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Aims and Objects:

To promote the study of social and economic problems of agriculture and rural areas and also to promote technical competence for teaching and research in Agricultural Economics and allied subjects through:

(a) research in problems of agricultural economics and rural development;
(b) periodical Conferences and Seminars;
(c) publication of books, reports, papers or summaries of papers either separately or collectively, or in a periodical which may be issued under the auspices of the Society;
(d) co-operation with other institutions having similar objects, such as the International Association of Agricultural Economists and the Indian Economic Association, etc.

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(Organ of the Indian Society of Agricultural Economics)

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ANNOUNCEMENT

In view of the overwhelming response received last year, it is proposed to continue to organise a special session containing paper presentations by Ph.D scholars from different Universities of India.

The award to the maximum best 10 presentations would consist of a memento and a certificate.

It is mandatory for Ph.D. Scholars who present their papers to be a member of the Society. The student's concessional membership fee is Rs. 800/-

In this context, we invite paper presentation from Ph. D Scholars in the form of Abstract as well as ppt presentation on the basis of their Ph.D Research or any relevant topic pertaining to Agricultural Economics at the 80th Annual Conference of ISAE at Centre for Agricultural and Rural Development (CARDS), Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu).

Entries for the presentation along with the membership fee in the form of Abstract along with their ppt should be sent before August 31, 2020:

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PRESIDENTIAL ADDRESS

Towards Inclusive Agricultural Development: Growth Performance, Welfare Challenges and Policy Innovations *

R. Radhakrishna†

I

MACRO CONCERNS: AGRICULTURE AND DEVELOPMENT

Agriculture promotes economic change and development in India through its causal links with factor and product markets. It employs about half of the work force but contributes to only about 15 per cent of the gross domestic product (GDP). In the economically weaker states, however, its contribution to state domestic product and to employment is much higher. Relatively low productivity in agriculture led to a concentration of the poor in this sector. Agricultural productivity improvement contributes to growth and provides, thereby, a route for poverty reduction. Theoretically, it is possible to reduce poverty as well as expand domestic market for industry by raising labour productivity in agriculture and spreading its gains among the low-income groups. Stabilising farmers' income through risk management would reduce transient poverty as well.

In Asian countries, rapid growth in recent decades has led to a shift of resources and workers from agriculture to non-agricultural activities (Radhakrishna, 2017). The process is marked by a transfer of workers from low productivity sectors to high productivity sectors. There is also a change in the structure of demand with a faster rate of increase in the demand for services like financial and personal services. These changes in the structure of demand, production, and employment may be attributed to policy reforms and innovation in information and communication technologies (ICTs). The pattern of structural transformation is not uniform across all countries. The fast-growing East Asian countries, such as the Republic of Korea, Malaysia, Taiwan, and China, have experienced the transfer of labour from agriculture to manufacturing, whereas the structural changes in India did not conform to the above pattern. In India, the share of agriculture in GDP is falling sharply but the share of agricultural workers among the total workers remains high. The growth of labour-intensive manufacturing sector, which provides employment to unskilled and semi-skilled workers, lagged behind. Less labour-intensive service sector, which provides employment to highly skilled and educated labour, has experienced high growth. This

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*Presidential Address delivered at the 79th Annual Conference of the Indian Society of Agricultural Economics held during November 21-23, 2019 under the auspices of College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh).

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resulted in slow expansion of formal employment and high expansion of low paying informal employment spread over rural and urban spaces.

In some Asian countries, employment in agriculture has declined on account of mechanisation, and agricultural diversification took place from traditional food crops to commercial crops, leading, thereby, to an expansion of the rural non-farm sector. Inadequate infrastructure in rural habitations and small towns in some Asian countries led to large scale migration to metropolitan centres, putting pressure on the urban infrastructure. Migrants were compelled to reside in slums. This could have been prevented, had there been a significant improvement in agricultural productivity induced by technology as well as expansion of non-farm sector. In India, the decline in agricultural employment commenced only recently, but such a decline has been rather slow (Binswanger-Mkhize, 2013).

Large volume of literature exists to show that both the overall level and pattern of growth do matter (Ravallion and Dutta, 1996). Agricultural growth has a crucial role in the process of poverty reduction in terms of its direct effect on the rural economy and indirect spillover effects on urban economy. Very few developing countries in the world achieved sustained GDP growth without agricultural growth in their early phase of development (Pasha and Palanivelu, 2003). The poverty reduction effect of agricultural growth is high, especially in countries with low inequality, significant employment opportunities, and decent wage rate. During the pre-reform period, modeling analysis of the linkages between agriculture and industry has shown that a 10 per cent increase in the agricultural output would increase industrial output by 5 per cent. With that, urban workers would benefit both from industrial employment and price deflation (Rangarajan, 1982). Although the magnitude of industrial growth in response to agricultural growth may have declined, the direction of the change may still remain the same even during the post-reform period. Modeling of agricultural sector in the 1980s showed that an abnormal increase in agricultural production with flexible price regime, i.e., without intervention in the market, would adversely affect incomes of farmers in the short-run. But, on the other hand, an increase in the food prices due to a drop in food production would adversely affect the poor (Murty and Radhakrishna, 1982; Radhakrishna and Sarma, 1984). The fluctuation in the agricultural markets, particularly for cereals, would destabilise the economy. This is indeed the basis for the ‘Razor Edge’ problem (Alagh, 1995). What is more, an increase in cereal price would hurt the poor the most and would aggravate income inequality (Radhakrishna and Ravi, 2004). Clearly, from the welfare point of view, stabilisation of food prices by public intervention in the food markets is essential.

Cost-reducing and labour-absorbing technical progress is essential for developing country like India. If rural non-farm sector and urban industrial sectors grow at sufficiently higher rates, they can absorb the surplus labour and surplus food. If they grow at lower rates, with limited possibilities for agricultural export, terms of trade may turn against agriculture. In practice, the fall in food prices is moderated by increasing buffer stocks and expanding wage employment programmes. This may cause fiscal strain. Commercial crops, not covered under market intervention such as perishable fruits and vegetables, tobacco, cotton, oilseeds, etc., often experience price collapse. Price collapse hurts their growers and often subjects them to transient poverty, debt traps, and suicides. If agricultural production lags behind demand, it leads to food inflation, causing, thereby, an increase in nominal wage rates of industrial workers. These effects clearly suggest the need for agricultural growth with stability achieved through strong farm-non-farm linkages. The virtuous cycle between agriculture and non-farm enterprises play a strategic role in providing employment opportunities in the rural areas (Mellor, 1978; Stern, 2001).

Unlike the case of industry, supply-side adjustments in agriculture involving reallocation of resources and net additional investment for capacity expansion take a much longer period (Storm, 1992). Changes in policy regime, not backed by appropriate institutional changes, will have an adverse effect on farmer's livelihood (Radhakrishna, 2009). There is a widely held view that some of the agrarian institutions decayed in the beginning of the post-reform period, as they could not adapt themselves to the ongoing changes in policy regime. The liberalisation of agriculture had exposed commercial agriculture to the volatility of world commodity markets. When agricultural prices in world market were declining in the latter half of the 1990s and the early years of the 2000s, India dismantled its quantitative restrictions and slashed the tariff rates. Further, the withdrawal of government support severely hurt the farming community, particularly oilseed growers. The gains from the subsequent rise in the international rice price might have disproportionately accrued to the middlemen operating between the direct producers and consumers. The desirable goal of agricultural growth with stability has become more distant because the policy instruments are too blunt to mitigate the risks affecting farmers (Radhakrishna, 2009). It is in this context, some public mediation between global prices and domestic food prices assumes critical importance.

II

AGRICULTURAL GROWTH PERFORMANCE

Agricultural production in India was virtually stagnant for several decades prior to Independence. Per capita agricultural output declined by 0.72 per cent per annum during 1911-1941 and food grain output, a major source of food security, declined by 1.14 per cent per annum (Blyn, 1966). India was also saddled with a large population living in abysmal conditions and depending on agriculture for livelihood. The national government formed after Independence accorded priority to agriculture by undertaking several measures. The main policy thrust prior to the mid-1960s, i.e., pre-Green Revolution period, was on agrarian reforms as well as modernising agriculture through large scale investment in irrigation and power and creation of other infrastructure, such as credit institutions, regulated markets, roads and extension as also research institutions. Community development and co-operatives were promoted. Intensive Agricultural District Programme (IADP) was also a major initiative undertaken. India did succeed in breaking the prolonged structural stagnation. During 1949-50 and 1964-65, food grain production increased at the rate of 2.98 per cent per annum and crop output increased at the rate of 3.19 per cent and productivity increased by 1.60 per cent each in the case of both groups (Dantwala, 1970).

The better performance of agriculture witnessed during the early phase of planning could not be sustained. During the mid-1960s, India experienced drought in successive years, in addition to two wars, which led to food crisis. There was severe imbalance between demand for and supply of food. Food grain prices were moderated by PL-480 imports from the US. Wheat was the major component of the PL-480 imports. However, markets of non-food grains experienced inflationary pressure. Though the ratio of food grain to non-food grain crops was in favour of the non-food crops, there was no breakthrough in their production, possibly due to lack of technological developments (*ibid*). This crisis prompted the government to give an overriding priority to the goal of achieving self-sufficiency in food grains by launching the Green Revolution. Public investment in irrigation and agricultural research was stepped up.

Over the Green Revolution period, i.e., from the mid-1960s to the close of the 1980s, India achieved near self-sufficiency in food grain production and experienced an improvement in food security. In the first phase of the Green Revolution, i.e., during the 1970s, there was a significant inter-regional and inter-crop imbalance in agricultural growth. In the second phase of Green Revolution, i.e., during the 1980s, crops like rice, oilseeds and pulses registered high growth, especially in the Eastern and Central regions, where poverty was widespread, and the regional variations in agricultural growth were moderated to some extent. The 1980s were considered to be the best years of Indian agriculture when labour productivity and total factor productivity were at their peak (Binswanger-Mkhize, 2013).

The food grain (cereal) production recorded a growth rate close to 1.3 (2.0) per cent per annum in the 1970s and food grain as well as cereal growth rate accelerated to about 5.0 per cent per annum in the 1980s (Table 1). The relative price of food grains declined after the mid-1970s (Figure 1). Consequently, the dependency on imports declined in the Green Revolution period, i.e., the 1970s and 1980s. In the 1980s, production of cotton, chilies and livestock products also recorded high growth rates .The acceleration in the growth of high value agricultural products came, however, more from area shift from coarse cereals rather than from productivity improvement. There has also been a significant reduction in poverty, especially during the 1980s.

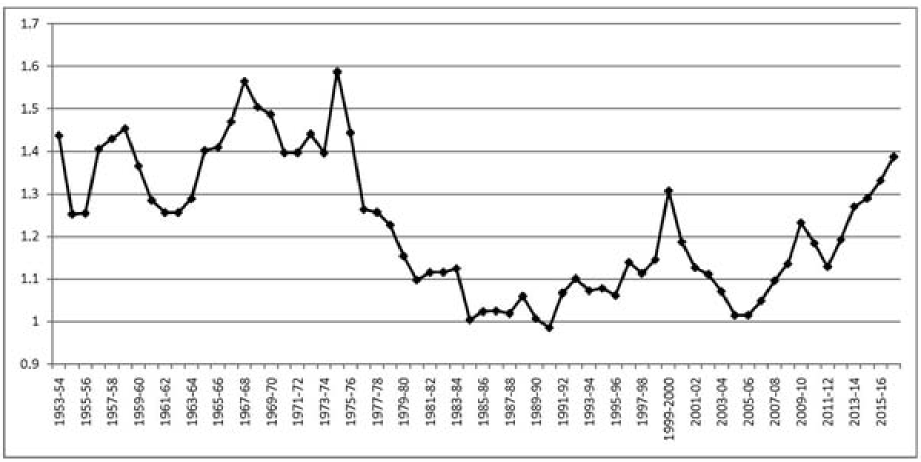
Coming to the reform period, the early phase of the post-reform period (1990s) witnessed decline in the overall growth rate of agriculture and allied sector to 3.1 per cent from 4.5 per cent in the per cent per annum in the 1980s (Table 1)). The 1990s also witnessed a decline in the growth rates of food grains, tobacco, cotton, chilies, and livestock. The relative price of cereals, which registered a declining trend in the 1980s, witnessed a rising trend in the 1990s (Figure 1). There was also a substantial increase in cereal price during 1999-2000, which might have hurt the poor the most.

TABLE 1. GROWTH RATES OF OUTPUTS FROM AGRICULTURE AND ALLIED SECTORS (2004-05 PRICES)

(*average annual growth rates*)

	1970-71 to 1979-80	1980-81 to 1989-90	1990-91 to 1999-2000	2000-01 to 2009-10	2011-12 to 2016-17#
(1)	(2)	(3)	(4)	(5)	(6)
Cereals	1.98	5.02	2.34	0.63	0.79
Food grains	1.27	4.99	2.14	0.74	1.64
Fruits and vegetables	3.72	3.25	5.53	3.73	3.84
Chilies	4.02	5.77	3.86	4.75	8.82
Onion			6.02	6.07	6.58
Tobacco	5.05	3.67	1.10	3.16	-0.53
Cotton	4.80	6.24	1.22	8.64	-1.60
Livestock	3.78	4.71	3.85	4.07	5.21
Milk and milk product	4.60	5.60	4.33	3.73	4.92
Fisheries	2.92	5.51	5.11	3.69	7.19
High value agriculture	3.62	4.19	4.53	3.89	4.95
Value of output from Agriculture	1.30	4.52	3.03	1.85	1.48
Value of output from agriculture and allied activities	1.72	4.54	3.12	2.52	2.74

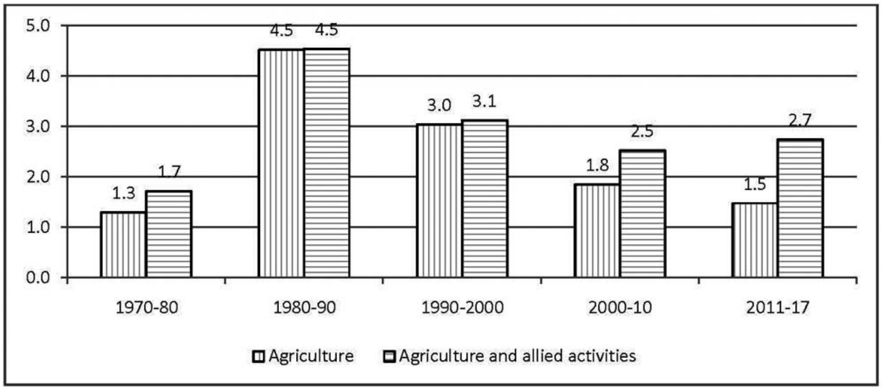
Source: Author's computation from CSO Data.
Note: # in 2011-12 prices.



Source: Economic Advisor, Government of India.
Note: Relative price refers to wholesale price index of cereals deflated by wholesale price index of all commodities with 2004-05 as base.

Figure 1. Relative Price Trend for Cereals during 1953-2016.

The annual growth rate of agriculture declined to 1.8 per cent per cent in the 2000s and further to 1.5 between 2011-12 and 2016-17 (Table 1 and Figure 2). The growth rates of fruits and vegetables also slowed down to about 3.8 per cent per annum in both the periods. What is worse, food grain production recorded a growth rate of 1.6 per cent per annum between 2011-12 and 2016-17.Agriculture and allied sector witnessed an annual growth rate of 2.7 per cent between 2011-12 and 2016-17. Relative price of cereals, which declined in the first half of 2000s, showed an uptrend in the later part of the 2000s (Figure 1).



Source: Author's computation from CSO data.

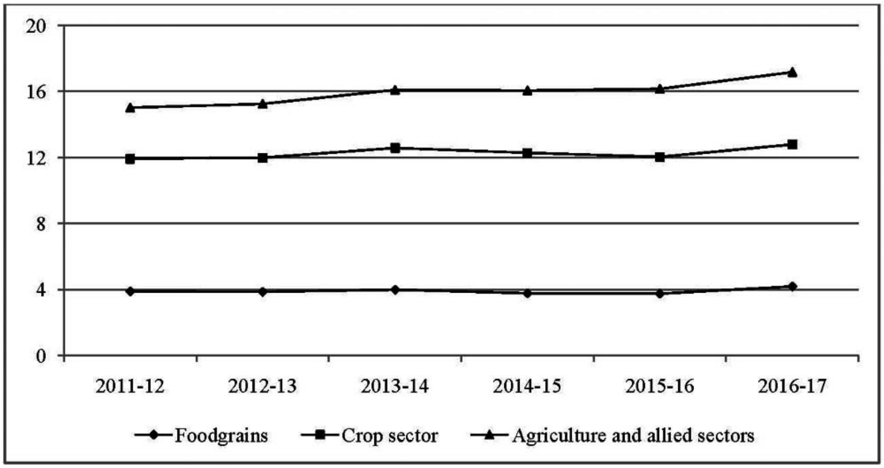
Figure 2. Decadal Growth Rate of Value of Output of Agriculture and Allied Activities in India (Per cent).

The sluggish growth of agriculture during 2011-2017 is depicted in Figure 3. The poor performance of agricultural growth was widespread across states. A large number of states witnessed either less than one per cent or negative growth rate of gross value added (GVA) at 2011-12 prices during 2011-2017 (Radhakrishna and Mishra, 2019, Figure 4). If these trends persist, it aggravates rural-urban disparities and acts as a constraint on long term growth by affecting effective demand. Relative price of cereals also registered a rising trend (Figure 1). Deceleration in the growth of crop output and rising trend of relative price of cereals should be a cause of concern as it hurts the poor the most. These trends need to be reversed.

III

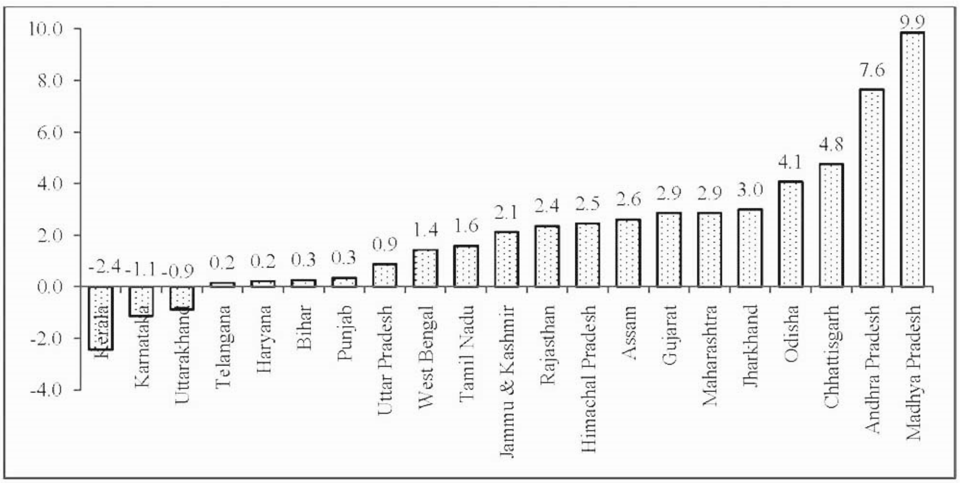
AGRICULTURAL INVESTMENT

Investment in agriculture and allied activities by both public and private agencies does contribute to the growth of agriculture which creates forward and backward linkages to the growth of other sectors. The share of gross capital formation (GCF) in agriculture and allied activities to total gross capital formation fluctuated around 12 to 20 per cent during the 1950s, 1960s and 1970s, and steadily declined thereafter (Shetty, 2019). The share of GCF in agricultural and allied activities in the aggregate GCF of the economy declined from 18.4 per cent in 1980-81 to 7.1 per cent in 2010-11 (Figure 5A). In the period 1980-81 to 2010-11, the ratio of GCF in agricultural and allied activities to GDP has hovered below 4 per cent. Clearly it indicates agriculture, as compared to other sectors, received less priority in GCF.



Source: Author's estimation from CSO data.

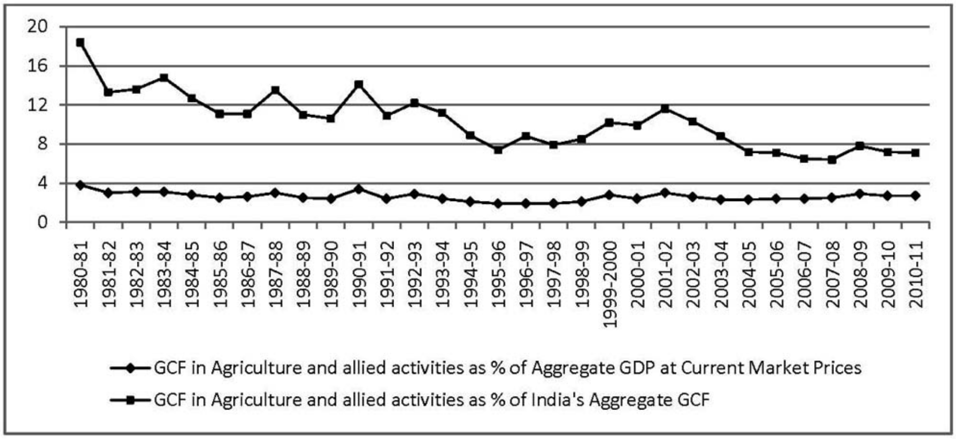
Figure 3. Gross Value of Output from Food Grains, Crop Sector and Agriculture and Allied Sectors in India at 2011-12 prices (in trillion).



Source: Author's estimation from CSO data.

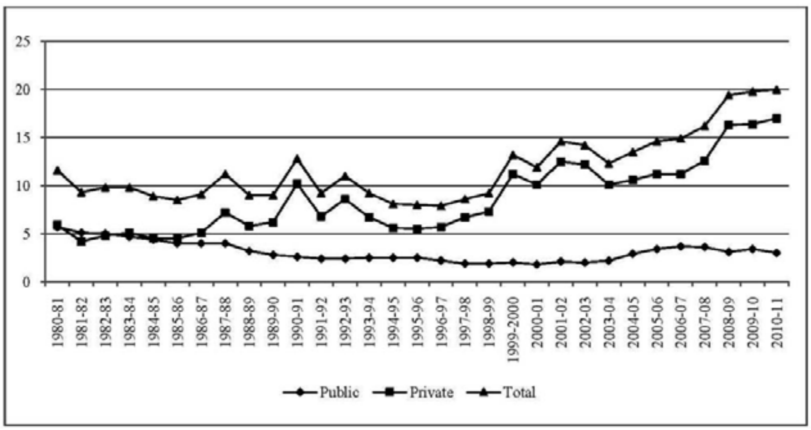
Figure 4. Growth Rate of Gross Value Added (GSVA) in Agriculture and Allied Activities among Major States during 2011-12-2016-17 at 2011-12 Prices (per cent).

The relative shares of public and private sectors in GCF in agricultural and allied activities (AGCF) have changed over time. Between 1980-81 and 1983-84, the public and private AGCF as a ratio of GDP in agricultural and allied activities remained the same at about 5 per cent; and thereafter, the share of public sector in GDP in agricultural and allied activities declined to about 2 per cent in 2003-04 and moderately increased to nearly 3 per cent in 2011-12 (Figure 5B). Studies show that public investment in agriculture in the early phase of planning crowded in private investment in agriculture, but the relationship got weakened now. In the early phase of planning the crowding in could be due to the fact that irrigation, infrastructure, etc., received higher weightage in the public investment but their weightage declined subsequently.



Source: EPWRF, 2019.

Figure 5A. Gross Capital Formation (GCF) in Agriculture and Allied Activities as a Percentage of Aggregate GDP at Current Market price and as a Percentage of India's Aggregate GCF (at 2004-05 prices).



Source: EPWRF, 2019.

Figure 5B. GCF in Agriculture and Allied Activities as a Percentage of GDP from Agricultural and Allied Activities (at 2004-05 prices).

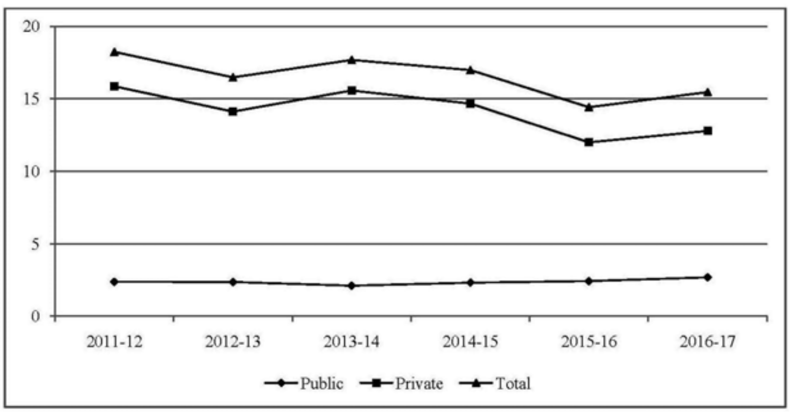
The private sector AGCF as a ratio of GDP in agricultural and allied activities hovered around 5 per cent during 1980-81 to1986-87; increased to 10 per cent in 1990-91; declined to about 6-7 per cent in the early phase of the reform period (up to

1998-99); and then, steadily rose to about 18 per cent in 2010-11 (Table 5B). It dominated the change in AGCF. The AGCF (public and private) as a percentage of agricultural GDP increased steadily from about 7 in 1997-98 to 21 in 2010-11.

What Explains the Increase in Private Capital Formation?

Since 1998-99, multiple factors have promoted private investment in agriculture (Shetty, 2019): (i) rising wages as well as labour scarcity has motivated the farmers to invest in labour saving mechanisation; (ii) relative price shift in favour of agriculture has induced private investment in agriculture; and (iii) the policy of doubling agricultural credit in every three years announced in 2004 and subsequent expansion of term lending by banks have a positive effect on private investment. It is a paradox that the substantial increase in private investment as well as total investment in agriculture has not resulted in accelerating aggregate growth. It could be due to the fact that a considerable private investment has gone for substitution of labour and hence incremental capital-output ratio has risen.

Coming to the recent period, as per the revised National Income Series (2011-12), public sector GCF in agriculture and allied activities as a percentage of Gross Value Added (GVA) in agriculture and allied activities at constant prices fluctuated between 2.4 to 2.7 per cent during 2011-12 to 2016-17 (Figure 5C) (Shetty, 2019). Private sector GCF in agriculture and allied activities as a percentage of GVA in agriculture and allied activities declined from 15.9 per cent to 12.8 per cent. Consequently total GCF (public + private sectors) in agriculture and allied activities as a percentage of GVA in agriculture and allied activities declined from 18.2 in 2011-12 to 15.5 per cent in 2016-17 (*ibid*). The slowdown of agricultural growth as well as declining share of agricultural GCF in GVA has adverse effect on agricultural investment in the recent period. This needs to be addressed.



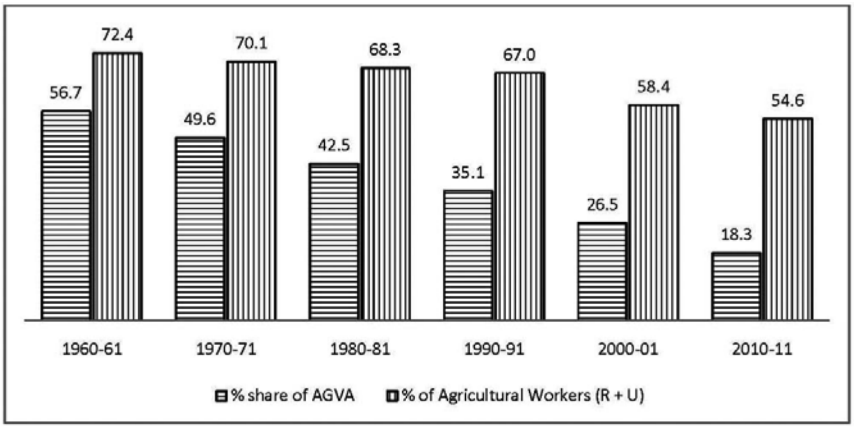
Source: Shetty, 2019.

Figure 5C. GCF in Agriculture and Allied Activities as a Percentage of Gross Value Added Agricultural and Allied Activities (at 2011-12 prices).

IV

AGRICULTURAL EMPLOYMENT

In 2011-12, though agriculture accounted for 14.1 per cent of GDP, its share in workforce was high at 47.5 per cent (Thomas, 2015). On the other hand, though the service sector accounted for 58.5 per cent of GDP, its share in employment was low at 27.9 per cent. However, the secondary sector had the share of 27.5 per cent of GDP as against the share of 24.6 per cent of workers, almost maintaining some balance. Similarly, in the case of the manufacturing sector, there was a little difference between its share in employment (13.3 per cent) and in GDP (15.7 per cent) (*ibid*). The declining share of agriculture in GDP is on the expected line, but the sluggish decline of employment is a cause for concern (Figure 6). Even in rural India, the share of agriculture in net domestic product (NDP) was 36 per cent in the 2000s (Papola, 2014), whereas its share in total rural workers (principal and subsidiary status) was 64 per cent (NSS Report No. 554). It shows the disparity in income between agriculture and non-agricultural workers.



Source: Computed by A. Venkateswrulu.

Figure 6. Share of Agriculture in Agricultural Gross Value Added and Share of Agricultural Workers in Total Workers in India (per cent).

Employment in agriculture and allied activities has declined not only in relative terms but also in absolute terms. Out of the 472.5 million workers (rural plus urban) in 2011-12, 224.4 million (47.5 per cent) were employed in agriculture and allied sectors, whereas in 2004-05, 257.7 million workers were employed in agriculture and allied activities and their proportion in total workers was 56.3 per cent. Of the net fall of 33.3 million workers between 2004-05 and 2011-12, about 19.2 million net fall of workers was from self-employed workers in agriculture and allied activities, and about 13.5 million net falls from casual agricultural workers. This has contributed to a moderate increase in the share of self-employed workers in the total agricultural work force.

Rural female workforce in agriculture has also declined by about 27.2 million (17.5 million self-employed and 9.7 million casual workers) between 2004-05 and 2011-12. It is claimed that women withdrew from agriculture and were attending to domestic duties in their own households due to an improvement in the availability of income-earning opportunities for male members of the family and perhaps to avoid heavy manual work in agriculture. There is a degree of segmentation of agricultural labour market with female workers mostly engaged in repetitive and strenuous agricultural operations. Even with the progressive withdrawal of female workers, there has been feminisation of agriculture due to the shift of male labour from farm work to non-farm work.

The non-agricultural sector has been emerging as a source of employment in the rural areas. In 1983, only 19 per cent of rural workers were engaged in non-agricultural activities, as against 36 per cent in 2011-12. This shift has taken place among the economically weaker sections (Saha and Verick, 2016). Construction, trade and services were the major drivers of non-farm employment. There has been an increase in the demand for specific skills in non-farm activities, in commercial agriculture and in allied agricultural activities. These are some positive trends. It should be noted that the non-farm sector has better scope for regional spread than agriculture.

These developments have brought about perceptible changes in the employment patterns in rural areas. The percentage of self-employed in agriculture has risen but, in contrast, increasing casualisation of the workforce has taken place in the non-farm sector. On the whole, self-employed workers (usual and subsidiary status) in all sectors together accounted for 56 per cent of the rural work force and casual rural labour for 35 per cent. The proportion of households among the agricultural households having non-agriculture wage income as a principal source of income has increased considerably between 2002-03 and 2012-13 (NSS0's *Situation Assessment of Agricultural Households Surveys*). This has been more prominent among poorer agricultural households (Saha and Verick, 2016). Some of the farm households have not only diversified into high value crops but also engaged in non-farm sector as self-employed. For some of them, farming has become part time.

The average rate of daily wage earning of rural casual workers accelerated to 3.9 per cent per annum between 1993-94 and 2011-12 as compared to 2.5 per cent between 1983 and 1993-94 (Papola, 2014). The rate of increase in daily wage earnings was much higher between 2004-05 and 2011-12 as compared to the period between 1999-2000 and 2004-05. The daily wage earnings of rural casual workers have risen faster than daily wage earnings of urban casual workers and agricultural wages have grown at a higher rate than non-agricultural wages in the post-reform period (*ibid*). In rural areas, average daily wage earnings of casual labour in non-agricultural activities have been consistently higher than in agricultural activities throughout the period. However, the gap has narrowed down. Despite the higher growth rate of rural wages, urban wages were higher in 2011-12.

The ongoing trends in agricultural and allied sector employment signify that structural changes have been occurring in the rural labour market. Supply and demand factors are both responsible for these changes. On the supply side, the following three factors appear to be responsible: (i) decline in the rate of population growth, (ii) decline in the rate of labour force participation due to increasing enrolment of youth in educational institutions, and (iii) rural to urban migration. On the demand side, there has been an overall decline in demand for labour due to (i) mechanisation on account of increased wages and labour scarcity in peak season due to the implementation of Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), (ii) crop diversification from traditional labour intensive food crops to less labour intensive tree crops and horticultural crops, and (iii) significant and rapid expansion of the rural non-farm sector.

V

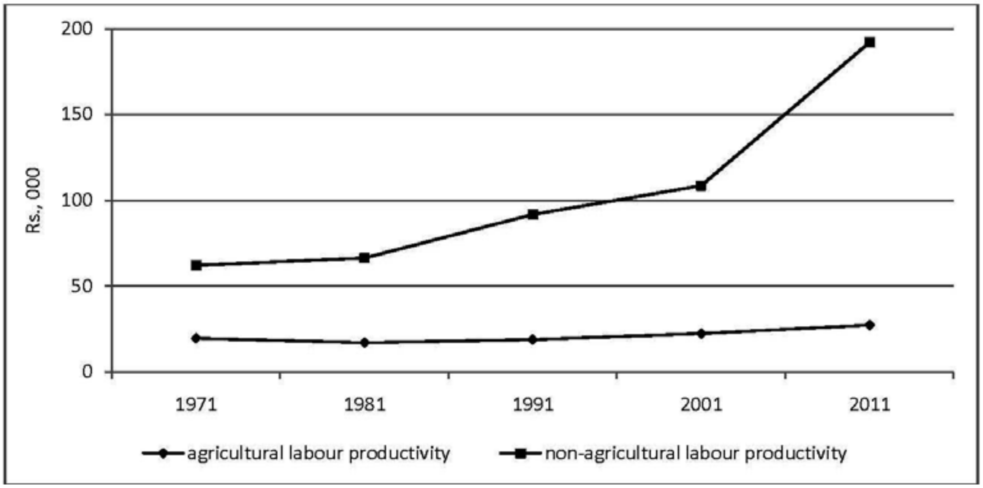
IS THERE CONVERGENCE IN THE PRODUCTIVITIES OF AGRICULTURAL AND NON-AGRICULTURAL WORKERS?

Empirical evidence on structural transformation of 86 countries from 1965 to 2000 shows that the gap in labour productivity between agricultural and non-agricultural workers approaches zero when incomes are high enough and the two sectors have been integrated (Timmer, 2009). A dynamic agriculture raises labour productivity, increases wages and reduces poverty. The process also reduces the relative importance of agriculture to the overall growth of the economy as the industry and service sectors grow faster.

On the contrary to the experience of the eighty six countries, there was no convergence in the productivities of agricultural and non-agricultural workers from 1971 to 2011 (Figure 7). In fact, the difference in productivities widened over time both in absolute and relative terms. While in 1971, the gap in the labour productivity between non-agriculture and agriculture at 2004-05 prices was Rs. 42,433, which has increased to Rs. 1,64,757 in 2011. In relative terms, the labour productivity of non-agriculture was nearly double than that of agriculture in 1971 and by 2011, it was almost six-fold higher. The gap widened substantially between 2001 and 2011.

How to Promote the Structural Transformation?

The long-term convergence of productivity between agriculture and non-agricultural workers depends on improving land productivity and promoting mobility of labour from agriculture to non-agriculture for decent employment. Such a transition can be facilitated by labour intensive economic growth including promotion of producer companies and equipping the farm youth with skills in demand. Such a transition would be the right path to eliminate rural poverty and address the widening inequalities.



Source: Computed by author from CSO and Census Data.

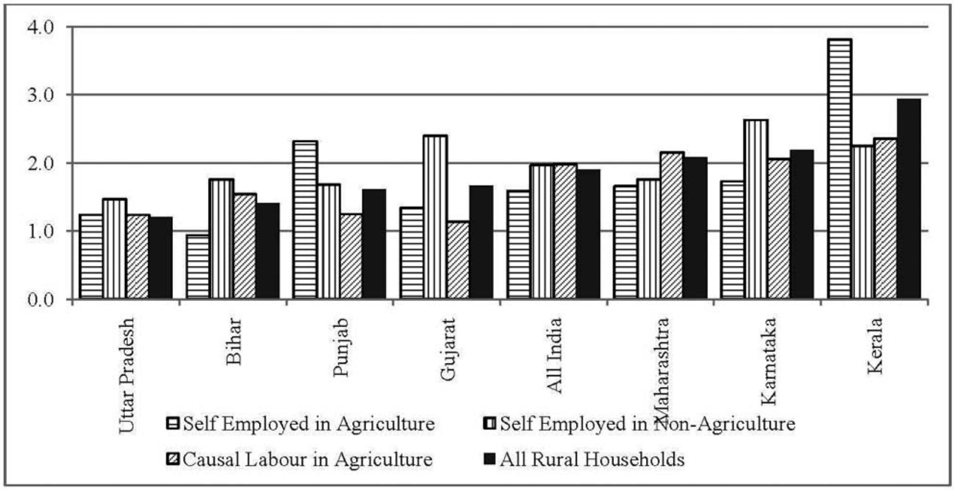
Figure 7. Agricultural and Non-agricultural Labour Productivity in India (at 2004-05 Prices), (Rs.000).

VI

WELL-BEING OF FARMING COMMUNITY: LEVELS OF LIVING

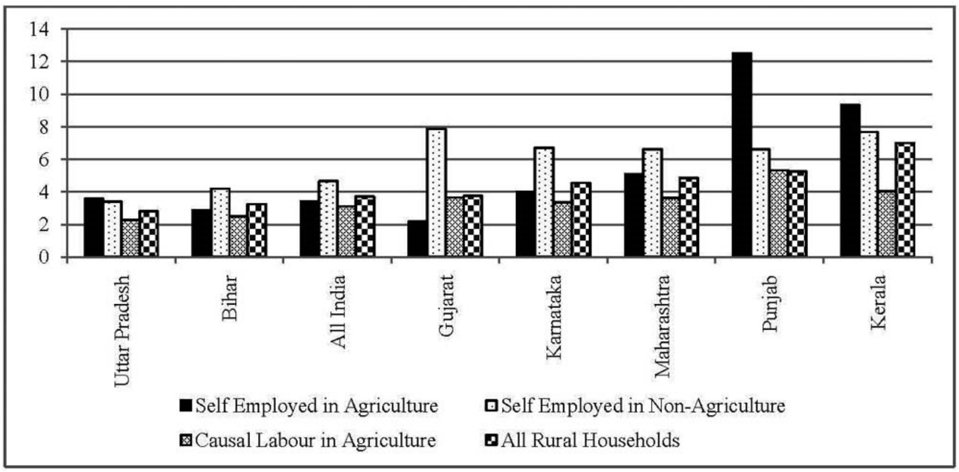
The proportion of agricultural households in total rural households declined from 68 per cent in 1993-94 to 55 per cent in 2011-12. The self-employed households in agriculture as a percentage of rural households declined from 38 per cent to 34 per cent and casual agricultural labour households declined from 30 to 21 per cent during that period (NSSO 50th and 68th Rounds). How do the improvement in levels of living and decline in the incidence of poverty among the self employed household in agriculture compare with other rural occupational groups?

In the post-reform period (1991-2012 self-employed households in agriculture in rural areas experienced moderate improvement in their well-being as reflected in their monthly per person expenditure and poverty reduction (See Figures 8 and 9). But, these households lagged behind the average rural households in respect of growth of monthly per capita consumption expenditure (MPCE). Households self-employed in non-agricultural activities in rural areas gained more than the households self-employed in agriculture. Evidently, the relative position of the households self-employed in agriculture worsened after 1991 reform. However, the MPCE of households self-employed in agriculture was more or less the same as that of all classes' average in all states in 2012, except for Punjab and Kerala where the MPCE of such self-employed households was markedly higher and the incidence of poverty was the lowest (Radhakrishna and Raju, 2015).



Source: Radhakrishna and Raju (2015).

Figure 8. Annual Growth Rate of MPCE at Constant Prices between 1993-94 and 2011-12 by Occupational Types and All Rural Households.



Source: Radhakrishna and Raju (2015).

Figure 9. Compound Rates of Decline in the Incidence of Poverty (per cent) between 1993-94 and 2011-12 by Occupational Groups.

The MPCE growth among agricultural labour households kept pace with that of All India rural households between 1993-94 and 2011-12 and witnessed higher growth than that of self-employed households in agriculture. Even with better growth, the absolute MPCE of agricultural labour households in 2011-12 was far below that of households self-employed in agriculture (Radhakrishna and Raju, 2015).

Between 1993-94 and 2011-12, the incidence of poverty in rural areas declined at 3.44 per cent per annum among households self-employed in agriculture and at 3.11 per cent per annum among agricultural labour households. These rates of decline were lower than the average rate of decline of all rural households (3.71 per cent per annum). Other rural labour households engaged in non-agricultural activities experienced the lowest decline (2.41 per cent per annum), while self-employed households engaged in non-agricultural activities experienced the highest rate of poverty reduction (4.66 per cent per annum).

What is worth noting is that the higher agricultural productivity in Punjab and diversification of sources of income in Kerala contributed to a higher income among the agricultural households in rural areas (Situation Assessment Survey of Agricultural Household of NSS 70th Round (2012-13)). The incidence of poverty was negligible among landholding classes above 0.40-1.00 hectares in Punjab and above 1.00-2.00 hectares in Kerala. Rural economy of Kerala already experienced diversification. In 2011-12, 31 per cent of rural workers (principal and subsidiary status) of Kerala were engaged in agriculture (NSS 68th Round, 2011-12). Rural economy of Punjab was less diversified. Agricultural labour constituted 52 per cent of total rural workers (*ibid*).

Gujarat and Maharashtra experienced slower growth of MPCE in rural areas and also slower reduction of poverty (Figures 8 and 9). In Gujarat, though agricultural Gross State Domestic Product (GSDP) was the highest among the major states and its growth was twice to that of All India annual growth rate, between 1993-94 and 2011-12, its MPCE increased at 1.34 per cent per annum for self-employed households and 1.14 per cent for agricultural labour households. The corresponding figures for All India were 1.59 per cent and 1.98 per cent respectively (Radhakrishna and Raju, 2015). The performance of poverty reduction during the post-reform period was better in the Southern states.

Cross-section regression analysis has shown that agricultural productivity (agricultural GSDP per net sown area), extent of irrigation (gross irrigated crop area/gross cropped area), road density and urbanisation have significantly and positively affected MPCE in rural areas and reduced the incidence of poverty among the self-employed households. The proportion of agricultural workers in rural workforce and, to some extent, agricultural land productivity would explain the inter-state variations in wage earnings per worker, MPCE and poverty (Radhakrishna and Raju, 2015).

For sustainable improvement in the well-being of farming community, India has to accord priority to agricultural productivity driven by total factor productivity, agricultural diversification, and income diversification by expansion of rural non-farm sector as well as promotion of pro-poor collective institutions to integrate small farmers into the development process. However, low level of education and skills among the farming community, particularly among the small farmers may act as a barrier to their mobility to rural non-farm sector. Evidently, the present situation marked by prevalence of unsustainable debt burden among the farming community is a challenge to overcome the widespread distress. It is essential to put a downward pressure on the prevailing high interest rates in the informal credit market by expanding formal credit to agriculture. Reducing the transaction cost of institutional credit by adopting technological innovation is imperative.

VII

AGRICULTURAL INCOMES AND INSTITUTIONS: NEED FOR REFORMS

There is a disconnect between agricultural growth and improvement in farmers' incomes. The value of agricultural produce at retail prices is substantially higher than the prices received by the farmers. The margins that accrue to middlemen between direct producer and consumer are very high. Moreover, the increasing capital and credit intensity of agricultural marketing technology restricts market access to small and marginal farmers.

7.1. *Agricultural Produce Markets*

Lack of remunerative prices to agricultural produce is one of the main causes of farmers' distress. Capital and credit intensive agricultural marketing, restricts active participation of small and marginal farmers in commodity markets. Agricultural Produce Markets managed by the state governments through Agricultural Produce Market Committees (APMCs), have not been effective in providing remunerative prices to the small and marginal farmers. The Union Government has proposed a model Agricultural Produce and Livestock Marketing (Promotion and Facilitation) Act, 2017 for bringing functional and administrative uniformity among the agricultural produce markets in the country. The provisions of the Act aim to promote efficient functioning and transparency in the marketing of agricultural produce. The Government of India has advised the states to introduce legislations for the establishment of private markets and yards for direct exchange of produce between the buyers and sellers without government interference. It also recommended promotion of Public Private Partnership (PPP) in the management and development of agricultural markets in the country. These initiatives, if implemented properly, will not only contribute to agricultural diversification but also lead to distributive efficiency. Many states have adopted the Act partially or fully. One of the significant provisions of the Act is to develop a pan India market (electronic National Agricultural Market (e-NAM)) in which both sellers and buyers use the Information and Communication Technology (ICT) for trading agricultural produce. There are 585 markets registered so far under the e-NAM scheme, of which 371 are functional.

Mobile Apps were designed for the use of farmer sellers, traders and other stakeholders to participate in the e-NAM. One of the provisions in the model Act is to provide unified license for traders to operate across the markets. In order to reduce the marketing costs and consumer prices, 12 states have abolished market fee on fruits and vegetables and also deleted them from the list of notified commodities. Direct marketing of farm produce is also advocated by the model Act. Direct marketing licenses were granted to private entrepreneurs. Establishment of private markets, to bring competition between them and the markets controlled by APMCs, is also envisaged by the Act for facilitating storage and pledge finance for the agricultural produce. Further, all the storage structures, i.e., cold storages, silos and other private go downs, were notified as sub-markets. The storage documents issued by them are made negotiable. If the provisions of the model Act are implemented in the letter and spirit, they would promote managerial and functional efficiency of agricultural markets. Otherwise they will remain only on paper.

What is to be Done for Enhancing the Bargaining Position of Farmers in the Market?

Capacity building among farmers to form collectives should be the core element of any strategy, particularly for strengthening the bargaining position of farmers (small and marginal farmers) in the market. The farmers' awareness should be built through consolidation of their collective strength. Equally important is the state government's market interventions in critical areas such as price stabilisation, technology support, provision of infrastructure, imparting marketing skills, etc. Some of the following successful farmer collectives and market intervention by the state governments can be replicated in other parts of the country.

ITC e-Choupals: International Business Division of Indian Tobacco Company (ITC) started about 6500 e-choupals in 40,000 villages of 10 states to network villages and procures agricultural products for domestic and export purposes (ITC, *e-choupal* portal). ITC has set up small internet kiosks at the village level to provide real-time market information related to prices, availability of inputs, weather data and other aspects relevant to farmers. Locally identified farmers, called *sanchalaks,* manage these kiosks. Farmers can sell their produce directly to ITC and get cash in ITC collection centers. It benefits farmers in getting higher farm gate prices, as ITC could directly procure from the farmers by removing the intermediaries. It also benefits the company by reducing its sourcing cost and gaining wider reach and networks. ITC's intervention in supply chain benefits the farmers by increasing their sales. According to ITC, farmers increased their sales realisation by 10 to 15 per cent and it succeeded in saving procurement cost to the tune of 3 to 4 per cent. It needs to be assessed whether small and marginal farmers benefit from the ITC initiative and whether it can be replicated.

e-NAM: In Chhattisgarh and Andhra Pradesh, for traders participating in e-NAM, Rs. 0.25 rebate is given in the market fee to be paid on every purchase of notified agricultural commodities. In Sandspur Market of Gujarat, 30 per cent exemption in the total market fee is given to the traders operating through e-NAM. In Madhya Pradesh and Uttarakhand, 0.5 per cent to 10 per cent market fee is waived on e-NAM proceedings respectively. These incentives will have their impact on the ultimate consumer prices in a big way. That the farmers get benefitted from e-auction is evident from the fact that the arrivals in the market after introduction of e-NAM have been increasing steadily. The value of commodities traded through the unified platform (e-NAM) has almost doubled from Rs. 6,509 crore in 2014-15 to Rs. 12,597 crore in 2015-16.

Rural Distribution (RUDI for short): RUDI, an organ of the NGO of Self-employed Women Association (SEWA), is a Farmer Producer Company with 600 members. It has 42 processing units in the state and most of the members are women. It tried to establish supply contacts with some companies and procure products from the members for supplying to the companies. As soon as they get the order, they inform the members about the price at which they will buy. If the members agree to the price, the commodities are transported from them to the companies at the cost of the company. RUDI charges 2 per cent commission from the members for getting their produce sold through it. It has obtained license from the APMC to act as the licensed buyer and to pay the market fee. Since storage facilities are not available with the farmer members, the produce is generally sold without much profit.

Maha Mango/Maha Grapes/Maha Anar of Maharashtra: The State Marketing Board of Maharashtra provides handholding to the entrepreneurial farmers to market the fruits largely grown in the state under its brand name, prefixing "*Maha*" (short for Maharashtra) to variety of fruits. The farmers are organised into co-operatives and the Board provides the necessary technical support to them to grow and market their produce both in India and abroad. Cargo hub is established at Pune, where the farmers bring their produce for upcountry sale/export. At the cargo hub, the produce is graded, packed and air lifted to different destinations. The Board has established post-harvest training centre in Talegaon near Pune to train the farmers of different fruit co-operatives.

Marginal Farmers Markets of Kerala: It is a network of 265 primary agricultural markets, self-governed by about 125,000 marginal farmers across Kerala. A decade long social mobilisation through self-help group (SHG) route has enabled marginal farmers to acquire required skills to manage group marketing. Every farmer-member is made aware of his/her democratic right to participate in the decision-making and his/her responsibility towards ensuring transparency in the administration of markets, including price discovery. Towards this, they are being supported by a professional body: Vegetable and Fruit Promotion Council (Keralam), promoted by the state government. Through this collective marketing, the farmers benefit from scale economies and realise best possible price for their produce.

SAFAL, Bangalore: The SAFAL market is designed exclusively for marketing of fruits, vegetables and flowers but, presently, only fruits and vegetables are sold in the market. A farmer who intends to sell in the market has to bring their fruits or vegetables after grading them into not more than three grades. Procured produce is classified and stored in cold storage. Auction, on the basis of sample, is conducted by electronic display system in the auction hall. The auctioneer starts the auction displaying the name of the fruit or vegetable, grade and the quantity. Auction commences with presumptive price at higher level than the ruling price on the electronic display board. With the commencement of the auction this price starts to descend. Descending of the price stops at that level and the table number from which the button was pressed is displayed. The name of the buyer and rate at which he is willing to purchase is determined. Since sale is not as per the lots of individual farmers, total value of the produce for particular grade is averaged and disbursed to the farmers on pro-rata basis. Board deducts a service charge at 3.5 per cent of the value of the produce from the farmer. There are no other marketing costs in the name of carting, storing, handling, weighing, etc. and hence the farmer realises better price.

Floor Price Scheme: The Karnataka Marketing Board has implemented "Floor Price Scheme" to procure commodities that are not covered under the minimum support price (MSP) scheme of Government of India, viz., onion, potato, green chili and tomato. Whenever market price falls below the minimum support price fixed by the state government, the state provides money to government agencies to procure the produce at the MSP. For this purpose, the Board has constituted a revolving fund with contributions from the market committees and grant from the Government of Karnataka.

Building Storage Space at Village Level in Tamil Nadu: Under the guidance of Mysore Resettlement and Development Agency (MYRADA) an NGO of small farmers in the Germalam village in Erode district pooled a tiny share of their own resources, took institutional credit through the SHGs located in the village and constructed two warehouses. The village SHG manages these warehouses at the lowest possible cost. The charge of storing one bag of produce by the members contributed to the construction of warehouses is Rs. 1 per month, whereas it is Rs. 1.5 per month for other individuals. Thus, the community involvement has facilitated in minimising the storage losses and contributing to the efficient supply chain.

Complementary efforts in building institutions such as Farmers' SHG Federations and Producer collectives, including producer companies, and imparting skills for integrating small farmers with agri-business are equally important. These measures would promote earning opportunities to farmers' households from farm and non-farm sources. Also, effective public intervention is essential to manage risks originating in both production spheres as well as in the markets.

It is essential to recognise that consumption patterns are changing due to higher growth as well as globalisation. As a consequence, the food basket is getting diversified and demand for quality food is on the increase. This is reflected in the high share of high value commodities in the consumption basket of the households. Changing lifestyles, market integration and trade liberalisation at the global level have led to increasing demand for processed food. In future, both diversification and quality will influence agricultural growth and both will open opportunities for investment in agri-business. The moot question is how far this growth would strengthen the livelihood base of the farming community in traditional agriculture, particularly in rain fed areas.

7.2 *Agricultural Land Markets*

Under the Constitution of India (Seventh Schedule), land is predominantly a state subject. Indian land markets, therefore, are heterogeneous. A variety of land markets exist with different levels of rights over land ownership, usage and revenue. Since each state is entitled to frame policies to manage its own land markets, the rules and regulations that govern agricultural and urban land differ across states.

There are several constraints for the emergence of a well-functioning land market in India due to some inherent problems with land (Mearns, 1999). The legal and effective regulatory framework can, to some extent, overcome these problems. Despite land reforms, the land market continues to be highly distorted due to several factors. Land records are inaccurate and outdated. There are widespread disputes relating to land titles. High transaction costs have discouraged formal land transactions. Initiatives, which could have made the market function better, have not been taken; while some regulations, particularly relating to tenancy, are counterproductive. Land market in India is distorted by vested interest of richer farmers who block reforms, industrialists who take advantage of land scarcities, and corrupt bureaucrats who are involved in tampering with land titles and records. All of them have a strong hold on land markets.

There is a significant transfer of land from farmers to the promoters of various projects, which has been the source of widespread social discontent. Estimates show that during 1991 and 2003, 2.1 million hectares of land was acquired for non-agricultural purposes. Large area of land has been acquired for Special Economic Zones (SEZ) of which a major part remained vacant and unused. Lands given at subsidised rates to establish industries in SEZ, after land prices shot up lands were mortgaged banks for loans to be used for purpose other than establishing industries in SEZ. Undivided Andhra Pradesh, Gujarat, Maharashtra and Tamil Nadu accounted for 70 per cent of land acquisition for SEZ. Bhaduri (2016) has shown how political corruption and patronage of the corporate sector by the governments has resulted in the allotment of land and other natural resources at subsidised rates to the corporate entities, leading to forceful eviction of the poor from their dwellings and deprivation of their livelihoods.

Successive rounds of NSS have shown that with a downward shifting of large holdings (> 10 ha) occurring into the upper end of the farm size ladder, semi-medium (2 to 4 ha) and medium (4 to 10 ha) holdings have not only survived but also recorded a comparatively better performance than large holdings (Vyas, 2014). Late Professor V.S. Vyas argued that expansion of semi-medium and medium holdings is desirable from both growth and equity points of view and made the following suggestions: “Small farmers should be encouraged, and enabled, to expand their holdings through purchase or leasing land from bigger farmers; Supportive institutions of research, extension, credit and marketing should be geared to assist small farmers; Marginal farmers and absentee large farmers should be encouraged to sell or lease out land." Commission on Inclusive and Sustainable Agricultural Development of Andhra Pradesh (APCAP) in its Report (2016) recommended that the state should create a land bank for small, marginal and tenant farmers. It should acquire the land through market process and sell the same to small and marginal farmers and tenants on easy terms. Credit agencies should be persuaded to extend long term loans to such tenant and small farmers who aspire to purchase land. The land banks promoted by the state should encourage the large farmers and absentee landowners to lease out land to land bank with an assurance to the owners to restore the land to the owners after the lease period. The land bank, in turn, can lease out the land for the potential tenants.

7.3 *Agricultural Credit Markets*

Tenant farmers require both short term production credit as well as long term investment credit. The short-term oral leases and uncertainty of its renewal are the main reasons why farmers are unable to access institutional credit or make long term investments in agriculture. Banks are not enthusiastic about extending credit due to oral tenancy and lack of collateral.

A way out would be to remove all restrictions on leasing land; lease agreements should be registered; and there should be efficient machinery for adjudication. APCAP suggested that (i) tenants should be organised into self-help groups and federated at various levels to improve their negotiating power with banks for production credit, (ii) state should permit registration of tenancy by Panchayat or revenue official and financial agencies should recognize the certificates issued by them for providing production as well as investment loans, and (iii) tenants should be identified at the *Gram Sabha* in the presence of representatives of Gram Panchayat, and financial agencies.

The *Vikas Jana Shakti-type* of model launched by Karnataka *Grameen Vikas Bank* to meet the credit needs of the vulnerable groups can be adopted for reaching out to tenant farmers even without recorded tenancy.

Tenant farmers should be incentivised through skill development, institutional credit and entrepreneurial guidance to explore and take up micro enterprises such as agro-processing in the supply chain, either on individual or on group approach. The banks should be directed to provide credit under the interest subvention scheme to enable them to take up these allied and non-farm activities. This strategy may lead to diversification of the household income of tenants, which can provide some income security and enhance their bargaining power in the tenancy market. In the long run, the bargaining position of the tenants depends on the supply and demand forces in the lease market. If demand lags behind supply, the bargaining strength of tenants will be strengthened.

VIII

LAND DEGRADATION, WATER USE EFFICIENCY AND NATURAL FARMING: A PARADIGM SHIFT

India's share in world population is about 17 per cent, whereas its share in freshwater resources is only about 4 per cent. About 25 per cent of global ground water usage is from India. Water use efficiency in crop cultivation in India is the lowest in the world. Indian farmers use 3 to 5 times more water than Chinese, Israeli and American farmers for the same crop (Kant, 2019). Over 20 million wells pumped water in India with free power supply by state governments. It is claimed that Punjab uses three times more water than Bihar for the production of a kg of rice. India is exporting more than 10 trillion tonnes of water through export of basmati rice (Kant, 2019). To meet the water requirement of irrigation and drinking water, it is essential to conserve and augment all water bodies. It is suggested that lessons can be drawn from Telangana's Mission Kakathiya which restores about 21,275 irrigation tanks, and Andhra Pradesh's experience, where the water recharge technology has been used to raise ground water levels (Kant, 2019).

Although use of nitrous, potassium and phosphate fertilisers (NPK) has contributed to agricultural growth, its indiscriminate use led to salinity in the land and erosion of the soil fertility. Our field visits and interaction with officials in Andhra Pradesh revealed the spirit of competition in the use of chemicals is observed among farmers without realising the negative impact. There are instances of fertile lands becoming alkaline due to continuous and excessive use of chemical fertilisers. Mono-cropping is another aspect that leads to land degradation. Use of chemical pesticides will have adverse effect on health of the consumers of agricultural products. The farmers practicing conventional chemical agriculture have to depend on the market for seeds, fertilisers and pesticides. As these markets are mostly monopolised, the prices go up and the cost of production per hectare goes on rising as compared to the value of output per hectare, as is being reported by the farming community.

It is in this context, Zero Budget Natural Farming (ZBNF) is emerging as an alternative to chemical agriculture paradigm. It replaces the use of chemical fertilisers and pesticides with organic inputs, prepared from cow dung, cow urine, jaggery, pulse flour, neem leaves, crop residues, and so on. "*Acchadana*" or mulching in natural farming is the process of covering the topsoil with cover crops and crop residues. This produces "humus", which conserves topsoil, increases water retention, improves soil fauna, and essential nutrients, and controls weeds. The proponents of natural farming are of the view that it is eco-friendly, enhances soil fertility, improves crop yields, and reduces cost of production. These pronouncements have yet to be validated by field surveys.

Crop rotation, practice of multiple cropping, and growing *azoles* which suppresses the weeds are all in the basic principles of natural farming. It is believed that natural farming enhances porosity of soil, humus formation (that promotes microbial activity and soil fauna), improves the soil structure and fertility, decreases carbon percentage and salinity in the soil. There is sufficient evidence to show that the practice of natural farming has transformed the alkaline lands to fertile lands. It is believed that natural farming increases soil health in general. However, the spread of natural farming in waterlogged delta areas may pose problems because of scarcity of the required inputs for natural farming.

ZBNF has taken roots in some states such as Andhra Pradesh, Karnataka, Kerala, Gujarat, Himachal Pradesh, Uttarakhand, and Chhattisgarh. According to *Economic Survey (2018-19),* 1.6 lakh farmers were already practicing ZBNF. It has been officially promoted in Andhra Pradesh since 2016-17. The Centre for Economic and Social Studies (CESS), Hyderabad carried out a comparative study of costs and returns of natural farming and chemical farming in the agricultural year 2018-19 covering both *kharif* and *rabi* seasons in Andhra Pradesh. The preliminary results show a marginal improvement in the yield rate of majority ZBNF crops. But there is a significant reduction in the cost of production of all ZBNF crops leading to higher net returns per hectare. It was claimed that there is an initial lag in yield improvement, and it may take three years to reverse land degradation. One has to wait and see the efficacy of natural farming by conducting in-depth field surveys across agro-climatic regions. Surveys should cover not only the cost of cultivation and changes in crop yields, but also record soil health, environment, marketing, food security and so on. Its long-term consequences will have to be observed.

IX

TOWARDS INCLUSIVE AGRICULTURAL DEVELOPMENT

The main reasons as to why some of the developing countries in Asia are able to achieve speedy reduction in income poverty and multiple deprivations in a short span of time are now clear. Rao (1996) argues that the initial conditions for growth and poverty reduction in East Asian countries, such as China and South Korea, were more favourable for rapid growth and speedy poverty reduction than in India. For instance, implementation of radical land reforms, mobilisation of adequate resources by the state for investment in physical infrastructure as well as human resource development were instrumental in reducing poverty, despite their ideologies and socio-political differences (Rao, 1996 and 1998). In China, the commitment of the ruling elite, strength of public institutions, radical structural reforms, and enhancement of people’s capabilities through health and education facilities contributed to rapid poverty reduction (Malik, 2012). Similarly, focus on small and medium enterprises in its development policy has also played an important role in promoting growth as well as employment (Pasha *et al*., 2003).

In India, had radical land reforms been implemented soon after Independence and required investments made in human development and infrastructure thereafter, poverty reduction could have been much sharper and more sustainable. Though many radical reforms are not politically feasible in India, electoral democracy helped the enactment and implementation of nation-wide rights-based programmes such as MGNREGA, National Food Security Act 2013, Right to Education Act (RTE), 2009 and National Rural Livelihoods Mission (NRLM) 2011, etc. If these are properly implemented, marginalised groups could emerge as pressure groups and this may lead to a socially just economy. What seems to be feasible in India is only an incremental approach to improve the living conditions of the vulnerable groups. This should be complemented by a labour-intensive process of development and the needed institution-building.

Since a large number of the poor depend on agriculture for their livelihood, achieving the goal of poverty reduction as well as inclusive growth depends on the improvement of agricultural productivity and processes that facilitate the migration of agricultural workers to the rural non-farm sector by diversifying the sector. These will contribute to the diversification of employment opportunities as well as household income. This had been the process of transition towards an industrial economy in many East and Southeast Asian countries, which experienced a sharp reduction in poverty (Barker and Dawe, 2001).

Raising minimum support price and cash transfers may serve as a palliative in the short-term but cannot address the root cause of widening labour productivity between agriculture and non-agriculture. The long-term convergence of the two depends on improving land productivity and promoting labour mobility from agriculture to non-agriculture for decent employment. Youth belonging to farm households is opting out of agriculture and seeking jobs in non-agriculture. Such a transition can be facilitated by labour intensive economic growth, including promotion of producer companies and equipping the farm youth with skills on demand. Such a transition would be the right path to eliminate rural multidimensional poverty and reverse the widening inequalities.

Thus, to achieve inclusive growth, there is a need to develop collective institutions such as self-help group (SHG) federations to bring together small and marginal farmers, particularly tenant farmers. It has to be started from the grassroots level. For these, collective efforts, capacity building of farmers, institution building and technological innovations are necessary. It is in this context, the experience of Kerala's Vegetable and Fruit Promotion Council *Keralam* (VFPCK) is noteworthy. Under this initiative, about two lakh marginal and tenant farmers have been organised into 10,000 SHGs, and their collective strength has been built through the formation of federations as well as business networks consisting of about three hundred farmers' markets. These organisations could deal with the markets, banks, and technology providers successfully. This has improved the small farmers' access to development agencies as well as strengthened their bargaining power in local transactions. Through this collective platform, these farmers could earn significantly higher prices. Its "Master Farmers" approach has resulted in capacity building of farmers which is crucial for an endogenous development process. This has remarkably boosted the social and entrepreneurial capital of small farmers. The successful case of SHG farmers of *Sri Dharmasthala Rural Development Trust* is worth nation-wide replication.

Another option could be to organise the small and marginal farmers into producer co-operatives to tap the advantages of scale economies. In the Indian context, though there have been institutions like farmers' producer companies and joint liability groups of small farmers and tenants, the progress in their expansion has been very tardy. Special efforts need to be made to accelerate the growth of these institutions. Institutional arrangements have to be evolved to involve professionals in the preparation of project proposals for the establishment of Farmer Producer Companies, besides providing hand-holding support during the gestation period.

Another category of institutions relating to governance are Panchayati Raj Institutions, which can be entrusted with the task of local level planning and implementation of programmes for infrastructure, as is being done in Kerala. Collective institutions and PRIs could motivate the poor farmers to shed their passivity and to play an active role in the local level institutions of governance so that they can participate in policy decisions.

State level apex bodies need to be created to promote and nurture Farmers' SHG Federations, Famers' Markets and Producer Companies. There is also a need for building institutions for managing the risks and also to extend technical knowledge and influence public policy for the well being of the farming community. The most important issues related to the farming communities are reducing regional inequalities, maintaining livelihood security, and improving the well being of women and children. In addition to these, issues such as the educational and health status of farmers should also be addressed. Development administration has to be accountable to the public. Above all, political commitment to the cause of inclusive growth assumes overwhelming importance.

X

CONCLUDING REMARKS

Agricultural growth decelerated in the current decade. Yields of food grains are almost stagnant and that of commercial crops such as cotton and tobacco have declined. Gross capital formation in agriculture as a percentage of GDP at current market prices was less than 3 per cent for a number of years since the mid-1980s and about 6 to 8 per cent of India's gross capital formation during the period 2004-05 to 2010-11. Even the expenditure on agriculture and allied sectors, of both centre and states together, was low at less than 3 to 5 per cent of GDP, during the period 2004-05 to 2010-11 (EPW Research Foundation, 2014). At the all India level, the incidence of indebtedness of cultivator households increased from 26 per cent in 1991 to 35 per cent in 2012. Notably, a half of the indebted households in 2012 borrowed from non-institutional agencies (Rajakumar *et al*., 2018). These negative trends are the cause the widespread distress of farming community being witnessed now.

What has to be done? To reverse the worsening situation of agriculture, it is necessary to transfer a sizeable proportion of small and marginal farmers with unviable small holdings from agriculture to non-agriculture. The precondition for such a transformation is the growth of productive rural and semi-urban non-farm sector, having input-output linkages with agriculture. There is a need for substantial breakthrough in agricultural productivity driven by institutional reforms, and technological innovations. For this to be sustainable, the terms of trade should also remain favourable to the rural sector.

There is considerable inter- and intra-regional variations in the agro-climatic conditions, endowments, risks affecting the livelihoods of farming community, governance of public delivery systems and local institutions. What is needed to bring about a change is a bottom up approach as adopted in Kerala’s people campaign model, and promoting collectives such as self-help groups to improve the bargaining power of farmers in the market and to enhance the efficacy of delivery systems by empowering them. It is utmost important to improve land productivity by total factor productivity driven by technology as in the 1980s attributed to Green Revolution without degradation of natural resources. Diversification of sources of farmer’s household income by undertaking non-farm activities may provide income security.

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SPECIAL LECTURE

Poverty and Agricultural Policy Since Dantwala*

Yoginder K. Alagh†

I

INTRODUCTION

Prof. Dantwala's slim monograph on poverty since Dadabhai Naoroji is a classic paper. Immersed as I have been in the measurement of poverty and malnutrition queston, I have always known that the numbers issue is set in the larger societal question of what is the minimum requirement of subsistence. As the Marxist scholar Eric Hobsawm has stated elegantly examining it through the centuries, this is a dynamic standard by which society measures itself. It changes as we progress. What was acceptable half a century ago would not be today and it will rise again. I was invited to deliver at the Bombay School of Economics, which was later published by the school as a part of a well known series. Concluding the third lecture Dantwala Saheb said Alagh is a carpenter in the most elegant sense of the term.

Dadabhai Naoroji raised the issue of poverty in the context of the 'specie', question and the drain effect. A part of the larger imperialism debate issue and was obviously raising it not just as a measurement question but of poverty and deprivation in the globally exploitative economy and Dantwala as a prominent Indian socialist was at the heart of that more important socio-economic question of global exploitation in his poverty paper.

To say that I was a carpenter was a great compliment to a 33 year old economist who was a chela of the iconic Dantwala. It brought me back to my University of Pennsylvania days as a student and a teacher there and my teacher the nobel lauriatte Lawrence Klien teaching us the approach of the cowles commission that you face a problem and then develop the theory to solve it and that is carpentry and economics at its best.

Soon thereafter, V.N. Dandekar, Dantwala's personal friend was to organise a three day retreat at Lonavala on the measurement of poverty question. I was then in the planning commission as PPD adviser modelling the green revolution in the agricultural sub-model of the Fifth Five Year Plan, which Dantwala saheb read on request from Lakdlawala saheb, and sent me extensive pencilled notes on the first

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draft. Getting back to Dandekar, he would organise meetings within the budgets of the sponsors, but tell them, I will spend as I want to. Remember the attack from K.N. Raj and George, at the CDS Kerala on the consequences of ignoring tapioca in the diet. I have opposed prohibition in Gujarat and so don't drink there. Elsewhere I am also what can be called a social drinker, in the sense of giving company. Anyway as Dandeker was pouring the whiskey, Pranob Bardhan who was an invitee at the seminar, piped in "ýou are giving Yoginder more" to which Dandeker shot back, 'body weight my friend, bodyweight,' much to the amusement of all, at the comparison of the pathan and the elegant bengali. The seminar interestingly was being attended by Vithal Babu from the Andhra cadre of the IAS and Ashok Parthasarathi from the PMO's office. I knew Pranob because we were both selected at the university level, he at Burdwan and me at Jaipur by the great A.K. Dasgupta. In those days much against the prevalent orthodoxy both me and Pranob had built up the case for an agricultural income tax as opposed to the arguments of scholars like Prof. Lakdawala.

Dantwala's presidential address to the Indian Society of Agricultural Economics was to make a powerful plea to have an effective agricultural price policy and he designed a framework for it. This was Dantwala at his best. You are to establish systems to reverse exploitation on a global plane and you have to do it at home. He was a major factotum of the Congress socialist forum and Jawahar Lal Nehru was their leader. Jawahar Lal would lead Ashoka Mehta, Jay Prakashji and others. To the fiery Mehta and comrades like Dantwala, it was always a tinge of regret that Bapu would catch hold of both strategy and tactics effortlessly and they would have all have to fall in line, with a tinge of remorse.

Not all that much has changed. It's all new. It's all the same. It's clear to me that the nyaya scheme is a successor to Dantwala's perception of poverty from the thinking of Dadabhai Navroji. The future lies in all round agricultural development and if more is needed on that please take off the shelf Dantwala's cotton marketing in Saurashtra, an all time classic. But until then you also need support. The cotton farm needs protection from marauding animals and fencing. If futures don't work because of thin markets the state has to step in and not throw away the baby with the bath water. The Bombay school and Dantwala are in the tradition of relevant market socialism and not the dreary and heavy hand of the state. The lactating mother has to have her nutrition and the girl child holds up half of the sky. If you can do it right a cash transfer is better than doles. Good. Good not only for the farmer but also for the landless labourer and marginal farmer.

More generally today, this much is history of ideas. Important to me as a teacher. But does Dantwala have relevance to the agricultural world of today and tomorrow. On May 1, 2019 as I write this it is extremely likely that some extremely antideliviuan ideas contemporary scene be the recipients of the butt of criticism, most justified, some vicious. My speculation is along positive lines. As we emerge out of the dark ages of attacks on knowledge, institutions and fact based policy arguments, will the thinkers of the past like Dantwala have some relevance for us. If so we should pause and recapitulate.

A monopoly of trade in grains was short lived. In the eighties, in the evenings I spent with them in Mumbai, Pune or Ahmedabad, they would recount with amusement their thinking in the end of the decade of the sixties of the last century. For a limited period of time complete nationalisation of wholesale trade in grain could be traced back to the influence of thinking of economists of their influence. But soon private trade was introduced, particularly in higher quality grains. These were generally high-priced, more than the quality differential that the Commission for Agricultural Costs and Prices (CACP) allowed, the Food Corporation of India purchased at, and were largely privately traded.

If prices slumped, the State Governments would intervene but in a limited way, with limited funds, and with nowhere like the organisation that FCI has.

Going into the Contemporary Scene

The agriculture issue has gained public attention as the terms of trade which had risen in the first decade of this century after falling in the period after the Manmohan Singh liberalisation – were again moving against the farmer.

Since 2013, according to CACP, the fall in the terms of trade was around five per cent.

So when everybody else's income was rising, the farmer was losing out and was coming out on the road. We do not have data on the terms of trade for the last two years, but according to most indications of price relatives, the farmer was not doing too well.

Can Higher MSPs Do the Trick for Farmers and the Policy Makers?

All this is well known. More recently, the twist was with the claim that 'MSP would be 50 per cent higher than the cost of production'. The increase in minimum support price (MSP) announced was respectable. The increase in cereal crops, with some exceptions was 15 to 20 per cent higher than last year. Oilseeds were 13.42 per cent and cotton 23.97 per cent higher. Jowar, castor and sugarcane MSPs were marginally lower than last year. These are all good prices, taking into account that government has, for more than a decade, given the bonuses on CACP recommendations. The novelty this year was the claim that a 50 per cent increase in MSP has been provided over the cost of production.

The increase in MSP over the cost of production – measured as all paid-out expenses (A2) plus family labour (A2+FL)- was above 50 per cent in case of each *kharif* crop. So, the NITI Aayog's top officials – Rajiv Kumar and Ramesh Chand, are correct when they say that MSP is 'fifty percent higher than paid out costs'. But M.S. Swaminathan is correct too, when he said that the increase is below what was recommended. The National Commission on Farmers led by Swaminathan had said that the MSP should be “at least 50 per cent more than the weighted average cost of production”. This needs explanation.

The big question is, should the support price cover only the paid-out costs or all the costs.

All costs would include the imputed values of owned land, imputed interest on own capital, imputed value of family labour and imputed remuneration for the management function of the farmer.

Specific difficulties arise and questions are raised on the imputation of the values of farmers’ own resources.

The NITI Aayog’s economists’ argument that rental and interest imputations on capital costs should not be incorporated in MSPs as was recommended by the Swaminathan Committee, leaves much to be desired. Rental incomes, it is correctly argued, are unearned income as defined in Ricardian economic theory. But, we do not follow these principles in setting tax or tariff policies for non-agricultural goods. If Mr. Adani can get income nice, why not the farmer.

The price fixing rules provide that, according to the existing practice, DES applies a normative rate of interest at 12.5 per cent on working capital and 10.0 per cent on the fixed capital. Considering that a large proportion of farmers resort to non-institutional loans from sources like moneylenders, a higher rate of interest should be provided.

The case for including actual interest costs seems quite clear. But it seems very unlikely that there will be policy coordination between agricultural price policy and tariff policies to protect the efficient Indian farmer. Getting players like Walmart to buy farmer’s produce and give them space in its warehouses is far more important, but simultaneously we are told that this has slowed down because of the influential trader lobby. In pulses, vegetables and fruits, and milk and milk products – where demand is rising fast and which drives food and agri inflation – the infrastructure has yet to be built.

The Challenge of Procurement at MSP

That 150 per cent business is a ‘no-brainer’ and is taking away policy focus from more important areas of infrastructure and credit provision. Policy coordination is always easy in a textbook, but normal persons don’t like to give up power. Only the exceptional become more powerful by shedding power and coordinating for the larger good. Another reason could be a fear of rule-based systems. For then, you are not seen as the benefactor and this can be important in pre-election periods. There are real problems. M.L. Dantwala is as relevant today as he was then.

To have MSPs and, separately, free imports is like pouring water in a leaking bucket. He saw it then formulating the framework for the Agricultural Prices Commission (APC) and agricultural policy in India. Perhaps there is a divinity which inspires the chosen ones!

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SPECIAL LECTURE

Structural Transformation: India in a Global Perspective Since the 1960s*

Uma Lele†

It has been an honour and a pleasure to memorialise Dr. S.R. Sen. I met him when I joined the World Bank in 1971, as a young professional. He was an Executive Director representing South Asian countries on the World Bank's Board. Notwithstanding his seniority relative to mine, he was always accessible to young Indians, as a mentor—even for one-on-one meetings—and he and his wife invited young people, like me, to social occasions at their home.

As the Founder and Institutionalist, Dr. Sen left a big intellectual footprint.

Born in Noakhali, Bangladesh in 1916, he was an early member of the Indian Society of Agricultural Economics (ISAE) and of the International Association of Agricultural Economists (IAAE). I learnt recently that Professor Elmhirst played a leading role in the formation of both institutions.

Along with then ISAE President M.B. Nanavati, he hosted the 10th IAAE Conference in Mysore in 1958, with considerable fanfare. It was the first IAAE Conference in a developing country. Prime Minister Nehru inaugurated the Mysore Conference along with very many celebrities—for example, the Maharaja of Mysore, but also some of the most well-known Indian and international economists, demographers and sociologists including W. Arthur Lewis, V.M Dandekar, Irawati Karve, and Ali Khusro, names I used to know as a young adult.

With this background, it is not surprising that he served as President of the ISAE's 18th Conference in 1959. He was a scholar and civil servant in India and abroad. He reminds me of another statesman leader, Sir John Crawford. Their paths were similar and parallel.

As the Founder and Institutionalist, he served as Economic and Statistical Advisor in Ministry of Food and Agriculture, and helped build the economic and statistical system of the Ministry. He is credited with starting Farm Management Studies. My understanding is that Nobel Laureate Ravindranath Tagore invited young Elmhirst to visit Shantiniketan to help address problems of his tenant farmers. After spending two years working on the issues of Bengali farmers, Elmhirst recommended to Tagore that a longer term centre should be established in Shantiniketan to conduct

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studies of small farm communities. That was the beginning of the idea of the Agro-Economic Research Centres. It is possible that, with his close connection to East Bengal, Dr. Sen helped foster their growth. In any case, in view of the weakening support to agro-economic centres from the government, they need to be reinforced**.**

As member of the Planning Commission, he was Vice-Chairman of the Second Irrigation Commission, 1969–70, and other Foodgrains Enquiry Committee recommendations on price-support, which led to the formation of the Commission for Agricultural Costs and Prices in 1965. I worked with all these entities during my PhD and post-doctoral work in India, and I appreciate their importance.

However, Dr. Sen's contribution was much wider. He was co-founder (with Sachin Chowdhury) of the *Economic Weekly* (later renamed the *Economic and Political Weekly*). He was President-Elect and President of the IAAE's 15th and 16th Conferences in 1973 and 1976; he was Executive Director, World Bank Board, 1970–78. He was Chairman of the IFPRI Board at the crucial time when IFPRI was admitted into CGIAR.

He also worked on agricultural productivity in Eastern India. As member of the Sarkaria Commission on centre–state relations, he played key roles in policy issues.

I will confine the rest of my comments on Dr. Sen's regime as India's Executive Director on the World Bank Board in the 1970s. The seventies was a tumultuous time in the World Bank. He also became the Executive Director, representing Bangladesh at the time it became Independent, a development the US opposed.

As a board member representing India and South Asia, he was an important voice on the Board of Directors representing India and developing countries. The Board of Directors had 24 members with a strong share of representation from developed countries in an institution that runs on a shareholder model, unlike others, particularly UN organisations, where one country, one vote prevails. He was a calming influence when times were anything but calm.

To Understand the Tumultuous 1970s, We Need to Understand the Bank–India Relations in the 1960s

In the 1960s, as the largest developing member country, India was seen as seriously committed to development. The Western countries viewed India as an antidote to China. While India's five-year plans were inspired by the Soviet experience, and not the Western way of developing, the Bank supported those plans with one of the largest lending programmes, and indeed, many Western economists collaborated with India in the development and refinement of those plans. The overall view was one that "India could do no wrong."

- India's 1958 Balance of Payments crisis was followed by generous contributions, and as India's foreign exchange needs increased, the International Development Association (IDA), the concessional window of the Bank was established in 1960. A lesson from India's early development experience was that developing countries need large foreign exchange flows. Even if they use the resources productively, the returns take time to materialise. In the meantime, a repayment of loans after 10 years can create balance of payments deficits. Hence, they need concessional loans with low interest rates, which are payable over a longer period. IDA credits (as distinct from IBRD loans), carry a charge of 0.75 per cent—just enough to carry the administrative cost of managing the loan and credits are repayable over 40 years. India has been the largest recipient of World Bank loans and credits of any country, and it "graduated" from IDA in 2017, a successful case, as its per capita income increased.

- Many developments in the 1960s, though, changed the Bank's cozy relationship with India. The first was the War with China in 1962, which India lost—a loss of face for India's Western supporters as well. Prime Minister Nehru's passing in 1964 created such uncertainty about India's political stability—a frequently asked question was: "After Nehru, who?" The transitions to Mr. Shastri and Mrs. Gandhi turned out to be peaceful, showing India was maturing as a democracy.
- It was India's import substitution industrialisation strategy, however, that began to be viewed with skepticism. India's balance of payments situation had begun to deteriorate, and the World Bank mounted a comprehensive macroeconomic Bell Mission in 1964 to understand the impending economic crisis—steps India could take and the support the Bank would need to garner as the leader of Aid India's Consortium.Yet, India was highly vulnerable politically and in no mood to accept foreign scrutiny and criticism, US President Johnson, was already displeased with non-aligned India's criticism of the United States' policy in Vietnam, and he had adopted a 'short-tether policy on food aid' at a time when India was dependent on massive food aid from the United States. Food aid imports amounted to 10 million tonnes in 1964. The United States was running out of surplus food and was concerned about India's growing food aid dependence. The short-tether policy meant ships would leave the harbour of Baltimore only if India did not continue its public criticism of the Vietnam war. President Johnson was personally observing India's weather reports and the need for food aid and approved release of individual shipments.
- Bernard Bell reported directly to the President of the World Bank, George Woods, who reportedly was an India expert and highly supportive of India. The Bell Mission wrote a comprehensive report and made a number of recommendations, including to moderate, if not abandon, the import substitution industrialisation strategy, gearing imports to support India's agricultural needs, including fertilisers. It also recommended the devaluation of the rupee, in return for more support. India reluctantly devaluated the rupee in 1967, but the devaluation and other reforms had limited short term impacts.
- Domestic criticism of the Bell Mission was extensive, as it was considered an undue interference in India's internal affairs. Tensions were so high, as per my interview with Bernard Bell in 1988, on his arrival in Calcutta, one newspaper

ran a headline, "To Hell with Bell." India also complained and rightly that the World Bank did not come up with its promised level of aid.

- A redeeming feature of the Bell mission was its agricultural annex led by Sir John Crawford of Australia, which planted the seed of the Green Revolution—a technology-driven strategy with major reforms to ensure public sector delivery of seed, fertiliser, and credit; a minimum price support programme through the establishment of the Agricultural Prices Commission; the establishment of the Food Corporation of India; and a fertiliser import policy backed by the Bank's import support for fertilisers and support for the expansion of surface irrigation. While the Green Revolution strategy, too, was unpopular with Indian intellectuals, it had the strong support of C. Subramaniam, then the Minister of Agriculture, and M.S. Swaminathan of the Indian Council of Agricultural Research (ICAR). By the end of the 1960s, India had turned its large food imports to meet recurrent food shortages into perpetual food self-sufficiency which prevails today even though India's population has nearly tripled and area under cultivation has not increased much, in large part due to the adoption of new technology by millions of small farmers mostly in irrigated areas.

The 1970s was a calming period between India and the World Bank, despite many external shocks—Dr. Sen's style and substance made a difference**.**

- In 1971, India had another war with Pakistan. Bangladesh was striving for separation from Pakistan and became independent with strong support from India, particularly from Mrs. Gandhi. With a deteriorating situation in East Bengal, India had received nearly 10 million refugees. From India's viewpoint, the situation was untenable, but the United States was opposed to Pakistan's imminent division between Pakistan and Bangladesh.
- To express its opposition, the United States sent its seventh fleet into the Bay of Bengal, raising temperatures in India. Mrs. Gandhi aided the separation of the two countries and was the first to recognise Bangladesh.
- As someone born in Noakhali in 1916, Dr. Sen was proud to represent Bangladesh.
- Henry Kissinger called Bangladesh a "basket case" and happily, he has been proven wrong, as we will show below.

Despite its history from the 1960s, India became the largest recipient of IDA since its establishment. What explains this phenomenon?[1]

- McNamara's poverty focus was articulated in his 1973 Nairobi speech, which became a watershed in the World Bank, branding it as an organisation with a mission to eradicate poverty—a dramatic difference from its image as an infrastructure bank in the 1950s and 1960s.

- McNamara's mission coincided with Mrs. Gandhi's "Garibi Hatao" slogan.[2]
- Slightly more than 40 per cent of IDA went to India from 1970 to 1979, despite US opposition—India became IDA's largest recipient.
- There was more Bank tolerance of public enterprises.
- In 1973, the first oil price shock caused further challenges for India. The United States' largest grain sale to the Soviet Union had led to skyrocketing of food import bills; the food and oil price increases, factors beyond India's control, led once again to balance of payments difficulties. India undertook some price reforms and some export orientation.
- This time India was in a better position to respond to the external shocks. Its external reserve situation was less precarious. India had generated the Green Revolution. Also, after the Bangladesh triumph, India was more confident in contrast to 1962, after the loss of war with China, and prior to the success of the Green Revolution.

India Influenced the World Bank

- As an important development partner, the World Bank learned a lot in small and large ways from India. For example, the establishment of IDA was caused by the need for soft loans of long maturity to avoid balance of payments crises and indebtedness in developing countries.
- Programme loans to deal with balance of payments difficulties and macroeconomic crises became important complements to project lending.
- The Bank modified its practice of International Competitive Bidding (ICB), which had been the bread and butter of the Bank's infrastructure financing. With IDA, also came a willingness to accept a greater share of local cost financing together with local procurement of goods and services.

The 1980s and 1990s saw a new, less prominent role for the World Bank in India and for India in the World Bank

- China joined the World Bank and the International Monetary Fund in 1980.
- As another mega country, and a new kid on the block, India had to learn to compete with China on "voice and influence" and IDA although overall China received only 0.6 per cent of IDA and "graduated" from IDA eligibility more quickly. The African economic crisis in the 1980s and 1990s also increased demand on IDA.
- More IBRD assistance hardened lending terms for India.
- Much happened between 1980s and 2014, when India "graduated from IDA."
- The Sen era had ended with the phenomenon called "the Rise of Emerging Countries".

In the rest of my presentation I speak of how entries of China and Bangladesh changed India's position. The overall shares of the three countries in Bank lending so far have been India: 13.2 per cent, China 2.6 per cent, and Bangladesh 8.2 per cent.

India in Its Neighbourhood: China and Bangladesh—Why Focus on Them?

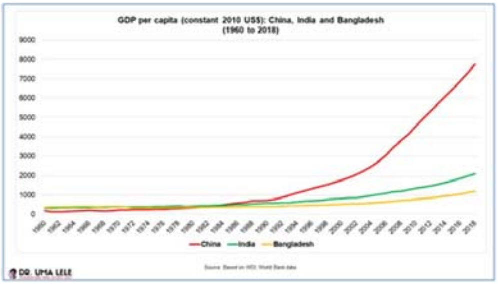
- First, because China is now years ahead of India in development. It all started since 1979, when China joined the World Bank and undertook its major economic reforms, starting with the Household Responsibility System, giving land rights to peasants. That greatly increased China's agricultural productivity. Unlike India, China was export-oriented from the outset, as it had no external support, nor did India have any expectation of external support and felt such support would compromise its sovereignty. China has enjoyed a sustained balance of payments surplus, unlike in the case of India, whose import substituting industrialisation strategy and more precarious weather has made it vulnerable to frequent balance of payments difficulties. China's reforms in agriculture, manufacturing, and other sectors have been bolder and more frequent compared to India's with less external aid.
- China has had a "Three-Legged Development Strategy":
  - Household Responsibility System
  - Town and village enterprises which metamorphosed into an industrialisation strategy, including reform of state-owned enterprises
  - Special Economic Zones in coastal China which became dramatic export producers.
  - After 2007, the financial crisis, China provided an economic stimulus, becoming a technological powerhouse and has been transforming its economy from a manufacturing export hub to a service sector economy.
- Another striking performance is of Bangladesh, which started way behind India. Bangladesh has been "booming" since the mid-1990s. It has better indicators in several respects than India on an average, for example, on agricultural productivity growth, declining infant and child mortality, and women's representation. The set of figures in the Annexure at the end, prepared on a strictly comparative basis, show the situation of three countries over a long period.
- India has much to learn from both neighbours going forward.

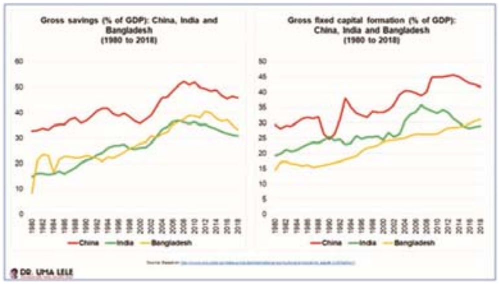
NOTES

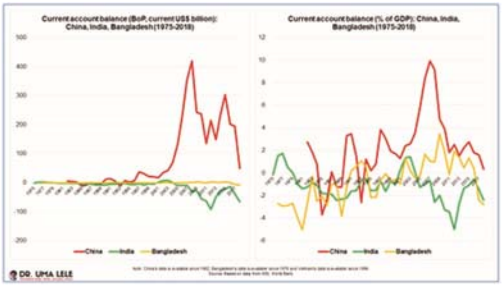
1) This section benefitted from an unpublished paper by Jochen Kraske, who participated in the Bell Mission as a young professional and later served as the World Bank's resident representative and historian before his retirement from the Bank.

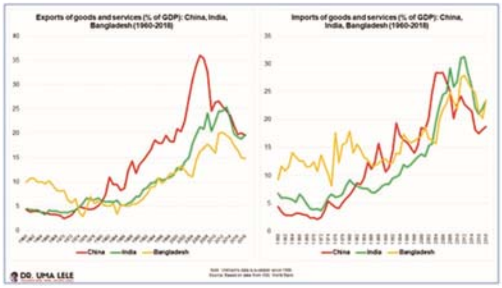
2) Coincidentally, Mahbubul Haq, a Pakistani economist and advisor in the World Bank's Development Policy Staff where I was an economist, contributed to both speeches. In the case of Mrs. Gandhi, her speechwriter was rumoured to have taken paragraphs from Mahbub ul Haq's writings without attributing them to him. She was later asked about this borrowing, and she was reported to have said good ideas can come from anywhere.

ANNEXURES


GDP per capita (constant 2010 US$): China, India and Bangladesh
(1960 to 2018)
China
India
Bangladesh
DR. UMA LELE


Gross savings (% of GDP): China, India and Bangladesh
(1980 to 2018)
Gross fixed capital formation (% of GDP): China, India and Bangladesh
(1980 to 2018)
China
India
Bangladesh
DR. UMA LELE


Current account balance (BoP, current US$ billion): China, India, Bangladesh (1975-2018)
Current account balance (% of GDP): China, India, Bangladesh (1975-2018)
China
India
Bangladesh
DR. UMA LELE


Exports of goods and services (% of GDP): China, India, Bangladesh (1960-2018)
Imports of goods and services (% of GDP): China, India, Bangladesh (1960-2018)
China
India
Bangladesh
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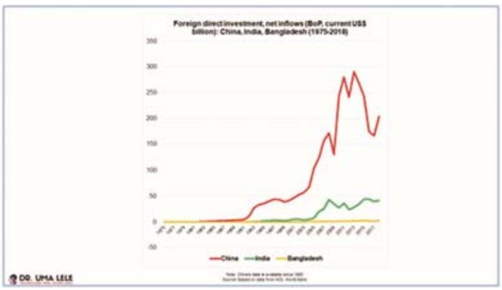
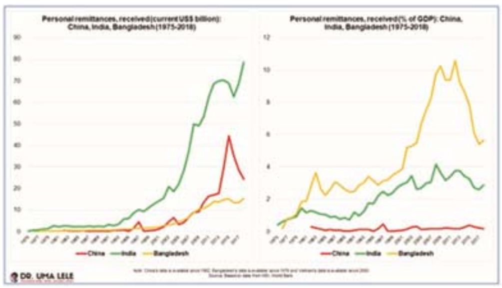
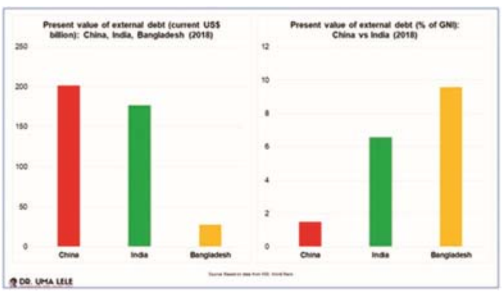

Foreign direct investment, net inflows (BoP, current US$ billion): China, India, Bangladesh (1975-2018)
China
India
Bangladesh
DR. UMA LELE


Personal remittances, received (current US$ billion): China, India, Bangladesh (1975-2018)
Personal remittances, received (% of GDP): China, India, Bangladesh (1975-2018)
China
India
Bangladesh
DR. UMA LELE


Present value of external debt (current US$ billion): China, India, Bangladesh (2018)
Present value of external debt (% of GNI): China vs India (2018)
China
India
Bangladesh
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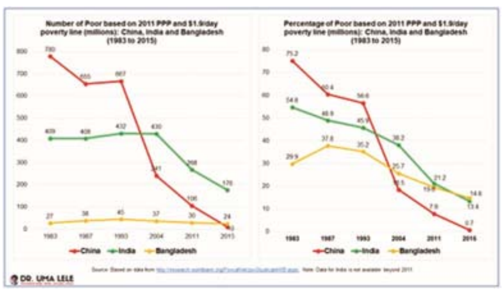
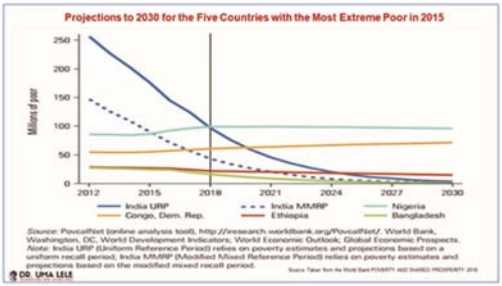

Number of Poor based on 2011 PPP and $1.9/day poverty line (millions): China, India and Bangladesh (1983 to 2015)
Percentage of Poor based on 2011 PPP and $1.9/day poverty line (millions): China, India and Bangladesh (1983 to 2015)
China
India
Bangladesh
DR. UMA LELE


Projections to 2030 for the Five Countries with the Most Extreme Poor in 2015
Millions of poor
India URP
India MMRP
Nigeria
Congo, Dem. Rep.
Ethiopia
Bangladesh
Source: PovcalNet (online analysis tool), http://iresearch.worldbank.org/PovcalNet/. World Bank, Washington, DC. World Development Indicators; World Economic Outlook; Global Economic Prospects.
Note: India URP (Uniform Reference Period) relies on poverty estimates and projections based on a uniform recall period; India MMRP (Modified Mixed Reference Period) relies on poverty estimates and projections based on the modified mixed recall period.
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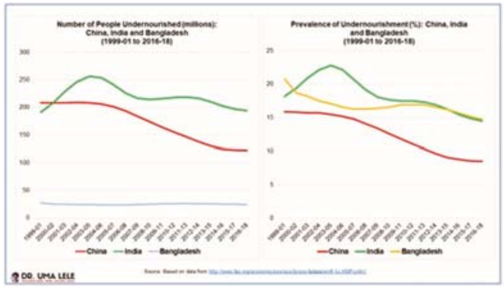
Number of People Undernourished (millions): China, India and Bangladesh (1999-01 to 2016-18)
Prevalence of Undernourishment (%): China, India and Bangladesh (1999-01 to 2016-18)
China
India
Bangladesh
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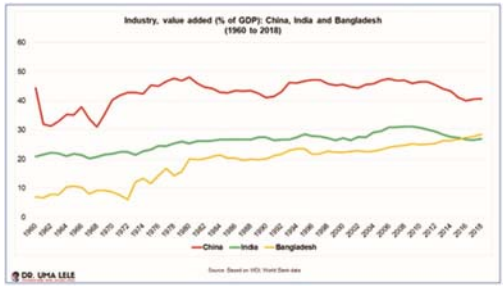
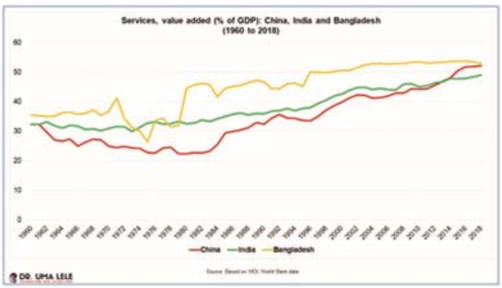
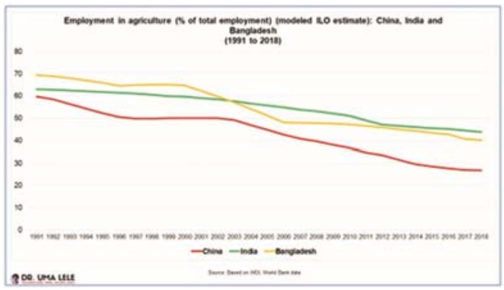
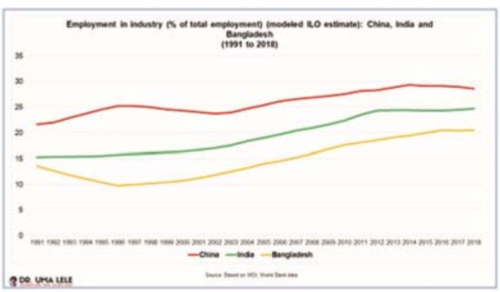
Agriculture, forestry, and fishing, value added (% of GDP): China, India and Bangladesh (1960 to 2018)
China
India
Bangladesh
DR. UMA LELE


Industry, value added (% of GDP): China, India and Bangladesh (1960 to 2018)
China
India
Bangladesh
DR. UMA LELE


Services, value added (% of GDP): China, India and Bangladesh (1960 to 2018)
China
India
Bangladesh
DR. UMA LELE


Employment in agriculture (% of total employment) (modeled ILO estimate): China, India and Bangladesh (1991 to 2018)
China
India
Bangladesh
DR. UMA LELE


Employment in industry (% of total employment) (modeled ILO estimate): China, India and Bangladesh (1991 to 2018)
China
India
Bangladesh
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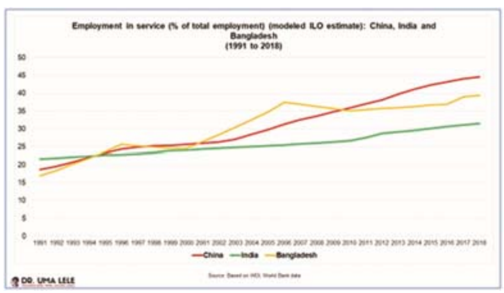
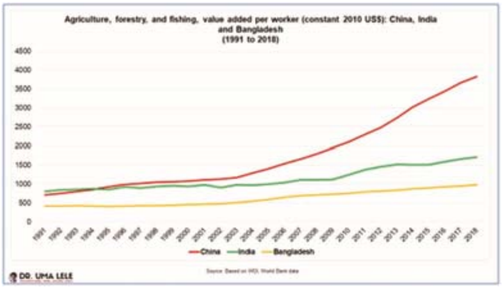
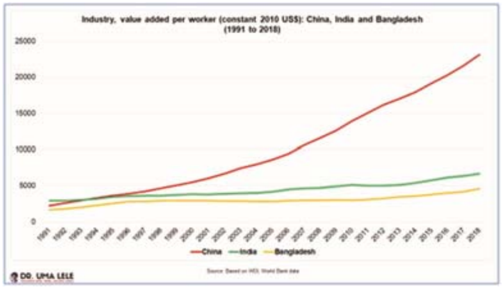
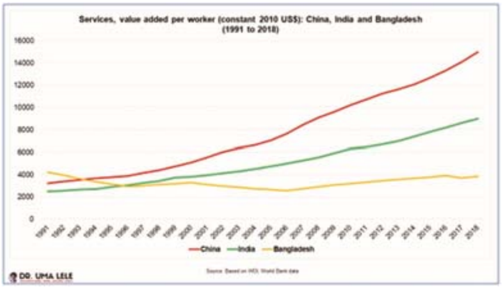

Employment in service (% of total employment) (modeled ILO estimate): China, India and Bangladesh (1991 to 2018)
China
India
Bangladesh
DR. UMA LELE


Agriculture, forestry, and fishing, value added per worker (constant 2010 US$): China, India and Bangladesh
(1991 to 2018)
China
India
Bangladesh
DR. UMA LELE


Industry, value added per worker (constant 2010 US$): China, India and Bangladesh
(1991 to 2018)
China
India
Bangladesh
DR. UMA LELE


Services, value added per worker (constant 2010 US$): China, India and Bangladesh
(1991 to 2018)
China
India
Bangladesh
DR. UMA LELE


Agricultural Total Factor Productivity (TFP) Index Growths: Bangladesh, China, India and
(1961-2016)
Bangladesh
China
India
DR. UMA LELE


Agricultural Total Factor Productivity (TFP) Index Growths: China, India and Bangladesh
(1961-2016) (Base Year 1995=100)
China
India
Bangladesh
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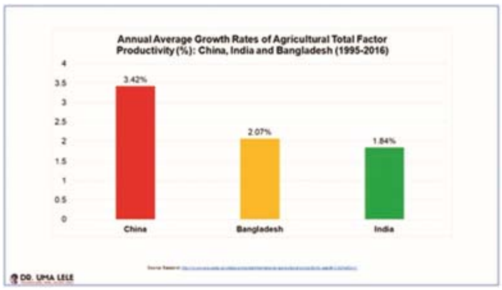
Annual Average Growth Rates of Agricultural Total Factor Productivity (%): China, India and Bangladesh (1995-2016)
3.42%
2.07%
1.84%
China
Bangladesh
India
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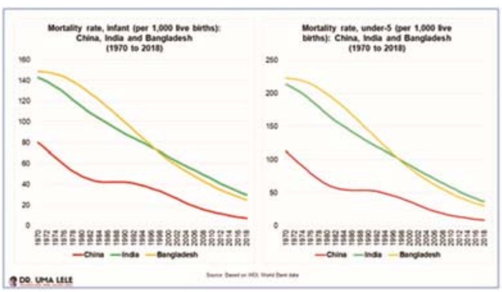
Mortality rate, infant (per 1,000 live births): China, India and Bangladesh
(1970 to 2018)
Mortality rate, under-5 (per 1,000 live births): China, India and Bangladesh
(1970 to 2018)
China
India
Bangladesh
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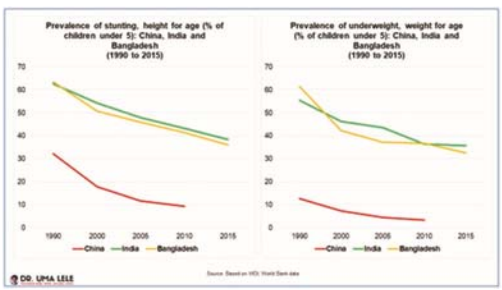
Prevalence of stunting, height for age (% of children under 5): China, India and Bangladesh
(1990 to 2015)
Prevalence of underweight, weight for age (% of children under 5): China, India and Bangladesh
(1990 to 2015)
China
India
Bangladesh
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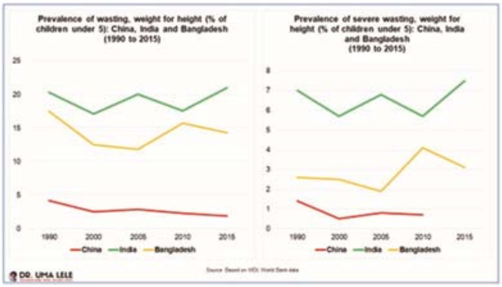
Prevalence of wasting, weight for height (% of children under 5): China, India and Bangladesh (1990 to 2015)
Prevalence of severe wasting, weight for height (% of children under 5): China, India and Bangladesh (1990 to 2015)
China
India
Bangladesh
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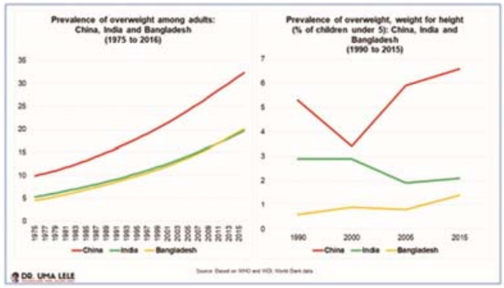
Prevalence of overweight among adults: China, India and Bangladesh (1975 to 2016)
Prevalence of overweight, weight for height (% of children under 5): China, India and Bangladesh (1990 to 2015)
China
India
Bangladesh
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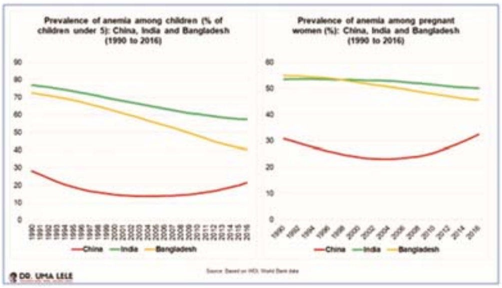
Prevalence of anemia among children (% of children under 5): China, India and Bangladesh (1990 to 2016)
Prevalence of anemia among pregnant women (%): China, India and Bangladesh (1990 to 2016)
China
India
Bangladesh
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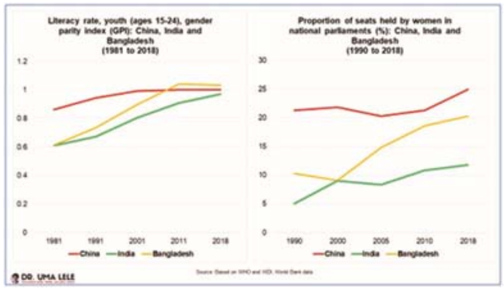
Literacy rate, youth (ages 15-24), gender parity index (GPI): China, India and Bangladesh (1981 to 2018)
Proportion of seats held by women in national parliaments (%): China, India and Bangladesh (1990 to 2018)
China
India
Bangladesh
DR. UMA LELE

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Doubling Farmers' Income Requires Increase in Demand *

Kirit S. Parikh†

I

WHAT DOES IT MEAN?

Prime Minister Narendra Modi stated on February 28, 2016 that it is his dream to see farmers' income double by 2022, when the country completes 75 years of Independence. Obviously the income has to be doubled from the income in 2015-16. What was not clear was if the income has to be doubled in real terms or in nominal terms. Either way if inflation is contained, it is a formidable task. Gulati anad Saini (2016) considered doubling income in real terms as an impossible task as it will require a growth rate of agriculture of 14.86 per cent per year for five years (though 2022-23 over 2015-16 has seven years). A NITI Aayog paper by Ramesh Chand (2017) argues that doubling income over 7 years will require a growth rate of 10.45 per year.

Another ambiguity is regarding farm income vs farmer income. If the aim is farm income- the production-centric, productivity increase led approach would help. It considers value of output. But if the goal is farmer income- the production has to be combined with profitability angle and thus emphasis has to be on market linkages, markets infrastructure etc. Here the doubling has to be of value added. Emphasis on farmer income makes sense and that is what I have assumed.

Doubling of farm income is desirable as it would have many benefits. The large prevalence of child malnutrition and stunting would get reduced. 44 million children under the age of 5 years are stunted with lifelong consequences. Every other death of 1.2 million under 5 deaths is attributable to under-nutrition. More balanced diet will be available to women and children who at present consume less of nutritive foods.

The Ministry of Agriculture and Farmers' Welfare (MoA&FW) had set up a "Committee on Doubling on Farmer's Income", which prepared a Report in 14 Volumes dealing with most aspects of the problem and policies (Government of India 2018). NABARD (2018) had also organised a National Seminar on "Doubling Farmers' Incomes by 2022". The Committee's report covers in great detail issues of increasing farmers' incomes through agricultural growth, post-production measures of marketing and storage, increasing productivity, augmenting water availability,

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I am thankful to Purvi Mehta for her suggestions and comments on an earlier draft.

increasing water and other input use efficiency, better extension and seed replacement, diversification to high value crops, exploiting the full value chain, price forecasting and marketing freedom, use of ICT, risk reduction through insurance, etc.

It also looks at changing pattern of demand in the country, emphasises the need to change the focus from 'Farm to Fork' to 'Fork to Farm" where demand will drive production. It also considers export demand as part of demand. The recommendations concern mainly increasing output. What is missing is forecasting of demand and a strategy to move agriculture from here to there in a given timeframe.

The paper has examined how demand forecast, its level and composition affect farm income. Even when many suggested measures are implemented, the difficulty of doubling farm income in 6-7 years seems very daunting.

A look at historical trend of agricultural gross domestic product (GDP) shows that the highest growth rate achieved since 1993-94 are shown in Table 1. The highest growth rate achieved in real income was 7.5 per cent per year over 2004-05 to 2011-12. In nominal terms, income doubled over 2004-05 to 2011-12 and have increased at high rates over a number of years. However, nominal income growth does not reflect a corresponding increase in welfare. While cultivators may benefit, agricultural labourers will suffer when inflation increases. So real income growth must be considered as the intent of Prime Minister's statement.

TABLE 1. GROWTH RATE OF INCOME PER CULTIVATOR SINCE 1993-94

	Income per cultivator		Growth rate over preceding period	
	Current prices	2004-05 prices	current prices	2004-05 prices
(1)	(2)	(3)	(4)	(5)
1993-94	12365	21110		
1999-00	24188	26875	11.8	4.1
2004-05	26146	26146	1.6	- 0.5
2011-12	79173	43258	17.1	7.5
2012-13	91416	41553	15.5	- 3.9
2013-14	104763	42760	14.6	2.9
2014-15	112507	43106	7.4	0.8
2015-16	120193	44027	6.8	2.1

Source: Chand (2017), Table 2.1.

II

THE POSSIBLE WAYS

There are a number of ways to increase farmers' income.

(a) Increase output prices, i.e., give a better terms of trade (TOT) to farmers. This will increase production but will reduce consumption. How does one balance this? How does one realise better TOT for farmers? If government interferes with dual prices, it will wind up with large amounts of stocks. What is the fiscal implication of it? How is it to be financed? If at the cost of investment then growth rate of the economy goes down, incomes will go down and consumption will fall even more increasing public stocks. What does the government do with the stocks? TOT increase would have some welfare costs also. If wages of agricultural labour goes up in step with TOT, then the adverse welfare impact would be only on poor urban consumers. Narayana *et al*. (1991) have discussed the general equilibrium impact of TOT policies. Effective implementation of minimum support price is difficult to achieve. Besides, a report in *Indian Express* of April 17, 2019 (Mukherjee, 2019) shows that MSP for mustard was not effective in Rajasthan for the last three years. Increased demand is important if farmers are to get a higher price.

(b) *Increase Consumption and Exports*: If the economy grows rapidly and demand for agricultural products increase either for domestic consumption or for exports or both, this will create incentives to increase output through higher prices without government intervention and that will increase farm income. Thus rapid economic growth will be required. It will also create higher employment opportunities in non-agricultural activities, draw away workers from agriculture and reduce number of farmers. This will also increase per farmer income. This is the process historically followed in many industrialised countries and in a sense is inevitable for India to follow. Creating employment opportunities rapidly becomes a major issue. Prime Minister Narendra Modi has set an ambitious target of tripling annual agricultural exports to US$100 billion by 2025. This requires a set of coordinated reforms and actions.

(c) *Increase Production through Technical Change and Investment*: If land productivity can be increased through enlarged irrigation either through increased investment or through more efficient use of water using micro-irrigation can increase farm output without increase in relative prices. Increased yields can also be realised through new varieties of crops and animal breeds. This will reduce costs and increase value added for the same level of output giving higher incomes to farmers.

(d) *Change Cropping Patterns*: With growth of income, the pattern of consumption will change. This will call for a change in cropping pattern. We have already seen that the share of vegetables, fruits, milk and animal products in total value of agricultural products have increased. One very important factor will be consideration of and diversification into sub-sectors that are exhibiting better growth rates, e.g., livestock that is growing at the rate of 4.8 per cent with the total output more than all grains combined. To accelerate this process and to have all farmers share in this process requires development of marketing and transport channels. This however is not enough. Demand will restrict the extent to which cropping pattern change can lead to higher incomes.

(e) *Income Transfer*: As initiated by the BJP government and as was promised by the Congress party through its NYAY scheme, this can raise farmers' income to whatever level is desired. The Government plans to give annually Rs. 6000 to 12.5 crore poor farm families with an annual outlay of Rs. 75000 crore under the Pradhan Mantri Kisan Samman Nidhi. As per the NSS household consumption

> expenditure survey of 2011-12, the monthly per capita expenditure (MPCE) of the poorest five per cent of people in one of the poorest states, Bihar was Rs. 608 whereas the poverty line MPCE was Rs. 971. With a household size of 5.5 and an increase in consumer price index of 23 per cent from 2011-12 to 2017-18, the household annual expenditure is less than Rs. 50000. With Rs. 6000 added it is still below the poverty line expenditure of around 79000 (=971*5.5*12*1.23). This transfer reduces poverty by 20 per cent (Parikh, 2019) but in no way doubles farm income. Of course the additional Rs. 75000 crore to poor people will increase demand for agricultural produce and there will be some indirect impact on farm income.

The catch however is resources. How does one finance such a scheme? Additional resources need to be raised. If this is not done and it leads to fiscal deficit and inflation or reduced public expenditure on health, education or investment, it can be counter-productive.

Of course, these are not exclusive options, one can think of a mix of policies.

III

THE IMPORTANCE OF DEMAND

In all of these demand plays an important role. Demand depends on income (consumption expenditure) and relative prices both in the rural and urban areas. The consumption pattern also changes from class to class. When national income increases with economic growth, the income distribution changes and people move to a higher expenditure class. Thus the pattern of consumption at the national level also changes. Parikh *et al*. (2016a) have econometrically estimated a non-linear demand system based on many rounds of NSS household consumption survey data, 51st round (1994-1995) to 64th round (2007-08), as well as data from the Central Statistical Organisation (CSO) of national level consumer expenditures over these years. It is a non-linear demand system and price and income elasticities suitable for projections extending over 30 years that involve large increases in income. Elasticities are calculated for 22 consumption commodities of which 14 are agricultural goods, agro-processing, textiles, manufacturing, coal, electricity, water supply, transport and services. The approach is extendable to many more commodities. We also present piece wise linear approximations of the demand system that can be incorporated into a long term policy model. Thus we estimate a Linear Expenditure System (LES) for each of ten rural and ten urban expenditure classes of consumers.

Based on this, the structure of projected demand for 2039 is compared with that in 2007 in Figure 1.

It is seen that the share of food grains, pulses, oilseeds and sugarcane falls from nearly 43 per cent in 2007 to 23 per cent in 2039. The share of milk and milk products increases from 16 per cent in 2007 to 30 per cent in 2039. The share of animal products increases from 12 per cent to 14 per cent. The large increase in milk and milk products is consistent with the consumption of top decile in NSS data on household consumption expenditures. This has significant implications. Emphasis on expanding dairy output and animal products can provide income opportunities to many small farmers and landless households. Over 2011-12 and 2015-16, the gross value of livestock products increased by an average growth rate exceeding 5.5 per cent.

Thus in any strategy to double farm income, one must factor in demand and its composition.

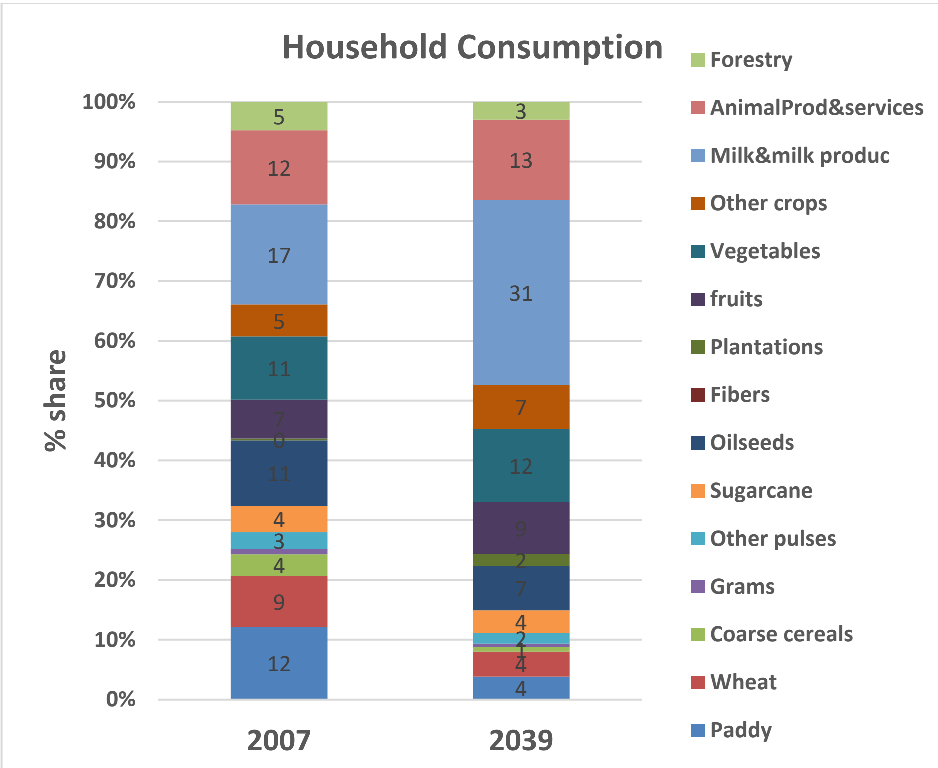

Figure 1. Changing Structure of Consumer Demand for Farm Products.

The issues involved in doubling of farmer incomes have been used to examine some results from simulations carried out with a model (Parikh *et al.*, 2016b) with 15 agricultural commodities, endogenous income distribution and demand system. The model is a multi-sector, inter-temporal linear programming one that maximises present discounted value of household consumption over 2003-04 to 2039.

Table 2 shows the projected agriculture GDP, per capita household consumption for three selected years, 2015, 2019 and 2023. By 2023 Ag-GDP grows by 80 per cent whereas per capita consumption grows by 150 per cent. This is aggregate consumption at the national level.

TABLE 2. PROJECTED AGRICULTURE GDP AND PER CAPITA CONSUMPTION

Year	AG-GDP (Billion Rs.)	Per captia consumption (Rs./year)	Ratio to 2015	
			AG-GDP	Per captia consumption
(1)	(2)	(3)	(4)	(5)
2015	6469	38728	1	1
2019	8955	60939	1.4	1.6
2023	11799	95888	1.8	2.5

The impact on consumption of farm products is seen in Table 3. This is based on a scenario where we have assumed higher development of irrigation, faster technical progress and higher levels of import and export bounds. It is seen that over 2015 and 2023 expenditure on milk and milk products doubles, those on animal products, fruits and vegetables nearly double and the total expenditure on farm products increases by 80 per cent.

TABLE 3. HOUSEHOLD CONSUMPTION OF FARM PRODUCTS

	Household consumption of farm products at 2003-04 prices (Rs. Billions)		
Commodity	2015	2019	2023
(1)	(2)	(3)	(4)
Paddy	734	795	837
Wheat	616	733	838
Coarse cereals	189	194	191
Grams	73	91	109
Other pulses	222	279	336
Sugarcane	402	550	700
Oilseeds	899	1143	1392
Fibers	0	0	0
Plantations	52	92	177
Fruits	679	974	1351
Vegetables	1089	1542	2078
Other crops	562	808	1127
Milk and milk products	2126	3251	4699
Animal services and poultry, eggs, meat, fish	1238	1752	2325
Forestry	305	365	447
Total expenditure	9187	12570	16608

Household consumption does not include farm products consumed as intermediate inputs or in restaurants, hotels, etc. These are however related to the level of household consumption. So the impact on domestic supply would be much larger. The impact on domestic production that determines farm income will depend on the level of trade.

Table 4 gives the ratios of consumption to supply and consumption to domestic production. The consumption to supply ratios are all lower than 1.0 suggesting that the remaining is either government consumption, investment, intermediate use or net imports. When the ratio of consumption to domestic production is higher than the ratio of consumption to supply, it indicates net imports. We see that in 2023 in all food grains including pulses and oil seeds, imports take place. While in sugarcane, milk and products, vegetables and animal products the country is self-sufficient.

TABLE 4. HOUSEHOLD CONSUMPTION, SUPPLY AND DOMESTIC PRODUCTION

	Consumption/supply			Consumption/domestic production		
	2015	2019	2023	2015	2019	2023
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Paddy	0.73	0.66	0.60	0.91	0.83	0.75
Wheat	0.72	0.66	0.62	0.89	0.82	0.77
Coarse cereals	0.87	0.81	0.75	0.87	1.08	1.00
Grams	0.58	0.54	0.48	0.64	0.60	0.54
Other pulses	0.68	0.62	0.57	0.76	0.68	0.63
Sugarcane	0.56	0.52	0.50	0.56	0.52	0.50
Oilseeds	0.63	0.57	0.56	0.70	0.55	0.62
Fibers	0.00	0.00	0.00	0.00	0.00	0.00
Plantations	0.23	0.22	0.27	0.21	0.20	0.27
fruits	0.75	0.68	0.67	0.75	0.69	0.68
Vegetables	0.78	0.75	0.73	0.78	0.76	0.73
Other crops	0.35	0.34	0.34	0.36	0.48	0.48
Milk and milk products	0.88	0.86	0.86	1.26	0.86	0.86
Animal services and poultry, eggs, meat, fish	0.69	0.69	0.68	0.69	0.69	0.68
Forestry	0.60	0.52	0.45	0.55	0.47	0.42

Since farm incomes depend on domestic production, along with increase in household demand, domestic production also has to increase. Raising demand alone is not sufficient to double farm income.

IV

IMPORTANCE OF VALUE ADDED

Farmers' incomes depend on how much is value added in production. Table 5 shows the projected value of agricultural output and value added.

TABLE 5. VALUE OF OUTPUT AND VALUE ADDED

	2015	2019	2023
(1)	(2)	(3)	(4)
Total value Ag output	12484	18736	25096
Value added /output	0.52	0.48	0.47

Value added is slightly more than half in 2015 but gradually reduces as increased output requires more intensive use of inputs. Thus though the value of output doubles, value added goes up by 80 per cent over 2015 to 2023. This is one year more than the targeted year for doubling of 2022 and it is the value added in agriculture. Not all of the value added in agriculture accrues to the farmers, a sizeable part goes to agricultural labourers. Since the per capita earning of agricultural labourers is likely to be smaller than that of farmers, the farmers' income may almost double.

V

WHAT DO WE NEED TO DOUBLE FARM INCOME?

Some of the assumptions which are implicit in the way a macro model works are that marketing channels function and that consumers get the product they want, all the value added accrues to the farm sector and that there are not leakages and farmers get a fair share of the value added in agriculture. These assumptions underscore the importance of the various suggestions made by the Committee on doubling farm income in marketing regulations, storage, warehousing etc.

We have not assumed any MSP regime or wedges between consumer price and producer price apart from the standard trade margins.

What we have specifically assumed in this scenario are as follows:

- Net cultivable area does not increase and remains at 140 million hectares.
- Irrigated area increases from around 70 million hectares to 85 million hectares by 2023.
- TFP growth rate is 3 per cent per year.
- Import can be as high as 20 per cent of domestic supply for wheat and rice, 25 per cent for coarse grains, and 30 per cent for milk and milk products and other crops.

Are these assumptions realisable? With ground water recharge, wider adoption of micro-irrigation, the drive to push solar irrigation pumps, which facilitate micro-irrigation and provide incentive to the farmers to use less water if they can sell surplus electricity to electricity distribution companies, irrigation can expand rapidly.

To realise a TFP growth of 3 per cent per annum requires research in high-yielding varieties of crops and animals, effective extension to reach the knowledge to farmers and persuading them to adopt the technology, timely supply of inputs and the much needed infrastructure of roads and power. With the emphasis the government has on rural roads and 24x7 power to all one can expect the infrastructure to be in place. However, getting the research and extension system in shape poses some challenges.

The high levels of imports which are permitted goes against the idea many people have on food security and self-reliance. The need for such high levels of imports arise from the high levels of demand generated and despite the growth in irrigation and TFP the country is not able to produce the required agricultural produce domestically. Also high levels of imports permit optimal allocation of domestic resource of land and water to different crops and facilitate diversification.

Growth of demand requires growth of the economy and high levels on demand require higher growth rate of the economy.

VI

INCREASING EXPORTS

As Srinivas and Mehta (2018) observes for increasing agricultural exports, we need to act on three fronts. "Prioritize the digital infrastructure for connecting smallholder farmers to exporters in the least developed states. … Accelerate technical and business expertise among small and medium enterprise (SME) trader-exporters. … public private partnership and incentives linked to business models that make it easier for smallholders and SMEs to become suppliers without raising transaction costs". It is also worth noting that the value of agricultural exports is around US$ 40 billion which is larger than the value of exports of textiles and garments put together (Shah, 2019). Thus export growth does provide an option to increase demand. However, for that we need diversification and production at competitive prices.

VII

CONCLUSIONS – DOUBLING OF FARMERS' INCOME NOT WITHOUT GROWTH IN DEMAND

1. Farmers' incomes can be doubled by either increasing their output, or getting higher price for their output or through direct income transfers. Demand plays an important role here.
   - Higher output without corresponding increase in demand will lower prices and the impact on farm income can be small or even negative.
   - Ensuring higher price through a high minimum support price (MSP) without increase in demand will be difficult to implement and even when implemented the government will wind up with huge stocks. These may have to be unloaded on international market at substantial losses and the government finances will be stressed.
   - Just transferring money to farmers can increase their income. The share of value added in agriculture, forestry and fishing in total GVP in 2018-19 was 15.87 per cent in current prices. Thus doubling of farm income through such transfers will require expenditure of 15 per cent of GDP. This is clearly infeasible and in any case not sustainable.
   - High growth rate for the economy is required to increase demand for agricultural produce, which will stimulate increase in agricultural output and create incentives for diversification.
   - Demand can be increased also through exports, for which diversification and production at internationally competitive prices is required.
2. Increase in output and diversification requires actions on many fronts.
   - Increase irrigation and promote micro-irrigation.
   - Spread solar pumps for irrigation with surplus power purchased by DISCOMs to save water and facilitate micro-irrigation.
   - Establish marketing and storage systems or farmer's holding capacity which is less than 5 per cent at the moment.
   - For this, expanding coverage and inclusivity of farm credit is important. The Government of India (2018) has observed (Volume VII) that one percentage point increase in credit supply from public banks leads to approximately 0.82 per cent increase in price realisation of crops other than paddy. Credit increase farmer's holding capacity, technology adoption and diversification.
   - Provide facilities for expanding milk output where marketing and storage are even more critical.

- Expand agricultural research to create options for high-yielding varieties of crops and livestock appropriate to different agro-climatic conditions.
- Effective extension to make farmers aware of these options is critical.
- Up-to-date information to farmers on prices and demand can enable them to maximise their gains.

This increased output has to go in steps with increased demand.

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SUMMARIES OF GROUP DISCUSSION

Subject I

Coping with Risks and Climate Change through Conservation of Natural Resources with Particular Reference to Agriculture: Appropriate Technologies and Practices

Rapporteur: Chandra Sekhara Rao Nuthalapati *

The papers presented in this session focused mainly on issues such as accelerating agricultural output and farmers' income through diversification; technology adoption and input use efficiency; marketing of produce through alternative channels and efficient utilisation of bio-waste.

There was a lot of enthusiasm among the researchers in addressing the issues of risks of climate change with particular reference to agriculture by harnessing appropriate technologies and practices. The following are the recommendations flowing from the papers presented in the session as well as in the deliberations held:

- Banning paddy sowing till June 15 precipitated stubble burning problem in Punjab. Among the available methods, sowing with happy seeder was found to be the best option to circumvent this menace and the resultant pollution. Apart from a 2 per cent rise in net income, it can save 732 cumt/ha of water and 8.76 tonnes of carbon dioxide. Farming community needs support for this with significant investment subsidies for the machines as well as upgrading the tractor capacity.
- Meta-analysis of the studies shows that employing zero tillage or minimum tillage without mulching and crop rotation reduced yields. Harnessing all the three techniques simultaneously increase yields. Also, yields in minimum tillage are higher than those in the zero tillage.
- The study on climate resilient zero budget natural farming (CRZBNF) in Andhra Pradesh concludes that the yield normalisation did not happen by third year and the profits are not encouraging. Therefore, farmers may not readily adopt CRZBNF and residue free farming through precision farming can be the middle path.
- SRI- reduces water usage by 40 per cent, apart from increasing yields by 46 per cent, reducing costs by 23 per cent and profits by 3.75 times. There is no price premium. It will take more than three years to normalise the yields. Without state

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support, SRI is not profitable but economically efficient and environmentally sustainable.

- The key finding from SRI cultivation in dry land region is that these farmers find it difficult to control water in view of the uncertainty in rains and narrow window of less than a month for sowing. Disadoption after the state subsidies is the norm with 76 per cent wanting to disadopt.
- Climate change is likely to impact sorghum yields by 218 kg/ha in sorghum and 274 kg/ha in pearl millet and the yield vulnerability will be higher during 2071-98 than 2021-2050. The problem however is disparate impacts across districts. The study also concludes that encouraging agricultural research through investments can mitigate these impacts.
- Zero tillage not spreading because of machinery costs. A study from UP found that it can decrease carbon emission by 15-19 kgs and water use by 528-1424 cumt/ha. Deliberations indicate that caution has to be taken to factor in the production and use of by-products in both the systems while comparing them.
- Crop insurance products need to be designed in such a manner that it not only acts as a risk transfer tool but also a potent device to reduce risk and crop loss by inducing the desirable proactive and reactive responses among insurance users. Delayed settlement of claims is serious problem. On the other hand, the covariance of risk is an issue for delivery for service providers.
- Protected cultivation of rose under polyhouses helps enhance yield price and income. With a 12 per cent discount rate, profits can go up by 23-74 per cent with an internal rate of return of 17.21 to 23.79 per cent. Given these huge benefits, it is necessary to continue capital subsidy for their installation in farmers' fields.
- Climate change has increased monsoon maximum as well as minimum temperatures impacting crops yield adversely in the north-eastern states. Evidence indicates positive role for technology in mitigating these effects. Therefore, more emphasis has to be placed on development of varieties and their diffusion.
- Analysis reveals that annual rainfall has shown declining trend in all north-eastern states like Assam, Manipur Mizoram, Nagaland Tripura and Sikkim, except Arunachal Pradesh. The near non-existent irrigation infrastructure in these states need attention.
- Wheat cultivating farmers in Uttar Pradesh identify harnessing short duration variety as the most effective strategy to mitigate climate change.
- Mitigating farm level risk need micro management like regular weather advisory services disease or pest attack forecasting because weather aberrations are more the critical factors than climate change as far as farm-level production management is concerned. Cropping system intensification and crop diversification are the suitable options for risk mitigation at the farm level and can increase farm incomes.

- Direct seeded rice in Odisha is found to afford a cost benefit of 2.2 and enhance farm labour skill to adopt zero tillage operations and related practices.
- Pollination management intervention in Kashmir Valley increased farm gate value output of apples by 40 per cent with more number of 'A' grade apples compared to non-managed orchards. The total estimated pollination service value is 1260 crores.

A roadmap for sustainable intensification for addressing groundwater balance concludes that SRI, precision farming and laser levelling are the technologies for unsustainable paddy in the north-western region, permanent raised-bed planting, happy seeders etc for wheat in the Indo-Gangetic plain; and sustainable sugarcane initiative drip and furrow irrigation for sugarcane in states like Maharashtra, Tamil Nadu and Uttar Pradesh.

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Subject II

Doubling Farmer's Income from Demand Perspective

Rapporteur: Parmod Kumar*

Domestic consumption is growing in most segments and has capability to absorb the farm output provided market is appropriately linked. One can naturally expect that the rising food demand will be accompanied by increasing demand for its safety and quality owing to rising health consciousness of the masses. Thus, the main challenge is developing technology including varieties and breeds that are not only high-yielding but also safe to human health. For a billion plus population, domestic demand led agriculture growth ought to be the key for raising farmers' income provided agriculture supply moves in consonance with the changing demand. It is useful to seek policies that can influence demand and raise farm incomes faster. The target of doubling farmers' income requires reforms such that, every grain produced must find gainful-end-use. In addition, the ongoing efforts on various resource use optimisation, productivity enhancement and reforming markets will need to be ramped up making the growth in farmers' income a real and achievable story.

In this context, papers were invited to flag issues related to doubling farmers' income from the perspective of changing nature of demand for agricultural commodities and how the agriculture sector accommodates such changes. A total number of 26 papers were received. All papers considered under this theme can be grouped into three sub-themes. Analysing the various aspects of demand side, the first sub-theme is titled as demand-led agriculture growth that can result in enhanced farmers' income. The second sub-theme summarises doubling farmers' income either by increase in productivity or reduction in cost. Under the third sub-theme, various subjects like farm, non-farm and off farm activities; commodity value chains; income and employment; and agriculture and industry linkages were focused. The major findings and broad conclusions of papers under doubling farmers' income from demand perspective are the following:

MAJOR FINDINGS

- Per capita income of urban population is expected to rise more than the national average in the near future which will raise their demand for consumption of high value crops and allied products like vegetables, milk, eggs, chicken and meat.

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Demand for high value commodities will also rise due to change in tastes and dietary habits. In order to avail the opportunity of rising demand, the smallholder farmers need to diversify their agriculture into high value crops and other demand driven products. Such an opportunity needs to be utilised using appropriate strategies to achieve the desired goal of doubling farmers' income.

- Demand for processed foods is set to grow every year as urbanisation picks up pace and food processing sector has to tap this potential which will largely benefit the farmer as a producer of raw material. The challenge is to ensure that these drivers of growth are associated with the creation of more decent jobs that are accessible to youth, women and social groups across the country, particularly in rural areas.
- There is need for diverse marketing outlets for farmers for providing them appropriate price of their produce. Channels, like direct purchase, contract farming, farmer consumer market yards, private wholesale market and APMC need regulation and promotion. Creation of value either through new products or product differentiation can help tap new market segments and get a higher price for the farmers' produce.
- Collective bargaining through FPOs, mechanisation of farm activities, use of recommended seeds, bio fertilisers and bio-pesticides are the major cost reducing strategies. Crop diversification, value addition, marketing of produce through farmer groups, use of high yielding varieties and adoption of integrated farming system are the major income enhancing strategies.
- Introduction of pollinisers and pollination management for yield and quality gains, re-engineering cold storage and supply chain management and creation of infrastructure for processing fruits for value chain are critical for ensuring equitable returns to farmers. Besides well-designed harvesting tools can help reducing post-harvest losses and raise benefit cost ratio which is important for doubling farmers' income.
- To reduce pressure on land, non-agricultural sector must be strengthened in addition to improving agricultural productivity. The income from non-farm and wages can be increased through imparting skill development trainings, linkages, capacity building and farming user groups or self-help groups (SHGs). Non-farm activities that involve technological innovation to be designed for higher productivity of land and labour.
- The income from cultivation can be enhanced through crop diversification, improved crop management practices, adoption of timber/fruit-based agroforestry systems, rain water harvesting and use of micro/ pressured irrigation methods. The animal productivity can be enhanced by selection of improved breeds, livestock diversification and providing balanced nutrition.
- Zero Budget Natural Farming (NF) technique trains farmers to manage through domestic inputs reducing their dependence on market resources. Natural Farming

may not look as yield enhancing farming practices, but definitely increases farmers' income through cost reduction and enhances long-term sustainability.

- There is a need to develop new policies on the marketing and processing of tribal products to raise producers' share in consumer rupee for doubling farmers income in tribal areas. Cultivation of medicinal crop like ashwagandha may not only uplift the socio-economic condition of the farmers but also can open new avenue for agri-entrepreneurship through processing of such products for export market.
- Create employment avenues for smallholders outside agriculture that provide credit, training and necessary inputs to rural households and public investment in rural infrastructure, such as roads and bridges, telecommunications, education, energy and water.
- Livelihood diversity could address production constraints of income growth in sugarcane-based farming systems in case of crop failures and builds investment capacity through farm and nonfarm activities integration which provides growth and stability in farmers' income. Integrated farm management system is helpful not only increasing income of the farmers but also providing opportunities for raising productivity and reducing their cost of production.
- It is pertinent to move from "Agriculture" to "Agri-business" mindset, i.e., how value addition on farm produce can generate rural employment and significantly improve farmers' income. Value addition in floriculture provides avenues for increasing farmers' income in line with the rising demand in this particular area.

MAJOR SUGGESTIONS

1. To capitalise growing demand for high-value commodities in the urban sector create better urban infrastructure for the food industry to facilitate farmers' access to these markets.
2. Make value chain mapping-based interventions to address market failures. Upgrade rural haats and join them with e-NAM.
3. To strengthen the bargaining power of small farmers and the aggregators like FPO/Companies and co-operatives should play the role of intermediaries for ensuring remunerative prices to smallholders.
4. Cluster-based milk collection centres and infrastructure development like cold storage and quality control facility should be improved.
5. Good agricultural marketing practices; group marketing and group contracts need to be promoted to reduce information asymmetry between firm and growers and to reduce the transaction costs of dealing with small growers.
6. For better bargaining power to growers involve PACS in procurement under MSP. This already prevails in the states like Madhya Pradesh, Bihar and Uttar Pradesh.

7. Natural Farming/zero budget farming through reduction in cost of cultivation and with better product price leads to better profitability. Generate scientific evidences for different combinations of ZBNF practices under different agro-ecological conditions and for different crop combinations. NF products may be given separate identity as non-chemical products, so as to fetch premium price on the line of organic products.

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Subject III

Agriculture, Nutrition and Employment Nexus: Welfare Perspective

Rapporteur: J.V. Meenakshi*

"Food security exists when all people, at all times, have physical and economic access to *sufficient*, *safe and nutritious food* that meets their dietary needs and food preferences for an active and *healthy* life" (emphasis added). This definition of food security by FAO in 1996 encompasses both access to food as well as health. It necessitates a wider, multi-sectoral view, for analysis.

A food systems approach is increasingly seen as the lens through which the structural changes occurring in agriculture and nutrition in India are to be viewed. A major channel linking agriculture to health and welfare is through enabling the consumption of diversified diet. A diversified diet is an indication of a diet high in macro- and micro- nutrients, which in turn leads to better nutritional outcomes, especially for children. The paper on this theme provides an empirical substantiation of this relationship. It uses data from both the NSS and the NFHS to find that (a) both household income and education are significant predictors of dietary diversity; (b) dietary diversity is higher in farm households than in labour households in rural areas, suggesting that on-farm availability of diverse foods may be important; (c) dietary diversity is a major determinant of child underweight outcomes; (d) there are significant regional differences in the prevalence of underweight in rural Uttar Pradesh, indicating that targeting of interventions is merited.

There are several other channels by which agricultural outcomes and practices affect nutrition and health. The labour market is an example—higher wages, especially of women, translate into additional resources that are available to invest in child health, among other competing uses. Additional working hours, on the other hand, absent alternative caregivers, may place further demands on women's time, which is often under-valued and unaccounted for. Another example is that of water, with irrigation requirements translating into mining of groundwater levels to such an extent that the quantity and quality of drinking water are adversely affected, compromising human health. Climate change, with rising extreme weather incidents, is likely to exacerbate these issues. A third area relates to the development of agricultural value chains. Processed foods are often high in sugar and fat content,

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which in turn are the contributing factors to the rising incidence of overweight and obesity.

Thus the overall theme has the potential to support a rich set of analyses, and the field of agricultural economics is best placed to undertake research to provide solutions to these challenges.

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ARTICLES

Impact of Dairy Co-operative Society on Adoption of Improved Farm Practices: A Farm Level Experience in Assam

Baban Bayan*

ABSTRACT

The study makes an attempt to estimate the impact of becoming member of dairy co-operative society (DCS) on adoption of improved and production augmenting farm practices such as fodder cultivation, adoption of artificial insemination (AI) and concentrate feeding among dairy farmers in Assam. As simple comparison between members and non-members of DCS on the impact indicators may be embedded with selection bias and may not give accurate estimates, the study has used propensity score matching to address selection bias based on observed covariates. Relying on information from a sample of 202 smallholder dairy farmers and by estimating the average treatment effects on the treated (ATT), the study has shown that members of DCS are significantly found to practise fodder cultivation, adopt more AI and feed more amount of concentrates to their animal. Given that these impact indicators of becoming members of DCS may have productivity enhancing effect, the co-operative system of dairying in the state needs to be strengthened to develop the dairy sector of the state.

Keywords: Dairy co-operative society, Improved farm practices, Impact, Propensity score matching, Assam.

JEL: Q12, Q13.

I

INTRODUCTION

Policies, besides targeting to improve productivity and overall production of the small and marginal farmers, providing better access to market has been an important element in the strategies to ensure rural development and poverty reduction. According to FAO (2012), a strong co-operative provides a range of services to its members that include access to natural resources, information, communication, input and output markets, technologies and training. Dairy co-operative society is considered an important medium for distribution of milk and technological innovations and thus membership of DCS may positively affect the adoption of certain improved farm technologies. Studies point out that the smallholder farmers face marketing constraints which impede them from exploiting the benefit of market opportunities (Fischer and Quaim, 2012). These constraints sometime become more severe for perishable commodities like milk. Large scale milk handling in the unorganised sector stresses the importance of dairy co-operative society (DCS) as

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The study is part of the author's doctoral thesis title "Dairy Productivity and Crossbreeding Technology Adoption in Assam: Impact and Determinants" submitted to the Department of Humanities and Social Sciences, Indian Institute of Technology, Guwahati in January 2018.

vital channel for the marketing of milk, its potential role to increase production and reduce cost of procurement, processing and marketing of dairy products through economy of scale approach (Rangasamy and Dhaka, 2008). In the Indian context, DCS, besides providing an assured market for milk, also provide inputs and services like credit to the member-producers (Taneja and Birthal, 2005). Over the years, the role of dairy co-operatives are conceived as the major driving force for the success of white revolution and country's increased milk production to the tune of 155.49 million tonnes during 2015-16 from a production as low as 17 million tonnes during 1950-51. Presently, dairy co-operatives collectively procure 15.58 million tonnes of milk accounting for 10 per cent of the total milk production in the country indicating the importance of dairy co-operatives in India (NDDB, 2016). The impact of taking membership of dairy co-operatives on raising production, marketing and other farm performance indicators are well documented (Kumar *et al.,* 2013; Bardhan and Sharma 2012; Chagwiza *et al.* 2016). Studies in other parts of the world show the impact of agricultural co-operatives on the adoption of improved farm practices. In the Ethiopian context, Abebaw and Haile (2013) showed that membership of agricultural co-operatives had impact on fertiliser adoption; while, Verhofstadt and Maertens (2014) in Rwanda found a significant impact of co-operative membership on the probability of farmers to adopt mineral fertiliser and improved seeds. However, there is paucity of studies to show dairy co-operative's role in the adoption of improved farming practices which are production augmenting in nature.

Dairy co-operatives handling milk along with the number of member-producers in Assam has increased significantly during 2000-01 to 2015-16. The daily milk procurement by co-operatives was 3,000 litres with only 1000 member-producers in 2000-01 which increased to 22000 litres with 16000 member producers during 2015-16 (NDDB, 2016). The expansion of dairy co-operative sector in Assam may also bring other associated impacts on the farmers along with increased marketed surplus, income, employment, etc. In a recent study, Bayan (2018) has emphasised on the positive impact of DCS membership on increased farm performances of smallholder dairy production system. The present study is thus focused on identifying the role of DCS on the adoption of improved farming practices such as fodder cultivation, adoption of artificial insemination (AI) and feeding concentrate to the animal. These outcome variables are of particular importance in the context of Assam due to its embodied potential to augment dairy production concurrently with grade cattle adoption. Furthermore, the outcome variables are specifically linked to the understanding that declining area under pasture land and lack of fodder cultivation practices among farmers has stood as a major challenge for dairy development in the state. The area under fodder cultivation in the state is only 0.15 per cent of the total cropped area against the all India average of 2.29 per cent (Feroze *et al.,* 2010). Again, AI being an important and economically viable technique of cattle crossbreeding, its coverage of breedable cattle population is still abysmally low (reflected in only 3.84 per cent crossbred cattle population) in Assam even though AI was started way back in 1970s with the launch of Intensive Cattle Development Project (ICDP). Similarly, feeding concentrate to the animal is also quite low in the state even though studies point out its importance to raise productivity.

In order to control for selection biases arising from simple comparison of members and non-members of DCS on their outcome variables, the study has used propensity score matching (PSM henceforth).[1] PSM is a widely used semi-parametric technique for impact evaluation of programme participation (DCS membership status in our case). The study is organised in four sections including the introduction. Section II discusses materials and methods used in the study. While, Section III presents the results and discussion of the study, Section IV finally concludes the paper.

II

MATERIALS AND METHODS

Data

The study was conducted in three districts of Assam, namely, Barpeta, Sonitpur and Karbi Anglong for a data set of 245 smallholder dairy farmers. Multistage sampling technique was followed for selecting the sample farmers for the study. In the first stage, districts were stratified into high, medium and low in terms of AI coverage of breedable cattle population and crossbred cattle population density per hundred hectares of geographical area. Following this, one district was randomly selected from each stratum with Barpeta belonging to high, Sonitpur to medium and Karbi Anglong to low stratum. In the second stage, two representative community development blocks (CDB) were chosen from each district with the understanding that one CDB has high and the other with a relatively low AI coverage and crossbred cattle density. Some key informants in the district; such as district veterinary officer (DVO), and block veterinary officer (BVO) and veterinary officers (VO) in the block and state veterinary dispensary guided the selection process of the CDB. In the third stage, three sample villages from each CDB were selected considering that the villages have sizable number of crossbred cattle and AI coverage of breedable cattle population. Finally, 30 per cent sample farmers from each village were selected and interviewed using systematically designed and pre-tested questionnaire.

The farm locations were filtered in terms of availability of at least one active dairy co-operative society (DCS) with the farmer’s likelihood of being member/non-member of that DCS. Farm locations that did not have a DCS with the understanding that spatial distribution of those farmers may not be influential to take membership of DCS were dropped from the original data set. Thus 202 farmers were the ultimate sample size with co-operative membership status (74 members and 128 non-members) as the target variable.

Method: Propensity Score Matching

The present study has used propensity score matching method to assess the impact of DCS membership on adoption of three improved farm practices, namely, fodder cultivation for feeding the farm animals, adoption of AI and concentrate feeding. Following Rosenbaum and Rubin (1985) and Gitonga *et al.* (2013) the whole estimation strategy of impact evaluation using PSM is based on two stages. In the first stage, estimation of conditional probability of being member of DCS or propensity score is carried out using a Probit model based on pretreatment characteristics.[2] The propensity score equation is of the following form:

$$p(X) = \Pr[Z = 1 \mid X] = E[Z \mid X]; \quad p(x) = F\{h(X_i)\}, \qquad \ldots(1)$$

where F{.} can be cumulative distribution function for X which is a vector of pre-treatment characteristics (Becerril and Abdulai, 2009). Propensity score is a single index variable that addresses dimensionality problem arising due to the heterogeneity between the set of observables of both members and non-members of DCS.

In the second stage, members and non-members are matched on their propensity score using commonly applied matching algorithms such as nearest neighbor matching (NNM), Kernel based matching (KM) and radius matching (RM).[3] In NNM, each observation in the control group (non-member) is matched to one or more observations in the treatment group (member) based on their closest propensity score. In KM, each observation in the treatment group is matched to weighted averages of individuals who have similar propensity score. Radius matching takes into account tolerance level on the maximum propensity score distance between an observation in the treatment group and entire observations in the control group who are within that distance (Chen and Zeiser, 2008; Gitonga *et al.*, 2013).

The main purpose of PSM is to balance the distribution of observable covariates of the two groups (members and non-members of DCS) to ensure that there is overlap (no systematic difference in the distributions) (Lee, 2008). The preconditions for a matched sample between groups are: (i) two sample *t*-test for each observation indicating that after matching there is no systematic difference; (ii) comparison of pseudo R^2 and joint significance of covariates (*p*-values of likelihood ratio test) indicating that after matching the pseudo R^2 should be lower and the joint significance of covariates should be rejected (*p*-values should be insignificant (Sianesi, 2004); (iii) following the reduction of mean absolute standardized bias (MASB) approach (Rosenbaum and Rubin, 1985) which suggests that standardised bias of greater than 20 per cent is found to be considerably large and an indicator that the matching process has failed; and (iv) finally, check common support or overlap visually using propensity score graph (‘psgraph’ command in STATA 14).

Fulfilling the conditions of matching, the average treatment effects on the treated (ATT) are computed after dropping the observations that lie outside the common support or overlap regions as follows:

$$ATT = E(Y_1 - Y_0/Z_t = 1) = E(Y_1/Z_t = 1) - E(Y_0/Z_t = 1) \qquad ....(2)$$

where, Y_1 and Y_0 are the outcome variables of our interest in the treated and control states respectively; and Z_t is an indicator variable (treatment status) pointing out membership of DCS. However, PSM has the limitation that it fails to control selection bias arising from unobserved variables such as risk perceptions, motivations, etc. Nevertheless, it is a good method and used extensively to evaluate the impact of programme participation, as it is based on counterfactual approach of causality and avoid selection bias arising from systematic differences between treated and control group on their observed variables.

III

RESULTS AND DISCUSSION

Descriptive Results

Table 1 presents the choice of outcome and explanatory variables and their definitions and measurement. The outcome variables of our interest being fodder

TABLE 1. VARIABLE DEFINITION AND MEASUREMENT

Variable (1)	Type (2)	Definition (3)	Measurement (4)
Outcome variables			
Fodder cultivation	Dummy	If the farmer had cultivated Napier or Oats variety grass during 12 months preceding the survey	1 if yes, 0 otherwise
Adoption of AI	Dummy	If the farmer had adopted AI as breeding method during 12 months preceding the survey	1 if yes, 0 otherwise
Concentrate feeding	Continuous	Amount of concentrate fed per litre of milk	grams
Explanatory variables			
Age	Continuous	Age of household head	Years completed
Education	Continuous	Number of years in school	Years completed
Family size	Continuous	Total household members	Numbers
Herd size	Continuous	Total number of cattle in the farm	Numbers
Distance to all-weather road	Continuous	Distance from the farm to the nearest all-weather road.	Metre
Access to Credit	Continuous	If the household accessed credit during 12 months preceding the survey	1 if credit accessed, 0 otherwise
Beneficiary of govt. dairy development programme	Dummy	Farmers ever benefitted from any dairy development programme during 12 months preceding the survey	1 if beneficiary, 0 otherwise
Extension	Continuous	Average number of times the farmer met the extension agent during 12 months preceding the survey	Years completed
Financial inclusion	Dummy	Whether the farmer has a bank account during the survey	1 if yes, 0 otherwise
Price of milk	Continuous	Average price received for the milk sold	Rs.

Source: Author's own definition.

cultivation, adoption of AI and concentrate feeding may play a vital role in enhancing productivity and overall milk production in the state. The selection of the explanatory variables, likely to influence the membership of DCS, was guided by previous studies (Chagwiza *et al.,* 2016; Ma and Abdulai, 2016; Mojo *et al.*, 2017; Bardhan and Sharma, 2012).

Description of the data on demographic and socio-economic characteristics and improved farm technologies collected through primary survey questionnaire is presented in Table 2. The households are categorised into member (treatment) and non-members (control) of DCS in which 36.63 per cent are members and 63.37 per cent are non-members (Table 2).

TABLE 2. DESCRIPTIVE STATISTICS FOR OUTCOME AND EXPLANATORY VARIABLES OF UNMATCHED SAMPLE (MEAN)

	Treatment (N=74)		Comparisons (N=128)		*t*-test (2-tailed)
Variables (1)	Mean (2)	Std. error (3)	Mean (4)	Std. error (5)	Difference (6)
Fodder cultivation	0.6081	0.0571	0.0876	0.0242	0.5205***
Adoption of AI	0.9459	0.0265	0.2920	0.0390	0.6540***
Concentrate feeding	400.3013	0.1969	227.0993	0.1249	173.202***
Age	51.5135	1.3783	50.2920	1.0868	1.2215
Education	8.5946	0.5072	5.1241	0.3790	3.4705***
Family size	5.7973	0.3208	5.7226	0.1901	0.0747
Herd size	6.6892	0.6698	6.8905	0.6952	0.2013
Distance to all-weather road	310.8243	44.4030	421.8978	32.7134	-111.0735**
Access to credit	0.2703	0.0519	0.0876	0.0242	0.1827***
Beneficiary of government dairy development programme	0.5000	0.0585	0.0511	0.0189	0.4489***
Extension	15.5811	1.5786	5.0438	0.5226	10.5373***
Financial inclusion	0.9054	0.0343	0.6788	0.0400	0.2266***
Price of milk	32.2838	0.8133	32.8832	1.0446	- 0.5994

Source: Author’s estimation based on field survey data.
Note: *** Significant at 1 per cent.

The members and non-members of DCS appear to be similar in terms of their age, family size, herd size and price of milk, but have significant difference on the remaining variables. For example, members have higher years of schooling compared to non-members. The average years of schooling of members is 8.6 years against 5 years for non-members. Members have better access to road infrastructure as average distance to all-weather road for members is less by 111 metres from the non-members counterpart. Members are significantly better-off in terms of accessing various institutional services such as access to credit, beneficiary of dairy development programme and financial inclusion by an average margin of 18.27 per cent, 44.89 per cent and 22.66 per cent respectively compared to their non-members counterpart. The average number of times the members met the extension personnel during the year preceding the survey is about 15 vis-à-vis only 5 for non-members.

Table 2 also shows that with respect to the outcome variables members are better-off compared to their non-members. However, these differences are not sufficient to draw inferences of positive impact of DCS on the adoption of productivity raising farm practices. The confounding factors need to be controlled and thus PSM technique is the way forward to estimate the impact.

Determinants of Co-operative Participation

Probit regression results, in which the DCS membership status (1=member; 0=otherwise) was regressed on baseline characteristics, are presented in Table 3. As a first step of PSM, the probit model equation (Eq. 1) estimates the propensity of becoming member of DCS for each household. The joint statistical significance of explanatory variables (LR χ^2 test statistics = 101.15, *p*-value =0.000) indicate a good fit of the model. The pseudo R^2 (0.3700) also implies a good model fit as pseudo R^2 falling in the range of 0.2 to 0.4 is considered to indicate so (Elder *et al.,* 2012). The results of the probit regression show that membership of a DCS is significantly and positively influenced by education of the household head. The educated household head is better able to comprehend the necessity of marketing organisation like co-operatives for profitable farming and thus a positive association is envisaged in the study (Table 3). The findings of the study, consistent with Abate *et al.* (2014) and Mojo *et al.* (2017), shows positive and statistically significant relation between the variable ‘beneficiary of government dairy development programme’ and becoming member of DCS, indicating that beneficiary farmers have 50.67 per cent higher chance of becoming member of DCS. This may be because farmers could be easily reached for providing free green fodder seeds and subsidised concentrates as part of government dairy development programmes through a network of DCS. Farmers may be motivated to take membership if they find such programmes in place. Meeting the extension agents frequently may become an important source of information for farmers which may influence positively the membership of DCS. In our study too we found a positive and significant relation between membership of DCS and access to extension support. The remaining variables namely, age, family size, distance to all-weather road, access to credit and financial inclusion are according to the expected sign but found statistically insignificant. Variables such as herd size and price of milk are negatively associated with membership of DCS. This may have the implications that members are smaller size farmers with more high yielding crossbred cattle compared to their non-members. Similarly, although price of milk can be an important signal to motivate farmers to take membership of DCS, several studies point out that co-operatives are weak in offering better prices (Chagwiza *et al.*, 2016; Kumar *et al.*, 2013; Bardhan and Sharma, 2012). However, obvious indication is such that, the better-off farmers tend to join DCS as results are somewhat consistent with the descriptive statistics (explanatory variables) in Table 2.

TABLE 3. PROBIT ESTIMATION OF FACTORS INFLUENCING MEMBERSHIP OF DCS

Variables (1)	Coefficient (2)	Std. error (3)	Marginal effect (4)
Age	0.0085	0.0097	0.0030
Education	0.0661**	0.0270	0.0238
Family size	0.0401	0.0464	0.0145
Herd size	- 0.0152	0.0229	- 0.0055
Distance to all-weather road	0.0001	0.0003	0.0005
Access to credit	0.3104	0.3263	0.1164
Beneficiary of government dairy development programme	1.3717***	0.2904	0.5067
Extension	0.0575***	0.0143	0.0207
Financial inclusion	0.2191	0.2999	0.0768
Price of milk	- 0.0079	0.0103	- 0.0028
Constant	- 2.2259***	0.7324	
LR Chi^2 (8)	101.15		
Prob> Chi^2	0.000		
Pseudo R^2	0.3700		
Number of observation	202		

Source: Author's estimation based on field survey data

Notes: ** and *** Significant at 5 and 1 per cent level, respectively; marginal effects are estimated using 'mfx' command in STATA 14 after Probit model estimation.

Covariate Balancing Test Results

The second step of PSM is the matching of members and non-members of DCS (treatment and control) on their propensity scores using three different matching algorithms/estimators. Table 4 shows that the pseudo R^2 of the estimated Probit model indicating how well the relevant covariates explain the probability of becoming member of DCS, was high before matching (37 per cent) comes down to the range of 3.8 to 6.7 per cent. In similar lines, the *p*-values of the likelihood ratio test of the joint significance were all significant before matching becomes insignificant after matching. This points out that no systematic differences are seen in the distribution of covariates between members and non-members of DCS after matching. The joint significant impact of the observable covariates on DCS membership decision, expressed by significant χ^2, could not be rejected before matching was always rejected after matching for all the matching estimators. The mean absolute standardised bias are in the range of 11.1 to 15.6 per cent (all below 20 per cent as per the requirements) indicating a good match of the treated and control group.

Overlap or common support was also checked by visual inspection at the distributions of the propensity scores for the members and non-members of DCS (Figure 1). It shows that the two distributions are greatly overlapped. Propensity scores that lie outside the common support regions are shown on the graph as 'treated off support' indicating that they do not have suitable comparisons and are dropped in the treatment impact estimations.

TABLE 4. INDICATORS SATISFYING BALANCING PROPERTY BEFORE AND AFTER MATCHING

Matching algorithm (1)	Pseudo R^2 before matching (2)	Pseudo R^2 after matching (3)	LR χ^2 (p-value) before matching (4)	LR χ^2 (p-value) after matching (5)	Mean standardised bias before matching (6)	Mean standardised bias after matching (7)	Total per cent bias reduction (8)
NNM[a]	0.370	0.038	101.15*** (0.000)	6.68 (0.755)	45.2	11.1	75.44
KBM[b]	0.370	0.061	101.15*** (0.000)	10.90 (0.365)	45.2	15.6	65.48
RM[c]	0.370	0.067	101.15*** (0.000)	11.97 (0.287)	45.2	15.5	65.71

Source: Author's estimatiom based on field survey data.
Note: *** Significant at 1 per cent.
a NNM = five nearest neighbor matching with replacement and common support.
b KBM = kernel based matching with band width 0.06 and common support.
c RM = radius matching with caliper 0.1 and common support.

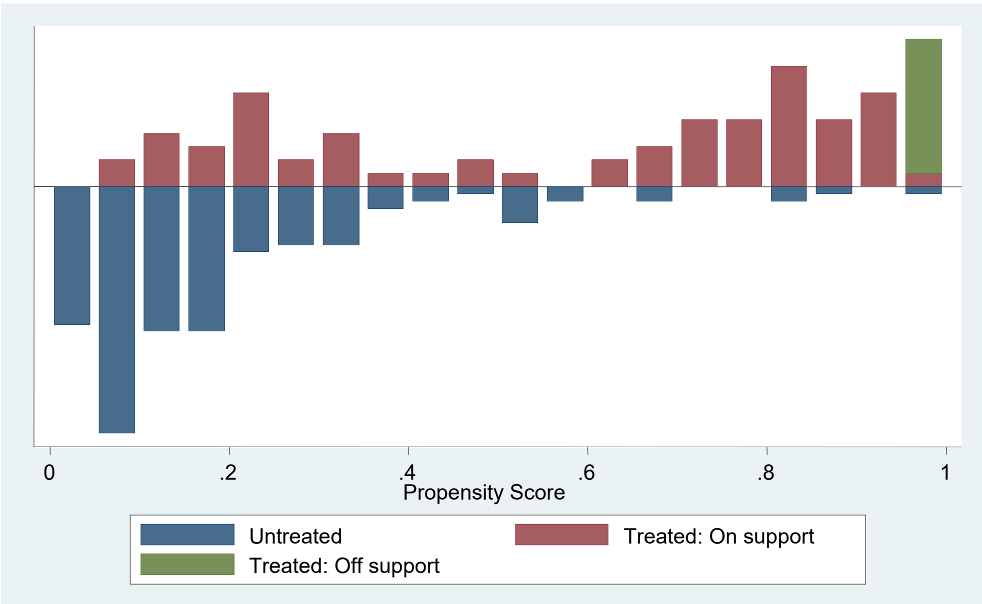

Figure 1. Distribution of the Propensity Scores and Common Support for Propensity Score Estimation for the DCS Members and Non-Members.

Impact of DCS Membership

To estimate the impact of being member of DCS, PSM method was employed to estimate the average treatment effect on the treated (ATT) after matching the member and non-member groups. For the sake of robustness of the results alternative estimators were used (Table 5). The results showed that all the estimators had almost similar results for their respective outcome variables. It is evident from Table 5 that taking membership of DCS seem to motivate farmers to adopt improved farm practices such as green fodder cultivation, adoption of AI and concentrate feeding per litre of milk which are important for raising overall dairy productivity. More specifically, rate of fodder cultivation will be less by a significant 49.37-51.25 (*p*-value=0.000) percentage points if the farmer is not a member of DCS. Similarly, there is a positive and statistically significant effect (*p*-value=0.000) of DCS membership on adoption of AI. Farm households with membership of DCS and doing AI for their animals are higher by 37.58 – 40.69 per cent compared to the counterfactual non-members. Finally, both members and non-members fed concentrate to their animal but with a significantly varying degree. Table 5 shows that members of DCS are found to feed more concentrate per litre of milk produced daily to the farm animals as compared to the non-members by the range of 209.41 to 228.17 grams/per litre of milk.

TABLE 5. ESTIMATION OF ATT: IMPACT OF DAIRY CO-OPERATIVE SOCIETY ON ADOPTION OF IMPROVED FARM PRACTICES

Outcome variables	NNM (5)	KBM (0.06)	RM (0.1)
		ATT	
(1)	(2)	(3)	(4)
Fodder cultivation	0.5125***	0.4937***	0.5034***
	(5.53)	(4.27)	(3.89)
Adoption of AI	0.4031***	0.3758***	0.4069***
	(3.41)	(3.47)	(3.57)
Concentrate feeding	228.1742***	213.7756***	209.4082***
	(2.98)	(2.63)	(3.28)

Source: Author's estimation based on field survey data.

Note: ATT estimates of all matching algorithms are obtained through implementation of 'psmatch2' command (given by Leuven and Sianesi, 2003) in STATA 14; Figures within brackets are the bootstrapped z statistics using 50 replications; ***Significant at 1 per cent.

NNM (5) = five nearest neighbour matching with replacement and common support.

KBM (0.06) = kernel based mathing with bandwidth 0.06 and common support.

RM (0.1) = radius matching with caliper 0.1 and common support.

IV

CONCLUSION

In the study an attempt was made to see the impact of dairy co-operative society on adoption of certain improved farm practices which can be considered production augmenting. Since, simple comparison between members and non-members of DCS is associated with selection bias due to non-randomness in the selection of being in the treatment group, propensity score matching technique was employed to arrive at unbiased estimates of the outcome variables.

The findings show a positive and statistically significant impact of smallholder dairy farmers' participation in dairy co-operative society on green fodder cultivation, adoption of AI, and feeding concentrate to the farm animal. The ATT estimates of three different matching algorithms show that the rate of fodder cultivation is significantly reduced by 49.37-51.25 per cent if the farmer is not a member of DCS. Similarly, rate of adoption of AI among members of DCS is significantly more over the counterfactual non-members by a range of 37.58-40.69 per cent. Finally, although both the DCS membership groups feed concentrate to their animal, members of DCS fed more concentrate in the range of 209.41-228.17 gram/litre of milk produced. These results have important implications for the dairy development in Assam. Facilitating dairy farmers' access to market through DCS or other such farmer producer organisation may enhance milk productivity and production of the state. Hence, there is a need towards distribution of green fodder seed and subsidised concentrate feed to the farmers through DCS under certain dairy development programmes. Furthermore, in AI diffusion programme of the state to raise high yielding crossbred cattle population, DCS has to be identified as an important medium for the knowledge dissemination on AI to increase its rate of adoption. Overall, given the positive impact of DCS participation, the system of co-operative dairying in the state needs to be strengthened to improve the overall scenario of the dairy sector.

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NOTES

1) The selection bias may arise because treatment (members of DCS) and control (non-members) groups may be systematically different on their observed and unobserved characteristics and members may self-select to be in the treatment group.

2) PSM is based on two main assumptions: one, conditional independence assumption (CIA) or unconfoundedness, that is after controlling for observed covariates (X_i) the potential outcomes of our interest are independent of treatment assignment; two, common support or overlap assumption indicating that after matching members and non-members lie in the same domain.

3) For more details on matching algorithms see Caliendo and Kopeinig (2008) and Becker and Ichino (2002).

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Sources of Agricultural Growth and Its Determinants: A Regional Analysis of Uttar Pradesh

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ABSTRACT

The paper examines the sources and patterns of growth in crop sector in Uttar Pradesh and identifies the drivers through panel data from 2004-05 to 2015-16. The results reveal that yield and diversification are found to be the sustainable sources of growth in crop sector in all regions except Bundelkhand. However, these sources have varied widely across the regions. The fixed effect regression model result show that irrigated area, electricity, road length, agricultural loan, agricultural market, fertilisers, tractor, literacy rate, planned expanses and normal rainfall are drivers of agricultural growth. Thus, infrastructural, institutional, technological and socio-economic factors ought to be improved through new policies.

Keywords: Crop sector, Sources of growth, Decomposition analysis, Rural infrastructure, Fixed effects model.

JEL: C33, Q11, Q12, R11

I

INTRODUCTION

It has been widely known that agriculture is one of the most effective instruments for achieving growth and reducing poverty especially in rural economies (Kumar *et al.*, 2011). However, the promise of agriculture to reduce poverty and initiate development in any economy can be realised only if the state works in tandem in providing the core public goods, investing in physical and institutional infrastructure and regulating natural resource management apart from facilitating the private sector to pitch in profitably (World Bank, 2008). One such initiative of the Indian state was witnessed during the Green Revolution which proved quite fruitful for the Indian agricultural sector. During this phase, factors such as technological change, investment in infrastructure by way of irrigation facilities, market access, road connectivity; development of institutions particularly extension of credit services and enabling input and output price policies became the major drivers of agricultural growth throughout the country. The effects of Green Revolution also trickled down to various states. Uttar Pradesh per se benefited immensely and has been the highest producer of some food grains and non-food-grains such as vegetables, fruits, sugarcane and potato throughout the country and is commonly known as the "granary of the nation".

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The agricultural growth statistics was also quite commendable. From negative growth rate of -0.9 per cent in the Third Five Year Plan (1961-66), agriculture sector grew at 5.23 per cent towards the 1980s. But after the 1990s agricultural growth in UP has been going through its own ups and downs (Government of Uttar Pradesh, 2017). It may be due to factors similar to those at the national level which might have caused decline in agricultural growth in Uttar Pradesh as well. For instance, the technologies that had driven growth may have started showing signs of fatigue (Evenson *et al*., 1999; Murgai *et al*., 2001; Sidhu, 2002; Chand *et al*., 2010) or the increased frequency of extreme climate events, such as droughts and floods, might have added to the sluggishness and instability in agriculture.

Besides plummeting yields, the aspect of crop diversification also contributed to the slowdown in agricultural growth in UP. Despite crop diversification gaining pace throughout the country during the 1990s (Birthal *et al*., 2007), the same was not true for the state of Uttar Pradesh. Being endowed with abundant natural resources; diverse agro-climatic conditions, varied soil type, abundant rainfall- which has immense scope for growing horticultural crops (Basu, 2008), the rate of crop diversification is less in the state. Hence, fostering rapid and sustainable growth in agriculture continues to be a major policy challenge for the state.

Uttar Pradesh has the highest population base throughout the country. Surging population gives rise to urbanisation and a sustained rise in per capita income. These changes ensue a significant transformation of the food basket, in quantity as well as quality (Joshi and Kumar, 2011). In order to maintain the momentum, this will cause pressures on the existing resources as the domestic production will not be as easy to meet as in the Green Revolution period. Considering the fact that the gross cropped area of UP is around 26 million hectares, there is little, if any or no scope to expand the land frontiers. Hence, intensification of the existing production systems remains the only option. This will entail competition for land, water and energy. Consequently, energy prices will rise rapidly. With the unfolding of globalisation, the sector will come under the pressure of adjustment to global market forces. Thus, addressing these challenges requires an understanding of the past sources of growth and their determinants in the context of the agricultural sector in Uttar Pradesh.

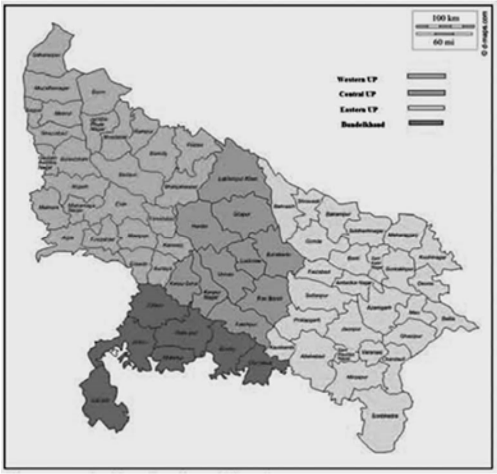
The internal sources of agricultural growth may be improvement in crop productivity, resource use efficiency, diversification, modernisation of technology, rural infrastructure and improvement of real prices received by farmers while shifting cultivators from farm to non-farm occupations and better terms of trade constitute the external sources of growth. Hence, this study is an attempt to analyse the changes in the patterns and sources of growth in the crop sector in Uttar Pradesh, which accounts for close to two-third of the total value of output by agriculture sector in the state. A better understanding of the nuances of the past sources of growth is pivotal to provide empirical support to design appropriate research and development strategies for sustainable intensification of agriculture. Specifically, the study quantifies the changes in the sources of growth in crop sector and identifies the drivers for growth at aggregate level as well as regional level of the state. Further, it discusses the economic, institutional and policy factors underlying these changes and suggests strategies for higher, more sustainable and more inclusive agricultural growth of the state.

II

DATA BASE

To analyse the sources of agricultural growth, data on area, production, yields, farm harvest prices and wholesale price of crops from 75 districts of Uttar Pradesh was considered. Data on area, production and yield of 41 crops, namely; rice, wheat, jowar, bajra, maize, barley, millets; arhar, gram, masoor, peas; groundnut, linseed, rapeseed, til, sunflower, soyabean, cotton, sugarcane, mango, banana, papaya, litchi, guava, jackfruit, aonla, muskmelon, potato, sweet potato, onion, brinjal, cabbage, cauliflower, okra, tomato, green peas, coriander, garlic, ginger, chillies and turmeric were obtained from *Agricultural Statistics at a Glance*, DES, Ministry of Agriculture, Planning Department of Uttar Pradesh, Horticulture Board of Uttar Pradesh and UPDES. The selected crops for the present study account for more than 90 percent of both the total cropped area and the value of output of the crop sector in Uttar Pradesh (UPDES).Similarly, value of output by specific crop was generated by multiplying production with Farm Harvest Prices. Farm Harvest prices were taken out from Department of Agriculture and Co-operation Network (DACNET). These values were initially generated at current price. Later, wholesale price indexes were retrieved from the Office of Economic Advisor website in order to convert current prices into real prices (at 2011/2012 base). The time series on area, production, productivity, real prices and real value of output were later smoothened by applying Hodrick-Prescott (HP) filter by an appropriate adjustment factor. The HP filtered data series were used for analysing the patterns and sources of growth. Finally in order to identify the drivers for conducting regression analysis utilised variables related to fertiliser consumption, tractor, irrigation, roads, electrification, agriculture market, school, health centre, forest area, normal rainfall and loan for primary sector obtained from Uttar Pradesh Directorate of Economics and Statistics (UPDES).

Table 1 presents the salient features of the four administrative regions of Uttar Pradesh. The Western region (WUP) consists of 26 districts marked by fertile landscape and the highest gross cropped area and cropping intensity at 9.90 million hectares and 160.80 per cent respectively. The rural population in the region is 70.88 per cent while the urban population is 29.12 per cent. Population density is second highest after Eastern region at 978.79 persons per sq. km. The Eastern region (EUP) comprises 27 districts. This region is less fertile than the Western region. The gross cropped area is 8.55 million hectares while the cropping intensity is 155.72 per cent. 88.60 per cent of the population resides in rural areas while 11.40 per cent



Uttar Pradesh is characterised by varied resource endowments, climate, infrastructure and institutions which may influence the crop composition, technology adoption, input usage, crop yields and prices, ultimately likely to influence the patterns and sources of growth across regions. The paper therefore restricts the analysis to patterns and sources of growth at regional levels for the state of Uttar Pradesh. Uttar Pradesh is divided into four administrative regions—Western (26 districts), Eastern (27 districts), Central (10 districts) and Bundelkhand (07 districts)—based on their geographical contiguity or proximity (see Figure 1).

Source: Author's classification.

Figure 1. Administrative Regions of Uttar Pradesh.

resides in urban areas. The population density of the Eastern region is 993.04 persons per sq. km. The Central region (CUP) consists of 10 districts.77.40 per cent of the population resides in rural areas while 22.60 per cent of the population resides in urban areas. The gross cropped area is 4.74 million hectares while the cropping intensity is 153.78 per cent. The Bundelkhand region (BUP) consists of seven districts and 79.17 per cent represents rural population while 20.83 per cent represents urban population. The gross cropped area is 2.74 million hectares and the cropping intensity is 132.67 per cent.

TABLE 1. UTTAR PRADESH AT A GLANCE: DEMOGRAPHIC, SOCIO-ECONOMIC AND LAND-USE STATISTICS

Variables (1)	WUP (2)	CUP (3)	EUP (4)	BUP (5)	UP (6)	INDIA (7)
Population in million (census 2011)	72.83	35.97	79.89	9.68	199.8	1210
Rural population (per cent) (census 2011)	70.88	77.40	88.60	79.17	77.7	68.8
Urban population (per cent) (census 2011)	29.12	22.60	11.40	20.83	22.3	31.1
Geographical area LUS (mHa)	8.04	4.53	8.64	2.96	24.10	328.7
Population density (persons per sq km)	978.79	872.51	993.04	320.43	829.00	382
Gross cropped area (mHa)	9.90	4.74	8.55	2.74	25.89	196.9
Cropping intensity (per cent)	160.80	153.78	155.72	132.67	156.15	139.86
Number of districts	26	10	27	7	70*	676

Source: ICRIER report and UPDES.
Note: Five new districts merged with existing districts.

III

METHODOLOGY

The technique of decomposition has been used in order to arrive at the results. The main variable utilised for the decomposition of data is agricultural growth. Through the growth accounting approach of Minot *et al*. (2006), agricultural growth was decomposed by source and crop. Source refers to the variables identified, i.e., area, productivity, price and diversification while crops refer to the database of 41 crops grown in Uttar Pradesh. For instance, according to this approach, the change in gross revenue from a single crop can be decomposed into change in cropped area, change in yield, change in real price and a residual representing the interaction among area, yield and real price. One more source of growth is the diversification factor which represents reallocation of area from one to other crops. These sources of change or growth in gross revenue are influenced by a number of economic and non-economic factors.

Assuming that a farmer behaves rationally, he or she maximises profit from his or her land by choosing a production mix, inputs, and technologies subject to his resource endowments and markets. If Ai is area under crop i, Yi is its production per unit area, and Pi is the real price per unit of production, then the gross revenue R from n crops can be written as

$$R = \sum_{i=1}^{n} A_i Y_i P_i \qquad \text{....(1)}$$

A_i can be further expressed as the share of crop i in the total cropped area, $(a_i) = A_i / \sum_i A_i$ and substituting this expression in equation (1) we get

$$R = \left(\sum_{i=1}^{n} a_i Y_i P_i\right) \sum_{i=1}^{n} A_i \qquad \text{....(2)}$$

The total derivative of both sides of equation (2) provides the absolute contribution of changes in these components to the change in gross revenue

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \left(\sum_{i=1}^{n} A_i\right) d\left(\sum_{i=1}^{n} a_i Y_i P_i\right) \qquad \text{....(3)}$$

Equation (3) is only an approximation, as it excludes the interaction term. The second term on the right-hand side of this equation can be further decomposed from a change in sums to the sum of changes, as follows

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} d(a_i Y_i P_i) \qquad \text{....(4)}$$

Further expansion of the second term of Equation (4) results in the following expression:

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} (a_i Y_i \, dP_i) + \left(\sum_{i=1}^{n} A_i\right)\left(\sum_{i=1}^{n} a_i P_i \, dY_i\right) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} (P_i Y_i \, da_i) \qquad \text{....(5)}$$

Equation (5) decomposes change in gross revenue due to changes in (i) total cropped area, (ii) crop yields or technology (iii) real prices and (iv) diversification or land reallocation. The first term on the right-hand side of this equation represents the change in gross revenue due to a change in total cropped area. The second term on the right-hand side captures the change in gross revenue due to a change in the real prices of commodities. The third term measures the change in gross revenue due to a change in crop yields or technology. The fourth term represents the change in gross revenue associated with changes in crop composition. A positive fourth term indicates a diversification from lower-value to higher-value crops. Dividing both sides of equation (5) by the overall change in gross revenue (dR) gives us the proportionate share of each source in the overall change in gross revenue or agricultural growth.

Construction of Panel Data Regression Model

Panel data regression analysis has been used to quantify the association between per hectare value of output by crop sector (PHVOCS) and its determinants, i.e., gross irrigated area as per cent of gross sown area (GIA), ratio of electricity consumption by agriculture sector to total electricity consumption (ELECAG), literacy rate (LITR), total road length of per thousand hectare (RLPTH), gross sown area per tractor (GSAPTRA), zila yojna actual expense per thousand hectare (ZYAE), agricultural markets per thousand hectare (MANDI), amount of loan distribution in agriculture sector per thousand hectare (AGLTL), normal rainfall in mm (NRAIN), fertilisers consumption per hectare (FERCON). Natural log value of the variables have been taken into account for this purpose. Pooled ordinary least square regression model, Fixed Effects Model (FEM) and Random Effects Model (REM) are the important method for panel data analysis. In pooled OLS estimation, it is assumed that coefficients across time and cross-section remain the same. The major problem with this model is that it does not distinguish between the various entities or panels (districts) that we have. In other words, it denies the heterogeneity and individuality condition. For best model selection between FEM and REM, Hausman specification test is applied in order to check the suitability of the method for panel data analysis.

Fixed Effect Model (FEM)

For capturing the individuality of each state (cross-sectional unit), intercept is varied by using dummy variable for fixed effects. Fixed effect models for panel data (intercept or individual) are given by equation;

$$\begin{aligned} PHVOCS_{it} = {} & \beta_1 + \beta_2 GIA_{it} + \beta_3 ELECAG_{it} + \beta_4 LITR_{it} + \beta_5 RLPTH_{it} \\ & + \beta_6 GSAPTRA_{it} + \beta_7 ZYAE_{it} + \beta_8 MANDI_{it} + \beta_9 AGLTL \\ & + \beta_{10} NRAIN_{it} + \beta_{11} FERCON_{it} + u_{it} \end{aligned}$$

here, i = 1,2,3,-----70 [cross section (districts)] and t = 1,2,3------12 [time period (years)]

u_{it} stochastic error term

Random Effect Model (REM)

In the random effect model, it is assumed that the individual specific coefficient β_{1i} is fixed for each time-invariant. In the random effects model, it is assumed that β_{1i} is a random variable with a mean value of β_1 (no i subscript here) and the intercept of any cross-section unit is expressed as in following equation;

$$\beta_{1i} = \beta_1 + \varepsilon_i$$

where ε_i is a random error term with mean '0' and variance σ_ε^2.

Therefore, random effect model for panel data can be written as by the equation;

$$\begin{aligned} PHVOCS_{it} = \; & \beta_1 + \beta_2 GIA_{it} + \beta_3 ELECAG_{it} + \beta_4 LITR_{it} + \beta_5 RLPTH_{it} \\ & + \beta_6 GSAPTRA_{it} + \beta_7 ZYAE_{it} + \beta_8 MANDI_{it} + \beta_9 AGLTL \\ & + \beta_{10} NRAIN_{it} + \beta_{11} FERCON_{it} + w_{it} \end{aligned}$$

where; $w_{it} = \varepsilon_i + u_{it}$

The composite error term w_{it} has two components; ε_i represent the cross-section or individual-specific error component and u_{it} represent combined time series and cross-section error component.

Hausman specification test (1978) is used to select appropriate model between fixed effects model (FEM) and random effects model (REM) and it is given by equation;

$$H = (\hat{\beta}_{RE} - \hat{\beta}_{FE})' [Var(\hat{\beta}_{FE}) - Var(\hat{\beta}_{RE})]^{-1} (\hat{\beta}_{RE} - \hat{\beta}_{FE})$$

IV

SOURCES OF GROWTH AT THE STATE LEVEL

The patterns and sources of agricultural growth by crop sector in Uttar Pradesh from 2004-05 to 2015-16 and its two sub-periods, i.e., 2004-05 to 2009-10 and 2010-11 to 2015-16 respectively has been estimated in Table 2. In the table, it is found that the share of cereals in gross cropped area has increased marginally though its share in value of output decreased drastically over a period of time. Also, the share of cereals in overall growth was impressive at 20.03 per cent. For coarse cereals and pulses, their share in gross cropped area as well as value of output has decreased considerably during the study period. Also, the share of foodgrain in gross cropped area and value of output has decreased though the growth was significant during the study period. Regarding oilseeds and sugarcane, their share in gross cropped area and value of output accelerated but growth of only sugarcane was highly remarkable.

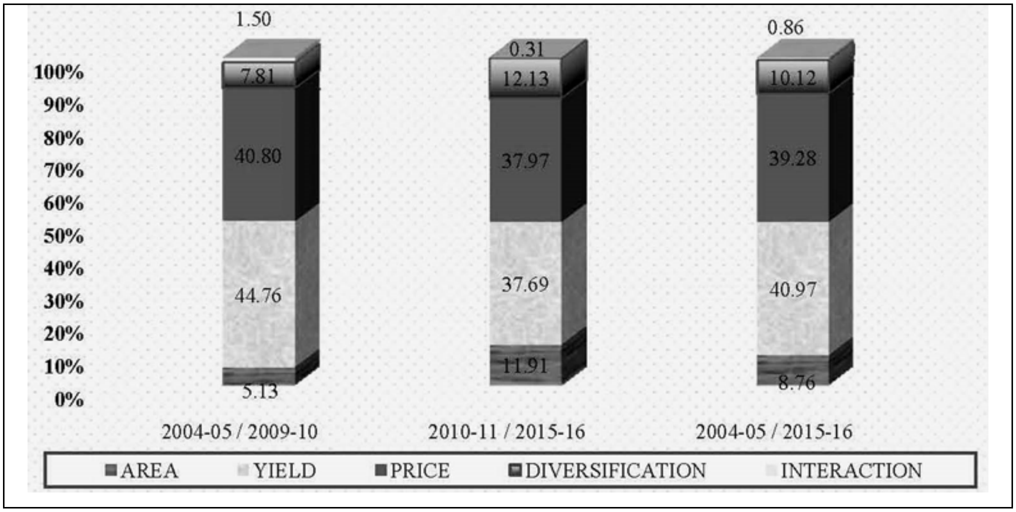
The share of vegetables and fruits in the gross cropped area increased considerably but in the case of value of output of vegetables in particular, it increased but for fruits, it declined. In the case of spices, gross cropped area remained stagnant while its value of output declined with a negative growth rate over the study period. Hence, from the overall analysis, it is observed that cereals; particularly wheat and rice being the dominant crops accounted for close to two-thirds of the gross cropped area and contributed about half the value of output by crops sector while oilseeds and sugarcane occupied about 13 per cent of gross cropped area representing about one-third of the gross value of the output of crops during the study period. On the other hand, vegetables, fruits and spices are the next most important crop groups in the state. These crops accounted for around 5.0 per cent of the gross cropped area and nearly one-fifth in value of output of crops during the study period. Thus, growth of crop sector reveals a very clear pattern of the growing importance of high-value crops during the study period in Uttar Pradesh.

TABLE 2. CONTRIBUTION OF VARIOUS CROPS TO AGRICULTURAL GROWTH IN UTTAR PRADESH

	Share in gross cropped area			Share in real value of output			CAGR in real value of output			Share in overall growth
Crop groups	2004-05 to 2009-10	2010-11 to 2015-16	2004-05 to 2015-16	2004-05 to 2009-10	2010-11 to 2015-16	2004-05 to 2015-16	2004-05 to 2009-10	2010-11 to 2015-16	2004-05 to 2015-16	2004-05 to 2015-16
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Cereals	64.94	65.87	65.41	44.00	40.51	42.09	0.28	0.68	1.67	20.03
Coarse cereals	9.14	8.39	8.76	3.40	3.09	3.23	-1.30	- 0.88	1.63	1.49
Pulses	8.29	7.16	7.72	5.42	5.00	5.19	-4.36	- 2.30	0.65	0.95
Foodgrain	82.36	81.43	81.89	52.82	48.61	50.51	-0.38	0.26	1.54	22.05
Oilseeds	4.15	4.51	4.33	2.32	2.50	2.42	3.08	1.63	3.98	2.74
Sugarcane	8.93	8.98	8.95	26.25	30.07	28.35	0.33	1.34	6.94	55.94
Vegetables	2.98	3.43	3.21	8.56	9.14	8.88	3.26	4.50	4.30	10.86
Fruits	1.34	1.41	1.38	9.39	9.04	9.20	0.19	3.52	2.98	7.80
Spices	0.24	0.24	0.24	0.66	0.64	0.65	-0.35	-0.04	3.65	0.67
Total	100.00	100.00	100.00	100.00	100.00	100.00	-0.06	0.60	3.52	100.00

Source: Estimated by authors.

Further, the growth of value of output by crop sector in Uttar Pradesh has been decomposed into change in cropped area, yield, real prices and diversification. The contributions of these sources of growth in value of output by crops sector from 2004-05 to 2015-16 and its two sub-periods, i.e., 2004-05 to 2009-10 and 2010-11 to 2015-16 respectively are presented in Figure 2. In the figure, it is found that the area expansion accelerated during the sub-periods and grew at an average of 8.76 per cent from 2004-05 to 2015-16 in the state. However, the growth in yields and real prices has been pulled down during the sub-periods and the overall period. On the other hand, diversification of crops increased substantially during the sub-periods and grew at an average rate of 10.12 per cent during the study period. The declining share of yields was well compensated by a phenomenal rise in the diversification of the production towards fruits, vegetables, sugarcane and all other crops. It is observed that the growth of yields increased significantly due to the better availability of water, improved agricultural inputs, soil fertility and better climatic conditions. The change in real farm prices may have been influenced by agricultural price policy, demand and supply imbalances of production and commodity substitution. Moreover, diversification might have been influenced by changes in the relative prices of agricultural commodities, costs of production and the level of development of infrastructure. Hence, it is quite clear that the sources which influenced the gross revenue of agriculture have extensive variations during the study period in Uttar Pradesh.



Source: Authors' calculation.

Figure 2. Sources of Growth in Crop Sector in Uttar Pradesh.

V

SOURCES OF GROWTH AT REGIONAL LEVEL

The sources of growth by crops sector at regional level of Uttar Pradesh during two sub-periods, i.e., 2004-05 to 2009-10 and 2010-11 to 2015-16 respectively are presented in Table 3. It is found that the contribution of area in the value of output in agriculture was highest in Bundelkhand (28.57 per cent), Western region (4.89 per cent), followed by Eastern region (0. 42 per cent) and decreased drastically in the Central region (-2.12 per cent) during 2004-05/ 2009-10. An increasing trend is observed in the share of value of output in area across all the regions from 2010-11 to 2015-16. But this is not true in case of yields as the value shares of yields declined among all the regions over the period of study. In particular, the value shares of yields were highest in Eastern region in Uttar Pradesh which may be due to increasing land developmental opportunities, fertile soil and better availability of water. However, the effect of real prices was a mixed bag and revealed fluctuations which may be due to changes in the terms of trade to crop sector. The contribution of real prices particularly declined in the Western and Central regions whereas it increased significantly in the Eastern and Bundelkhand regions during the period of study. The growth of diversification also improved across all the regions except in the Western region. It improved by more than fifty per cent in Bundelkhand region in the study period. This may be due to the significant shift in the cropping pattern from traditional crops to cash crops as this region is highly drought prone and hence less water availability and climatic variability have serious repercussions for agricultural development in the state.

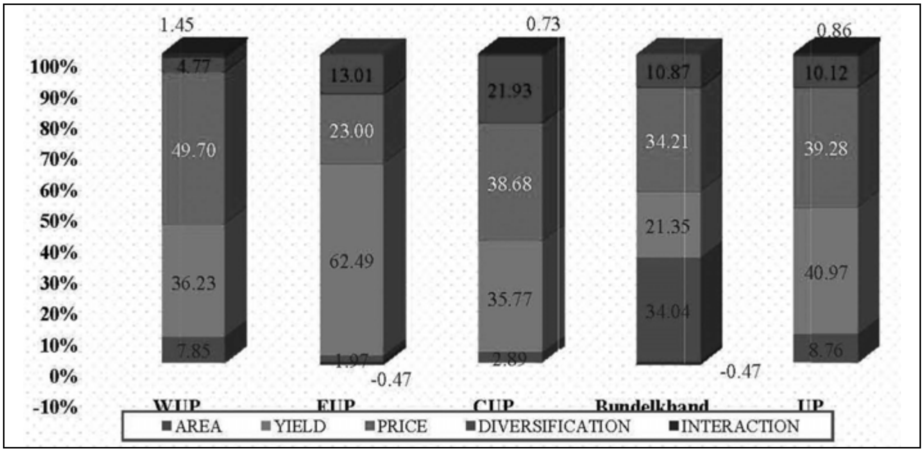
TABLE 3. SOURCES OF GROWTH IN CROP SECTOR AT REGIONAL LEVEL OF UTTAR PRADESH

Regions (1)	Periods (2)	Area (3)	Yield (4)	Price (5)	Diversification (6)	Interaction (7)	Total (8)
WUP	2004-05 to 2009-10	4.89	36.61	52.63	5.03	0.84	100
	2010-11 to 2015-16	10.53	35.90	47.03	4.53	2.01	100
EUP	2004-05 to 2009-10	0.42	69.46	21.76	9.19	-0.83	100
	2010-11 to 2015-16	3.52	55.56	24.22	16.81	-0.11	100
CUP	2004-05 to 2009-10	-2.12	35.93	44.30	17.48	4.41	100
	2010-11 to 2015-16	6.50	35.65	34.63	25.14	-1.92	100
Bundelkhand	2004-05 to 2009-10	28.57	32.77	30.63	5.55	2.48	100
	2010-11 to 2015-16	37.71	13.68	36.62	14.45	-2.46	100

Source: Estimated by authors.

The sources of growth in the crop sector at regional level in Uttar Pradesh from 2004-05 to 2015-16 are presented in Figure 3. It can be seen that the share of area by crops sector was the highest in Bundelkhand at 34.04 per cent while it was lowest for yields when compared with the rest of regions during the study period. On the other hand, there is a contrasting observation witnessed in the Eastern region. Despite having very low share in terms of area, the share of yield has increased significantly. This may be due to yield-augmenting technologies, better soil and water conservation and management practices besides favourable climatic conditions. For Central region, growth in area accounted for 2.89 per cent and contributed 35.77 per cent towards yield by crop sector. Price is the other dominant source of growth contributing about 50 per cent towards agricultural growth in the Western region. Herein, area accounts for 7.85 per cent and productivity 36.23 per cent, respectively with least diversification opportunities. Hence, in a nutshell, it is observed that the contribution of various sources to agricultural growth by crop sector across the various administrative regions have widespread fluctuations. Growth in yields by crops sector was remarkable in the Eastern region which may be due to better water availability, favourable weather conditions, fertile soil, availability of credit facilities and improved technology. The effect of price was found to be highly significant in the Western region which may be due to better market price for farm produce, demand

and supply balances and rise in the minimum support prices (MSPs) during the study period in Uttar Pradesh.



Source: estimated by authors calculation.

Figure 3. Sources of Growth in Crop Sector at Regional Level of Uttar Pradesh.

The contributions of various crops in agricultural growth at the regional level in Uttar Pradesh from 2004-05 to 2015-16 are presented in Table 4. Wheat and rice are the dominant cereal crops of the state. Consequently, the share in the gross cropped area of cereals was the highest among other crops, particularly in the Eastern region. On the other hand, growth of area of coarse cereals and pulses was very low in all the regions and about half of the area under coarse cereals and pulses was found in the Bundelkhand region over the study period. The contribution of area under oilseeds was highest, i.e., 12.62 per cent in Bundelkhand region while the share of gross cropped area of sugarcane accounted for 14.84 per cent in Western region and lowest, i.e., 0.35 per cent in Bundelkhand region during the study period. Vegetables, fruits and spices are the main horticultural crops in the state. The total value shares of area under these crops contributed about 6.0 per cent in Western region, followed by 3.0 per cent in Eastern region and 4.0 per cent in Central as well as Bundelkhand regions.

With regard to the share of cereals in real value of output, it was also the highest, i.e., 58.21 per cent in Eastern region during the study period. The share of pulses and coarse cereals in real value of output was the best in Bundelkhand region in case of pulses while in case of coarse cereals, the Western region accounted for as high as about 4 per cent of value share and contributed least, i.e., 0.88 per cent value shares for pulses. The share of total foodgrain in the value of output was the highest, i.e., 71.64 per cent in Bundelkhand region during the study period. The Western region accounted for the highest gross cropped area as well as real value of output for

TABLE 4. CONTRIBUTION OF VARIOUS CROPS TO AGRICULTURAL GROWTH AT REGIONAL LEVEL IN UTTAR PRADESH

Regions (1)	Cereals (2)	Coarse cereals (3)	Pulses (4)	Foodgrain (5)	Oilseeds (6)	Sugarcane (7)	Vegetables (8)	Fruits (9)	Spices (10)	Total (11)
Share in gross cropped area										
WUP	59.69	13.25	1.51	74.45	4.16	14.84	4.53	1.59	0.43	100
EUP	78.42	5.69	6.28	90.40	1.54	4.71	2.04	1.24	0.07	100
CUP	67.73	6.29	5.86	79.87	5.55	10.03	2.34	1.92	0.29	100
Bundelkhand	36.24	7.52	39.11	82.87	12.62	0.35	4.02	0.08	0.05	100
U.P.	65.41	8.76	7.72	81.89	4.33	8.95	3.21	1.38	0.24	100
Share in real value of output										
WUP	34.78	4.41	0.88	40.07	2.61	38.15	9.54	8.52	1.11	100
EUP	58.21	2.14	5.48	65.82	1.05	17.19	6.82	8.98	0.14	100
CUP	41.70	1.92	4.06	47.68	2.72	28.94	5.99	14.28	0.39	100
Bundelkhand	29.81	3.17	38.66	71.64	5.91	1.10	20.68	0.52	0.14	100
U.P.	42.09	3.23	5.19	50.51	2.42	28.35	8.88	9.20	0.65	100
Annual compound growth in real value of output										
WUP	0.62	2.76	- 2.70	0.80	2.46	6.21	3.84	4.83	4.40	3.57
EUP	2.58	- 0.67	0.19	2.26	2.45	7.60	3.33	3.70	- 1.02	3.37
CUP	1.53	- 1.39	- 4.01	0.93	4.62	7.58	1.71	0.32	1.11	2.79
Bundelkhand	4.39	1.68	3.31	3.53	9.35	10.27	9.12	5.75	6.00	5.21
U.P	1.67	1.63	0.65	1.54	3.98	6.94	4.30	2.98	3.65	3.52
Share in overall growth										
WUP	6.01	3.40	- 0.66	8.98	1.80	66.40	10.26	11.52	1.37	100
EUP	44.44	- 0.42	0.31	44.16	0.76	38.74	6.73	9.86	- 0.04	100
CUP	22.83	- 0.96	-5.83	15.83	4.51	74.56	3.67	1.65	0.15	100
Bundelkhand	25.09	1.02	24.56	48.46	10.61	2.17	36.18	0.58	0.16	100
U.P.	20.03	1.49	0.95	22.05	2.74	55.94	10.86	7.80	0.67	100

Source: Estimated by authors.

sugarcane due to indulgence in better farm practices, availability of irrigation facilities, agricultural assets and financial services. For horticultural crops, the area under vegetables, fruits and spices together accounted for 6.55 per cent in Western, followed by 3.35 per cent in Eastern, 4.55 per cent in Central and 4.15 per cent in Bundelkhand region. The share in value of output of these crops in Western, Eastern, Central and Bundelkhand regions was 19.17 per cent, 15.94 per cent, 20.66 per cent and 21.34 per cent respectively during the study period.

The CAGR of cereals showed a positive growth rate but showed mixed trends for coarse cereals and pulses across almost all the other regions during the study period. The growth of commercial crops like oilseeds and sugarcane and horticultural crops such as vegetables and fruits grew at a positive rate in the state. It is thus observed that all the regions are transforming their cropping patterns from traditional crops to high value systems in the state. The share of sugarcane in overall growth was around two-thirds while cereals, coarse cereals, pulses, oilseeds, vegetables, fruits and spices accounted for one-third in Western region over the study period. In case of Eastern region, the share in overall growth of cereals was highest at 44.44 per cent, followed by -0.42 per cent for coarse cereals and 0.31 per cent of pulses. Oilseeds and sugarcane accounted for 0.76 per cent and 38.74 per cent respectively. This region is considered as the food basket of the state.

It is also considered better due to availability of water, technological transformation and farming opportunities. The share in overall growth of vegetables and fruits together accounted for about 16.59 per cent while spices revealed a negative growth rate at -0.04 per cent in the Eastern region. The share in the overall growth was the highest, i.e., 74.56 per cent for sugarcane, followed by 22.83 per cent of cereals, 4.51 per cent of oilseeds and became negative for both coarse cereals and pulses in the Central region. Horticultural crops, vegetables, fruits and spices together accounted only around 5.0 per cent during the study period in Central region. Considering Bundelkhand region, cereals, coarse cereals and pulses together accounted for half of the share in the overall growth whereas oilseeds and sugarcane contributed for 10.61 per cent and 2.17 per cent respectively. Similarly, the share in the overall growth of vegetables, fruits and spices together was about 37 per cent in Bundelkhand region. The contribution of various crops in agricultural growth has wide spread variations across all the regions in Uttar Pradesh during the study period. There are several policy and non-policy drivers responsible for such variations of growth of various crops sector and their contributions to the agricultural growth in the state.

IV

PANEL DATA REGRESSION RESULTS

The panel data regression results of value of output by crop sector and its determinants for the period 2004-05 to 2015-16 are presented in Table 5 which is calculated by using STATA. The Chi square value of Hausman test has revealed that these two models are not different enough to reject the null hypothesis. Hence, fixed effects model (FEM) is applied to evaluate the drivers of value of output by crop sector. The regression result shows that the values of within, between and overall R-square are 0.4755, 0.1726, 0.2136 respectively, which implies that the regression model on the whole explains 21.36 per cent per annum of the total variations in per hectare value of output in crop sector.

The FEM further reveals that all the drivers of agricultural growth, which has been taken in present study, had a significant impact on value of output by agriculture sector. The parameter relating to the rural infrastructure viz., gross irrigated area, electricity consumption by agriculture sector, road length of per 1000 hectare, zila yojna actual expense per 1000 hectare and agricultural markets had a positive and significant impact on agricultural growth (value of output). On the inputs side, i.e., fertiliser consumption, availability of tractor and agricultural loan are found also to be the main sources of agricultural growth. Moreover, literacy rate and normal rainfall had a positive and significant impact on per hectare value of output by crop sector in Uttar Pradesh. The findings of the regression result indicate that rural infrastructure variables along with agricultural input variables need to be incorporated for formulating the holistic agricultural policy to enhance the agricultural growth of the state.

TABLE 5. PANEL DATA REGRESSION RESULT OF VALUE OF OUTPUT AND ITS DRIVERS

Fixed-effects (within) regression		Number of observations = 840		
Dependent variable: per hectare value of output by crop sector (PHVOCS)				
Group variable (i): District		Number of groups = 70		
	within = 0.4755	Observation per group = 12		
R- Squared	between = 0.1726	F(10,760) = 68.91		
	overall = 0.2136	Prob > F = 0.0000		
Independent Variables (1)	Coefficient (2)	Standard Error (3)	Test Statistics (Z) (4)	Significance Level P>|z (5)
GIA	0.23672	0.07011	3.380	0.001
ELECAG	0.04222	0.01418	2.980	0.003
RLPTH	0.08692	0.04247	2.050	0.041
MANDI	0.02812	0.02142	1.310	0.189
AGLTL	0.01530	0.00729	2.100	0.036
FERCON	0.03538	0.01745	2.030	0.043
GSAPTRA	0.04186	0.02157	1.940	0.053
LITR	0.88516	0.10969	8.070	0.000
ZYAE	0.02702	0.00783	3.450	0.001
NRAIN	0.04053	0.01739	2.330	0.020
Constant	4.38798	0.53512	8.200	0.000
Sigma_u = 0.37139083		*Sigma_e = 0.12373894*		*Rho = 0.900084*
F test that all u_i=0:		*F(69, 760) = 58.48*		*Prob > F = 0.0000*
Hausman Test Statistics				
Test: Ho: difference in coefficients not systematic				
chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 63.06			Prob>chi2 = 0.0000	
Fixed Effect Model is appropriate for panel data analysis				

Source: Author's calculation.

VII

CONCLUSION AND POLICY IMPLICATIONS

Uttar Pradesh is commonly known as the "granary of the nation". But, since the 1990s, agricultural performance in Uttar Pradesh has been a mixed bag. The disparities have surfaced more particularly at the regional level whereby the performance of WUP has been better in comparison to the other regions. It can be thereby asserted that the differences in the patterns and sources of agricultural growth across regions of state, owe primarily to the differences in policy environments and resource endowments.

The analysis of sources of growth in UP at regional level reveals four important implications. *First,* the prospects for growth via area expansion are limited due to land constraints except in Bundelkhand region. However, area fluctuations within regions are observed. As competition for land is likely to surge due to the increasing demand for land for residential and industrial purposes, the only possibility for enhancing the contribution of area expansion to growth is through intensifying the cultivation of existing cropped land through extending irrigation facilities. *Second,* real prices play an important role in stimulating agricultural growth. Agricultural growth decomposing to output prices is the highest in the WUP while it was the lowest in the Eastern region. It is noticed that the administered price–led growth may distort cropping patterns, degrade natural resources and widen interpersonal and regional disparities as the benefits of price increases accrue in proportion to the marketable surplus which obviously is less for poor farmers (Joshi *et al*., 2006). Thus it is necessary to enhance competition in the market place and improve market and transportation infrastructure to reduce marketing and transaction costs.

Third, fluctuating yields in the crop sector remain a matter of concern. It might be due to a variety of various factors. In the context of Uttar Pradesh, it is witnessed that the agricultural growth has the highest stake in yields in the EUP followed by WUP, CUP and Bundelkhand in that order. In order to increase yield, there is need to improve the rural infrastructure by sustaining the level of public investment in agriculture. Also, investment in agricultural research and extension is far from adequate which can cater to this need. *Fourth,* diversification towards high-value commodities is a sustainable source of growth and provides a cushion to agricultural growth. At the regional level, it is witnessed that diversification has been high in CUP while lowest in the WUP. For diversification, it has been witnessed that there has been some progress in dismantling policy and institutional barriers to the high-value agriculture and food industry in the last few years. But, harnessing its potential for inclusive growth can translate into attaining the objectives of Doubling Farmers' Income and ensuring food security.

Moreover, with respect to the drivers propelling agricultural growth in Uttar Pradesh, the panel data regression analysis reveals that rural infrastructure variables, viz., irrigated area, electricity consumption, road length, amount of loan distribution, fertilisers consumption, gross sown area per tractor, literacy rate, Zila yojna actual expense and normal rainfall were found the significant drivers of agriculture growth by crop sector in Uttar Pradesh. The regression findings suggest that there is need to improve infrastructural, institutional, technological and socio-economic factors through new programmes and policies, which directly or indirectly affect the agricultural growth.

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Economic Utilisation of Areca Leaf Sheaths for Rural Livelihood

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ABSTRACT

The enormous supply of areca leaf sheaths coupled with raising consciousness among society towards usage of eco-friendly products have paved a way for emergence of rural based areca leaf product manufacturing units. Areca growers reaped net profit of Rs.7120 per acre by selling leaf sheaths to manufacturing units. The industry has generated employment ranging from 2 labourers in very small units to 242 labourers in very large units per unit per annum depending upon the size of the industry. The manufacturers reaped net returns ranging from 0.65 lakh in very small units to 121.9 lakhs in very large units. The capital budgeting analysis indicated wealth generation of Rs. 0.72 lakhs in very small units and Rs. 59.09 crores in very large units with the annual rate of return of 17 and 88 per cent, respectively, indicating economic worthwhileness of areca leaf products manufacturing units. It is noteworthy that very large units repaid the initial investment in 0.13 years while others took more than one year. The data envelopment analysis indicated that very small, small and very large units were found to be cost inefficient with efficiency scoring of 0.5, 0.79 and 0.72, respectively. It was evident from the conjoint analysis that the consumer preference was influenced by quality parameters like desired dimensions, portability, ecofriendly nature and price of leaf products. There exists vast scope for development of this vital industry with potential supply of raw materials at 144 crore leaf sheaths produced in the state per annum. Hence, it is suggested that Government should encourage such agro based rural industries for development of rural economy.

Keywords: Areca leaf sheaths, Economic utilisation, Eco-friendly, Employment, Rural livelihood.

JEL: P25, Q18, Q21, Q52.

I

INTRODUCTION

Arecanut is cultivated extensively in the state of Karnataka on an area of 2.61 lakh hectares with annual production of 3.82 lakh tonnes. About three million farmers are dependent on arecanut for their livelihood as it generates enormous employment and income. Arecanut produces main product (Betelnut) and by-products (leaf sheath and arecanut husk). The main product is marketable while by-product goes waste if not properly utilised. Earlier, leaf sheaths were used as mulching material or source of organic matter. Of-late due to technological innovations in agro-based industries, it is possible to manufacture leaf products of different dimensions. As plastic goods are banned in many states, arecanut based products are gaining importance and penetrating deeper into the consumer market. It is observed that units manufacturing arecanut leaf plates and bowls on small scale as well as large scale have mushroomed

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in arecanut growing belts. Due to easy availability of raw materials in sufficient quantity and ever escalating demand in local and international market, entrepreneurs have been showing keen interest in establishing such units. The units are capital and labour intensive, generates substantial employment for the people living around. Keeping in view the economic significance, social and environmental importance and export potentiality of this vital rural based industry, the present study envisages detailed investigation into economic aspects of arecanut leaf product manufacturing to throw light on by-product utilisation for economic development of the region.

The study is divided into four sections. Section II provides details of methodology followed, i.e., selection of sample respondents, source of data, statistical tools employed to estimate economics, efficiency, customer preference, projection of raw material supply and contribution to state's gross domestic product (GDP). The results and discussion are presented in the third section, while the policy issues are discussed in the last section.

II

METHODOLOGY

2.1 *Data Source*

Primary data pertaining to capital investment made on the manufacturing unit, recurring expenses on labour, raw materials, packing materials, electricity/fuel were elicited from owners of manufacturing unit using pretested schedule.

2.2 *Selection and Categorisation of Areca Leaf Products Manufacturing Units*

The sample industries are not registered companies hence, the post stratification of industries has been made on the basis of number of leaf sheaths processed per day and magnitude of capital investment into very small, small, medium, large and very large units to capture the influence of scale economies (Table 1). Five units each representing above size groups aggregating to 25 units were selected from Shivamogga district of Karnataka state. Since the study is confined to Shivamogga district only, it was felt the sample of 25 units was representative and adequate. An attempt has been made to identify the crucial factors influencing consumer preference for areca leaf products. A sample of 30 respondent consumers were selected from Shivamogga city to represent the population using random sampling. Generally the consumers were found to use both areca products and plastic based products. Hence, the above sample representing the population was adequate and representative. Similarly, a sample consisting of 60 areca growers of Shivamogga district were selected randomly to elicit information on disposal of areca leaf sheaths, cost incurred towards disposal and returns accrued.

TABLE 1. CHARACTERISTICS OF ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS

Particulars (1)	Very small (2)	Small (3)	Medium (4)	Large (5)	Very large (6)
Number of leaf sheaths processed per day per unit	550	2000	4850	10000	20000
Capital investment per unit (Rs.)	107050	792000	1992000	3587000	15895000
Type of pressing machine used	Hand operated	Hand operated	Pedal operated hydraulics	Pedal and DC operated hydraulics	Hydraulics and hydropneumatics
Customers and destination of the product	Local	Local	Within state	National	National and International markets
Source of energy	Wastes generated out of leaf sheaths	Gas cylinder	Electricity	Electricity	Electricity

2.3 *Analytical and Statistical Tools*

Enterprise budgeting, data envelopment analysis, conjoint analysis, economic feasibility analysis, simple ratios and percentages were employed in processing raw data to draw meaningful inferences. Valuation of variable resources was made on per square inch basis.[1] Fixed costs were arrived at based on capacity utilisation.[2]

(a) *Returns*

Gross returns was arrived at by multiplying the quantity of finished products produced with selling price. Net returns was computed by taking the difference of total cost and gross returns.

(b) *Value Addition*

Value addition is the difference between the cost of raw material and price of finished product (Gangwar *et al*., 2010). The percentage value addition was estimated considering percentage change in the value of commodities at different stages, i.e., raw and finished forms [(price of finished good - price of raw material)/ (price of raw material)]*100.

(c) *Economic Viability of Investment*

Economic feasibility of investment on areca leaf plate and bowl manufacturing units was assessed employing net present worth, modified internal rate of return[3] and benefit cost ratio. Pay-back period an undiscounted measure was also worked out (Kiran *et al*., 2019).

(d) *Conjoint Analysis*

Conjoint analysis was performed considering various factors such as nature of product (areca or plastic products), price, shelf life (long/short), eco-friendliness (yes/no), dimensions (flexible/rigid), portability (yes/no), quality (infection free or not), market accessibility (niche, limited, unorganised or unlimited and organised), social preference (yes/no), religious and cultural preference (yes/no). Thirty customers using both areca leaf products and plastics were given the preferences schedule to rank cards/combinations as per their opinion. Using orthogonal design in SPSS 16 version, 38 card combinations were selected, of which 6 cards were considered as hold out cases. The ranks given for various combinations by all the customers were used to identify crucial factors determining consumer preference products.

(e) *Data Envelopment Analysis (DEA)*

Cost efficient input oriented constant returns to scale model was employed to assess efficiency of areca leaf product manufacturing units. The analysis was performed using Coelli software (Chinnappa *et al*., 2018). For each Decision Making Unit (DMU), areca leaf products i.e., plates and bowls produced per year, labour employed (man-days), raw materials (sq. inch) and corresponding unit prices of inputs were considered in the calculation of cost- DEA efficiency score (Ernest and Retha, 2002). The rationale behind considering only labour and raw materials in the assessment of efficiency score was their percentage (>70 per cent) contribution towards total cost. The best DMU operates at 100 per cent technical efficiency (efficiency score =1) and the DMU with lower technical efficiency (score <1) works at a percentage less than 100. Allocative efficiency or otherwise called as pricing efficiency relies on cost of inputs. It is related to cost of inputs in relation to output, and equilibrium condition is attained when marginal cost equates average revenue. DMU's allocative efficiency is with regard to the allocation of inputs vis-a vis its price for a given level of output, so as to minimise the cost of production. The cost efficiency refers to the product of technical and allocative efficiencies expressed in percentage.

III

RESULTS AND DISCUSSION

3.1 *Economics of Production of Areca Leaf Plates and Bowls*

(a) *Capital Investment*

The very small units have been set up by small investors in the areca belt to earn their livelihood as household industries. The capital investment required for its establishment was Rs.1,07,050 per unit. The major investment was on hand pressing machines constituting over 98.1 per cent of the total investment (Table 2). The waste leaf sheaths are used as fuel hence, electrification was not necessary.

TABLE 2. CAPITAL INVESTMENT ON ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS

Particulars (1)	Very small (2)	Small (3)	Medium (4)	Large (5)	Very large (6)
Building		400000 (50.5)	500000 (25.1)	1157000 (32.3)	
Machine	105000 (98.1)	280000 (35.4)	1230000 (61.7)	1477000 (41.2)	14303500 (90)
Electrification charges			150000 (7.5)	150000 (4.2)	405000 (2.5)
Washing platform		10000 (1.3)	12000 (0.6)	25000 (0.7)	48500 (0.3)
Bore well with pumpset		70000 (8.8)	70000 (3.5)	98000 (2.7)	100000 (0.6)
CC camera				40000 (1.1)	40000 (0.3)
Sintex, washing gun, 1/2 hp motor to operate washing gun		32000 (4.0)	30000 (1.5)	40000 (1.1)	30000 (0.2)
Vehicle to procure raw material				300000 (8.4)	968000 (6.1)
Miscellaneous	2050 (1.9)			300000 (8.4)	
Total	107050	792000	1992000	3587000	15895000

The investment of Rs.7,92,000 per unit was required for small units of which, cost of buildings came to 50.50 per cent and machinery accounted for 35.4 per cent. Building of dimension 40’×14’ is essential to house hand pressing machines, perform grading and packing operations. The godown of dimension 45’×21’ is indispensable for storage of raw materials. About 14 hand pressing plate and bowl making machines operated by using gas cylinder as energy source were installed in the unit (Table 2).

The medium units required an investment of Rs.19,92,000 per unit for establishment (Table 2). Pedal operated hydraulic machines were employed to press leaf sheaths into plates and bowls. The investment on machines came to Rs.12,30,000 (61.75 per cent). Machines are operated with electricity. An investment of Rs.1,50,000 was made towards electrification charges for availing power supply of 15hp.

The capital investment made on large units came to Rs.35,87,000 per unit. Cost of building was highest at Rs.11,57,000 (32.3 per cent) followed by machines Rs.14,77,000 (41.2 per cent). Direct current (DC) operated hydraulic machines were employed in production of plates and bowls. DC operated machines reduce drudgery of human labour. CC camera in the premises enabled effective supervision of the unit. A total advance amount of Rs.3,00,000 @ Rs.15,000 was lent to each labourer as an advance amount to confirm their availability round the working period (Table 2).

The capital investment of Rs.1,58,95,000 per unit was required to establish very large units with hydro-pneumatics and hydraulic machines of which, pressing, cutting, grinding machines, drier, UV chamber and packing machine accounted for

Rs.1,43,03,500. Pressed leaf plates are subjected to drying with driers to maintain optimum moisture level. Care is taken to dry finished products to the desired moisture level and reduce possible microbial infestations at the time of storage and transit. The plates and bowls are subjected to grinding machine to give soft edge and smooth surface. UV treatment prevents mycelial and microbial infection. The products in these units are of high quality primarily meant for export. Power supply to the unit was obtained from KPTCL with an investment of Rs.4,05,000 (Table 2).

(b) *Income Accrued to Arecanut Growers*

Each acre of areca plantation with 640 palms produces 6,400 leaf sheaths per annum. Of-late farmers have realised the importance of this by-product after the inception of areca leaf plate manufacturing units in the surrounding regions and started supplying leaf sheaths to them at nominal rates to earn revenue. Arecanut growers realised gross returns of Rs.7,680 per acre and net returns of Rs.7,120 per acre after making provision for expenditure towards collection and bundling. The net income per leaf sheath worked out to Rs.1.11 (Table 3).

TABLE 3. INCOME GENERATED TO ARECANUT GROWERS

Particulars (1)	Value (2)
Palms per acre (No.)	640
Leaf sheaths per acre (No.)	6400
Expenditure towards collection of leaf sheaths per acre (Rs.)	560
Price per leaf sheath (Rs.)	1.2
Gross returns per acre (Rs.)	7680
Net returns per acre (Rs.)	7120
Net returns per leaf sheath (Rs.)	1.11

(c) *Profitability of Areca Leaf Plates and Bowls Manufacturing*

In very small units, the total cost of manufacturing plates came to Rs.2,11,034 per manufacturing unit. Of this, labour shared maximum at Rs.1,02,238 (48.45 per cent) followed by raw materials at Rs.71,505 (33.88 per cent) and fuel at Rs.18,465 (8.75 per cent). An expenditure of Rs.4,877 (2.31 per cent) was made on packing and packaging using polythene covers and bags of 42″ size. The interest on fixed capital indicated inventory position of very small units, was barely 1.74 per cent of the total cost. The depreciation on plant and machineries accounted for 2.87 per cent of the total cost. The total cost incurred on production of bowls of 4.5″ and 6″ dimension came to Rs.44,754 per manufacturing unit while the operational expenditure constituted 82.21 per cent of the total cost. As usual, labour and raw material formed the major chunk at Rs.17,762 (39.69 per cent) and Rs.12,422 (27.76 per cent), respectively. The unit cost of manufacturing plates (12″ and 10″) and bowls (6″ and 4.5″) worked out to Rs.2.46, Rs.1.75, Rs.0.72 and Rs.0.46, respectively (Table 4).

TABLE 4. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN VERY SMALL AND SMALL UNITS

Particulars	Very small units Value [Rs.]						Small units Value [Rs.]							
	Plates			Bowls			Plates					Bowls		
Variable cost [VC]	12″	10″	Total	6″	4.5″	Total	10″	8″	8×4″	11″	Total	4″ Round	4″ Square	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Raw material	42200	29305	71505	7950	4472	12422	549115	87858	43929	442953	1123855	95180	21965	117144
	(0.84)	(0.58)	{33.88}	(0.21)	(0.12)	{27.76}	(1.25)	(0.80)	(0.40)	(1.52)	{52.35}	(0.20)	(0.20)	{41.15}
Labour	60337	41901	102238	11367	6394	17762	290708	46513	23257	234504	594982	50389	11628	62018
	(1.20)	(0.84)	{48.45}	(0.30)	(0.17)	{39.69}	(0.66)	(0.42)	(0.21)	(0.80)	{27.71}	(0.11)	(0.11)	{21.78}
Packing materials	2787	2090	4877	1600	1033	2633	31390	7847	7847	22679	69764	8036	2676	10712
	(0.06)	(0.04)	{2.31}	(0.04)	(0.03)	{5.88}	(0.07)	(0.07)	(0.07)	(0.08)	{3.25}	(0.02)	(0.02)	{5.08}
Annual repairs	285	285	570	215	215	430	5300	848	424	4275	10847	919	212	1131
	(0.01)	(0.01)	{0.27}	(0.01)	(0.01)	{0.96}	(0.01)	(0.01)	(0.0004)	(0.01)	{0.51}	(0.002)	(0.002)	{0.40}
Fuel	10897	7568	18465	2053	1155	3208	71113	11378	5689	57365	145545	12326	2845	15171
	(0.22)	(0.15)	{8.75}	(0.05)	(0.03)	{7.17}	(0.16)	(0.10)	(0.05)	(0.20)	{6.78}	(0.03)	(0.03)	{5.33}
Interest on working	1942	1352	3294	386	221	608	47381	7722	4057	38089	97250	8494	2001	10496
capital	(0.04)	(0.03)	{1.56}	(0.01)	(0.01)	{1.36}	(0.11)	(0.07)	(0.04)	(0.13)	{4.53}	(0.02)	(0.02)	{3.69}
Sub total	118448	82501	200949	23572	13490	37062	995007	162167	85204	799865	2042243	178380	42027	220407
	(2.36)	(1.65)	{95.22}	(0.62)	(0.36)	{82.21}	(2.27)	(1.48)	(0.78)	(2.74)	{95.13}	(0.38)	(0.39)	{77.42}
Fixed cost [FC]														
Depreciation	3023	3023	6047	2278	2278	4557	13614	3402	3402	9077	29495	14748	3402	18150
	(0.06)	(0.06)	{2.87}	(0.06)	(0.06)	{10.18}	(0.03)	(0.03)	(0.03)	(0.03)	{1.37}	(0.03)	(0.03)	{6.38}
Interest on fixed capital	1831	1831	3663	1380	1380	2760	34284	8568	8568	22860	74280	37140	8568	45708
	(0.04)	(0.04)	{1.74}	(0.04)	(0.04)	{6.17}	(0.08)	(0.08)	(0.08)	(0.08)	{3.46}	(0.08)	(0.08)	{16.06}
Rental value of land	188	188	375	188	188	375	208	208	208	208	832	208	208	416
	(0.004)	(0.004)	{0.18}	(0.005)	(0.005)	{0.84}	(0.0005)	(0.002)	(0.002)	(0.0007)	{0.04}	(0.0004)	(0.002)	{0.15}
Sub total	5042	5042	10084	3846	3846	7692	48106	12178	12178	32145	104607	52096	12178	64274
	(0.1)	(0.1)	{4.78}	(0.1)	(0.1)	{17.19}	(0.11)	(0.11)	(0.11)	(0.11)	{4.87}	(0.11)	(0.11)	{22.58}
Grand total [VC+FC]	123490	87544	211034	27418	17336	44754	1043113	174345	97382	832010	2146850	230476	54205	284681
	(2.46)	(1.75)		(0.72)	(0.46)		(2.38)	(1.59)	(0.89)	(2.85)		(0.49)	(0.50)	
Quantity	50160	50160		37800	37800		438000	109500	109500	292000		474500	109500	
Gross returns	148975	107844		37800	26460		1274580	240900	208050	989880		284700	87600	
	(2.97)	(2.15)		(1.0)	(0.70)		(2.91)	(2.20)	(1.90)	(3.39)		(0.60)	(0.80)	
Net returns	25485	20300		10382	9124		231467	66554	110668	157870		54224	33395	
	(0.51)	(0.40)		(0.27)	(0.24)		(0.53)	(0.61)	(1.01)	(0.54)		(0.11)	(0.30)	
Value addition [VA] (Rs.)	2.13	1.57		0.79	0.58		1.66	1.4	1.5	1.87		0.4	0.6	
Per cent Value addition	253.57	270.69		376.19	483.33		133	175	375	123		200	300	
Break even output	8266	10084		10121	11312		75165	16914	10873	49454		236800	29702	

Notes : Figures in parentheses indicate unit costs and returns. Figures in flower bracket indicate percentage to the total.

The manufacturer realised net returns of Rs.0.51 and Rs.0.4 per plate of 12″ and 10″ and Rs.0.27 and Rs.0.24 per bowl of 6″ and 4.5″ respectively. The net return earned per plate was higher than bowls. The average variable cost indicated increasing trend with increase in the size of plates.

In small units, the total operational cost on areca plates of various dimensions came to Rs.21,46,850 per manufacturing unit. Of this, variable cost constituted for 95.13 per cent and rest was fixed cost (4.87 per cent). The expenditure on raw material alone was Rs.11,23,855 (52.35 per cent) followed by labour at Rs.5,94,982 (27.71 per cent) and fuel at Rs.1,45,545 (6.78 per cent). Gas cylinder was used as fuel to operate hand pressing machines. An expenditure of Rs. 69,764 (3.25 per cent) was incurred towards packing materials. Among fixed costs, interest on fixed capital formed 3.46 per cent followed by depreciation at 1.37 per cent. The total cost incurred for manufacturing of 4″ round and square bowls came to Rs.2,30,476 and Rs.54,205, respectively per manufacturing unit. The variable cost formed 77.42 per cent and remaining 22.58 per cent was formed by fixed cost. Of the total cost, raw material formed major item at Rs.1,17,144 (41.15 per cent) followed by labour at Rs.62,018 (21.78 per cent), Interest on fixed capital was Rs.45,708 (16.06 per cent) and depreciation on machineries and accessories was Rs.18,150 (6.38 per cent). The per unit cost of production ranged from Rs.2.85 to Rs.0.89 for 11″ and 8×4″ plates. The 10″ plates were sold at Rs.2.91, 11″ at Rs.3.39, 8″ at Rs.2.2 and 8×4″ at Rs.1.9. In case of bowls of 4″ round and 4″ square, an average expenditure of Rs.0.49 and Rs.0.50 was incurred on per unit basis fetching net returns of Rs. 0.11 and Rs.0.30, respectively (Table 4).

Medium units manufactured plates of 12″, 10″ and 8″ dimension and incurred cost of Rs.35,29,701 per manufacturing unit. The variable cost formed major chunk at Rs.33,10,951 (93.80 per cent) and rest 6.20 per cent by fixed costs. Of the total cost, raw material constituted 63.58 per cent at Rs.22,44,068. The other major items of expenditure were labour (17.78 per cent), packing materials (6.43 per cent) and interest on fixed capital (4.23 per cent). An expenditure of Rs.1,15,674 (3.28 per cent) was made on electricity per annum. The total expenditure made on production of 6″ and 4″ bowls came to Rs.11,32,750 per manufacturing unit. The variable cost formed 80.73 per cent of the total cost and rest being shared by fixed cost 19.27 per cent. The major item of expenditure was on raw material at Rs.5,88,332 (51.94 per cent) followed by labour at Rs.1,64,510 (14.52 per cent), packing materials at Rs.71,837 (6.34 per cent), depreciation of machines and accessories at Rs.67,850 (5.99 per cent) and interest on fixed capital at Rs.1,49,400 (13.19 per cent). The unit costs and returns of medium units as given in the Table 5 indicate that the net returns was higher in case of 8″ plates followed by 12″ and 10″ plates. The average cost of production was Rs.2.55, Rs.1.82 and Rs.1.23, respectively for 12″, 10″ and 8″ plates. Bowls of 6″ and 4″ were manufactured by medium units for which cost of Rs.0.76 and Rs.0.42 was incurred. The net return obtained per bowl was in order of Rs.0.24 and Rs.0.18.

TABLE 5. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN MEDIUM AND LARGE UNITS

	Medium units Value [Rs.]							Large units Value [Rs.]								
Particulars	Plates				Bowls			Plates						Bowls		
Variable cost [VC]	12″	10″	8″	Total	6″	4″	Total	10″ square	8″ round	10″ round	7″ round	6″ round	Total	4″ round	4″ square	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Raw material	1210284	630356	403428	2244068	453856	134476	588332	1928984	925912	1446738	708902	520826	5531362	154319	154319	308637
	(1.66)	(1.15)	(0.74)	{63.58}	(0.41)	(0.18)	{51.94}	(1.32)	(0.85)	(1.32)	(0.65)	(0.48)	{62.06}	(0.21)	(0.21)	{48.11}
Labour	338421	176261	112807	627490	126908	37602	164510	523204	251138	392403	192277	141265	1500287	41856	41856	83713
	(0.46)	(0.32)	(0.21)	{17.78}	(0.12)	(0.05)	{14.52}	(0.36)	(0.23)	(0.36)	(0.18)	(0.13)	{16.83}	(0.06)	(0.06)	{13.05}
Packing materials	110312	67526	49276	227112	51100	20683	71837	117600	70200	88200	54000	50400	380400	20400	20400	40800
	(0.15)	(0.12)	(0.09)	{6.43}	(0.05)	(0.03)	{6.34}	(0.08)	(0.06)	(0.08)	(0.05)	(0.05)	{4.27}	(0.03)	(0.03)	{6.36}
Annual repairs	6400	4800	4800	16000	9600	6400	16000	15593	11695	11695	11965	11965	62911	7796	7796	15593
	(0.01)	(0.01)	(0.01)	{0.45}	(0.01)	(0.01)	{1.41}	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	{0.71}	(0.01)	(0.01)	{2.43}
Electricity	62386	32493	20795	115674	23395	6932	30326	148637	71346	111478	54624	40132	426218	11891	11891	23782
	(0.09)	(0.06)	(0.04)	{3.28}	(0.02)	(0.01)	{2.68}	(0.1)	(0.07)	(0.10)	(0.05)	(0.04)	{4.78}	(0.02)	(0.02)	{3.71}
Interest on working	84362	44431	28871	157664	33243	10305	43548	132675	64582	99506	49595	37129	383488	11491	11491	22982
capital	(0.12)	(0.08)	(0.05)	{4.47}	(0.03)	(0.01)	{3.84}	(0.09)	(0.06)	(0.09)	(0.05)	(0.03)	{4.30}	(0.02)	(0.02)	{3.58}
Sub total	1771609	933053	606289	3310951	698102	216398	914500	2866694	1394873	2150020	1071363	801716	8284667	247754	247754	495507
	(2.43)	(1.70)	(1.11)	{93.80}	(0.64)	(0.30)	{80.73}	(1.96)	(1.27)	(1.96)	(0.98)	(0.73)	{92.94}	(0.34)	(0.34)	{77.23}
Fixed cost [FC]																
Depreciation	27140	20355	20355	67850	40710	27140	67850	49300	41250	29550	39450	28200	187750	17180	17000	34180
	(0.04)	(0.04)	(0.04)	{1.92}	(0.04)	(0.04)	{5.99}	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	{2.11}	(0.02)	(0.02)	{5.33}
Interest on fixed	59760	44820	44820	149400	89640	59760	149400	107610	80708	80708	80708	80708	430440	53805	53805	107610
capital	(0.08)	(0.08)	(0.08)	{4.23}	(0.08)	(0.08)	{13.19}	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	{4.83}	(0.07)	(0.07)	{16.77}
Rental value of land	500	500	500	1500	500	500	1000	2143	2143	2143	2143	2143	10714	2143	2143	4286
	(0.001)	(0.001)	(0.001)	{0.04}	(0.0005)	(0.001)	{0.09}	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	{0.12}	(0.003)	(0.003)	{0.67}
Sub total	87400	65675	65675	218750	130850	87400	218250	159053	124100	112400	122300	111050	628904	73128	72948	146076
	(0.12)	(0.12)	(0.12)	{6.20}	(0.12)	(0.12)	{19.27}	(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	{7.06}	(0.10)	(0.10)	{22.77}
Grand Total [VC+FC]	1859009	998728	671964	3529701	828952	303798	1132750	3025747	1518974	2262421	1193664	912767	8913571	320881	320701	641583
	(2.55)	(1.82)	(1.23)		(0.76)	(0.42)		(2.07)	(1.39)	(2.07)	(1.09)	(0.83)		(0.44)	(0.44)	
Quantity	730000	547500	547500		1095000	730000		1460000	1095000	1095000	1095000	1095000		730000	730000	
Gross returns	2175400	1127850	930750		1095000	438000		4117200	2409000	3066000	1992900	1105950		518300	438000	
	(2.98)	(2.06)	(1.70)		(1.00)	(0.60)		(2.82)	(2.20)	(2.80)	(1.82)	(1.01)		(0.71)	(0.60)	
Net returns	316391	129122	258786		266048	134202		1091453	890027	803579	799236	193183		197419	117299	
	(0.43)	(0.24)	(0.47)		(0.24)	(0.18)		(0.75)	(0.81)	(0.73)	(0.73)	(0.18)		(0.27)	(0.16)	
Value addition (Rs.)	1.32	0.91	0.96		0.59	0.42		1.5	1.35	1.48	1.17	0.53		0.5	0.39	
Per cent Value addition	80	79	130		144	233		114	159	112	180	110		238	186	
Break even output	158007	184588	110821		361001	287913		184945	133441	133810	145596	396609		197643	280569	

Notes: Figures in the parentheses indicate unit costs and returns. Figures in the flower bracket indicate percentage to the total.

Large units manufactured 10″ square, 8″ and 10″ round, 7″ and 6″ plates incurring an expenditure of Rs.89,13,571 per manufacturing unit. Of the total cost, variable cost accounted for 92.94 per cent (Rs.82,84,667) and remaining 7.06 per cent was fixed cost. Raw material accounted highest at Rs.55,31,362 (62.06 per cent) followed by labour Rs.15,00,287 (16.83 per cent), packing material at Rs.3,80,400 (4.27 per cent), electricity Rs.4,26,218 (4.78 per cent), interest on working capital Rs.3,83,488 (4.30 per cent) and interest on fixed capital Rs.4,30,440 (4.83 per cent). All the units irrespective of their size borrow mainly from banks for establishment and running of the units incurring interest payments. The large units had made substantial investment and incurred higher interest on fixed capital. The manufacturing of 4″ round and 4″ square shaped bowls required an expenditure of Rs.3,20,881 and Rs.3,20,701, respectively per manufacturing unit. The variable cost incurred on bowls was Rs.4,95,507 (77.23 per cent) and fixed cost shared 22.77 per cent at Rs. 1,46,076. As usual, the expenditure made on raw material was maximum at Rs.3,08,637 (48.11 per cent). Labour formed 13.05 per cent of the total cost and remained as the second largest cost component. Interest on fixed capital at Rs.1,07,610 (16.77 per cent) was the other major cost item. The large manufacturing units of areca plates and bowls spent Rs.2.07, Rs.1.09 and Rs.0.83 for each piece of 10″, 7″ and 6″ round plates and Rs.0.44 for 4″ round and 4″ square bowls. The net returns realised were Rs.0.73 in case of 10″ and 7″ round plates. The 6″ round plates fetched meager returns (Rs.0.18). Brought net returns of bowls was Rs.0.27 (4″ round) and Rs.0.16 (4″ square) (Table 5).

Very large units are involved in manufacturing plates of dimensions 9″, 8″, 7×8.5″ and 6″ incurring an expenditure of Rs.4,22,02,973 per manufacturing unit. Of the total cost, the share of variable cost was maximum at Rs.3,58,09,830 (84.85 per cent) and the rest was shared by fixed cost (15.15 per cent). The expenditure made on labour was highest at Rs. 1,84,46,396 (43.71 per cent) followed by raw materials at Rs.98,56,477 (23.35 per cent), Interest on working capital Rs.31,35,338 (7.43 per cent), rental value of land Rs.26,00,000 (6.16 per cent) and electricity Rs.24,30,364 (5.76 per cent) are the other major costs in plate manufacturing. Bowls of 4″ and 3.5″ dimensions are manufactured at very large units by incurring total cost of Rs.76,66,365 per manufacturing unit. The share of variable cost was 60.72 per cent at Rs.46,54,658 and fixed cost at Rs.30,11,707 (39.28 per cent). The share of fixed cost reflects the magnitude of capital investment made on the unit. As usual, labour formed the major chunk at Rs.20,46,528 (26.69 per cent) followed by raw material Rs.10,93,523 (14.26 per cent), packing materials Rs.5,96,167 (7.78 per cent), rental value of land Rs. 13,00,000 (16.96 per cent), depreciation Rs. 7,88,433 (10.28 per cent) and interest on fixed capital Rs.9,23,274 (12.04 per cent). As could be seen in the Table 6, the average cost of production of plates ranged from Rs.2.56 (9″) to Rs.1.38 (6″). All plates fetched higher returns due to their better selling prices.

TABLE 6. ECONOMICS OF ARECA LEAF PLATES AND BOWLS IN VERY LARGE UNITS

Particulars	Value [Rs.]							
	Plates					Bowls		
Variable cost [VC]	9″	8″	7×8.5″	6″	Total	4″	3.5″	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Raw material	4460713	2680099	1228761	1486904	9856477	917842	175681	1093523
	(0.64)	(0.50)	(0.47)	(0.28)	{23.35}	(0.13)	(0.10)	{14.26}
Labour	8348224	5015805	2299626	2782741	18446396	1717741	328786	2046528
	(1.19)	(0.94)	(0.88)	(0.53)	{43.71}	(0.24)	(0.18)	{26.69}
Electricity	1099902	660846	302982	366634	2430364	226317	43319	269636
	(0.16)	(0.12)	(0.12)	(0.07)	{5.76}	(0.03)	(0.02)	{3.52}
Repairs	214925	163433	80597	161194	620149	223881	55970	279851
	(0.03)	(0.03)	(0.03)	(0.03)	{1.47}	(0.03)	(0.03)	{3.65}
Packing materials	457856	348161	171696	343392	1321105	476933	119233	596167
	(0.07)	(0.07)	(0.07)	(0.07)	{3.13}	(0.07)	(0.07)	{7.78}
Interest on working capital	1412376	852018	391197	479747	3135338	308578	60376	368954
	(0.20)	(0.16)	(0.15)	(0.09)	{7.43}	(0.04)	(0.03)	{4.81}
Sub total	15993996	9720362	4474860	5620612	35809830	3871293	783365	4654658
	(2.28)	(1.82)	(1.70)	(1.07)	{84.85}	(0.53)	(0.43)	{60.72}
			Fixed cost [FC]					
Rent	650000	650000	650000	650000	2600000	650000	650000	1300000
	(0.09)	(0.12)	(0.25)	(0.12)	{6.16}	(0.09)	(0.36)	{16.96}
Depreciation	605516	460445	227069	454137	1747167	630746	157687	788433
	(0.09)	(0.09)	(0.09)	(0.09)	{4.14}	(0.09)	(0.09)	{10.28}
Interest on fixed capital	709075	539192	265903	531806	2045976	738619	184655	923274
	(0.10)	(0.10)	(0.10)	(0.10)	{4.85}	(0.10)	(0.10)	{12.04}
Sub total	1964591	1649637	1142972	1635943	6393143	2019366	992342	3011707
	(0.28)	(0.31)	(0.43)	(0.31)	{15.15}	(0.28)	(0.54)	{39.28}
Grand Total	17958587	11369999	5617831	7256555	42202973	5890658	1775707	7666365
[VC+FC]	(2.56)	(2.13)	(2.14)	(1.38)		(0.81)	(0.97)	
Quantity	7008000	5329000	2628000	5256000		7300000	1825000	
Gross returns	56414400	39168150	21155400	24966000		25550000	4562500	
	(8.05)	(7.35)	(8.05)	(4.75)		(3.50)	(2.50)	
Net returns	38455813	27798150	15537569	17709444		19659341	2786794	
	(5.49)	(5.22)	(5.91)	(3.37)		(2.69)	(1.53)	
Value addition (Rs.)	7.41	6.85	7.58	4.47		3.37	2.4	
Per cent value addition	1158	1370	1613	1596		2592	2400	
Break even output	340484	298307	179996	444550		679921	479392	

Notes: Figures in the parentheses indicate unit costs and returns. Figures in the flower bracket indicate percentage to the total.

(d) *Value Addition*

Value addition reflects the income and employment potential subsumed in the process of conversion of raw material into finished product. The value addition in very small units was estimated to be 253 and 270 per cent in case of 12″ and 10″ plates while 376 and 483 per cent in the case of 6″ and 4.5″ bowls, respectively. Manufacturers procure raw materials at Rs.0.84 and turn it to 12″ plate by spending Rs.2.46 and sell at Rs.2.97 retaining Rs.0.51 as margin. Thus, Rs.0.84 worth raw material was transformed into Rs.2.97 worth finished good (Table 4). In small units, the value addition was found to be highest in 8×4″ rectangular plates at 375 per cent. It was in the order of 200 and 300 per cent, respectively in case of 4″ round and 4″

square bowls (Table 4). The value addition was found to be highest in case of 4″ bowl at 233 per cent due to lower cost of raw material (Rs.0.18) and manufacturing (Rs.0.42) in case of medium units. In plates, it ranged between 80 to 130 per cent (Table 5). The value addition in large sized units ranged between 112 to 180 per cent in plates and 186 to 238 per cent in bowls. It was highest in bowls due to lesser cost of raw materials (Table 5). The extent of value addition was over 1000 per cent in 9″ and 8″ plates and 1500 per cent in 7×8.5 and 6″ plates in very large units due to scale economies (Table 6). The economic benefits of value addition mainly depend on the operation of scale economies in the manufacturing, operational and pricing efficiency.

(e) *Break Even Output*

The results of break-even analysis indicated that production of plates and bowls of various dimensions across different sizes of manufacturing units was observed to be higher than break even output signaling the presence of profit (Table 4 to 6).

3.2 *Summary of Economics of Areca Leaf Products*

(a) *Income Accrued to Manufacturers*

The summary of economics of areca leaf products in different sized units on per manufacturing unit basis is presented in Table 7. The very small unit realised gross returns of Rs.3,21,079 and net returns of Rs.65,291 from sale of 1,75,920 plates and bowls of 12″, 10″, 6″ and 4.5″ dimension. Small units produced a total of 15,33,000 plates and bowls of 10″, 11″, 10″ round, 8″, 8×4″ and 4″ round and square dimensions and obtained gross returns of Rs.30,85,710 and net returns of Rs.6,54,179. The medium unit stood third in order with net returns of Rs.11.04 lakhs from sale of 36,50,000 units' incurring an expenditure of Rs. 46.62 lakhs. Large unit manufactured 73 lakhs of plates and bowls of different dimensions and shapes earning gross returns of Rs.1,36,47,350. The net returns accrued to the large unit was Rs.40,92,196. The total quantity of 9″, 8″, 7×8.5″, 6″ plates and 4″and 3.5″ bowls manufactured by the very large unit came to 2,93,46,000 units generating gross returns and net returns of Rs.17,18,16,450 and Rs.12,19,47,110, respectively.

(b) *Employment*

Employment generation in man-days was estimated on per unit and per annum basis and discussed below. Areca leaf products manufacturing is regarded as labour intensive enterprise. The enterprise has created employment of 600 man-days in very small units, 3285 man-days in small, 3960 man-days in medium, 7920 man-days in large and 88210 in very large units (Table 7). In other words, very small units provided employment for 2 labourers, small for 9 labourers, medium for 11 labourers, large for 22 labourers and very large for 242 labourers per unit per annum. A perusal of table clearly reflects the reliance of industry on women labour force. Women labour force contributed 55 to 78 per cent of the total work force in the industry. It could be regarded as one of the possible ways of women empowerment. Men labour was predominantly used for pressing of leaf sheath into various sizes and shapes of plates and bowls using machinery. Women labour was engaged in cleaning, drying, washing, grading, packing and labelling of finished goods for marketing.

TABLE 7. SUMMARY OF ECONOMICS OF ARECALEAF PRODUCTS

Particulars/Unit size (1)	Very small (2)	Small (3)	Medium (4)	Large (5)	Very large (6)
Physical output					
Plates (No.)	100320	949000	1825000	5840000	20221000
Bowls (No.)	75600	584000	1825000	1460000	9125000
Income accrued to manufacturers					
Total variable cost (Rs.)	238012	2262650	4225450	8532420	40464489
Total fixed cost (Rs.)	17776	168880	437000	702032	9404850
Total cost (Rs.)	255788	2431531	4662451	9555154	49869340
Total returns (Rs.)	321079	3085710	5767000	13647350	171816450
Net returns (Rs.)	65291	654179	1104549	4092196	121947110
Employment					
Women	360 (60)	2555 (78)	2520 (64)	4320 (55)	59704 (68)
Men	240 (40)	730 (22)	1440 (36)	3600 (45)	28506 (32)
Total	600	3285	3960	7920	88210
Income accrued to labour force (Rs.)	120000	657000	792000	1584000	20492924
Operational efficiency measures					
Gross ratio	0.8	0.79	0.81	0.7	0.29
Operating ratio	0.74	0.73	0.73	0.63	0.24
Fixed ratio	0.06	0.05	0.08	0.05	0.05
Capital turnover ratio	3	3.9	2.9	3.8	10.81
Economic viability					
NPW (Rs.)	72092	1518852	5901036	17273053	590858458
MIRR (per cent)	17	25	48	57	88
BCR	1.03	1.07	1.16	1.2	2.05
Pay back period (years)	1.64	1.21	1.8	0.88	0.13
Economic efficiency					
Technical efficiency	0.65	0.86	1	1	1
Allocative efficiency	0.76	0.92	0.92	1	0.72
Cost efficiency	0.5	0.79	0.92	1	0.72
Existing level of resource use					
Raw material (sq. inch)	14365290	98988000	2.46E+08	4.42E+08	1.393E+09
Labour in man-days	600	3285	3960	7920	88210
Optimum level of resource use					
Raw material (sq. inch)	10651956	92823150	2.46E+08	4.42E+08	1.393E+09
Labour (man-days)	190.861	1663.2	3960	7920	31838.4
Per cent deviation from optimum					
Raw material (sq. inch)	34.86	6.64			
Labour (man-days)	214	97.5			177

(c) *Income Generation to Labour Force*

It may be observed that income generation to labour force per unit per annum varied from Rs. 1.2 lakhs to Rs. 20.50 lakhs across the size groups. Very small units generated income of Rs. 1.2 lakh, small units Rs. 6.57 lakh, medium units Rs. 7.92 lakh, large units Rs. 15.84 lakh and very large sized units Rs.20.5 lakh to rural labour folk (Table 7). The income potential directly varied with size.

(i) Operational Efficiency of Areca Leaf Plates and Bowls Manufacturing Units

Operational efficiency expressed in terms of gross ratio, operating ratio and fixed ratio indicated that very large units are more efficient with gross ratio of meagre 0.29 indicating that total cost incurred towards production of products formed hardly 29 per cent of the gross returns. Next in the order was a large sized unit with gross ratio of 0.7. In rest of the cases, gross ratio hovered around 0.8. The capital turnover ratio was highest at 10.81 in very large units and in rest of the cases it hovered around 3 indicating every rupee of capital earned gross returns of Rs. 3 to the unit (Table 7).

(d) *Economic Viability of Investment*

The costs and returns streams were discounted at the rate of interest charged by commercial banks (12 per cent) to work out NPW, BCR and MIRR. NPW ranged from Rs. 72,092 in very small units to Rs. 59.1 crore in very large units indicating economic viability and amount of wealth generated by the unit over its life period after duly accounting for inflation (Table 7). BCR ranged from 1.03 in very small units to 2.05 in very large units justifying investment worth-whileness. MIRR ranged 17-88 per cent across all the sizes of manufacturing units. As the MIRR was quite high, entrepreneurs can borrow credit from commercial banks or co-operatives at the rate of 12 per cent and invest on areca leaf plate unit to reap returns at the rate of MIRR. Based on MIRR, the investment made on manufacturing units is considered to be safe and economically worthwhile. Pay-back period signaled that within a very short time period of <1 year, the investment made on the unit could be recovered in case of large and very large sized units. In rest of the cases, it took close to 2 years for recovery.

(e) *Economic Efficiency*

The perusal of Table 7 clearly indicates that medium, large and very large units were found to be technically efficient with efficiency score of 1. Technical efficiency score was lowest in case of very small unit at 0.65 reflecting the existence of inefficiency to the tune of 35 per cent. The situation was little better in case of small units at 0.86. The possible reason for inefficiency was the size and scale of business.

Size reflects the magnitude of capital investment and scale reflects the operational capacity to utilise the capital. Both of these were found to be low in case of very small and small restraining them to produce more per unit of input. Large, medium and small units were found to be allocatively efficient in order of magnitude with efficiency score of 1 and 0.92, respectively. Very large units had allocative inefficiency of 28 per cent. In order to produce quality output, very large units heavily depend on manual labour for performing special operations like drying, scrubbing, buffing, quality packing, labeling more precisely. Very small, small and very large units were found to be cost inefficient. Cost inefficiency in case of very small and small units is due to technical and pricing inefficiency. In order to improve efficiency, the very small units should reduce raw materials by 34.86 per cent and labour by 214 per cent and small unit by 6.64 and 97.5 per cent. In case of very large sized units cost inefficiency was solely due to allocative/pricing inefficiency. It could be resolved by reducing dependence on manual labour by 177 per cent through mechanisation of operations (Table 7).

3.3 *Consumer Preference for Areca Leaf Products*

Conjoint analysis was carried out to assess consumer preference for areca leaf products (Table 8). Higher utility score for factors indicate greater preference. Most of the factors considered for assessment of customer preference for areca leaf products are of discrete type. Discrete represents presence of yes or no levels. Price is the only factor which is treated as scale variable. The conjoint analysis assumes linear model for price factor implicating its linear relation with utility. The direction of relation between price and utility is indicated as 'less' indicating that lower levels of price factor are preferred. It explicitly indicates that utility possesses linear and negative relation with the price. Higher the price, lesser the utility and vice versa. The sign of utility estimates exhibit the relation between factor and utility. As expected, price has got negative sign signaling the presence of inverse relation with utility. As price increases, utility gained by consumer decreases. The utility estimate was -1.93 for price of more than three rupees while it was less (-0.48) for price level less than one rupee. Quality and shelf life of the product had negative sign reflecting the existence of negative relation with utility. Areca leaf products are more prone to mycelial infection compared to plastics consequently affecting shelf life. Plastic based products are free from mycelial growth and possess better shelf life. Dimensions and portability are the major factors having greater bearing on utility. The utility estimate of dimension and portability was 3.61 and 1.52, respectively. Customers prefer areca leaf products over plastics or paper based products because of the availability of products in desired dimensions and shapes. Areca products are flexible in terms of dimensions while plastics or paper based products are more rigid restricting the preference of customers. Portability is the other factor influencing customer preference for areca leaf products over plastics. Portability enables easy handling due to its heat resistance when hot food is served. Nature of the product is the other major factor influencing consumer preference with utility estimates of 1.20. This reflects the presence of ecological and environmental concern and consciousness among customers. The factors which have got least influence on customer preference for areca leaf products are social and religious factors. Social and religious factors will remain neutral between areca based and plastic based products in terms of customers' preference.

TABLE 8. FACTORS INFLUENCING CONSUMER PREFERENCE FOR ARECA LEAF PRODUCTS

Factors (1)	Levels (2)	Utility estimate (3)	Std. error (4)	Importance score (5)
Dimension	Flexible	3.61	1.29	26.5
	Rigid	- 3.61	1.29	
Portability	Portable	1.52	1.29	11.94
	Non portable	- 1.52	1.29	
Quality	More prone to fungal infection	- 1.3	1.29	11.07
	Less prone to fungal infection	1.3	1.29	
Price	< Rs.1	-0.48	1.15	10.26
	>Rs.1 to Rs. <2	-0.97	2.3	
	>Rs.2 to < Rs.3	-1.45	3.45	
	>Rs.3	-1.93	4.6	
Nature of product	Areca leaf products	1.2	1.29	9.13
	Plastic products	- 1.2	1.29	
Shelf life	Long shelf life	- 0.38	1.29	8.22
	Short shelf life	0.38	1.29	
Eco-friendliness	Eco-friendly	0.6	1.29	7.53
	Non-ecofriendly	- 0.6	1.29	
Market accessibility	Niche, limited and unorganised market	0.81	1.29	6.37
	Unlimited and organised market	- 0.81	1.29	
Social acceptance	More	0.55	1.29	5.33
	Less	- 0.55	1.29	
Religious and cultural	More	- 0.08	1.29	3.64
acceptance	Less	0.08	1.29	
Constant		17.71	3.15	

The relative importance of each factor known as an importance score are computed by taking the utility range for each factor separately and dividing by the sum of the utility ranges for all factors. The values thus represent percentages and sum up to 100. The calculations are done separately for each consumer and the results are then averaged over all customers. Dimension (26.50), Portability (11.94), Quality (11.07), Price (10.26), Nature of the product (9.13) are the important factors influencing consumer preference for areca leaf products. Social and religious factors have got very low importance score reflecting their meager influence on consumer preference.

3.4 *Supply of Raw Material (Areca Leaf Sheaths)*

Areca leaf sheath is the crucial raw material in areca leaf plates and bowls manufacturing industries. Its supply was estimated for Karnataka state as a whole and for major arecanut growing regions in the state. Shivamogga, Chickmagalur, Uttara Kannada, Dakshina Kannada and Udupi are the traditional arecanut growing districts of the state. Tumkur, Davangere and Chitradurga are the non-traditional districts of arecanut (Kiran *et al.*, 2014). To estimate supply of raw material, i.e., areca leaf sheaths, estimates of area under arecanut in major districts and state as a whole is essential. The estimate of area under arecanut for the study year 2016-17 was arrived at through extrapolation. The data on area under arecanut from 2005 to 2014 was obtained from Directorate of Economics and Statistics, Bangalore for state and major districts. Exponential model was employed for estimating the rate of growth in area. Excepting Chickmagalur, in all other districts positive growth rate was observed indicating the potential of area expansion. The rate of growth was highest in Tumkur (6.63 per cent) followed by Udupi (5.81 per cent), Shivamogga (5.54 per cent), Davangere (5.20 per cent), Chitradurga (2.97 per cent) and Uttara Kannada (2.62 per cent). The rate of growth in area was 3.62 per cent for the state. The estimate of area for the year 2016-17 was arrived at by extrapolating area during 2014-15 at the corresponding exponential growth rate. Extrapolated estimates of area under arecanut are presented in Table 9. Consultation with officials of Department of Horticulture revealed the actual area under bearing arecanut gardens. The rationale is, only the bearing arecanut palm sheds leaf sheaths. Area under bearing arecanut palm was arrived at by considering the percentage of area under arecanut at bearing stage. Drip irrigated arecanut garden produce better quality raw material as compared to arecanut gardens irrigated by flood and sprinkler methods as they are prone to fungal infections and are of poor quality. Thus, the potential supply was estimated considering the area under drip irrigation in consultation with the State Horticulture Department. Information on number of palms per hectare and number of leaf sheaths shed per palm was gathered. On an average, there are 1500 palms on one hectare and each palm sheds six leaf sheaths per annum. At this rate, potential supply of raw material was estimated for major districts and state as a whole. As per the estimates, the potential supply of raw material in Karnataka state stood at 143.89 crore leaf sheaths per annum. In the order of magnitude, Chickmagalur at 25.94 crore emerged as the major source of raw material supply followed by Shivamogga (24.11 crore), Davangere (21.66crore), Dakshina Kannada (19.09 crore) & Tumkur [17.71 crore] (Table 9).

3.5 *Projection of Supply of Areca Leaf Sheaths during Next Five Years*

Efforts have been made to forecast raw material supply for next 5 years. This estimate will serve as an indicator for prospective entrepreneurs to have their start up in eco-friendly sustainable enterprise. Raw material supply varies with area under arecanut at the same pace of growth. Hence, rate of growth in area under arecanut was used to forecast raw material supply. Accordingly, the raw material supply at 2021-22 stood at 173.68 crore (Table 10).

TABLE 9. SUPPLY ESTIMATES OF ARECA LEAF SHEATHS IN KARNATAKA STATE (2016-17)

District (1)	Area in ha. (2016-17) (2)	Per cent area under bearing garden (3)	Area under bearing garden (ha.) (4)	Area under arecanut connected to drip (ha.) (5)	Total number of palms (6)	Total number of leaf sheaths shed per year (7)
Chitradurga	23922	0.8	19137.6	17223.84	25835760	155014560
Davangere	41145	0.65	26744.25	24069.83	36104738	216628425
Tumkur	36434	0.6	21860.4	19674.36	29511540	177069240
Shivamogga	55820	0.6	33492	26793.6	40190400	241142400
Dakshina Kannada	37875	0.7	26512.5	21210	31815000	190890000
Uttara Kannada	19353	0.8	15482.4	12385.92	18578880	111473280
Chickamagalur	37930	0.95	36033.5	28826.8	43240200	259441200
Udupi	8954	0.6	5372.4	4297.92	6446880	38681280
Karnataka	280488	0.7125	199847.7	159878.2	239817240	1438903440

TABLE 10. EXTRAPOLATED SUPPLY ESTIMATES OF ARECA LEAF SHEATHS IN KARNATAKA STATE

Major districts/Year (1)	2017-18 (2)	2018-19 (3)	2019-20 (4)	2020-21 (5)	2021-22 (6)
Chitradurga	164359161.7	169240628.8	174267075.4	179442807.6	184772259
Davangere	239743544.5	246863927.7	254195786.4	261745401.2	269519239.7
Tumkur	201326962.7	207306373.5	213463372.8	219803235	226331391
Shimoga	268601082.5	276578534.7	284792917.2	293251266.8	301960829.4
Dakshina Kannada	202672524.9	208691898.9	214890048.3	221272282.7	227844069.5
Uttara Kannada	117390999.6	120877512.3	124467574.4	128164261.4	131970739.9
Chickmagalur	225840710.7	232548179.9	239454860.8	246566670.2	253889700.3
Udupi	43306617.65	44592824.2	45917231.07	47280972.84	48685217.73
Karnataka	1544965646	1590851125	1638099404	1686750956	1736847459

3.6 *Contribution to State's Gross Domestic Product (SGDP)*

Value addition method of estimation of national income was employed to ascertain the contribution of areca leaf plates and bowls manufacturing units to state gross domestic product. Most demanded dimension of areca leaf products such as plates (12″, 10″ and 8″) and bowls (6″ and 4.5″) were considered for the estimation procedure. The estimation requires information on potential supply of raw materials in the state, average number of plates/bowls manufactured, gross returns accrued to farmers, manufacturers, wholesalers and retailers. Weighted averages for these estimates were computed considering sample units of varied size of the present study. Weighted averages were considered for further computation to avoid statistical bias. The potential raw material supply in the state for the year 2016-17 was estimated to be 143.89 crore. Using this enormous amount of raw materials, 287.78 crore areca leaf products (plates/bowls) could be manufactured. The weighted proportion of raw materials utilised for manufacturing plates and bowls of different dimensions were in the order of 20 per cent, 15 per cent, 15 per cent, 30 per cent and 20 per cent for 12″, 10″,8″, 6″ and 4.5″, respectively. The number of plates/bowls manufactured in the same order stood at 57.56, 43.17, 43.17, 86.33 and 57.56 crores. Value addition to areca leaf sheaths at different stages viz., cultivation, manufacturing, wholesaling and retailing across products of different dimensions came to Rs. 808.23 crores (Table 11). The stakeholders such as farmers, manufacturers, wholesalers and retailers, respectively shared 27.6 per cent, 34.5 per cent, 10.2 per cent and 27.8 per cent of the contribution to GDP from the areca leaf sheath sector.

TABLE 11. CONTRIBUTION OF ARECA LEAF PLATES AND BOWLS MANUFACTURING UNITS TOWARDS STATE'S GROSS DOMESTIC PRODUCT (SGDP)

Stages / Dimensions (1)	12″ (2)	10″ (3)	8″ (4)	6″ (5)	4.5″ (6)	Total value addition (7)	Share (8)
No. of plates/bowls	575561376	431671032	431671032	863342064	575561376		
Returns accrued to farmers per plate /bowl	1.66	1.15	0.74	0.41	0.18		
Total returns accrued to farmers	955431884.2	496421686.8	319436563.7	353970246.2	103601047.7	2228861429	27.58
Returns accrued to manufacturers per plate/bowl	1.31	1.38	1.46	0.59	0.52		
Total returns accrued to Manufacturers	753985402.6	595706024.2	630239706.7	509371817.8	299291915.5	2788594867	34.50
Returns accrued to wholesalers per plate/bowl	0.4	0.5	0.2	0.2	0.2		
Total returns accrued to Wholesalers	230224550.4	215835516	86334206.4	172668412.8	115112275.2	820174961	10.15
Returns accrued to retailers per plate/bowl	1.25	0.9	0.9	0.6	0.4		
Total returns accrued to Retailers	719451720	388503928.8	388503928.8	518005238.4	230224550.4	2244689366	27.77
Total value addition	2659093560	1696467159	1424514408	1554015717	748229789.9	8082320633	

Note: Total leaf sheaths supply – 1438903440 and No. of plates/bowls manufactured with available raw material-2877806880.

IV

CONCLUSION AND IMPLICATIONS

The foregoing discussion concludes with major findings, i.e., arecanut growers realised net returns of Rs.7,120 per acre from sale of leaf sheaths. The profit accrued to manufacturers varied from Rs.65,291 (very small units) to Rs.12,19,47,110(very large units). Areca manufacturing unit proved itself as labour intensive providing employment in the range of 2 to 242 labourers round the year across very small to very large sized units. It is considered as prime source of economic empowerment of women in the rural areas as majority (55 to 78 per cent) of the labour force engaged was constituted by women. Value addition was found to be highest in case of very large sized units at 1165 to 1622 per cent in plates and 2497 to 2684 per cent in bowls due to the operation of scale economies. Investment on the manufacturing unit was proved to be economically viable. Conjoint analysis identified dimension, portability, quality and price as the major factors influencing customer preference to areca leaf products against the substitutes available in the market. In terms of economic or cost efficiency, very small, small and very large units were found to be inefficient. The estimated raw material supply during the next five years would be 173.68 crore in Karnataka state. Areca by-product industry contributes Rs.808.23 crores or Rs.8 billion to state's GDP.

The farmers have to be educated in the scientific management of shed leaf sheaths collection, bundling, stocking and transportation. This helps the manufacturers to procure quality raw materials required for their industries. Efforts in this direction may be done by Department of Horticulture/District industry centres. Since it is an upcoming agro-based industry, government must take steps to protect and promote them in a big way providing subsidies/ grants/ free electricity etc. Organised and efficient marketing system is lacking in this line of industry. Hence, government may think of providing orderly marketing system through market regulation. Consumers/customers interested to buy areca based products for their needs should also be educated on source, quality, usage and disposal through mass media. As large work force is engaged in manufacturing of areca products, the service conditions as found in case of other industries can also be extended to them, *viz*., provident fund, gratuity, minimum wages, leave facility, overtime bonus etc.

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NOTES

1) Valuation of raw materials: Manufacturers procure raw material from arecanut growers of surrounding regions at farm gate price. Wastage of five per cent of leaf sheath was noticed and accounted as cost in themanufacturing process. Valuation of plates and bowls was done on sq. inch basis by multiplying leaf sheath area in sq. inches with per sq. inch cost. The total procurement cost of raw material inclusive of wastage was divided by available leaf sheath area for manufacturing of plates and bowls in sq. inches to arrive at cost of raw material.

Valuation of labour:Labour used in the industry was valued using wage rates provided locally on per manday basis and apportioned on the sq. inch basis.

Valuation of electricity/fuel: Electricity/fuel charge per sq. inch area of leaf sheath was estimated by dividing total electricity charges by total leaf sheath area used for plates and bowls manufacturing.

Valuation of packing and packaging materials: Quantity of packing materials (polythene covers in kg) and packaging materials (large sized bags of 45"or 46" / boxes in number) required to pack finished products was taken into consideration. The obtained quantity was later multiplied with market price of materials. Quantity of twines required in kg to stitch packaging materials was considered and multiplied with market price to cost account twines.

Annual repairs: Repairs of machines, motors and accessories used in the manufacturing unit was apportioned across finished products based on their capacity utilisation.

Interest on working capital: Interest rate charged by commercial banks for recurring expenses on agro-based industries was considered. Interest component was worked out on total working capital. Interest rate varied across size of manufacturing unit and type of loan availed by the entrepreneur.

2) Capacity utilisation refers to share of production of individual commodities in the total production.

3) Modified internal rate of return (MIRR) sums the discounted negative cash flows to the starting time and sums the positive cash flows to the final period adjusting for the reinvestment rate. By dividing and taking the nth root, it determines the rate of return for the positive and negative cash flows. *MIRR* = (Future value of discounted positive cash flows / present value of negative cash flows at the financing cost of the company)^(1/n)-1.

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Book Review

Digital India for Agricultural and Rural Development: Scope and Limitations, Edited by Kamal R. Gupta and V.B. Angadi, Gaurang Publishing, 2019. Pp.xiv+249.

The Indian agriculture sector is at crossroads, facing a multitude of challenges. The daunting task of achieving higher productivity levels to feed the escalating population using increasingly constrained resources is a challenge in itself. Besides, the sector needs to provide livelihood security to all sections of farmers. This is tough because the marginal and small farmers are yet to benefit fully from the government schemes and policies on agriculture. At a period when the government is pressing on increasing farm income, the benefits cannot wait to reach these farmer categories. It is under this scenario that the applications of digital technologies become important in agriculture.

The book starts with the scope and limitations of digital technology applications for agriculture and rural development. It wonderfully explains the digital technology advancements and the need for incorporating those in the agricultural sector. Internet of things (IoT) applications and its benefits in the context of small farmers are dealt in briefly. IoT applications enable the researchers and farmers to improve the farm performance supported by the data generated locally. Such data has great relevance to enhance the output in Precision Farming and related novel agricultural practices. The introductory chapter has the capacity to intrigue the readers on the subject. Most chapters that followed are devoted to explaining how different digital technologies can help improve the agriculture performance, except the ones that dealt with specific cases on E-trading, Manipal Business Solutions, Amul and Block Chain Technology.

The chapter on E-trading of agricultural commodities has dealt in detail the importance of E-trading for India, the E-trading platforms available at present, their ground-level performance and the benefits to stakeholders. The Government of India recognised the need for setting up of a pan-India electronic platform to carry out trade in agricultural commodities. The programme is implemented in the name of National Agricultural Market (eNAM), and it connects the existing APMC mandis to create a unified national market for agricultural commodities. It is thus apt that a chapter is devoted to the E-trading of agricultural commodities through the eNAM. The chapter deliberates in detail the need for a unified agricultural market, the concept of E-trading, variants of the currently available online platforms, objectives of eNAM, ground-level facts on the functioning of eNAM and the benefits to the stakeholders. The authors reiterate that the farmers of our country do not have access to adequate market information. The middlemen continued to exploit them and the government has attempted several policy measures to address this. eNAM is the latest among such measures that target to ensure a fair price to farmers and prevent the cartelisation by the marketing agents. Rightly, the chapter discusses the Unified Market Platform (UMP) ahead of the eNAM. The UMP is an initiative of the ReMS, a joint venture between NCDEX and Karnataka government. It is the first E-trading platform attempted for agricultural commodities that provided online access to all participants of the APMC market of Karnataka holding a license issued by the state government. eNAM is also conceptualised similarly but implemented across the country. The ground level shreds of evidence provided by the authors indicated that the farmers and traders are now comfortable to deal with the computers for trading, and they exercise their bargaining powers. The quality consciousness and transparency have improved, and the sellers participate in E-auctions irrespective of the proximity to mandis. However, the grading, sorting and quality assaying facilities need to be improved quickly to win the confidence of the farmers and traders.

After the very important case of eNAM, the book moves to a broader discussion on the challenges faced by the Indian agriculture sector and how can the digital technologies contribute to overcoming those. This broad topic is covered through chapters three, four, five, eight, eleven, fourteen and fifteen. The issue of sustainability in agricultural production in future, constrained resources, climate change impacts, and food security of the increasing population are the key challenges to be dealt with by the agriculture sector. The authors attempt to take us through the journey of technology development in Indian agriculture, and the barriers to technology adoption, which is interesting. The contribution of GM technology in enhancing cotton production is highlighted. The chapter on IT-driven sustainable agripreneurial ventures tries to take the educated, young section of the Indian farmers into confidence. The author reiterates that digital agriculture has the potential to enhance the performance of the agriculture sector. Precision agriculture is also dealt in detail along with the contribution of digital technology in functioning of precision farms, and its different cases. The potential of disruptive technologies in efficiency improvement of farms is highlighted. The role of digital technologies in rural development is discussed in chapter eight by calling attention to the "Digital India" programme of the government of India. The nine pillars identified by the government as growth areas for rural development are detailed. The discussion is continued in chapter nine, as a case study of Manipal Business Solutions (MBS). MBS utilise ICT infrastructure to take services to rural India. It is a great initiative that has brought the benefit of digital payments, banking services and value-added services to the proximity of the rural population.

A mention of different applications of digital India is given along with the status of the operation. Another key aspect covered in the book is the need for knowledge revolution for agriculture. It highlights the importance of creating awareness among the farmers on digital technologies and their applications on agriculture. The application of artificial intelligence for plant stress identification, image-based insight generation, and improving agricultural accuracy is explained. IoT is a highly promising family of technologies which is capable of offering many solutions towards modernisation of agriculture. The book devotes three chapters to emphasise the importance of IoT in future agriculture in India. Examples of utilisation of IoT on agricultural monitoring and control, controlled environment agriculture, open field agriculture, livestock, and tracking the food supply chain is mentioned. The depiction of the structure of IoT for agriculture is very interesting and throws light on the different elements of IoT. The importance of integration of IoT with cloud computing, which has a powerful storage, processing and service capability is rightly pointed out. The different international cases of IoT applications in agriculture discussed act as a motivator for such ventures in India. Big data analysis is the term used to describe a new generation of practices designed so that farmers and related organisations can extract the economic value from large volumes of a wide variety of data by enabling high-velocity capture, discovery and analysis. However large infrastructure for data storage and processing analysis needs to be generated for reaping the benefits of big data. It can contribute to effective weather forecasting, pest and disease monitoring etc.

Blockchain technology (BCT) is another digital technology application quoted in the book to support future agriculture. BCT is a distributed ledger technology that empowers anyone with an internet connection to transfer anything of value-anywhere, anytime, with unmatched security and integrity. BCT can enable precision decision making among the farmers which in turn will improve efficiency. As the authors suggest, BCT can be utilised for better financing, smart farm contracts, land ownership records, transparent transactions, as well as for monitoring real-time data. A list of start-ups operating in India that uses BCT in various agricultural services is also given, and a glance through it apprise that BCT has the potential to begin a new era of development in the agriculture sector.

Digital technology cannot wait to contribute to the benefit of the agriculture sector, and that is the key message that the book unveil. It is felt that the book could have been structured in a better way, and the repetitive description of some of the topics be avoided. Still, considering the diversity of the topics covered and the subject expertise of the authors contributing, the book is suggested as a fine read to understand the basics of the necessity of digital interference in agriculture. This book is a good read for agricultural professionals and farmers considering its wide coverage and quality content. The book could be an initial reference for enterprising, educated and young professionals who would like to contribute to society through digital applications in agriculture.

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Proceedings of the Regional Seminar on Perspectives of Horti-Business in Development of North Eastern Region: A Brief Report

A two-day Regional Seminar on "Perspectives of Horti-Business in Development of North Eastern Region" was organised during February 24-25, 2020 under the auspices of College of Horticulture and Forestry, Central Agricultural University (Imphal), Pasighat, Arunachal Pradesh, Co-organised by NABARD - Itanagar and in association with Indian Society of Agricultural Economics (ISAE), Mumbai, ICAR-ATARI-Guwahati (Zone-VI) and Rajiv Gandhi University, Itanagar. Prof. M. Premjit Singh**,** Hon'ble Vice Chancellor, Central Agricultural University, Imphal was the Chief Patron of this seminar. Prof. Saket Kushwaha, Hon'ble Vice Chancellor of Rajiv Gandhi University, Itanagar was the Chief Guest of the inaugural occasion of the seminar. Dr. Gopa Kumaran Nair, General Manager, NABARD, Itanagar graced the occasion as Guest of Honour. Prof. B.N. Hazarika, Dean and Chairman, Dr. Ram Singh, Dr. Lakshmi Dhar Hatai was the Organising Secretary and Dr. S.K. Pattanaik was the convener of the seminar. Prof. Saket Kushwaha in his key note address emphasised on the need for organising such events in academic institutions, emphasised on enterprise combination of all the desired inputs to increase cropping intensity of horticultural crops in the region. He also stressed on value addition and marketing strategy of organic horticultural produce and their linkages for increasing income of farmers. Dr. Nair, Guest of Honour and GM of NABARD spoke about diversification of agricultural crops, cropping pattern and technology adoption and role of NABARD towards various schemes in boosting farmers' income in the Northeast during the inaugural programme.

Seven lead papers were delivered by eminent agricultural economists and horticulturists during the two-day seminar. The Seminar was attended by researchers from the North-Eastern Region. About 50 delegates including professors, scientists, research scholars and post graduate students delivered their research findings in three themes during technical sessions. It is hoped that valuable recommendations that emerged out the discussions during the seminar, would be proposed to the government(s) subsequently for formulating policy decisions concerning horti-business development in the NE region.

Prof. Ashok Kumar, Honb'le Vice Chancellor of Apex Professional University, Pasighat, Arunachal Pradesh graced the valedictory function as the Chief Guest. He was optimistic that this seminar being an appropriate platform to the students, scholars, social scientists and management experts to make scientific interactions and come out with concrete recommendations for the benefit of the growers as well as stakeholders engaged in the horticultural sector in the North Eastern Region. Guest of Honour, Prof. Dibakar Naik, Ex-Prof. Agriculture Economics, Central Agriculture University (Imphal) and Ex-DR OUAT and Dean, College of Agriculture, OUAT, Bhubaneswar, Prof. V.T. Raju, Ex-Dean, CPGAS, CAU, Umiam, Meghalaya and Prof. B.N. Hazarika, Dean and Chairman discussed on the prospects of sustainable horticultural production, from seed to market, providing a strategic framework for value addition and profitability for the horticultural sector of this North East Region. It was also expressed that in the recent past, the region has made commendable progress towards production of quality oranges, pineapple, banana and an array of vegetables including under-utilised and lesser known vegetables. For enhancing the growth in horticulture sector in the region quality seed and disease free transplants are indispensible. Presently the whole region is as one of the suitable niches for organic production to a number of fruits, vegetable and flowers ready to fetch premium price in national and international markets. In this context, well planned research strategies are needed to standardise the organic protocols for production of high feathered fruits, vegetables and flowers.

Horti-business plays a pivotal role in fostering and sustaining the tempo of rural development in the North Eastern Region. Efficient Horti-business is a pre-requisite in the development process of the economy of north eastern states. Adoption of horti-business technology and sustainable utilisation of resources can help the horticultural farmers in minimising the cost of production. New paradigm and challenges are needed for horticultural farmers of north eastern states in solving the problems like recurrent price fluctuations, high marketing, storage and transportation cost, non-availability of adequate storage facilities, post-harvest losses and lack of competitive marketing system of horticultural produce. Horti-business signifies sustainable resource management, enhanced income generations and enlarged employment opportunities from a long term prospective. The North Eastern Region has immense scope for horticultural business in the process of agricultural development. Horticulture is the main economic activity in NE region. This region is abundant in horti-crops like banana, pineapple, cashew nut, orange, khasi mandarin, citrus, passion fruits, kiwi, plums, pears, peaches, ginger and turmeric etc. which have high commercial value. Passion fruit cultivation is of special importance to Mizoram, Nagaland, Manipur and Sikkim which has good potential for exports. Kiwi fruit is being cultivated in Arunachal Pradesh, Sikkim, Meghalaya and hills of Manipur. North-eastern region is blessed by nature with tremendous biodiversity and extremely congenial climate for growing various kinds of ornamental crops (anthurium, gerbera, roses, heliconia, carnations, liliums and orchids etc.). It is estimated that high-value horticultural crops such as, fruits, vegetables, condiments and spices occupy as much as 15 per cent of the region's gross cropped area. For instance, the growing demand for horticultural products especially burgeoning market for processed fruits, vegetables and spices as well as booming floriculture market is an evidence of the scope for accelerating horticultural growth in NE states. Horticulture has become a sustainable and viable commercial venture for the marginal and small farmers of this region. For integrated development of horticultural sector, which focused on area coverage, quality production, creation of post-harvest facilities, value addition and horti-business potential in NER. Still markets are unorganised and value chain has ample scope to get rid of unorganised intermediaries to enhance the due share in consumers' rupee. Therefore, there is ample scope for triggering agricultural development through horticultural interventions in north eastern region. Horticultural business is the fastest growing sector contributing towards improving farm incomes, enhancing food and nutritional security, reducing rural poverty and accelerating the overall economic growth of the NEH region.

The following three broad subjects were discussed (Oral Presentation) during the two-day regional seminar.

1. Problems and prospects of horticultural production and marketing.
2. Horticulture for sustainable development and livelihood security.
3. Value chain and marketing strategy of agri-horti based products towards entrepreneurial development of NE region

As highlighted earlier, eminent agricultural economists, policy planners, government officials, civil society groups, research scholars across the north eastern region and country participated in the seminar. Hence, the proceedings is an outcome of the seminar may be is helpful for the policy makers, planners, different stakeholder like intermediaries, researchers, scholars involved into value chain of fruits, vegetables, spices and other horticultural produce for further course of action in a systematic manner.

MAJOR RECOMMENDATIONS OF THE SEMINAR

- Farm diversification and intensification can be the major objectives of the production systems approach to improve the socio-economic conditions and quality of life of individual farm families by increasing the productivity and net income of their farming.
- Agri-business/marketing centres should be setup at block level to provide actual and timely marketing information and to link and small-agri processing units with big food companies.
- For sustainability of horticultural production in North East the production system need to be strengthening by increasing productivity and establishment of horticultural producers organisation at the cluster level.
- For developing the horticulture marketing the export market need to be identified and State Governments may establish Horticultural Marketing Board.
- Technological intervention is a must for increasing productivity of horticultural crops.

- It is necessary to bring agriculture, health and nutrition together in a triangular relationship through partnerships.
- To increase the North-East's share in trade and employment generation, the need of the hour is to boost the production of high value crops and link the production with value chain management through processing and value addition.

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The Indian Society of Agricultural Economics

80th Agricultural Economics Conference

November 26-28, 2020, Coimbatore (Tamil Nadu)

The Indian Society of Agricultural Economics (ISAE) is pleased to announce its 80th Annual Conference to be held in Coimbatore (Tamil Nadu) during November 26-28, 2020. This Conference is being organised by Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu). Dr. Vasant P. Gandhi, NABARD Chair Professor, Centre for Management in Agriculture, Indian Institute of Management, Ahmedabad (Gujarat) is the Conference President. Dr.K. R. Ashok is the Local Organising Secretary of the Conference.

Conference Theme

- Institutions and Efficient Supply-Chains for Agricultural Development

- Agricultural Labour, Skill Development, Labour Productivity and Employment.

- Agricultural Trade with Special Reference to Plantation Crops and International Trade Agreements.

Dates to Remember

- Last Date for Submission of papers
  June 30, 2020

- Communication from ISAE about Acceptance of Paper
  August 31, 2020

- Last Date of Registration
  September 30, 2020

Pre-Conference Workshop

This year it has been decided to organise a pre-Conference workshop on experimental economics/RCTs for the young researchers to help design and implement randomised evaluations and to promote research transparency.

Conference Duration

As has been the convention every year the Conference will start at 9.30 am on November 26, 2020 and will conclude by 1 pm on November 28, 2020. Delegates and members who desire to attend the pre-Conference workshop are advised to reach

Coimbatore two days prior to the Conference and schedule their departure for the evening of November 28, 2020 or the morning of November 29, 2020.

SUBMISSION OF PAPERS

- The Conference is open to research scholars both from India and abroad. The papers may relate to India at the macro level or regional level.
- The papers should be submitted by email on the Society's email id at isaeindia1939@gmail.com
- Length of the paper should not exceed not exceeding 3500 words or 10 pages and should adhere to the current writing style of The Indian Journal of Agricultural Economics (IJAE). For further details, please visit http://www.isaeindia.org
- All papers should include a summary not exceeding 250 words. As usual the summaries of all accepted papers will be included along with the Full Length Papers in the Conference Number of our Journal.
- Authors must ensure that their submissions are original. Please note that all papers will be screened for plagiarism and accordingly accepted or rejected. Further, authors are solely responsible for violation with respect to plagiarism. A final undertaking will be sent to all papers accepted for full length.
- **Best Paper Awards and Fellowship:** Every year Indian Society of Agricultural Economics (ISAE) gives best paper awards – Dr. N.A. Mujumdar Prize Award to young scholars below 40 years for the best paper on each of the Conference theme and ISAE fellowship to a senior Indian scholar who has made outstanding contribution in the field of agriculture and rural development.

Presentation by Ph.D. Scholars

In view of the overwhelming response received last year, it is proposed to continue to organise a special session containing paper presentations by Ph.D scholars from different Universities of India.

The award to the maximum best 10 presentations would consist of a memento and a certificate.

It is mandatory for Ph.D. Scholars who present their papers to be a member of the Society. The student's concessional membership fee is Rs. 800/-

In this context, we invite paper presentation from Ph. D Scholars in the form of Abstract as well as ppt presentation on the basis of their Ph.D Research or any relevant topic pertaining to Agricultural Economics at the 80th Annual Conference of ISAE at Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University, Coimbatore (Tamil Nadu) during November 26-28, 2020.

Entries for the presentation along with the membership fee in the form of Abstract along with their ppt should be sent before September 30, 2020:

Hon. Secretary and Treasurer Indian Society of Agricultural Economics, C-104, First Floor, Sadguru Complex I, Near Vageshwari, Gen. A.K. Vaidya Marg, Goregaon (East), Mumbai-400 063. Tel.: 022 28493723.
Email: isaeindia1939@gmail.com

Panel Proposals

During the conference, it is planned to organise a panel session including a pre conference event. Proposals for panels are invited from scholars and institutions.

Each panel proposal should contain the following:

- Title of the panel and a description of the panel's theme
- Titles, authors and abstracts (within 500 words) of the papers to be presented
- Names, affiliations and short biographies (100-150 words) of the proposed presenters and discussants/commentators
- Name and contact information of the panel organiser

Note: A panel session will comprise of 4 – 5 paper presentations. The organisers / coordinators of each Panel Session are expected to be in charge of the Panel Discussion, including raising resources for speakers' travel and other expenditure. The proposals may be emailed to isaeindia1939@gmail.com by 20 August 2020.

Travel Arrangements

The Indian Society of Agricultural Economics does not have any regular source of funding. As such, it is expected that the the Conference Presidents, the Keynote paper-writers, Rapporteurs , paper presenters, resource persons and other participants will fund their travel costs through their own institutions or other sources.

SOCIETY'S MEMBERSHIP

The rates for Membership is as follows:

Life Membership Fees	Rs. 10000
Annual Membership Fees	Rs. 1000
Student Membership Fees	Rs. 800

MODE OF PAYMENT

The Society's fee may be paid by way of NEFT/RTGS transfer/Demand draft (DD) or local cheques.

Details for NEFT/RTGS transfers:

Account Name	: The Indian Society of Agricultural Economics
Account Number	: 54025434745
Bank Name	: State Bank of India
Branch	: Dalal Street, Mumbai

IFSC Code : SBIN0040433
MICR Code : 400002467

Kindly inform us when the amount is remitted to our account.

Details of payment through demand draft or cheques

Demand draft/cheque may be sent in favour of "Indian Society of Agricultural Economics" payable at Mumbai at the following address:

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C-104, First Floor, Sadguru Complex -1,
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Goregaon (E), Mumbai - 400 063.
Tel.: 022-28493723
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SUGGESTIVE OUTLINES ON CONFERENCE THEME FOR PROSPECTIVE CONTRIBUTORS

The 80th Annual Conference of the Indian Society of Agricultural Economics will be held under the auspices of Centre for Agricultural and Rural Development Studies (CARDS), Tamil Nadu Agricultural University, Coimbatore-641 003 (Tamil Nadu) from November 26-28, 2020.

The following subjects are selected for discussion:

1. Institutions and Efficient Supply-Chains for Agricultural Development
2. Agricultural Labour, Skill Development, Labour Productivity and Employment.
3. Agricultural Trade with Special Reference to Plantation Crops and International Trade Agreements.

Research Papers on the above themes are invited from members and other paper-writers for discussion at the Conference. The scope of each of the three themes is spelt out in the enclosed Indicative Outlines below. The Indicative Outlines are also available on the Society's website www.isaeindia.org.

The soft copy of the paper (not exceeding 3500 words or 10 pages), with its Summary not exceeding 250 words need to be submitted. The last date for the receipt of the papers at the Society's office is June 30, 2020.

SUBJECT I

INSTITUTIONS AND EFFICIENT SUPPLY - CHAINS FOR AGRICULTURAL DEVELOPMENT

Agriculture in India is dominated by small and marginal farmers, many of whom are poor. They often depend on multiple sources of income (farming, rearing of livestock, wage and salary from casual work) for their livelihoods. On account of their small land holdings, divided attention and other factors, their farming increasingly shows specialisation in certain crops (farm level specialisation). Different regions, depending on the resource characteristics and market signals among others, also show specialisation in production of certain crops. As a result today, there are increasing number of different cereals, oilseed and pulse growing regions in the country. On account of such crop-specific specialization, certain post-harvest infrastructure is required in the region. However, Government is often preoccupied with food management for the population in the country, has hardly enough resources to create suitable (need-based) infrastructure in the region. Therefore, the role of non-government organisations as that of collectives, co-operatives and corporate, that can improve supply of desired commodity from field to fork, becomes important. However rules and incentives referred to as institutions are important for organisations to remain in business.

Accessibility of farmers to factor and product markets is also often constrained due to tiny holdings and other associated factors. Access to common property resources are often denied owning to the dearth of suitable institutions. Many of these restrict growth of farm productivity and profitability; whereas the national priority of increasing farmer's income prevails. In this situation, it will be good for farmers to become a part of certain kind of collectives (self-help group, associations, interest group, producers' organisation). The collective besides other advantages, improves scale economy of farmers and helps in the formation of suitable rules for use of common resources.

There is enough evidence of the role of collectives of different kinds in the organisation of production. They help increase the productivity and profitability of farmers through more efficient utilisation of water in water market. Productivity of land has increased with the changes in land tenure system. The land kept fallow has been used with the collectives of women (*Kudumbashree)*. The instances of custom hiring of machines for farmers are also reported. However, examples of such collectives are limited, considering the size of the country. The replication of successful collectives requires detailed discussion on the context of collectives and factors responsible for differential growth of collectives in the country.

Producers' group, farmers' club, federation of self-help groups are one set of examples of a collective. Whereas farmer's owned business, joint ventures and management contracts to benefit farmers from agri-business opportunities are another set of examples. The collectives of different type often form larger assemblies to benefit from economies of scale. They often become part of big (global, distant market) supply chains to market commodity at distant places. Such outward looking development is a prerequisite for high rate of growth in agriculture. An institution like future market helps farmers in their orientation towards the market; but their participation in the future market requires them to form assemblies. Futures market thus, provides impetus to farmers to form associations.

Government facilities like creation of warehouse and provision of warehouse receipts; encouragement to "contract farming" and "direct purchase" by retail chains and similar other buyers; changes in APMC and similar Acts for representation of producer companies in APMC and similar markets, may improve supply chain of commodities. The collectives are often supported by the government, the self help group - bank linkage programme being an example. Government facilities as that of Agri-clinics, Kisan call centres and exchange of information with them have the potential to solve production and market related problems and improve supply chain for farmers. Such improvement in the supply chain, if any, needs to be analysed and discussed.

Advantages to farmers on becoming a part of such a bigger groups and chain are immense. A sustainable supply chain enforces certain standards (phyto-sanitary and others), technologies (cost reducing and natural resource conserving) and similar requirements for its members. The requirement for many of these standards start with the stage of sowing, quality of inputs used thereby making one believe that the quality of produce is ensured by the concerned collectives / co-operatives and corporate in the supply chain of the commodity.

The increased digitalisation has many advantages. The networking of stakeholders has become easier and this helps farmers in reduction of their cost of production and marketing in the supply chain of a commodity. Digitalisation with advances in space technologies has empowered organizations to undertake many difficult jobs such as risk assessment, quality testing, weather forecast etc. The increased digitalisation must have encouraged start-ups that help farmers in improving the supply chain of the commodity.

Our development experience suggests that the vicious cycle of small producers associated with low return (because of high cost of production and marketing) has been broken at many places with the help of different kinds of institutional arrangements mentioned above. Besides, farmer's household incomes can increase significantly if they reorganise their production and marketing structure as per the requirement of an institution. Numerous studies confirm direct correlation between the rate of growth in income on the one hand and reduction of poverty on the other.

In the above discussion institutions are set of formal and informal "rules" and organisations are "actors"; they together establish the basis for production, exchange and distribution. The present conference assesses the role of different kinds of collectives, associations, cooperatives and corporate (other than government and regulated markets) in developing an efficient supply chains of agricultural commodities. This implies that organisations' engagement with farmers is dictated by a set of formal and informal rules. The supply chain referred to here is from the supplier's perspective with a focus on production, logistics and coordination of moving products efficiently from farm to fork. The role of institutions for efficient resource management and supply chain for agriculture development in India has not been discussed adequately in the recent years. Therefore the 80^{th}Conferenceof Indian Society of Agricultural Economics (ISAE) invites members to contribute papers on the following areas of research:

1) The role of institutions in management of common pool and natural resources that relates to utilization and control of the resources, reflects real scarcity of the resources, and a more equitable distribution in use of the resources.
2) Role of institutions in agriculture input market that reduces market imperfections and market failure.
3) Studies that highlight the role of institutions in supply of credit and other services to agriculture and rural sector, in order to make this service more viable and attractive.

4) Studies that illustrates the role of institutions for research and extension that will encourage strong innovative efforts, to address the real needs and constraints of farmers.
5) Studies that highlight the role of institutions and networks in production, processing and output marketing that will lead to reduction in the transactions cost and increased returns to the farmers.
6) Studies that explain the role of institution in development, that are more effective in serving various development needs of farmers.
7) Studies that illustrate the role of institutions with new generation start ups in innovations in the supply chain.
8) Studies that presents the role of institutions in providing different kinds of benefits (training, investment) to farmers so that they have started earning significantly from non-farm sources.

The above points are illustrative, and members may also send papers in closely related areas which can be included under the theme of Institutions and Efficient Supply Chains for Agricultural Development.

SUBJECT II

AGRICULTURAL LABOUR, SKILL DEVELOPMENT, LABOUR PRODUCTIVITY AND EMPLOYMENT

(a) Agriculture Labour:

Agricultural sector not only plays an important role in improving the growth of rural economy but also the overall growth of the economy in India. This sector promotes economic change and development in India through its causal links with factor and product markets. Among the ten major sectors of Indian economy, the contribution of agriculture is the highest, both in employment as well as in value added output. It employs about half of the work force, but contributes to only about 15 per cent of the Gross Domestic Product (GDP). In the economically weaker states, however, its contribution to state domestic product and to employment is much higher. Relatively low productivity in agriculture led to a concentration of the poor in this sector. Agricultural productivity improvement contributes to growth and provides, thereby, a route for poverty reduction. Therefore there is requirement for specific set of skills in the field of agriculture. It is also possible to reduce poverty as well as expand domestic market for industry by raising labour productivity in agriculture and spreading its gains among the low-income groups (Radhakrishana, 2019). Therefore, growth and development of agriculture is significant for transformation of Indian economy and for inclusive development (Chand, 2019).

Traditionally, agriculture is the prime sector of rural economy and rural employment. Agricultural labour constitutes, numerically, the most important single element among the gainfully employed population in India, as it is the principal source of livelihood for around 55.3 per cent of the households in India as per the 68th round of NSSO (2014) data. As per the Census 2011 data, 54.6 per cent of total workers in India were part of the agriculture sector with a decline of 3.6 per cent point as compared to Census 2001 (GOI, 2018). Out of total agricultural workers, 54.9 per cent were agricultural labours and rest were cultivators (45.1%). Last decade (2001–2011) has seen a steep decline in the number of cultivators (by 8.5 million) and high increase in the number of agricultural labourers (by 37.5 million), after the decade of 1961-1971. This is disturbing development for agriculture country like India. For the first time since independence, agricultural labourers (144.3 million) have outnumbered the cultivators (118.8 million). Compared to 2001 census data, there has been increase of 44.33 per cent in the male population of agricultural labourers, while for females the number has increased by 24.56 per cent. There are many reasons for this development such as falling size of land holdings over time, farming becoming uneconomical increasing agricultural wages, rampant selling of agricultural land and shift of employment from the agricultural to non-agricultural sector. There is a marginal increase in the number of household industry workers but high increase in the number of other workers. Therefore, cost-reducing and labour-absorbing technical progress is essential for developing country like India. If rural non-farm sector and urban industrial sector grow at sufficiently higher rates, they can absorb the surplus labour and surplus food (Radhakrishna, 2019).

The pattern of livelihoods of rural people has changed as a result of the changes in occupational pattern of rural workers. Agriculture is no longer the major source of income of almost half of the rural households. Employment in agriculture has declined not only in relative terms, but also in absolute terms in recent years. But overall demand has increased due to relatively faster growth of employment in non-agricultural activities. More and more households have joined the ranks of labour households due to reduction in the size of their landholdings which now employ them only for a minor part of the year. The share of workers in the category of wage and salary earners has increased vis-a-vis that of the self-employed. There are evidences of labour market tightening, but surplus labour continues to be a widespread phenomenon. Yet, wages, not only nominal, but also real, have shown notable increase. Studies from different parts of the country reveal that agriculture labour markets are no longer characterized by coercive and exploitative relationship between employer cultivators and the labour; or, at least, that these relationships are not shaped by non-economic factors. Phenomenon of ‘unfree’ labour is becoming increasingly rare, and even when contracts are for longer periods, the terms are mutually agreed and not dictated by the employer cultivators (Papola, 2014). What are the factors responsible for these changes?

Labour availability is one of the important factors influencing farmers’ decisions to adopt new agricultural technologies. Often peak season labour scarcity (at the time of sowing, harvesting and weeding operations) causes operative constraints in crop cultivation (Mehta, 2019). Uncertainty in labour availability can also often explain the adoption of new labour saving crop technologies (Feder *et al*., 1985). In addition, the adoption of labour saving technological innovations is justified on efficiency grounds, as hired labour accounts for the lions' share in cost of cultivation (Binswanger, 1982). During the last decade, the agriculture sector in India has experienced a sharp drop in the availability of labour (*www.icrisat.org*). Government programme like the Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) has seen to have added to the tightening of the labour market in rural areas, in general, and in agriculture, in particular; and, contributed to 'secularization' of the labour market relations with increase in the bargaining power of labour (Papola, 2014). Most of the farmers as well as industrial associations have long been complaining about a shortage of farm labour because of the MGNREGA for a long time, but the figures present a completely different picture. The drop is in large part due to increased opportunities in the non-farm rural sector with the service and manufacturing sectors wooing the shrinking labour force with higher wages and more regular incomes.

On the labour supply front, the following developments need to be noted. First, the rate of population growth has declined resulting into a decline in the growth rate of persons in working age. Second, labour force participation rates have shown a secularly declining trend over the past four decades, especially in the case of women, as a result of, among other things, increasing enrolment in educational stream at different levels. Third, an increasingly larger number of persons from cultivating households are joining the ranks of wage labour; in fact the number of labour households has been continuously increasing. Fourth, partly as a part of this process but also as a general trend, share of wage workers, especially of the casual category has significantly increased. Fifth, rural to urban migration has increased. The number of persons commuting to urban areas for work has also steadily increased. And rural to rural migration from labour surplus to labour deficit regions/states to work in agriculture has emerged as an important form of migration. Sixth, labour supply to agriculture has been constrained on account of increase in employment opportunities in other activities and lately, it is contended, in MGNREGA works. And, seventh, an increasingly larger proportion of rural labour is getting educated and would be looking for jobs of different kinds, out of agriculture and in urban area. Thus, both kind of developments, some augmenting and others constraining labour supply seem to be in operation. The total number, of course, has seen an absolute increase: Rural labour force has increased from 200 million in 1972-73 to 294 million in 1993-94 and to 341 million in 2009-10 (Papola, 2014).

Demand side trends are also mixed. First, in agriculture, overall, there has been a decline in demand for labour, on account of mechanization, and a decline in the size of holdings with increase in small and marginal holdings operated mostly on self-employed basis. Second, diversification within agriculture from food to commercial crops has led to change in the nature and quality, though not necessarily in the quantity, of labour demand. Third, with emergence of agriculture as a year–round activity in many parts of the country, there has been an increase in demand for labour, even if not workers. Fourth, new form of farming, contract and corporate, have also led to a change in demand for labour, at least of the qualitative, if not quantitative, kind. Fifth, there has been an increase in the demand for labour, often of the skilled variety, in off-farm activities due to commercialization of agriculture. Sixth, and most important, the faster expansion of the non-farm activity has led both to an increase and a change in the nature of demand for labour. Seventh, MGNREGA has, in recent years, raised demand for labour, often in competition with agriculture (Papola, 2014). Though MGNREGA is causing serious labour shortages in agriculture as is often claimed, but it has made significant positive impact on wages in rural areas by 'setting higher benchmark for setting wages' by guaranteeing the statutory minimum wages to those employed in the works under the guarantee (Chand and Srivastava, 2014).

There is no doubt that the emergence of the non-farm sector as an important source of employment and livelihoods which has played an important role in raising wages, by creating new demand for labour and in the process reducing labour supply to agriculture. It is also true that higher agricultural productivity provides basis for higher wages. Yet, in spite of rising labour demand in the non-farm sector and emerging constraints in labour supply, there still prevails a significant magnitude of labour surplus in rural areas, as in indicated by relatively high person-day rates of unemployment. Another important dimension of labour supply in rural areas, especially to agriculture, is the changing educational composition of the rural labour force. It is generally observed that more educated workers are less interested in working in agriculture; and, therefore, their increasing proportion is also likely to constrain supply of labour for agricultural operations. What has been the impact of the above changes in demand and supply of labour in rural India? How far have the labour market trends influenced the levels and trends in wages in agriculture and other activities? What has been the role of institutional factors such as minimum wages, public works and trade unionism? Need detailed analysis on these issues.

(b) Employment:

Employment in agriculture and allied activities has declined not only in relative terms but also in absolute terms. Out of the 472.5 million workers (rural plus urban) in 2011-12, 224.4 million (47.5 per cent) were employed in agriculture and allied sectors. Whereas in 2004-05, 257.7 million workers were employed in agriculture and allied activities and their proportion in total workers was 56.3 per cent. Of the net fall of 33.3 million workers between 2004-05 and 2011-12, about 19.2 million net fall of workers was from self-employed workers in agriculture and allied activities, and about 13.5 million net falls from casual agricultural workers. This has contributed to a moderate increase in the share of self-employed workers in the total agricultural work force.

Rural female workforce in agriculture has also declined by about 27.2 million (17.5 million self-employed and 9.7 million casual workers) between 2004-05 and 2011-12. Withdrawal of female from labour force was highest amongst agricultural labour households followed by cultivators and non-farm households both in percent and absolute terms, while in case of male, withdrawal from workforce found only among the agricultural labour households (Chand *et al.*, 2017). It is claimed that women withdrew from agriculture and were attending to domestic duties in their own households due to an improvement in the availability of income-earning opportunities for male members of the family and perhaps to avoid heavy manual work in agriculture. There is a degree of segmentation of agricultural labour market with female workers mostly engaged in repetitive and strenuous agricultural operations. Even with the progressive withdrawal of female workers, there has been feminisation of agriculture due to the shift of male labour from farm work to non-farm work. While Chand *et al.,* 2017 argues that rural workforce witnessed de-feminisation. One of the reasons for fall in female LFPR is reported to be their increased enrolment in education (Rangarajan *et al.,* 2011). Need to have more insights of same and the reasons for the withdrawal of female from labour force (‘not-in-labour force’).

NABARD (2018) survey of NAFIS 2016-17 findings reflect that for all households combined, the average monthly income stood at Rs. 8059/-, with that being higher for agricultural households (Rs. 8931) as compared to non-agricultural ones (Rs. 7269). The figures presented above highlight that wage labour was the most remunerative source of income for all households contributing a major proportion of roughly half of the total household income, the contribution being higher among non-agricultural households as compared to the agricultural ones. For the agricultural households, cultivation remained as the most prominent source contributing roughly 35% of the overall monthly income, followed by wage labour (34%) and Government/ private services (16%). Among the non-agricultural ones, it was the Government/ private service which contributed maximum (32%) to the total household income after wage labour which made up for roughly 54% of the total income.

Availability of employment opportunities outside agriculture also increases demand for labour within agriculture as a result of its becoming a year round activity and diversification into labour intensive crops are likely to have improved the bargaining position of labour to secure more favourable terms not only in terms of wages, but also of regularity of work and greater transparency, clarity and formality of labour contracts. It is also expected that interlinking of markets-land, credit and labour-leading to unfavourable terms in labour contract has weakened as these markets have evolved independently of each other and labour does not need to enter into interlinked contracts leading to unfavourable conditions in the contract for work. And, above all, the economic and labour market changes as well as social change in rural areas could have contributed to a decline in, if not disappearance, of the coercive conditions based on non-economic reasons resulting into one or the other kind of 'bondage' or 'un-freedom'. It is estimated that percentage of agricultural workers of total work force would drop to 25.7 per cent by 2050 from 58.2 per cent in 2001 (Government of India, *Economy Survey*, 2018a). With the decreasing labour force in agriculture, increasing yield or productivity is the key to growth, which has to be accelerated. Shortage of labour and finding solutions thereof should become a major focus.

With economic growth and structural transformation, it is expected that the employment in the economy will shift from agriculture to industry and services. But, agriculture continues to be a dominant activity in rural India with 59.4 per cent of male workers and 74.9 per cent of female workers engaged in it in 2011. However labour is highly differentiated in terms of its own attributes. Agriculture provides employment to not only the adult males of a household but also to women on the households (http://ficci.in). Women work extensively in production of major grains and millets, in land preparation, seed selection and seedling production, sowing, applying manure, weeding, transplanting, threshing, winnowing and harvesting. With the economic progress and development of non-farm activities, there is a decreasing trend in the proportion of both male and female workers in agriculture; however proportion of female workers has always remained higher than the male workers. This may be due to increasing outmigration of males from rural areas to urban areas in search of better paying jobs. As women labours are mostly unskilled and lack mobility, they tend to stay in the village, doing households chores and engage themselves in agricultural activities to support their families. Average daily wages for casual female workers have generally been around two-thirds of the male wages. Large variations across states have been an important feature of rural wage situation in India. Have different features and trends in the male and female labour market as noted earlier had any effect on gender difference in wages?

On other hand it has been reported that agricultural labourers have to face the problems of unemployment and underemployment. For a substantial part of the year, they have to remain unemployed because there is no work on the farms and alternative sources of employment do not exist. Agricultural wages and family incomes of agricultural workers are very low in India. In recent years, MGNREGA has also been considered responsible for causing labour shortage in agriculture, as due to the guarantee of employment at statutory minimum wages, which, most often happens to be higher than wage rates in agricultural operations, workers are attracted to MGNREGA works away from work in agriculture. The extent to which work under the Guarantee leads to a shortage of labour in agriculture would, of course, depend on the magnitude of employment under it vis-a-vis the overall supply of labour in rural areas. Livelihoods of labourers and also poor peasants remain precarious. Despite opening up of employment opportunities in non-farm activities, prospects of securing reasonably remunerative stable jobs are bleak. Agriculture is no longer a remunerative vocation for many of them still involved in it and manufacturing has not grown fast enough to generate enough jobs.During the period from December 2014 to December 2018, the average real wages of agriculture and rural workers grew at a rate of 0.5 per cent point per year compared to a rise of 6.7 per cent per year during the previous five years (2009-2013) (Damodaran, 2019; Nagraj, 2020). Under MGNREGA in rural areas, average days of employment provided per household during 2018-19 was 50.88 days with average wage rate per day per person of Rs. 179.13 while corresponding figure for the 2019-20 was 41.06 days with Rs. 181.52 per day respectively. The latest NRCB (2018) data which comes under Ministry of Home Affairs (MHA), revealed that a total of 12,936 unemployed persons committed suicide in 2018, which accounted for 9.6 per cent of the total suicides i.e., 1,34,516 suicides and were aged below 18 years to above 60 years, while corresponding figure for farmers suicides was 10349 (7.7%).

Labour Productivity:

Labour productivity is one of the various dimensions of productivity. Increase in labour productivity is important but not necessarily with a decrease of employment in agriculture especially in a labour surplus rural economy such as that of India. The disparity between a farm and non-farm worker in India remains high in the country. Studies report that this wide variation in worker productivity arises due to composition in rural output, overdependence on agriculture sector and nature of the work performed by different categories of workers. In year 2011-12 per worker income varied from Rs. 33,937 for agricultural labour to Rs.1, 71,836 for rural non-farm workers. In the same year a cultivator earned 2.27 times the income earned by a labourer from agriculture (Chand *et al.,* 2017). At the same time, per capita income of non-farm workers was more than twice the income of cultivators. These results show that among rural workers, agricultural labours are at the bottom in terms of worker productivity. Rural non-farm sector offers 2.76 times productive employment than the farm sector. The disparity in worker productivity between different categories of rural workers remained consistently high during the past four decades. Nevertheless after 2004-05, disparity among different categories of workers (except between non-farm workers of rural and urban areas) witnessed declining trend. With such low productivity of agricultural workers, the monthly per capita income pushes major part of workforce below poverty line. With link to low productivity in the agriculture sector is the availability of number of diploma and graduate in agriculture and related field, who obtain degree from State Agricultural University or other recognised institute. The agricultural graduate and diploma holder consider as skilled personnel often difficult to find suitable employment, and at the same time the agriculture sector paralysed due to poor extension services. During the last two decades the nature of agriculture has been changing rapidly and farmers requires support in the form of input availability, marketing, organisational, financial, technological and entrepreneurial front. The long-term convergence of productivity between agriculture and non-agricultural workers depends on improving land productivity and promoting mobility of labour from agriculture to non-agriculture for decent employment. Such a transition can be facilitated by labour intensive economic growth including promotion of producer companies and equipping the farm youth with skills in demand. Such a transition would be the right path to eliminate rural poverty and address the widening inequalities.

The wide variation in worker productivity arises due to composition of rural output, overdependence on agriculture sector and nature of the work performed by different categories of workers. It is to be noted that disparity between non-farm workers and agricultural labours reduced by 2.86 percentage points as compared to 1.07 percentage points reduction in disparity between non-farm workers and cultivators between 2004-05 and 2011-12. The reason for a steeper reduction in disparity between non-farm workers and agricultural labours was a higher rate of withdrawal of agricultural labours as compared to cultivators from the agricultural workforce (Chand *et al.*, 2017). Another reason was a significant increase in the wages rates and therefore wage earnings of the agricultural labours during this period (Chand and Srivastava 2014). One of the measures to accelerate non-farm employment and reduce dependency on agriculture is to impart skills and technical know-how to the largely unskilled agricultural labours in the rural areas.

Skilled Development:

Engagement of labour force in gainful employment is a critical determinant of development as it helps generate desirable resources and capitalise on available opportunities. The importance of formal training for improving the work output and productivity of individuals can hardly be over-emphasised. Agriculture needs to be made more profitable, attractive and enterprising so that not only the rural to urban migration is reduced but also farmers start taking pride in their profession. For this to happen, there is a need to develop skills among our farmers in various aspects of farming so that the traditional, time and cost consuming methods are replaced by scientific, modern, economic and efficient methods. Rural youth once skilled in farming and related enterprises can choose self employment in their own villages with Government help instead of migrating to unknown cities leaving their families behind. In agriculture, cognitive skills are required to make better decisions, technical skills required for handling various implements and interpersonal skills required for exchange of farm related information. Government has been implementing various Skill Development Initiatives to provide training to people to develop skilled manpower in various sectors including agriculture, food processing, apiculture, animal husbandry, farm machinery, etc. NAFIS 2016-17 survey of NABARD (2018) findings reflect that merely 11% of the members reported to have received any training for the reported usual activity that to hardly about 9% members in agricultural households. Agricultural households reflect a greater need for skill building when compared to their non-agricultural counterparts.

Skill development is the priority of the hour to revive Indian agriculture from agrarian distress. As the government focus is on Doubling Farmers Income, the skill development of farmers and rural youth is of paramount importance particularly in the field of seed production, marketing, cold chain, fisheries, livestock production etc. Agriculture sector need trained labour force in many areas like production procedures and practices, post-harvest management, value addition and food processing as well as farm machinery. Effective utilization of farm machinery requires more than transfer of information. There are acute shortage of skilled manpower to operate tractors, power tillers, combine harvesters and self-propelled like paddy translators, power weeders, reaper binders and for its repair, maintenance and periodical services thereof. In India, about 8 lakhs of tractors, 0.52 lakh of power tillers and about 5 thousand combined harvesters are sold in the market. Till now, 1.6 lakh trainees have been trained at FMTTIs under the various skill development programmes. Skill training helps individual farmers to reduce the cost of repair and operation. It also creates equipment demand for the industry by making farmers more receptive and by enabling farmers to derive full economic benefits from their equipment. For the nation, training can reduce wasteful use of fuels, and help energy conservation. There is a need to estimate the gap of skill manpower in the agriculture sector for farm mechanisation to cover falling job rolls.

Skill development is also an important driver to address poverty reduction by improving employability, productivity and helping sustainable enterprise development and inclusive growth. It facilitates a cycle of high productivity, increased employment opportunities, income growth and development[1].Agriculture Skill Council of India (ASCI) works towards capacity building by bridging gaps and upgrading skills of farmers, wage workers, self-employed & extension workers engaged in organised / unorganised segments of Agriculture & Allied Sectors. GOI has implemented Agri-Clinic & Agribusiness Centre scheme (AC & ABC Scheme) in the country since 2002 with an objective to create gainful self-employment opportunities to unemployed agricultural graduates, agricultural diploma holders, intermediate in agriculture and biological science graduates with PG in agri-related courses. It is reported that agri-venture have been established in 31 states under 32 different categories related to agriculture and allied sectors. On an average for the India as whole, out of total candidate trained, 40.98 per cent of candidates started their ventures. ACABC scheme also contributes a lot in providing agriculture extension services to the farmers of the country.

With this background, the indicative topics are suggested as follows:

- What are the reasons for high increase in number of agriculture labour and decline in number of cultivators?Assess the fast pace of casualisation of workforce in agriculture in India.
- What is the pattern of growth of cultivators and agricultural labourers for the states and its impact on agricultural growth?
- What are the factors responsible for migration of farmers from agriculture sector?
- Changes in agricultural workforce growth in labour productivity and factors responsible for lower productivity of agricultural workers? Is there convergence in the productivities of agricultural and non-agricultural workers?
- Whether there is scarcity of labour in agriculture sector and if yes, what is its impact on cost of cultivation of crops?
- Rural areas are witnessing varied experiences in terms of feminization of agriculture. Micro level studies are required to analyse the dynamics of woman employment in agriculture and its implications.
- Assess the effect of agricultural development and technological change on gender inequality in agri labour market/ Gender disparity in agri labour market/ Labour market imperfections and wage differentials
- Incidences of indebtedness among rural agricultural labour households; measures to improve the economic and social conditions of agricultural labour and its impact
- Education and skill development play an important role in absorption capacity of farm workers. Research on mapping of skill requirement at sub-national level, evaluation of on-

[1]https://niti.gov.in/sites/default/files/2019-01/Skill_Workforce.pdf

going skill improvement schemes, etc is required. The studies may also focus on how agriculture and agribusiness education along with creating rural entrepreneurship can enhance rural livelihood opportunities. Need to map the Institutional arrangements in the area of education and training for agriculture and understand how women in agriculture could harness more from the present structure, enhance their skill and therefore prove to be more productive in their work.

- Availability of skilled manpower for different job roles under farm machinery sector andestimate the requirements and gap of skilled man power for different job roles under farm machinery sector; strategies and programmes that may be required for filling up gap of skilled manpower in view of rapid mechanisation of agriculture in up coming periods.
- Status of implementation of Agri-Clinic & Agribusiness Centre scheme across the States of India; status of establishment of ventures/activities by agripreneurs and factors responsible for same; various benefits of extension services provided by agripreneurs though the Agri-Clinic & Agribusiness Centre to farmers andconstraints faced by agripreneurs in setting up of ventures/activities.
- Various rural and social development programs, especially MGNREGS, have contributed in reducing distress, creating infrastructure and accelerating the rural livelihoods. The evidences may be provided how these programmes have direct or indirect role in increasing wages & employment. The studies may also focus on how implementation of agricultural and rural development programs could be significantly improved.

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SUBJECT III

AGRICULTURAL TRADE WITH SPECIAL REFERENCE TO PLANTATION CROPS AND INTERNATIONAL TRADE AGREEMENTS

Agricultural trade is assuming increasing importance for the agriculture sector and the economy in the recent years. The economic reforms of 1991, the subsequent Agreement on Agriculture (AoA) of the WTO and the proliferating Regional Trade Agreements (RTAs) have made the country move rapidly in the direction of free trade and opened Indian agriculture into global competition. According to the WTO Regional Trade Agreements Information System, there are 303 RTAs which are in force globally and the number of active RTAs for India is reported as 16. The AoA and RTAs gave hope to developing countries like India that the opening up of the sector would remove discrimination against tradable agriculture and would lead to benefits through increased exports. Due to reduction in tariffs and imposing some discipline on subsidies, it was expected that the developing countries would be benefited due to their comparative advantage in agriculture. However, the outcomes were not as expected and have frequently not been beneficial for developing countries. This could be attributed to higher domestic agricultural subsidies and increased emergence and use of Non-Tariff Measures from the part of importing countries, often to restrict trade.

Plantation crops (coconut, arecanut, oil palm, cashew, tea, coffee and natural rubber and the minor ones like cocoa) assumed prominence in Indian agriculture largely due to their export orientation. With the opening up of Indian agriculture and high level of integration of domestic markets with the world markets, the policies were targeted towards promoting international competitiveness of these products.

India is the leading producer of plantation crops in the world and these crops account for 15 per cent of the area under horticultural crops in the country and about seven percent of the value of output of horticultural crops in India. Plantation crops account for about 3 per cent of the area under cultivation in India.

Plantation crops provide direct and indirect employment to people. Moreover, considering that vast majority of growers are small and marginal farmers, the functioning of the plantation sector can impact the life of 12.5 lakh growers and equal number of labourers. The plantation industry in South India plays an integral role in the economy of three states, Tamil Nadu, Kerala and Karnataka as these three states account for over 70 per cent of the area under plantation crops. The share of South India in estimated value of output of plantation commodities is about 60 per cent.

But, the sector has been facing several challenges during recent years. It has been losing out external markets and the domestic market is facing import competition. According to the annual report of the ministry of Commerce and Industry for 2018-19, the value of export of plantation crops decreased from US$ 1,819.82 million in 2017-18 to US$ 1,664.25 million in 2018-19, while the import increased from US$ 1039.28 million to US$ 1057.26 million. This is mainly due to the increased imports of Natural Rubber which has a share of 82.60 per cent in total plantation imports. The share of plantation crops in total export earnings of India decreased from 13.09 per cent in 1970-71 to less than 5 per cent in recent years.

Plantation sector problems are often highlighted as that of declining profit margins due to rising costs of cultivation, declining productivity and unfavourable price conditions. The gradual conversion of plantations to tourism and other alternate options are being reported. There are instances where the owners voice for relaxations on restrictions on land tenures, land ceiling and transfer. Low productivity, inadequate processing and market infrastructure, and low level of value addition and produce quality are some of the constraints that limit international trade in plantation commodities.

On the export front, India has a relatively poor performance in agricultural exports. There is substantial export potential for a number crops but the farmers are not benefiting sufficiently from this. The difficulties and issues include those of quality which are often related to residues, farm practices and lack of traceability. Other issues include those of poor marketing efficiency created by supply chain inefficiencies, weak logistics and excessive taxes. The export sector also suffers from lack of adequate and up to date market intelligence and poor image abroad.

On the other hand, agricultural imports are also becoming a significant concern. Large imports are affecting farmer prices and incomes substantially in a number of crops, and the potential for farmer income generation is also lost in the process. There appears to be a lack of good and active protection including through tariffs and other restrictions. Part of the reason for imports is poor productivity (technology) and production in a number of important crops, and lack of cost competitiveness.

For getting better prices and realization in exports, there is need to improve export Infrastructure across the value chain for export potential crops. There is need to have green logistics corridors for perishables at ports/airports. There is also a need to review the Essential Commodity Act for products with substantial export potential. There is need to establish a system for better forecasting of demand, supply and prices so as to support strong production for agricultural exports, as well as reducing dependence on imports.

For improving quality, rigorous extension works is required for improving farming practices, and implementing systems such as GAP certification to achieve reliable quality. Centralized online databases of SPS and other import standards are required along with dissemination of this information across stakeholders. Traceability systems need to be established to assure buyers of high quality and discourage bad practices and negligence. There is also a need for strengthening the support and help from Indian Embassies in major export markets.

For a stronger export performance there is great to strengthen market intelligence to identify the opportunities and specific needs in export markets. Product demand needs to be identified and market intelligence is also required to understand customer behaviour and preferences. With this, there is need to undertake and guide production based on the actual international demand. Some super foods produced in India need special promotion abroad. Overall, there is need to project India's products and undertake brand promotion in the international markets.

Special export clusters have proved very useful and there is need to for expansion of the clusters from existing 34 to 170. Integrated facilities in clusters & seaports/airports are required including pack houses, cold storage, sorting/grading facilities. Better linkages with sea ports/airports are required especially for horticulture and floriculture including reefer wagons in all long distance trains. Special efforts are required for the currently important exports including rice, buffalo meat, spices, oil meals, vegetable and fruits.

To keep an eye on imports, good market intelligence is required for all important imported commodities. Promotion of crops where imports are large (oilseeds, pulses) is required and farmers may be given some protection through appropriate tariff instruments and special safeguard mechanisms (SSM). The objectives of sound management of agricultural trade would be better prices, bigger markets and higher incomes for the farmers, increase in employment, better food security, more stable markets & prices, and reduction in farm distress.

Trade liberalisation policies have been operating mainly through prices and it has been argued that free trade creates high volatility in the world prices of agricultural commodities. This volatility would be directly transmitted to domestic prices due to the increased integration with the world markets. This eventually would lead to rise in the volatility of domestic prices, which would have serious implications for price stability and trade competitiveness. Frequent interventions by the government in the domestic markets have helped to check the sharp fluctuations in agricultural prices in the past, which would have been much more volatile had they been left to the market forces.

The vulnerability of the developing countries to fluctuations in international prices, whether as commodity exporters or food importers, has arguably increased as the liberalisation of markets has shifted price risk from governments to households. A high degree of variability in commodity prices and export earnings has serious consequences in the efficiency of resource-use, terms of trade, real incomes and fiscal position of commodity dependent countries and complicate the task of development planning in such economies. Countries prefer price stability even with trade as consistently higher producer surplus and consumer surplus can be realized only when the prices in the international market are reasonably stable.

Greater integration with the world market has also led to sharp decline and high volatility in prices of many crops that in turn inhibited investment, as noted by the Taskforce on Plantation Sector. As a result, the plantation sector which generates massive employment especially for women labour and located largely in ecologically fragile regions, became economically and socially vulnerable. This is reflected, among others, as the incidence of large number of suicides among farmers and agricultural workers.

RTAS are expected to improve economic ties and improve pre-existing trade relations between countries by further integrating into regional production networks and increasing its participation in Global Value Chain (GVC). But, India's GVC participation, especially in plantation crops, have been found to be comparatively low despite the RTAs. The export share of India with FTA partners have not increased much as that of the import share. Due to low MFN tariff levels and India typically facilitating greater imports than exports, tariff preference provided under its FTAs have not benefitted India significantly and also many of the commodities exported from India overlapped or matched with that of other FTA partners. According to the Asian Development bank the utilisation rate of India's FTAs varies between 5 and 25 per cent and the major reasons attributed for the under-utilisation were lack of information on FTAs, low margins of preference, delays and administrative costs associated with Rules of Origin, and non-tariff measures.

Large number of small and marginal farmers, agricultural labourers and value chain operators depend on this sector for their livelihood, mainly in the rural fragile ecosystems. Extreme volatility in commodity prices, affects small and marginal farmers and labourers whose wages are not index linked. These farmers with low propensity to save and poor access to efficient saving instruments cannot cope with the revenue instability resulting from fluctuation in output prices. The volatility in the producer prices has been primarily dissuading farmers from undertaking long term investments in agriculture. The flexibility in the cropping pattern to adjust with market conditions, in the short and medium terms, is also limited in the case of many of the trade dependent cash crops which are perennial, causing apprehensions among the various stakeholders. For instance , the cropping pattern of Kerala is characterized by the cultivation of plantation crops, natural rubber, tea, coffee, cardamom and coconut which, in general are either export oriented or import substituting. Consequent to the removal of Quantitative Restrictions (QRs) on import, plantation crops in general are facing the threat of low quality imports and the circumvention of Rules of Origin by simple accounting manipulation are also not appropriately taken care of. Thus, the states growing plantation crops stand apart in respect of its sensitivity to changes in the national and international trade environment. Many of these commodities are of low elasticity of demand and supply and hence don't respond adequately to changes in prices. Therefore, even small initial changes in prices tend to cause magnified effects.

Reduction or elimination of these distortions can help reduce the unevenness in world production and partially mitigate geographical risk. With the replacement of QRs by tariff and price based mechanisms, there are apprehensions that tariff regime alone would have serious implications for farmers in the developing countries, as a combination of poverty and low risk taking ability makes the farmers vulnerable to any exogenous shocks. To minimize the risks, the Special Products (SP) and Special Safeguard Mechanism (SSM) were the defensive instruments made available to the developing countries in the Doha Round to help them protect the livelihood and food security of their farmers. Even though WTO framework provides possibility of reducing major distortions in agriculture and improving disciplines required for greater predictability and stability, the impasse of the Doha round, especially in matters concerning to Special Products and Special Safeguard Mechanism, have greater implications on containment of import surges and price fluctuations in agricultural markets. Nonetheless, the mere availability of safeguard instruments may not be sufficient for ensuring protection. Developing countries need proper mechanisms and infrastructure to take advantage of these instruments. The policy instruments of exclusion list and negative lists that are agreed in connection with RTAs also were unable to take care of the import threats and the resultant price decline.

The Uruguay Round agreement has initiated a process of deregulation of trade in tropical commodities, especially among the producing countries. The FTAs among the developing countries would deregulate trade further and heighten competition among tropical commodity producers. It will make tropical plantation commodity producers more vulnerable, besides pushing down the share of producers in the value chain. The pressure of adjustment would be severe if the FTA members have competitive economies specialising in same set of products and sectors. The new FTAs among South and South East Asia might further aggravate competition in the upstream of the tropical commodity chains and thus run down value realised in these countries, especially by the farming communities. At the farm household level, the impact of price change depends on whether global and border price trends are passed through to the producer at local level and whether improvements in productivity and production are able to compensate in the context of falling prices.

For ensuring produce quality of agricultural commodities, there are different types of national and international regulations and requirements which is implemented through regulatory mechanisms like certification and labeling. The SPS Agreement aims to ensure the quality aspects while preventing unnecessary effects on international trade and from being misused for protectionist purpose. However, the implementation of SPS have acted against the trade interests in developing economies because of the lack of capacity to develop institutional arrangements that permit them to meet their SPS related commitments, which are also costly to implement.

The plantation labour force, mainly women workers are paid less than the minimum wages (often) and are subject to exploitation at different levels. With poor living conditions and inadequate food, they are vulnerable to communicable diseases and remain malnourished. Exposure to harmful chemicals used in the plantations for pest management lead to health issues among them. The facilities for medical support, quality education and decent life are often denied to these groups of workers as they are marginalised communities (either migrants from neighbouring states or tribes) and their bargaining power is poor. Kerala, a state where the share of plantation crops in cropping pattern is substantial, have seen the agitation of women plantation workers demanding higher wages and demanding fair living conditions. Ensuring social justice and equity to these farm workers, is an integral part of plantation management.

Plantation crops are generally grown in the fragile ecosystems (high ranges) in the major growing areas, which signifies their role in ecosystem management. Thus, even though international trade agreements have an important role to play in guiding agricultural trade, they need to be guided by market analytics and in convergence with the ongoing development activities and livelihood considerations in the plantation agriculture. The role of agriculture is to be viewed in the wider sphere of its social, ecological and economic significance.

In the backdrop of the above discussed concerns, the paper writers can contribute research papers covering the issues raised with specific focus on the following questions/areas:

1. Analysis of trade performance of various crops

including plantation crops in the context of multilateral and regional trade agreements. Whether the globalised policy regime has benefitted the interest of the society and resulted in improvement in /increase in farmer welfare?

2. Implications of FTAs and RTAs on production, consumption, employment and welfare using partialand general equilibrium approacheson individual plantation crops and theplantation economy

3. Implications of trade liberalisation on price volatility, integration and transmission to the domestic market and impact at the farm level in plantation crops.

4. Why does India have a relatively poor performance in agricultural exports? Even though there is substantial export potential in a number of crops, why are farmers not benefiting? What are the issues of quality including residues, farm practices, traceability? What are the difficulties in marketing efficiency including supply chain, logistics and taxes? In what ways can the market intelligence be improved and the poor image of Indian products be overcome.

5. Are large imports affecting farmer prices and incomes? What is the potential for farmer income generation is lost? Is there lack of good protection (tariffs & other restrictions) and how can this be better managed? What are the problems of poor productivity (technology) and low cost competitiveness in export crops and how can this be overcome?

6. What are the problems of export Infrastructure across value chains and how can this be improved? Is there need for green logistics corridors for perishables at ports/airports? How does Essential Commodity Act affect the export potential products? What systems need to be established for forecasting demand, supply, prices?

7. What kind of extension work is required for improving farm practices and need and benefits of systems such as GAP? What kind of centralized online database of SPS and import standards is required and how can it be disseminated across stakeholders? What is the need and experience with traceability systems? What kind of strengthening is required in the Indian Embassy support in major export markets?

8. What kind of market intelligence can help agricultural exporters and farmers? What is the need for understanding product demand, customer behaviour and preferences for exports? How can the production be reoriented for international demand? What is the scope for promotion of super foods and the scope and need for product and brand promotion in international markets?

9. What is the experience of export clusters and is there a need for

expansion of the cluster approach? What kinds of facilities are critical to have in clusters and where, such as integrated facilities in clusters and seaports/airports including pack houses, cold storage, and sorting/grading? What are the linkages required for horticulture/ floriculture products such as reefer wagons in all long distance trains? What is the performance of India's major exports including rice, buffalo meat, spices, oil meals, vegetable an fruits and how can this be improved?

10. What kind of market intelligence is required for imports? Is there scope for promotion of crops where imports are large (oilseeds, pulses)? How can farmers be effectively protected through mechanisms such as appropriate tariff instruments and Special Safeguard Mechanism (SSM)?

11. What is the scope and approach possible so that sound management of agricultural trade can contribute to better prices, bigger markets and higher incomes for the farmers, increase in employment, better food security, more stable markets and prices, and reduction in farm distress?

12. Plantation labour: issues in the context of trade liberalisation and gender issues

13. Trade competitiveness of various crops

14. Non-Tariff measures and various crops including plantation crops – legal and policy dimensions

15. Legal status and restrictions on ownership, management and labour in plantation sector and the political economy

16. Production Management practices in and trade impacts

17. Challenges and approaches towards sustainable management of plantations ensuring ecosystem health and trade off with alternate sectors(tourism/mining etc.)

18. Impacts of climate change on product quality and output from plantation sector

19. Defining plantation crops- legal and commercial dimensions and way forward

20. Ecosystem services from plantations and significance in changing climate scenario

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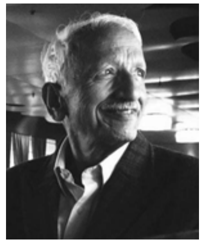

Dr. N.S. Jodha (1937-2020)

The Indian Society of Agricultural Economics deeply mourns the sad demise of Dr. N.S. Jodha on February 18, 2020 at the age of 83. He was an agricultural economist of national and international eminence and made outstanding contribution in the field of natural resource management and environmental economics.

Dr. Jodha did his Masters from Delhi School of Economics and obtained his Ph.D from University of Rajasthan. During his career he worked with CAZRI, Jodhpur, IARI New Delhi and various government institutions before shifting to different CGIAR Centers in India and overseas including ICRISAT Hyderabad and IITA East Africa. He briefly served the Environment Resources Division at the World Bank. He moved from arid and semi-arid tropics to focus on mountain regions as head of Mountain Farming Division at ICIMOD Kathmandu.

Dr. Jodha was Life Member of the Society. He presided over the sixty-eighth Annual Conference of the Society held at Andhra University, Visakhapatnam in 2008. The theme of his presidential Address was “Mountain Agriculture: Development Policies and Perspectives”. His pioneering work covered famine and poverty, common property resources, mountain development and climate change. He has published a number of books. The grief of Dr. Jodha’s loss is shared by his professional colleagues, office bearers of the Society and his large circle of friends.

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