ij} is the ij^{th} element of Leontief inverse matrix; and F_j is sum of row elements of sector i and n is number of sector.

Table 3: Percentage Share of each Category of Sector in Strong Backward Linkage in Haryana Economy

S.No	Sector	Backward Linkage Sub- Sector	Percentage Share	Forward Linkage Sub- Sector	Percentage Share
1	Primary	7(21)	33.30	2(21)	9.50
2	Secondary	8(20)	40.00	8(20)	40.00
3	Tertiary	0(9)	0.00	6(9)	66.70
4	Total	15(50)	30.00	16(50)	32

Source: Author Calculation

Table 3 shows the percentage share of strong backward linkage in Haryana economy. Analysis reveals that secondary sector is playing significant role in strong backward linkage with 40 percent share among three broad sectors in economy and followed by primary sector with 33.30 percent in 2007-08 where as share of tertiary sector is nil in backward linkage with other sectors of economy. *In short, secondary and primary sector is on lead in percentage share in backward linkage whereas*

tertiary sector is playing significant role in forward linkage with share 66.70 in economy and followed by secondary and primary sector with percent 40 percent and 9.50 respectively. *In short, tertiary sector is on hold in percentage share in strong forward linkage and supported by secondary and primary sector*

Indices of Power of Dispersion

The figures in each Column in the inverse matrix coefficient table indicate the production required directly and indirectly at each row sector when the final demand for the column sector increased by one unit. The total sum of column indicates the scale of production repercussion on entire industries, caused by one-unit final demand for the column sector. The vertical sum of every column sector of the inverse matrix coefficient is divided by the mean value of the entire sum of column to produce the ratio. This ratio indicates the relative magnitudes of the production repercussions that are which sector final demand can exert the greatest production repercussion on entire industries. This is called index of the *Power of Dispersion* and can be calculated as,

Index of the Power of Dispersion = (Column Sum of Inverse Matrix)/(Mean Value of Entire Vertical Sum in the Inverse Matrix)

or

Backward linkage index is defined by the ratio of average of j^{th} column of Leontief inverse to the total average, that is

$U_j = (1/n^* B_j) / ((1/n^*n)^* \sum B_j$

Where, $(1/n^* B_j)$ the column-wise average and, $((1/n^*n)^* \sum B_j$ is the total average.

Indices of Sensitivity of Dispersion

The figure for each row in the inverse matrix coefficient table indicates the supply required directly or indirectly at each sector when one unit of the final demand for the column sector at the top of table occurs. The ratio produced by dividing the total sum by the mean value of the entire sum of the row will indicates the relative influences of the one unit of final demand for a row sector, which can exert the greatest production repercussions on entire industries. This called the Index of the Sensitivity of Dispersion and can be calculated as

Index of the Sensitivity of Dispersion = (Sum of Row in Inverse Matrix) / (Mean Value of the Entire Horizontal Sum in Inverse Matrix)

or the index constructed for measuring the strength of forward linkage in the demand side model is defined as the ratio of average of i-th row sum of Leontief inverse to total average.

$U_i = (1/n^* F_i) / ((1/n^*n)^* \sum F_i$

Where $(1/n^* B_j)$ is the row- wise average and $((1/n^*n)^* \sum F_i$ is the total average.

Table 4: Percentage Share of Each Category of Sectors in Backward and Forward Linkage Index in Haryana Economy

Category	Backward Linkage Index			Forward Linkage Index		
	Primary Sector	Secondary Sector	Tertiary Sector	Primary Sector	Secondary Sector	Tertiary Sector
Strong Index value≥1	7(33.30)	8(40)	0(0)	2(9.50)	8(40)	6(66.70)
Intermediate Index value 1≤x≤0.8	14(66.70)	12(60)	9(100)	19(90.50)	12(60)	3(33.30)
Weak Index value≤0.8	0(0)	0(0)	0(0)	0(0)	0(0)	0.(0)

Source: Author Calculation

Linkage Analysis and Identification of Key Sectors

The direct and indirect forward and backward linkages are the indices for the identification of key sectors in an economy**.** Analysis of these indicators allows identifying sectors that as a seller or buyers of semi-products for intermediate consumption play the most roles in the economy.

If the column-wise average (row-wise average) is greater than the total average, then the sectors are said to have a strong integration with the rest of economy in terms of backward linkages and forward linkages. In other words, if $U_i > 1$, it means that the unit growth in demand in all sectors will result in above average growth in the sector, i.e., the products of sector i will be in the greatest demand (above the average for all sectors). If $U_j > 1$, it means that the unit increase in demand for the products of sector j will be cause an above average growth in production throughout the economy. While the other sectors have either moderate or weak linkage strength in the economy and based on the index value, key sector will be identified. All the fifty sectors are divided into three groups namely strong, intermediate and weak. The sectors with the index values either greater than or equal to one are grouped in the strong category. The intermediate group contains the sectors with index value less than one but greater than or equal to 0.80 while the rest are included in the weak group, that is

Strong Linkage Index ≥1

Intermediate Linkage Index ≥ 0.80

Weak Linkage Index <0.80

Table 5: Identification of Key Sector in Haryana Economy

S. No	Name of Sector(Haryana)
Strong Linkage Index ≥1	➢ **Primary Sector** Nil ➢ **Secondary Sector** Food Products, Paper and Paper Products, Rubber and Plastic Products ➢ **Tertiary Sector** Nil

Intermediate Linkage Index ≥ 0.80	➢ **Primary Sector** Paddy, Wheat, Bajra, Jowar, Maize Gram, Sugarcane, Khandsari, Bura, Oilseeds, Other Fiber, Fruits, Vegetables, Other Crops, Other Agriculture, Tobacco, Livestock, Forestry and Logging, Fishing, Mining and Quarrying ➢ **Secondary Sector** Beverages &Tobacco and Related Products, Cotton Textile, Woolen, Textile, Silk and Synthetics, Publishing, Printing and Related Products, Non Metallic Minerals, Basic Metals, Electrical Machine and Apparatus, Other Industries, Construction, Electricity, Gas and Water Supply ➢ **Tertiary Sector** Railways, Transport by Other Means, Storage, Communication, Trade, Hotels and Restaurants, Banking and Insurances, Real estate, Public Administration and Other Services
Weak Linkage Index <0.80	➢ **Primary Sector**- Nil ➢ **Secondary Sector**- Nil ➢ **Tertiary Sector**- Nil

Source: Author Calculation

Table explores the Identification of key sectors for Haryana and it is observed that only secondary sector has some sub sector as key sector as both index values are more than one. Secondary sector includes only three sub-sector namely 'food products', 'rubber and plastic products' and 'paper and paper products' whereas in Punjab economy there are six sub-sectors as; first three same as in Haryana and three more as, 'beverages, tobacco and related products', 'manufacturing of furniture and manufacturing NEC' and 'other industries'. *In short, secondary sector is playing significant role in linkage analysis in both the economies.*

Conclusions and Policy Implications

Structural transformation is an integral part of the economic growth and development process of any nation. The structure of output and employment changes as country develops and a well known stylized fact is that share of agriculture in output and employment falls and share of manufacturing and services corresponding rises during the industrialization process. Beyond a certain point as the manufacturing sector mature, productivity growth in manufacturing offsets employment growth and employment share of services continue to increase while employment shares of manufacturing begins to decline. Haryana and Punjab are the leader revolution for last four decades could not follow the traditional path of structure change where economy move from primary to secondary to tertiary sector in terms of share in output and employment. In view of increase in the importance of the services sector in Indian economy it became necessary to study growth of tertiary sector in agrarian economy of Haryana and Punjab. Even after the remarkable growth in sixties and seventies these economy slow down due to negative externalities of green revolution on one hand and poor industrial development on the other hand which is confined to only small enterprises and low value addition. Due to agrarian nature these economies also fail to capture huge amount of foreign direct investment and add a new cause in sluggish growth of industry in these economies. With this low level of human capital and physical infrastructure, State policies in regarding investment friend prone, Indo- Pak war of 1955 and 1971 and social disturbance of 1980s in Punjab in especially also contributed in slow industrialization in these economies. In this way economies is facing stagnation in agriculture at one hand and lack of industrialization on other hand fails to provide pre-condition of tertiary sector revolution in pre dominantly agrarian economy of Haryana and Punjab.

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