Diversification of Farm and Non-Farm Sectors and Structural Transformation of Rural Economy

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[1]Abstract

The structure of the rural economy in every country has been changing along with the overall economy. The farm and non-farm sectors- the two components of the rural economy – have been changing in structure through diversification of activities on the one hand and through increasing employment and income generation on the other. Whether the two sectors are complementary or substitutable in the context of overall economic development is an issue attracting the interest of the researchers. Whether diversification of the sectoral activities is conducive to bring about the desired transformation of the economy in general and rural economy in particular is an issue to be examined. How diversification of activities is changing with inter-sector linkages is also an issue to examined. The paper discusses these issues in the context of transformation of the rural economy in general and India's rural economy in particular in the framework of Input-Outputanalysis.

I. Introduction: Transformation of the Rural Economy

An economy may be subdivided in two sub-economies: rural and urban, on the basis of the size of the settlement and the type of economic activities undertaken by the inhabitants. Rural economy is defined by the **predominance** of agricultural activities. That is to say, agriculture and allied activities are the mainstay of the people living in rural areas. Apart from agriculture, in the rural economy manufacturing and services are also prevalent to some extent. For analytical

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convenience, manufacturing and services are clubbed together to form the non- farm economy. So, the rural economy comprises of two sub-sectors, farm sector and non-farm sector.

Farm activities include agriculture (crop production), plantation, animal husbandry (milk, meat, egg etc), forestry & logging and fishing, whereas the non-farm sector includes all other activities like agro-processing industries, wholesale and retail trading, storage and communication, transport and education , health industries and other service related activities . Over time the economy moves and tends to be transformed.

Transformation means movement / transition of the economy from one stage to another stage of development. The well-known pattern of transformation that has been experienced by the countries at different stages of development is the movement from agriculture (farm) to manufacturing and then to services. As an economy advances technologically over time, importance of the farm sector in terms of its share in GDP and share in total employment gets reduced and share of other two sectors increase gradually and follow the path: farm/agri→manufacturing/industry→services. The alternative path may be from agriculture to services. Transformation of an economy may be viewed from different perspectives. It may be analyzed at the production level in terms of employment and net domestic product (NDP). As the overall economy goes through the process of transformation, the rural economy is also expected to follow the similar process of transformation.

The question arises whether the rural economic transformation follows the overall economic transformation or otherwise. The question arises because the rural economy is a constituent sub-economy of the overall economy, the other being the urban economy and each sub-economy has its own compositional structure in production, in distribution, in employment etc, different from those of the other. More clearly, the question relates to whether in the rural economy agriculture

loses its prime importance over time in favor of non-farm activities and becomes transformed following the path of farm/agri→manufacturing/industry→services.

The analysis may be done through comparison of shares of the components in some well-defined variables like employment, output etc or in terms of a macro index which would account for the nature and the degree of transformation brought about in the rural economy.

In this paper the problems of transformation and diversification of the rural economy in general and the rural farm economy in particular are quantitatively studied. Section 2 discusses the factors influencing transformation and diversification of the rural economy of India. In section 3 the methodology of measuring diversification and transformation (indices) is discussed. Section 4 discusses the estimates while concluding remarks are contained in section 5.

Section 2. Factors influencing Transformation of the Rural Economy

Technological Progress: With growing mechanization of agriculture which may be the result of technological reform (e.g., Green Revolution in India), the input structure of the farm sector changes. Traditional inputs are being replaced by modern inputs like HYV seeds, bio-technologically engineered seeds, fertilizers, pesticides, irrigation and agricultural implements like tractors, harvesters etc. Increasing use of modern inputs increases the consumption of energy (petroleum, electricity etc.) which in turn replaces the bullock power in farm agriculture. Adoption of new technology increases agricultural output manifold. As productivity increases, average farm income increases undoubtedly (setting aside the debate of rising inequality in rural areas and adverse environmental impact of new technology). As a result of increase in production, there is also a corresponding increase in the marketable surplus. The subsistence farm economy which starts producing for the market becomes market oriented. Farmers in rural

areas are dependent on the market for the purchasing of inputs as well as for selling the farm output. Market expands and so farmer's supply decisions are more or less influenced by the market signals (market prices for inputs as well as outputs). That is to say, technological progress leads to *commercialization/capitalization* of the farm economy and hence of the rural economy. Simultaneously as production increases, agricultural demand for trading services, storage and communication lifts up. Improved transport and storage become necessary to handle the distribution and marketing of outputs and inputs.

Commercialization: Technological development and adoption of new technology by the farmers necessitate marketing of the farm inputs and setting up of repairing shops and agricultural extension services. So the non-farm economy in the rural areas gets a boost via the production linkage.

Apart from this, as average farm income increases, consumption of non –farm goods (consumer durables either produced locally and outside the rural areas) increases (consumption linkage). Increased demand for consumer goods and services result in expansion of the rural manufacturing sector and service sectors providing education and medical facilities, insurance and banking facilities etc.

Urbanization and Globalization: It is now an accepted fact that economic development which advances with industrialization and industrialization cannot be achieved without a simultaneous process of urbanization. With industrialization there emerge new urban centers on the one hand and expansion of the ones already in existence. Cities and towns are growing in both number and size. Improved means of transport and communication are bringing villages more and more nearer to the urban centers. This process of urbanization is accelerated with the advent of globalization.

The living pattern of the people is changing, which is reflected in the change in demand for agricultural products. Also with changes in the demand pattern, the crop pattern also changes; the relative importance of cereals and non-cereal crops is change. Also changes the occupational pattern of the people living in villages (rural areas).

Though agriculture is the main source of living for the rural people having low level of income and hence low level of living compared to that for the urban people, but with time non-farm activities are becoming the alternative source of livelihood for the rural people. With urbanization the secondary and tertiary sectors (i,e non farm) activities are being increasingly performed. Farm mechanization and above all commercialization of agriculture are playing the important role towards transformation of the rural economy in terms of employment, income and level of living. The volume of non-farm employment and income of the rural people have been undergoing substantial changes.

Clearly, increase in per capita income consequent upon increasing urbanization and non-farm activities has considerable impact upon the changing life-style and changing dietary pattern of the rural people.

The fact that has attracted the attention of the agricultural economists and policy makers is the 'declining per capita direct consumption of cereals' both in urban areas and in rural areas of India. The consumption of high value food commodities like fruits, vegetables, dairy products has increased both in urban as well as in the rural areas.

Total demand for cereals consists of direct demand for cereals by households (rural as well as urban) for consumption i.e., household demand for food and intermediate demand for cereals to be used as input like seed, feed, etc.. Increasing agricultural output and capital intensive agricultural growth have resulted in the **substantial growth in non-farm enterprises.**

Globalization means opening up of the domestic economy to the outside world. Since 1990s widespread liberalization of international trade and foreign investment have led to the rapid globalization (and open the rural economy to incentive in terms of improving TOT and challenges/competition). Export markets have opened up opportunities for the rural farm and rural non –farm enterprises. Because of trade liberalization there is growing demand for high value crops such as fruits, vegetables, flori-culture products.

Trade and investment liberalization has brought about rapid changes in agri-food system as multinational companies are entering into the food market (retailing) and in agro processing industries. With MNCs entering into the food market /agro proceesing industries, increasing private investment in storages and modern techniques are being used in the agro processing industries. Consequently, modern warehouses for crops and cold storages for perishables, chilling and processing of milk products are being established in the rural areas and more and more non farm employment is in turn generated.

It thus follows that improved technology and commercialization of agriculture, coupled with growing urbanization and global integration lead to the growth of the rural non-farm sector. Though rural non farm growth is farm- led, with growing urbanization and globalization RNFS (Rural Non-Farm Sector) may become more and more service- oriented.

Diversification of the Rural Activities

Rural non-farm sector (RNFS) plays an important role in reducing the widespread rural poverty through generation of employment and income and creation of effective demand for goods and services. The role becomes important as it can provide diverse employment opportunities to the rural people and in the process transform the rural economy in the desired direction of inclusive growth.

Expansion of RNFS may proceed in **two directions: (a) increasing 'multiplicity of activities' and b) increasing scale of the existing activities.** The former refers to employment (and establishment) diversification, defined as an increase in the number of opportunities (establishment) of labour and hence of income of a household, the latter increases the volume of employment directly as well as indirectly.

RNFS diversification is the process by which a rural household constructs a 'diverse portfolio' of non-farm activities for survival and improves his standard of living. The concept of rural non farm diversification has been used in this paper (Pal & Datta Biswas, 2010).

In RNFS a variety of activities people are now accepting as substitutes of farm activities. In this process employment diversification away from (outside) agriculture helps transformation of the rural economy. It i) increases income of the rural people considerably as non farm wage is usually higher than agricultural wage, ii) provides security and reduces the risk and uncertainty associated with farm income, iii) reduces the pressure of labour on land, ,and iv) reduces the tendency of the rural people to migrate to urban areas.

We must keep in mind that putting emphasis on rural transformation/ structural transformation of the rural economy and its sub-sectors is not at all meant to ignore the role of a great culture in development of the overall economy which is net suppliers of wage goods (Food) and inputs (raw materials) for growing industrial sectors in the national economy.

It becomes necessary to examine the structural transformation of the rural economy since the key to development lies in transformation and diversification. The extent to which the rural farm and non-farm activities have undergone any structural change is a matter of policy concern.

The present study aims to examine

i) whether India's rural economy has been transformed or tending to be transformed over-time;

ii) the pattern and the nature of such transformation: whether the importance of service sector-oriented activities are on the rise in rural areas or whether the importance of non service-non-agro business has been rising;

iii) whether the role of farm and non-farm sectors are complimentary or substitutable in the context of overall economic development: the interdependence of the farm and non-farm sector.

Section 3: Methodology:

3.1 Transformation Index:

In order to investigate the inter-temporal changes in the structure of a particular variable, a macro index called transformation index is suggested.

Let a and b be two non-negative vectors denoting two different states of a particular variable say x. θ be the angle between a and b.

Then

$$Cos\theta = \frac{\sum ab}{\|a\|\|b\|} = \frac{\sum ab}{\sqrt{\sum a^2 \sum b^2}}$$

$$so\ that\ \theta = Cos^{-1}\left[\frac{\sum ab}{\sqrt{\sum a^2 \sum b^2}}\right].\ For\ a \geq 0,\ b \geq 0, ab \geq 0$$

i)When $\theta=0^0$, then a and b coincide meaning that there is no change in the state of the variable **x**

ii) When $\theta=90^0$, the angular distance between a and b is 90^0 : two vectors are perpendicular to each other .

$$Thus \quad 0^0 \le \cos^{-1}\left[\frac{\sum ab}{\sqrt{\sum a^2 \sum b^2}}\right] \le 90^0$$

$$and \ then \quad \frac{0}{90^0} \le \frac{\cos^{-1}\left[\frac{\sum ab}{\sqrt{\sum a^2 \sum b^2}}\right]}{90^0} \le 1$$

$$or \ 0 \le \lambda \le 1 \ , where \quad \lambda = \frac{\cos^{-1}\left[\frac{\sum ab}{\sqrt{\sum a^2 \sum b^2}}\right]}{90^0}$$

λ is called the Transformation Index. It is unit free and a pure number .Here in this case a, b may be interpreted as vectors of a relevant variable with the stipulation that each element of a and b denotes the value share in total (ratio) so that ∑a=1=∑b. Thus **λ** will measure the overall change in the structure of the relevant variable. It is to be noted that the higher the value of λ, higher (smaller), the degree of structural change and vice versa. Clearly, for the vectors (of output/employment) at two time points λ=0 implying no change at all .Similarly, λ=1 indicates complete structural change. Actual value of λ lies between 0 and 1.

3.*2. Diversification index*:

In the formulation of transformation index, two different states (over time)of the variable are considered and compared to ascertain the nature and the degree of the structural transformation .But in the diversification index only one state of the variable is considered and the index is formulated . Subsequently different values of the index (corresponding to different states) are compared to evaluate the nature and the degree of diversification.

Following Theil's Entropy Index Pal (1988) defined the index of diversification as:

$$D = \frac{\sum p_i \,.\log(1/p_i)}{\log(n)}\,, \qquad 0 \le D \le 1,$$

where $p_i = x_i / \sum x_i$, x_i : i^{th} value of the variable, i=1,2,…..,n .

D=0 $\Rightarrow$ no diversification of activities,

whereas D=1 $\Rightarrow$ perfect diversification of activities which means that all the x_i's (activities) are getting equal importance. Higher (lower) is the value of D; higher (lower) is the level of diversification. D has been used in estimation.

3.3: Structural Interdependence

The I-O model describes the inter-dependence among the different producing industries of the economy. Thus it becomes a tool to measure the structural interdependence of an economy and to determine the extent and degree of inter-linkages among industries.

There are two approaches to the I-O models. The Input-Use approach is due to Leontief (1941) and the Output-distribution approach is due to Ghosh (1958) which was subsequently modified by Pal (1981 ,1988).

Input – Use Approach :

Define $a_{ij} = X_{ij} / x_j$: amount of output x_i used by industry j to produce output x_j; it is taken as fixed.

We write the balance equation for output i :

$$x_i = a_{i1}\, x_1 + a_{i2}\, x_2 + \ldots.. + a_{ii}\, x_i + \ldots + a_{in}\, x_n + C_i + E_i - M_i \quad \ldots (1)$$

i = 1, 2, …., n

In matrix notation

$$x = Ax + D \qquad \ldots (1a)$$

where $x = (x_j)$ an n-column vector of gross output.

$A = (a_{ij})$: an nxn input coefficient matrix.

$= X(x)^{-1}$; $x = \text{diag}\ (x_1, \ldots, x_n)$,.

$X = (X_{ij})$: nxn transaction matrix

$D = (C_j + E_j + IV - M_j)$: an n column vector of final demand net of competitive imports (M_j),

E_j: foreign demand (export), C_j: domestic demand, IV: inventory

Equation (1a) can be solved for the vector of gross output:

$$x = (I - A)^{-1} D. \qquad \ldots (2),$$

$(I - A)^{-1} = B$, which is called the Leontief inverse.

'B' is interpreted as the **impact matrix**. Its element $b_{ij} = \frac{dx_i}{dd_j}$ measures the impact on the gross output 'i' of the change in final demand for output j.

$$B \rangle 0,\ b_{ii} \rangle 1 \ \textit{and}\ b_{ii} \rangle \sum_{i \neq j} b_{ij},\ \ \textit{for each}\ i \ \textit{and}\ j \ \text{(Pal 1988)}$$

'B' the Leontief inverse is used to measure the effect of changes in interdependence among the producing sector (farm and non-farm sectors).

Section 4: Results and Discussions

4.1 Sectoral distribution of RNDP: Rising share of the rural non-farm sector?

Our objective is to examine whether the rural economy in India could transform itself in the context of economic development. Such transformation will be judged in terms of shares of farm and non-farm sub-sectors in total rural domestic product. If there is any kind of structural change, then what pattern was followed? As we know that due to progress in technology and increasing commercialization along with globalization and urbanization, both farm and non-farm sectors usually grow. And the growth of non-farm sector is a primarily farm-led growth.

Interestingly, in India in the rural areas, where economic activities are centered around agriculture and allied activities, its share in total rural NSDP has gone down continuously and significantly. On the other hand, the shares of other two sectors have been increasing gradually during the period 1970-71 to 1999-2000(Table 1(a)).

Another interesting feature to be noted is the growing importance of the service sector in the rural areas. In 1970s the share of the service sector was much above that of the rural industrial sector and this trend has continued in the subsequent period as well and over time the gap has widened particularly in the post reform period. Quite naturally in India the rural service sector (which comprises of transport, storage &communication, community and personal social services) grew as an aftermath of green revolution. And most of the rural industries belong to the unorganized, small scale categories.

But it can not be said that the rural sub -economy of India has followed the general development pattern of movement from agriculture to manufacturing and then to services; rather it is more or less service -led development. **The essential idea of the well- known**

development pattern is that, as the country develops initially, the economy moves from the farm sector to the industrial sector and in the next stage of development, service sector expands to facilitate the increasing industrialization and the economy then shifts towards the service sector. But in India the service sector has superseded the rural industrial sector because it mainly facilitates the growing agricultural sector. In1999-2000, 54% of rural NSDP came from agriculture and allied activities whereas the share of RNFS was as high as 45.4%. The share of the non-farm sector in RNDP has substantially grown which is indicative of the growing importance of RNFS(Table 1(b)).

A more disaggregate analysis reveals that though the share of all the components of RNFS in total RNDP increased over the years, the share of community , personal and social service sector has doubled during the period.

Table:1(a) Sectoral distribution of rural NSDP(%)

	1970-71	1980-81	1993-94	1999-2000
Agri &allied activities	72.37	64.36	57	54.41
industry(rural)	10.57	15.01	16.24	16.85
Services(rural)	17.06	20.63	26.76	28.74

Source : G.K Chadha (2003)

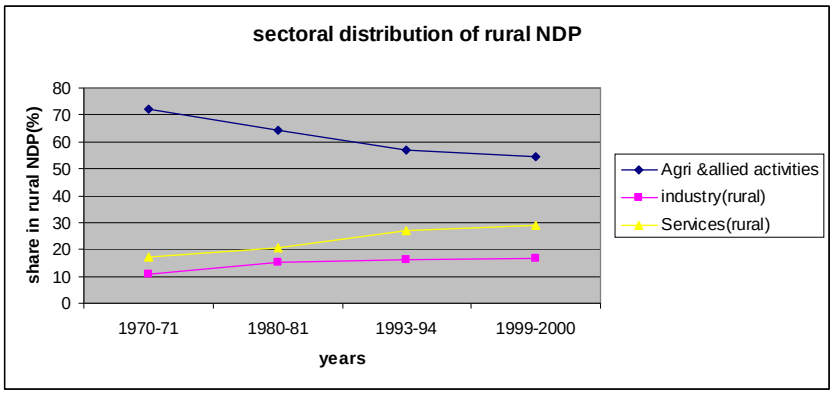

Table : 1(b) . Sectoral distribution of rural NDP(%)

	1970-71	1980-81	1993-94	1999-2000
Agri &allied activities	72.37	64.36	57	54.41
mining and quarrying	0.86	1.24	2.59	2.39
Manufacturing	5.87	9.16	8.16	8.13
Utilities	0.37	0.56	0.88	1.34
Construction	3.47	4.05	4.61	4.99
Trade,Restaurantsand hotels	2.72	6.68	7.77	6.94
Transport&storage,communication	1.26	1.32	3.41	4.17
Banking &Insurance	0.54	0.81	1.73	1.97
real estate ,business services	6.18	4.55	4.26	3.16
Community,social and personal services	6.36	7.27	9.59	12.5
total rural nonfarm sector	27.63	35.64	43	45.59
NDP	100	100	100	100
Diversifiation Index(rural activities)	**0.481**	**0.575**	**0.672**	**0.693**
Diversifiation Index(RNFS activities)	**0.853**	**0.859**	**0.913**	**0.905**

Source: G.K.Chadha(2003)

Table :1(c). Transformation Index (λ)

period	Rural activity	RNFS
	λ_R	λ_{RN}
1970-71 to1980-81	0.0570	0.2157
1980-81to1993-94	0.0493	0.1385
1993-94 to1999-2000	0.0403	0.1095
1970-71 to1999-2000	0.1210	0.2840

Calculations by authors

Diversification and Transformation: Both Rising?

Diversification indices for the rural economy and its component sub sectors indicate that RNFS sector is **more diversified** compared to the rural activity (the FS and NFS) and diversification indices have increased in both the cases continuously over the years from 1970 to 2000. RNFS was highly diversified (.905).

In spite of increasing diversification in the rural economy, the Transformation index does not indicate significant structural transformation in the rural economy. Transformation indices are

quite low for both the rural activities and RNFS in terms of their share in total RNSDP. Even then RNFS shows sign of structural transformation during 1970 - 2000 (Table .1(c)).

It thus follows that diversification of rural activities has not resulted in the structural transformation of the rural economy. It needs further investigation as to whether the diversification is pro-prosperity or pro-distress.

4.2. Rural Employment: Rising in Rural Non-Farm Sector?

Experience of developed countries shows that as a country develops the share of the farm (primary) sector in total employment declines, and those of other two sectors increase gradually. Is it valid for the rural sub-economy? It is expected that with the change in economic environment, rural employment has surely changed. In this section the structural change in the employment structure will be examined both for the rural economy as a whole and for the RNFS.

Employment in rural non –farm sector is broadly classified in six (6) categories. And the sectoral distribution indicates a gradual shifting away from the farm sector and gradual increase in the share of non-farm sector in total rural employment. (Table .2a). Still 75% of rural employment is in the Agri and allied activities which indicates the high dependence of rural people on the farm sector. **This may also suggest i) less mechanization of farm production (labor intensive mode of farm production prevails) in the rural areas of India and ii) also the increasing pressure of population on land**.

Table :2(a).Percentage Distribution of Workers

sectors	*1977-78*	*1983*	*1987-88*	*1993-94*	*1999-2000*	*2004-05*	*2007-08*
Agriculture	84.4	82.6	79.6	80.1	78.25	74.85	75
Mining	0.35	0.45	0.55	0.55	0.45	0.45	0.45
Manufacturing	6.15	6.75	7.2	7	7.45	8.15	7.55
Electricity	0.1	0.1	0.15	0.15	0.1	0.1	0.1
Construction	1.15	1.5	3.25	2.05	2.8	4.15	4.85
Trade,hotel,restaur	3.05	3.15	3.6	3.8	4.4	5.4	4.95
Transport &storage	0.65	0.9	1.05	1.15	1.65	2	2.1
Other services	4.15	4.55	4.6	5.2	4.9	4.9	5
Total	100	100	100	100	100	100	100

Source: NSS reports 531;Employment unemployment situation in India

NSS data during 1977-78 to 2007-2008 reveal that the percentage of workers dependent on agriculture has gradually declined from 84.4 to 75, though 1993-94 was an exception to this trend. Percentage of male workers engaged in agriculture fell sharply during the period.

Female workers are relatively more dependent on agriculture than their male counterpart and that during the period it shows signs of gradual decline with an exception in the period 1993-94.Two distinct phases came out clearly from the analysis: pre-reform period and post-reform period. Rural female workers engaged in the non-farm sector are severely hit by the reforms: they have fallen back on agriculture (Table: 2(b)).

Table:2.(b) Percentage distribution of workers between farm and non-farm activities: Male workers and Female workers

	1977-78	1983	1987-88	1993-94	1999-00	2004-05	2007-08
Agri male	80.7	77.6	74.5	74.1	71.3	66.5	66.5
Agri female	88.1	87.6	84.7	86.1	85.2	83.2	83.5
Agri total	84.4	82.6	79.6	80.1	78.25	74.85	75
Non-farm male	19.3	22.4	25.5	25.9	28.7	33.5	33.5
Non-farm female	11.9	12.4	15.3	13.9	14.8	16.8	16.5
Non farmTotal	15.6	17.4	20.4	19.9	21.75	25.15	25

Source: NSS Reports no: 531 on Employment and Un-employment situation in India2007-2008 calculations by authors

Employment Diversification: Rising?

Diversification of rural employment by activities has been examined from three different perspectives; i) diversification of rural activities (D_{RA}) (farm and non farm activities together), ii) diversification of activities between farm and non-farm ($D_{F\&NF}$) and iii) diversification of non-farm activities (D_{NF}) within the non-farm sector.

More the number of activities available in rural area, more the opportunities open to the rural people for their absorption resulting in higher growth. The value of the index D_{RA} has to be lower compared to other two indices because of the agrarian character of the rural economy. The rising value of D_{RA} shows the increasing importance of all kinds of activities in the rural area.

Higher and higher values of $D_{F\&NF}$ indicate that people in the rural areas are becoming more and more dependent on the non farm sector in the aggregative sense. And higher values of D_{NF} indicate greater diversification of RNFS, which implies rural people are getting employed in diverse non-farm activities resulting in the transformation of the rural economy.

Table: 2(c) Diversification-index of rural activities (D_{RA})

	1977-78	**1983**	**1987-88**	**1993-94**	**1999-2000**	**2004-05**	**2007-08**
Male	0.382	0.429	0.476	0.481	0.519	0.572	0.573
Female	0.248	0.255	0.308	0.280	0.292	0.323	0.324
total	0.319	0.349	0.399	0.390	0.418	0.466	0.466

Table:2.(d) **D-Index(farm and non-farm)** ($D_{F\&NF}$)

	1977-78	1983	1987-88	1993-94	1999-2000	2004-2005	2007-2008
male	0.708	0.767	0.819	0.825	0.865	0.920	0.920
female	0.526	0.541	0.617	0.582	0.605	0.653	0.646
Total	0.731	0.758	0.790	0.785	0.799	0.811	0.811

Table2(e): D- index(non-farm) D_{NF}

	1977-78	**1983**	**1987-88**	**1993-94**	**1999-2000**	**2004-05**	**2007-08**
Male	0.810	0.826	0.853	0.850	0.858	0.856	0.858
Female	0.648	0.646	0.711	0.663	0.650	0.673	0.702
Total	0.761	0.779	0.816	0.806	0.817	0.826	0.835

Data source: NSSO Report No 531: Employment and Unemployment Situations in India 2007-08(based on 11 activities specified by NSSO)

i) D_{RA} has a low value, indicating the importance of agriculture in the rural activities. **ii)** $D_{F\&NF}$ between farm and non-farm is very high showing the greater importance of non farm sector in the rural economy. iii) D_{NF} exhibits a higher value meaning that in the RNFS no one or two activities are dominant. iv) all the three indices have shown tendencies of gradual increase over the period of 30 years with a dampening effect during 1993-1994. Immediately after the reform had started, rural economy got a shock which is evident from the reverse trend in 1993-1994, though the economy has recovered thereafter from the shock and came back on the trend line (Tables 2.(c) to 2.(e)).

It would be quite interesting exercise to examine that, whether the increasing diversification of RNF activities and RA (as whole) have resulted in the transformation of rural employment structure. Transformation indices for the non farm employment (RNFE) and for the rural employment (RA) as a whole for the period 1977-78 to 2007-08 reveals significant structural transformation in both RNFE and RA and also there is increasing trend in the transformation process with an exception during the period of macroeconomic shock in the economy during 1987-88 to 1993-94.

Table: 2 (f). Transformation Index

	Non-farm activity	rural activity
Period	λ_{NF}	λ_{R}
1977-78 to 1983	0.831	0.515
1983 to 1987-88	0.851	0.555
1987-88 to 1993-94	0.845	0.549
1993-94 to 1999-2000	0.852	0.572
1999-2000 to 2004-2005	0.858	0.611
2004-2005 to 2007-2008	0.862	0.609
1977-78 to 2007-2008	0.869	0.610

Calculation by authors

The transformation index is quite high for the RNFE as compared to the RA as a whole although the rural employment structure lagged behind the RNF employment in terms structural

transformation. This difference may be attributed to the dependence of the rural people on the farm sector.

4.3 Rural Farm sector:

For the rural economy transformation does not end with the shifting away from agriculture and moving to other sectors. Rural economy is the provider of basic wage good (food) to the whole economy as well as supplier of raw materials to the industrial sector (agro processing industries). So its role in overall economic development cannot be ignored. . Structural transformation of the farm sector becomes an indicator of overall development. It is the farm sector which determines the pattern and the nature of the structural shift in the rural non-farm sector (RNFS).

So far the farm sector is concerned , it may be analyzed at 2 levels: i) at the farm level as a whole it consists of seven (7) aggregated sectors like food crops, cash crops, plantations , other crops , animal husbandry, forestry & logging, fishing , and ii) at the crop sub-sector level it comprises of 17 crop sub-sectors are considered.

Table: 3a. Sector -wise distribution of Farm output (in %)

	sectors	1983-1984	1993-1994	1998-1999	2003-2004	2006-2007
1	Food crops	37.10	31.61	29.41	31.09	32.26
2	Cash Crops	10.00	9.96	8.77	10.62	10.90
3	Plantations	2.32	1.06	1.10	0.96	1.24
4	other crops	22.97	27.18	30.02	26.34	25.71
5	Animal Husbandry	21.24	23.40	23.50	23.67	22.93
6	Forestry and Logging	4.72	3.52	3.52	3.22	2.97
7	Fishing	1.66	3.28	3.69	4.11	4.00
	Total farm output (in ` lac)	9413163 (100)	32266299.4 (100)	56372442 (100)	77249610 (100)	100431798 (100)
D-Index(farm output)		**0.804**	**0.805**	**0.804**	**0.812**	**0.812**

Source: Input-output tables for the years 1983-84,1993-94,1998-99,2003-04,2006-07 ,Ministry of Statistics ,GOI

Year-wise data on farm output (compiled from the input output table) shows that total farm output has increased during 1983-84 to 2006-2007. The share of constituent sub-sectors in total farm output gives an idea of the changes taking place in the farm sector. The data reveal that the shares of food crops, plantations and forestry and logging have declined during the period excepting in 1998-99. On the other hand, shares of 'other crops' (includes oilseeds, fruits, vegetables, etc) animal husbandry and fishing in total farm output have increased significantly. The diversification index calculated for the farm sector also indicates that the farm sector is highly diversified.

Table: 3b. Transformation Index for the farm sector and the crop sub –sector

period	λ (farm sector)	λ (crop sub-sector)
1983-1984 to 1993-94	0.847	NA
1993-1994 to 1998-99	0.84472	0.848
1998-99 to2003-04	0.84878	0.869
2003-04 to2006-07	0.84756	0.849
1983-84 to2006-2007	0.84889	0.850

Transformation index for the farm sector which is as high as .84 for all the periods also indicates high degree transformation of the farm sector. With increasing income and growing urbanization, the dietary pattern changes in favor of high value farm output (like fruits, vegetables, fishery product, milk, meat egg etc) and consequently the demand for such commodities increases. Globalization increases the export opportunities of such high value commodities. Indian farmers to some extent have responded to the change in demand for high value farm product. This market orientation of the rural farm economy in India is reflected in the high degree of diversification and transformation of the farm sector.

A more disaggregated analysis of the17- crop sub-sector also indicates the increasing share of Other crop (high value agricultural products includes fruits, vegetables, and oilseeds etc.) total

agricultural output (40% in 2006-07). Share of rubber has also increased during the time period Table 3b).

Table:3c. Percentage distribution of crop sub-sector in total agricultural output

	crop	1993-1994	1998-1999	2003-04	2006-07
1	Paddy	23.148	20.439	21.886	21.248
2	Wheat	12.223	12.886	13.051	14.300
3	Jowar	1.559	1.379	0.749	0.861
4	Bajra	0.734	0.842	1.074	0.810
5	Maize	1.334	1.408	1.585	1.431
6	Gram	2.320	1.951	1.635	2.230
7	Pulses	3.960	3.531	5.075	5.138
8	Sugarcane	6.506	5.987	4.307	6.277
9	Groundnut	3.334	3.109	2.452	1.271
10	Jute	0.318	0.306	0.257	0.202
11	Cotton	3.659	3.249	3.057	3.305
12	Tea	0.782	0.663	0.516	0.562
13	Coffee	0.390	0.516	0.246	0.368
14	Rubber	0.346	0.409	0.630	0.834
15	Coconut	1.647	1.459	1.167	0.834
16	Tobacco	0.457	0.580	0.398	0.313
17	Other crops	37.283	41.286	41.916	40.016
	Total(in ` llac)	2,25,24,309 (100)	3,90,63,570 (100)	5,33,10,194 (100)	7,04,04,802 (100)
	Diversification index(crop)	0.684	0.666	0.645	0.654

Source: Input-output tables for the years 1983-84,1993-94,1998-99,2003-04,2006-07 ,Ministry of Statistics

Calculation by authors

The Crop sub-sector is moderately diversified (Table: 3b) though its diversification has been slightly declining over the years while the transformation index(tab. 3c) for the crop sub-sector indicates substantial structural shift during the period considered in the analysis.

If the farm sector and the crop sub sectors are compared, then the analysis shows higher degree of diversification in the farm sector as compared to the crop sub–sector.(I-O table of 1983 available in the aggregative form). Interestingly, both the farm sector as a whole and the crop sector are highly and equally transformed and such structural shift comes through diversification. So such diversification of the farm sector is basically demand driven which is obviously a reflection of prosperity of the economy as a whole.

But for the sectoral share of non-farm output we have completely different picture (sec 4.1). Rural non farm sector in terms of its share in total RNDP was highly diversified but with low structural transformation.

4.4. Interdependence of Farm and Non-Farm Sectors: Impact Multipliers

Though the linkage between the farm and non-farm sectors have existed from the age of barter system, but with technological advancement this linkage is getting stronger and multidimensional. Agriculture plays an important role in promoting the growth and diversification of the non-farm sector in the rural areas as it uses more inputs like modern agricultural implements and chemical fertilizers. On the other hand agriculture supplies its output to the agro -processing industries.

Also there may be a possibility of re-investment of the profit in one sector into the other sector.

The inter-linkage between the farm and non-farm sector becomes important as the agricultural growth promotes growth and employment opportunities in the non-farm sector in the rural economy.

India's I-O tables for the years 1983/84, 1993/94, 1998/99, 2003/04 and 2006/07 are used in the analysis. The tables are in current prices. These are aggregated into 17 sectors, using the common scheme of sector classification. The aggregated first 7 seven sectors which comprise the farm sector are 1) food crops, 2) cash crops, 3) plantations, 4) other crops, 5) animal husbandry, 6) logging and 7) fishing. The next 8 sectors are industrial sectors which are 8) agro-industry I, 9) agro-industry II, 10) fertilizer, 11) pesticides, 12) petroleum, 13) electricity, gas & water supply, 14) agricultural implements and 15) other manufacturing. The remaining 2 sectors comprise the service sector which contains 16) transport and 17) other services. Our aggregation is obviously purposive. Our interest is to examine quantitatively the inter-linkage between the farm and non-farm sectors in general and among their components sub-sectors in particular. More specifically, we are interested to know the stimulating factors (sub-sectors) causing transformation and diversification of the sectors in question.

Own Impact Multiplier: Rising?

Estimates (Tables 4(a)-(c)) of impact multipliers reveal that the own-multipliers (impact of changes in own final demand) have not risen over time in all the sectors. Notably, among the sub sectors of the farm economy food crops, cash crops and animal husbandry have experienced rises in the multiplier effect of their final demand changes. In the overall non-farm economy, the sub sectors of agro-based industries, pesticides, petroleum, electricity-gas-water supply and other manufacturing have experienced rising own-multipliers. Furthermore, among all the sectors in

the economy, it is the highest own-multiplier, meaning that the sector is affected most by its own-final demand change.

Alien Row Multipliers: Rising?

In the I-O framework, gross-output of a sector is stimulated not only by its own final demand change but also changes in final demands of other sectors (alien final demands). True a sector's output is affected most (Pal, 1988) by its own final demand. But among the other sectors which sector comes to affect the sector by its final demand change? This is known by the row elements of the impact matrix. Here again the alien impact multiplier in respect of a particular sector have not always increased. Notably, sectors 5 and 8 (animal husbandry and agro-industry I) have the highest impact on food crops ,cash crops and fishing. It is quite obvious from the fact that these sectors heavily depend on the farm sectors for their inputs. These multipliers have, however, almost all through increased in cases of plantation and fishing. Among the other sectors where the alien row multipliers have increased are fertilizer, petroleum and product, other manufacturing, transport and services (Table 4(b)).

Column Multiplier: Rising?

Column multipliers measure, we have already said, the impacts of final demand change for a sector to which the column pertains, on the gross outputs of different sectors. Here again the maximum impact is experienced by the food crops sectors from the sector of manufacturing and the impact has risen over time. This is also observed in the most of the sectors under study. It is thus the sector 15 (other manufacturing) which is singularly identified for its highest impact on most of the sectors. The multipliers have also increased in most of the cases.

Section 5. Concluding Remarks

Judged by the indices of transformation and diversification India's farm and non-farm sectors in the rural economy have structurally changed to some extent during the period 1983- 2006. The output and employment structures of the two sub sectors have changed. Inter-industry linkages of these two sectors have also changed. Dependence of the farm sector on the non-farm sector and that of the non-farm sector on the farm sector have both increased. This is indicative of the increasing complementary role played by the two sectors in the India's rural economy.

Table 4(a): I-O Multipliers: Own Multiplier (diagonal elements of the inverse matrix)

Sectors	1983-84	1993-94	1998-99	2003-04	2006-07
Food crops	1.1096	1.1528	1.0998	1.4009	1.3563
Cash Crops	1.0576	1.0598	1.0315	1.1287	1.0759
Plantations	1.0038	1.0016	1.0020	1.0098	1.0035
other crops	1.0425	1.037	1.0166	1.0572	1.0322
Animal Husbandry	1.0266	1.0152	1.0132	1.0095	1.0050
Forestry and Logging	1.0027	1.0050	1.0044	1.0019	1.0031
Fishing	1.0000	1.0201	1.0145	1.0142	1.0654
Agro -Industry -I	1.1301	1.0651	1.0162	1.1388	1.1593
Agro-Industry -II	1.2917	1.2092	1.2038	1.2057	1.2153
Fertilizer	1.1139	1.4010	1.1310	1.0788	1.1129
pesticides	1.2087	1.2333	1.1833	1.1677	1.2692
Petroleum	1.2135	1.3360	1.3167	1.3784	1.4047
EGW	1.3623	1.3174	1.3824	1.3883	1.4198
Agricultural Implements	1.2305	1.1446	1.1021	1.0081	1.0110
other manufacturing	1.5148	1.5518	1.5280	1.6816	1.8337
Transport	1.1094	1.0852	1.0765	1.0963	1.1161
Services	1.1310	1.1360	1.1635	1.1336	1.1296

Source: Input-output tables for the years 1983-84,1993-94,1998-99,2003-04,2006-07 ,Ministry of Statistics , Govt of India
Calculation by authors

Table:4(b): I-O Multipliers : Alien Multiplier (Row-wise : Off-diagonal elements of the inverse matrix) Sector having the highest Impact

Sectors	1983-84	1993-94	1998-99	2003-04	2006-07
Food crops	Sec-5, (0.0583)	Sec-8, (0.0573)	Sec-8, (0.0992)	Sec-8, (0.1066)	Sec-8, (0.0882)
Cash Crops	Sec-8, (0.2880)	Sec-8, (0.2103)	Sec-8, (0.1265)	Sec-8, (0.1839)	Sec-8, (0.1874)
Plantations	Sec-8, (0.0488)	Sec-8, (0.0289)	Sec-8, (0.0234)	Sec-9, (0.0139)	Sec-9, (0.0171)
other crops	Sec-5, (0.3721)	Sec-5, (0.2107)	Sec-5, (0.2071)	Sec-5, (0.1579)	Sec-5, (0.1223)
Animal Husbandry	Sec-8, (0.0980)	Sec-8, (0.0978)	Sec-8, (0.0929)	Sec-8, (0.0887)	Sec-8, (0.0772)
Forestry and Logging	Sec-9, (0.0564)	Sec-9, (0.0375)	Sec-9, (0.0358)	Sec-9, (0.0269)	Sec-9, (0.0269)
Fishing	Sec-8, (0.0064)	Sec-8, (0.0124)	Sec-8, (0.0090)	Sec-8, (0.0183)	Sec-8, (0.0175)
Agro -Industry -I	Sec-11, (0.0457)	Sec-12,(0.0235)	Sec-5, (0.0243)	Sec-5, (0.0270)	Sec-5, (0.0166)
Agro-Industry -II	Sec-11, (0.0967)	Sec-1, (0.0812)	Sec-14,(0.0752)	Sec-16,(0.0559)	Sec-16,(0.0541)
Fertilizer	Sec-1, (0.0720)	Sec-3, (0.0864)	Sec-1, (0.1019)	Sec-1, (0.1054)	Sec-1, (0.1498)
pesticides	Sec-10, (0.0752)	Sec-11,(0.0211)	Sec-3, (0.0316)	Sec-3, (0.0800)	Sec-3, (0.0537)
Petroleum	Sec-10, (0.3303)	Sec-11,(0.4380)	Sec-11,(0.3912)	Sec-10,(0.5814)	Sec-10, (0.7799)
EGW	Sec-10, (0.1463)	Sec-11,(0.1524)	Sec-16,(0.1470)	Sec-14,(0.0897)	Sec-10, (0.0847)
Agricultural Implements	Sec-1, (0.0061)	Sec-1, (0.0033)	Sec-1, (0.0017)	Sec-1, (0.0055)	Sec-1, (0.0066)
other manufacturing	Sec-12, (0.8906)	Sec-10,(0.6074)	Sec-14,(0.5899)	Sec-14,(0.8298)	Sec-14, (0.9670)
Transport	Sec-13, (0.1093)	Sec-10, (0.1759)	Sec-13,(0.1304)	Sec-10, (0.1393	Sec-10, (0.1763)
Services	Sec-10, (0.3033)	Sec-11, (0.3020)	Sec-14,(0.3210)	Sec-14, (0.3359	Sec-10, (0.3572)

Source: Same as Table :4a

Calculation by authors

Table:4(c): I-O Multipliers : Alien Multiplier (Column-wise) Sector being influenced most by the sector

Sectors	1983-84	1993-94	1998-99	2003-04	2006-07
Food crops	Sec-15 , (0.0890)	Sec-15, (0.1097)	Sec-17,(0.1238	Sec-15, (0.1689)	Sec-15,(0.2751)
Cash Crops	Sec-10 ,(0.0686)	Sec-15,(0.0577)	Sec-17, (0.0731)	Sec-15, (0.0849)	Sec-15,(0.1150)
Plantations	Sec-5 , (0.0636)	Sec-5 ,(0.0673)	Sec-5, (0.0536)	Sec-17, (0.0927)	Sec-15,(0.0759)
other crops	Sec-15 ,(0.0573)	Sec-15, (0.0558)	Sec-17,(0.0546)	Sec-1, (0.0591)	Sec-15,(0.0528)
Animal Husbandry	Sec-5 ,(0.3721)	Sec-4,(0.2107)	Sec-4, (0.2071)	Sec-4,(0.1579)	Sec-17,(0.1243)
Forestry and Logging	Sec-15, (0.0476)	Sec-15,(0.0712)	Sec-15, (0.0663)	Sec-15, (0.0596)	Sec-15,(0.0642)
Fishing	Sec-15 ,(0.0403)	Sec-15 ,(0.0852)	Sec-15, (0.0637)	Sec-15, (0.0916)	Sec-15,(0.1177)
Agro -Industry - I	Sec-2, (0.2880)	Sec-17,(0.2270)	Sec-17,(0.2744)	Sec-17,(0.3100)	Sec-17,(0.3241)
Agro-Industry - II	Sec-17, (0.2216)	Sec-17,(0.2622)	Sec-17,(0.2920)	Sec-15, (0.3452)	Sec-15,(0.3520)
Fertilizer	Sec-15, (0.4322)	Sec-15,(0.6074)	Sec-15, (0.4838)	Sec-12, (0.5814)	Sec-15,(0.8483)
pesticides	Sec-15, (0.2852)	Sec-12,(0.4380)	Sec-12, (0.3912)	Sec-12, (0.4513)	Sec-12,(0.4509)
Petroleum	Sec-15, (0.8906)	Sec-15,(0.5437)	Sec-15, (0.5075)	Sec-15, (0.7289)	Sec-15,(0.8621)
EGW	Sec-15 , (0.4593)	Sec-15,(0.4910)	Sec-15,(0.3937)	Sec-15, (0.5704)	Sec-15,(0.6573)
Agricultural Implements	Sec-15, (0.6335)	Sec-15,(0.5863)	Sec-15, (0.5899)	Sec-15, (0.8298)	Sec-15,(0.9670)
other manufacturing	Sec-17, (0.2181)	Sec-17,(0.2634)	Sec-17,(0.2672)	Sec-17,(0.2849)	Sec-17,(0.2856)
Transport	Sec-15,(0.4151)	Sec-15,(0.2928)	Sec-17,(0.2980)	Sec-15, (0.3828)	Sec-15,(0.4453)
Services	Sec-15 ,(0.1170)	Sec-15,(0.1178)	Sec-15, (0.1253)	Sec-15, (0.1048)	Sec-15,(0.1124)

Source: Same as Table 4a

Calculation by authors

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