



DOUBLING FARMERS' INCOME

Rationale, Strategy, Prospects and Action Plan

RAMESH CHAND

नीति आयोग

**National Institution for Transforming India
Government of India
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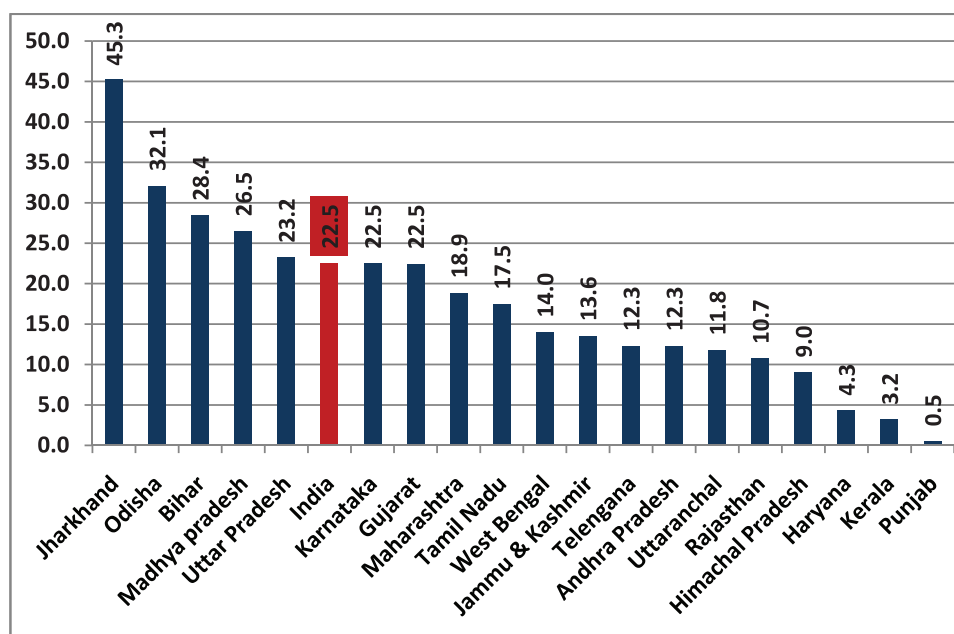
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Why Double Farmers' Income?

Past strategy for development of the agriculture sector in India has focused primarily on raising agricultural output and improving food security. This strategy involved (a) an increase in productivity through better technology and varieties, and increased use of quality seed, fertiliser, irrigation and agro chemicals; (b) incentive structure in the form of remunerative prices for some crops and subsidies on farm inputs; (c) public investments in and for agriculture; and (d) facilitating institutions. The strategy paid dividends as the country was able to address severe food shortage that emerged during mid-1960s. During the last half a Century (1965 to 2015), since the adoption of green revolution, India's food production multiplied 3.7 times while the population multiplied by 2.55 times. The net result has been a 45 per cent increase in per person food production, which has made India not only food self-sufficient at aggregate level, but also a net food exporting country.

The strategy did not explicitly recognise the need to raise farmers' income and did not mention any direct measure to promote farmers' welfare. The experience shows that in some cases, growth in output brings similar increase in farmers' income but in many cases farmers' income did not grow much with increase in output. The net result has been that farmers' income remained low, which is evident from the incidence of poverty among farm households. The NSSO data on Consumption Expenditure Survey for year 2011-12 reveals that more than one fifth of rural households with self-employment in agriculture as their principal occupation¹ were having income less than the poverty line. The proportion of farm households suffering from poverty was quite high in some states (Fig.1.1). The highest incidence was observed in Jharkhand where 45.3 per cent of farm households were under poverty.

Fig.1.1: Farm households with income below poverty line, 2011-12

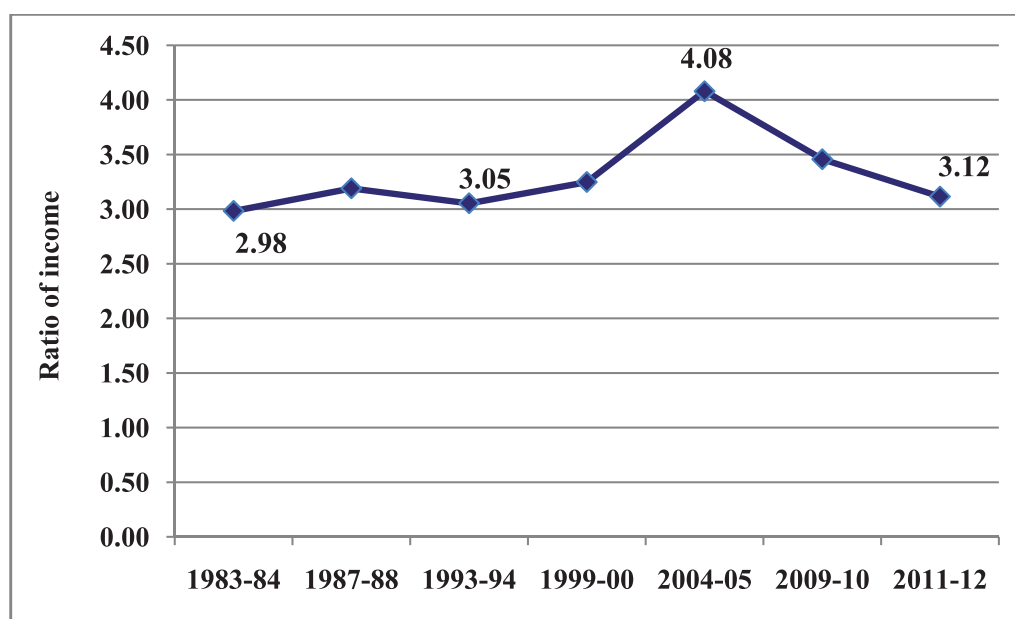


Source: Estimated from unit level Consumption Expenditure Survey data 2011-12, NSSO.

¹ Such households fit into the definition of farmers

Farmers' income also remained low in relation to income of those working in the non-farm sector (Fig. 1.2). During early 1980s, farm income per cultivator was just 34 per cent of income of a non-agriculture worker. This disparity was quite large and required a policy response to raise farmers' income at a faster rate. This could be done in two ways – high increase in sectoral income and/or decline in number of the farmers to share the total income of all the farmers. However, this did not happen and the level of disparity remained unchanged in the following decade. After 1993-94, relative income of farmers worsened and reached one-fourth of income of non-agricultural workers. There was some improvement during 2004-05 to 2011-12, but no change over the 1983-84 level. The past four years (2012-13 to 2015-16) again witnessed deterioration in relative income of farmers.

Fig. 1.2: Ratio of income per non agriculture worker to income per cultivator



Source: Authors estimation using data from CSO and NSSO.

Low level of absolute income as well as large and deteriorating disparity between income of a farmer and non-agricultural worker constitute an important reason for the emergence of agrarian distress in the country during 1990s, which turned quite serious in some years. The country also witnessed a sharp increase in the number of farmers suicides during 1995 to 2004 - losses from farming, shocks in farm income and low farm income are identified as the important factors for this. This period coincided with the sharp slowdown in the growth rate of agricultural output (Chand and Parappurathu 2012). The low and highly fluctuating farm income is causing detrimental effect on the interest in farming and farm investments, and is also forcing more and more cultivators, particularly younger age group, to leave farming. This can cause serious adverse effect on the future of agriculture in the country.

Realising the need to pay special attention to the plight of farmers the Central government changed the name of Ministry of Agriculture to Ministry of Agriculture and Farmers Welfare in 2015. It is apparent that income earned by a farmer from agriculture is crucial to address agrarian distress (Chand 2016) and promote farmers welfare. In this background,

the goal set by the Prime Minister Sh. Narendra Modi to double farmers' income by 2022-23 is central to promote farmers' welfare, reduce agrarian distress and bring parity between income of farmers and those working in non-agricultural professions.

1.1 The concept and timeframe

The goal of doubling farmers' income by the year 2022 has been dubbed as impossible and unrealistic by some experts (Gulati 2016). Some commentators have produced calculations that agriculture will require annual growth of 14.86 per cent per year for five years to get farmers' income doubled and pointed out that this growth level hasn't been achieved even for one year in the history of Indian agriculture. It seems that critics and sceptics focused more on five years and ignored substantive aspects of the matter (Chand 2016b). The substantive points are: one, what is the period and targeted year for doubling the farm income; two, what is to be doubled, is it output, value added or income earned by farmers from agricultural activities; three, whether nominal income is to be doubled or real income is to be doubled; and four, whether the targeted income includes only income derived from agricultural activities or would it also include income of farmers from other sources. Clarity on all these points is important to assess the possibility of doubling the income of the farmers as envisioned by the Prime Minister.

While talking about income of the farmers in a Kissan Rally in Bareilly, Uttar Pradesh, on 28th February, 2016, the Prime Minister stated that it is his dream to see farmers double their income by 2022, when the country completes 75 years of its Independence. It is obvious that he was referring to double the current income of the farmers or income for the agricultural year 2015-16 by agricultural year 2022-23. It is also evident that the PM referred doubling farmers' income by year 2022, which is seven years away from the base year 2015-16. And, if anything is to be doubled by the year 2022-23, it will require an annual growth rate of 10.4 per cent.

Again, it is important to clarify what is sought to be doubled. Is it the income of farmers, or the output or the income of the sector or the value added or GDP of agriculture sector? If technology, input prices, wages and labour use could result in per unit cost savings then farmers' income would rise at a much higher rate than the output. Another very important source of increase in farmers' income is the relative increase in prices of farm products compared to the prices of non-agricultural commodities. Past estimates of farm income show a significant difference between growth in output and growth in farmers' income. During 2004-05 and 2011-12, agricultural output at constant prices increased by 34 per cent while real farm income per farmer increased by 63 per cent (Chand et. al. 2015 p.142). In nominal terms, the output became 2.65 times while farmers' income tripled in the seven years period. Therefore, doubling of farmers' income should not be viewed as same as doubling of farm output.

It is obvious that if inflation in agricultural prices is high, farmers' income in nominal terms will double in a much shorter period. In the last 30 years, farmers' income at nominal prices almost doubled in five years twice, once during 1987-88 to 1992-93 and then during 2004-05 to 2009-10. Inflation in agricultural prices also leads to increase in real farm income if agricultural prices received by farmers increase at a faster rate relative to the prices paid by farmers i.e. when terms of trade for agriculture improves.

In a situation where non-agricultural prices do not rise, or, rise at a very small rate, the growth in farmers' income at real prices tends to be almost the same as in nominal prices. Anyway, the government's intention seems to be to double the income of farmers from farming in real terms.

Past Trend in Farmers' Income

It is ironic that estimates of farmers' income are not published by CSO, though time series and up to date estimates of sectoral income for agriculture are available in National Accounts Statistics. However, NSSO has generated estimates and sources of income of farmers based on its nation-wide surveys titled 'Situation Assessment of Farmers 2003' and 'Situation Assessment of Agricultural Households 2013'. The two surveys adopted different definitions of farmer or farmer households and therefore the estimates of income reported in the two surveys are not comparable.

The absence of adequate information on farmers' income makes it difficult to know adequacy, fluctuations and growth in farmers' income, and makes it impossible to know how various factors affect farmers' income. Some researchers have tried to fill this gap by preparing estimates of farmers' income. A notable study on this is by Chand et al (2015). It provides estimates of total and per cultivator farm income for the period 1983-84 to 2011-12, and identifies sources of growth in farm income. The authors report that increase in productivity, rise in real farm prices, and shift of labour force from agriculture, are the important determinants of growth in farm income. Another important finding of this study has been that agrarian distress, as revealed by farmers' suicides, increased when growth in farm income was low and it went down when farmers' income experienced high growth rate. Thus, the level of farm income was crucial to address agrarian distress. The study observed that the income earned from agriculture was not adequate to keep as many as 53 per cent farm households out of poverty, who operated on less than 0.63 hectare of land holdings.

Two national level surveys of NSSO titled Situation Assessment Survey of Farmers in 2003 (59th Round) and Situation Assessment Survey of Agricultural Households (SAS) in 2013 (70th Round) provide estimates of farmers' income from various sources including agriculture. According to SAS for the year 2012-13, the average annual income of a farm household from farm as well as non-farm sources was Rs. 77,112. Sixty per cent of total income of an agricultural household was derived from farm activities (cultivation and farming of animals) and 40 per cent was derived from non-farm sources (wages, salary, non-farm business etc.). In absolute terms, cultivation generated annual income of Rs. 36,938 and livestock provided Rs. 9,176, per agricultural household. According to this estimate, the share of livestock activity in total farm income of agricultural household was close to 19.89 per cent. This is much lower than the CSO estimates of share of livestock in net value added in agriculture sector for the same year, which was 28.6 per cent. This indicates that farm income reported in SAS differs significantly from CSO measures of farm income, presumably due to the specific definition of farmer used in the SAS 2013².

The most recent estimates of farm income were prepared by Chand et al. (2015) for the period 1983-84 to 2011-12. These estimates updated to year 2015-16 are presented in Table 2.1 at nominal prices as well as in real terms. Here it is important to mention

2 SAS 2013 defines an agricultural household as a household receiving some value of produce more than Rs. 3000 from agricultural activities and having at least one member self-employed in agriculture either in the principal status or in subsidiary status during last 365 days.

that farm income in real terms is not the same as the income at constant prices. These estimates were further extended to year 2015-16 to arrive at income for the recent years. During the past 22 years, between 1993-94 and 2015-16, farmers' income in nominal terms increased 9.18 times. During the same period, CPIAL (consumer price index for agricultural labour), which measures price change in rural India, increased 4.62 times. Taking away the effect of inflation, real farm income just doubled during past 22 years. Meanwhile, the farm income per cultivators shows a slightly higher increase due to the decline in the number of cultivators after 2004-05.

Table 2.1 : Trend in farmers' income in India, 1993-94 to 2015-16

Year	Net value added at market prices (Rs. crore)	Wage bill at market prices (Rs. crore)	CPIAL (2004-05=100)	Total farm income of all farmers' (Rs. crore)		Cultivators (Number in crores)	Farm income per cultivator (Rs.)	
				Market price	Real prices		Current price	Real prices
1993-94	223709	45755	59	177954	303814	14.39	12365	21110
1999-00	426582	90951	90	335631	372923	13.88	24188	26875
2004-05	527289	93130	100	434160	434160	16.61	26146	26146
2011-12	1409932	252804	183	1157128	632514	14.62	79137	43258
2012-13	1558480	245750	220	1312730	596695	14.36	91416	41553
2013-14	1753691	276532	245	1477159	602922	14.10	104763	42760
2014-15	1849931	291708	261	1558223	597020	13.85	112507	43106
2015-16	1940636	306010	273	1634625	598764	13.60	120193	44027

Notes:

1. Wage bills till the year 2011-12 are taken from Chand et al. (2015). For subsequent years wage bills are estimated using the proportion of wage bill to net value added for the year 2012-13.
2. Farmers' income are expressed in real terms using CPIAL (2004-05=100) as deflator.
3. Number of cultivators after the year 2011-12 were projected based on rate of growth between 2004-05 and 2011-12.

The results presented in table 2.1 reveal that farm income increased at different rates in different periods depending upon the growth rate in output, increase in wage bill, and changes in prices received by farmers relative to the changes in consumer price index for agricultural labour (CPIAL). During 1993-94 to 2004-05, which marks the first decade of economic reforms and liberalization in the country, value added in agriculture at 2004-05 prices witnessed 2.52 per cent annual growth. The implicit price index³ for agricultural commodities in this period increased by 5.65 per cent per year while the CPIAL showed an annual increase of 4.91 per cent. Income of all farmers taken together increased by 8.45 per cent per year at nominal prices. When this income was deflated by CPIAL to arrive at real income, the growth rate turned to be 3.30 per cent. This period also witnessed an increase in the number of cultivators from 14.39 crore to 16.61 crore. This resulted in much smaller increase in per farmer income as compared to the income of all the farmers. The growth rate in per farmer income turned out to be less than 2 per cent in this period.

³ Derived by taking ratio of value of agricultural output at current prices to value of agricultural output at constant (2004-05 base) prices.

The subsequent period till 2011-12 witnessed acceleration in total and per farmer income. Total income of all the farmers increased by 5.52 per cent per year during 2004-05 to 2011-12. In a sharp contrast to the first decade of the reforms, the period 2004-05 to 2011-12 witnessed decline in the number of cultivators, which translated into much higher growth in per farmer income as compared to the growth rate in income of all farmers. The rate of growth was 7.46 per cent a year, which is a great step towards achieving goal of doubling farm income. The period 2004-05 to 2011-12 faced a very favourable combination of factors which constitute farm income. Growth rate in output was impressive, number of farmers to share farm income declined and prices received by farmers increased at a much higher rate than the increase in prices paid by rural consumers.

This tempo of growth in farm income got a big setback after 2011-12 (Table 2.2). Output of crop sector witnessed small decline (0.29%) in the year 2012-13 at 2011-12 prices. This was followed by two consecutive below normal monsoons in years 2014-15 and 2015-16. Many parts of the country suffered from drought in these two years. Consequently, the growth rate in value added in agriculture decelerated to 1.6 per cent during 2011-12 to 2015-16. Agricultural prices received by farmers remained depressed despite poor output. The rate of increase in implicit prices of agricultural produce was much lower (6.88%) than inflation in CPIAL (10.52%). Because of these factors, real income of farmers followed a decline during 2011-12 to 2015-16.

Table 2.2: Growth rate in farm income in India, per cent per year

Period	Agriculture value added at constant prices	Farm income of all farmers		Farm income per cultivator		CPIAL base 2004-05	Implicit price index for agriculture
		Market prices	Real terms	Market prices	Real prices		
1993-94 to 2004-05	2.52	8.45	3.30	7.04	1.96	4.91	5.65
2004-05 to 2011-12	4.19	15.03	5.52	17.14	7.46	9.02	9.80
2011-12 to 2015-16	1.60	9.02	-1.36	11.01	0.44	10.52	6.88
1993-94 to 2015-16	2.87	10.61	3.13	10.89	3.40	7.21	7.35

It is pertinent to mention that the latest data on number of cultivators is available only up to the year 2011-12. Therefore, while calculating per cultivator income, it is assumed that farm workers would continue their withdrawal from agriculture at the rate observed during 2004-05 to 2011-12. Interestingly, even with less number of cultivators in agriculture sector, real income per farmer showed insignificant increase during 2011-12 to 2015-16. Presently, per cultivator income has been estimated as Rs 1,20,193 at current market prices.

Sources of Growth in Farmers' Income

Doubling real income of farmers till 2022-23 over the base year of 2015-16, requires annual growth of 10.41 per cent in farmers' income. This implies that the on-going and previously achieved rate of growth in farm income has to be sharply accelerated. Therefore, strong measures will be needed to harness all possible sources of growth in farmers' income within as well as outside agriculture sector. The major sources of growth operating within agriculture sector are:

- (i) improvement in productivity,
- (ii) resource use efficiency or saving in cost of production,
- (iii) increase in cropping intensity,
- (iv) diversification towards high value crops,

The sources outside agriculture include:

- (v) shifting cultivators from farm to non-farm occupations, and
- (vi) improvement in terms of trade for farmers or real prices received by farmers.

The possibilities of doubling farmers' income in real terms from above sources are explored in the following section.

(a) Sources of income growth within agriculture sector

3.1 Increase in agricultural productivity

There are two sources to increase in agricultural output viz. area and productivity. Due to rising demand for land for non-agricultural uses and already high share of arable land in total geographical area of the country, further expansion in area under cultivation is not feasible. Rather there is a decline of about 10 lakh hectares, as agricultural land has been diverted to non-agricultural uses since the year 2004-05. Therefore, agricultural output has to be increased through improvement in productivity per unit of land.

Productivity of most of the crops in the country is low and there is considerable scope to raise it. Except wheat, productivity of other crops in the country is below world average and much lower than agriculturally advance countries. Even, within the country there is large variation in yield across states. A large variation in yield across states is due to variation in access to irrigation but even for the states with similar irrigation coverage, productivity show significant variation.

District level data⁴ show that per hectare productivity of all crops taken together was Rs 56,510 under largely irrigated conditions as compared to Rs 35,352 under largely rain-fed conditions during biennium ending (BE) 2011-12⁵. Even the districts at same level of irrigation show large difference in aggregate productivity (Fig. 3.1).

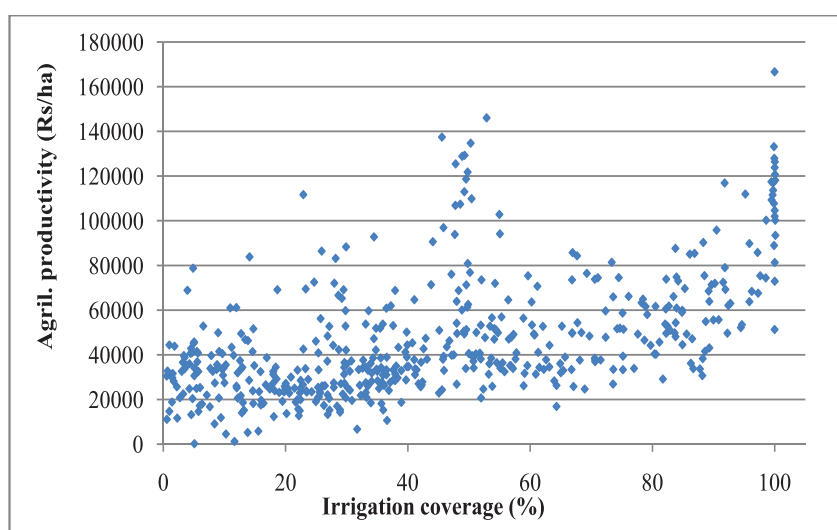
Variation in productivity at same level of irrigation and lower yield in India compared to the world average are due to poor level or low adoption of improved technology. Enhancing access to irrigation and technological advancement are the most potent instruments to raise agricultural productivity and production in the country.

Aggregate productivity of crop sector increased at the rate of 3.1 per cent per year during 2000-01 to 2013-14. Assuming same increase in input as in productivity, i.e. no change in resource use efficiency, will involve the same increase in net income. If this rate of growth in productivity is maintained, it will result in 16.7 per cent increase in total farm income in seven years or 25 per cent increase in ten years from the crop sector, which comprises 70 per cent of income from agriculture.

Livestock constitutes 30 per cent of the total income from agriculture sector. This sector has experienced growth rate of 4.5 per cent during 2000-01 to 2013-14. Maintaining the same growth in livestock sector in the coming years will raise total farm income by 10.8 per cent in seven years and 16.6 per cent in ten years period.

The contribution of increase in productivity/production of crop and livestock taken together adds up to 27.5 per cent increase in farm income in seven years.

Fig. 3.1: Aggregate crop productivity (Rs./ha. net sown area) across districts arranged according to irrigation coverage, average of 2010-11 and 2011-12



4 The data set pertains to 487 districts of India (covering 94% of net sown area).

5 Districts were classified into irrigated and rain-fed by using 35 per cent irrigation coverage as cutoff. Agricultural productivity (Rs/ha) was computed by taking sum of output (Rs) of selected agricultural commodities (rice, wheat, sorghum, pearl millets, maize, finger millets, barley, gram, pigeon pea, black gram, green gram, horse gram, moth, lentil, groundnut, sesamum, rapeseed and mustard, soybean, linseed, castor, safflower, Niger, Sugarcane, potato and onion multiplied by state level implicit prices of respective agricultural commodities, divided by net sown area.

3.2 Improvement in total factor productivity

The improvement in Total factor productivity (TFP) is an important source of output growth which directly contributes to cost saving and thus increase in income. TFP is the portion of output not explained by the amount of inputs used in the production. TFP accounts for effects in total output growth relative to the growth in total inputs used in production. TFP growth represents effect of technological change, skill, infrastructure, etc, which are not counted in the set of production inputs. It also includes increase in efficiency with which inputs are utilized in the production. According to Fuglie and Rada (2015), agriculture sector in India has witnessed 2.62 per cent growth in total factor productivity during 2004 to 2012. Another study on TFP at National Institute of Agricultural Economics and Policy Research, New Delhi, which is much more comprehensive in terms of considering inputs used in agriculture, also came out with similar findings⁶. The implication of 2.62 per cent annual growth in TFP is that farmers' income will also increase at same rate. If TFP grows at the same rate after 2015-16 then it will lead to 26.3 per cent increase in farmers' income by the year 2022-23.

3.3 Diversification towards high value crops

Diversification towards high value crops (HVCs) offers a great scope to improve farmers' income. The staple crops (cereals, pulses, oilseeds) occupy 77 per cent of the total or gross cropped area (GCA) but contribute only 41 per cent of total output of the crop sector. Interestingly, almost same value of output was contributed by HVCs (fruits, vegetables, fibre, condiments & spices and sugarcane), which just occupy 19 per cent of gross cropped area during 2013-14 (Table 3.1). Average productivity of HVCs after adjusting for cropping intensity variations was estimated as Rs. 1,41,777 per hectare as compared to Rs. 41,169 per hectare for the staple crops. With this differential in productivity, shifting one hectare area from staple crops to commercial HVC has the potential to increase gross returns upto Rs. 1,01,608 per hectare.

Between 2004-05 and 2013-14, area under HVCs in the country increased by 9.16 million hectare (Mha), at an annual growth rate of 3.31 per cent. Due to the large difference in area under HVC and staples, a 1 per cent increase in area under the former is equal to 0.25 per cent decrease in area under staples. Thus, a 1 per cent increase in area under HVC results in 0.319 per cent increase in output of crop sector, after netting out the decline in output due to area shift from staples to HVC. Based on these calculations it is estimated that if past trend in diversification continues in future, it has the potential to raise output of crop sector by close to 1 per cent each year. This can translate into 5 per cent increase in farmers' income by 2022-23.

Scope also exists to raise farmers' income by diversifying towards other allied enterprises like forestry rather than depending primarily on crop cultivation. India meets 40 per cent of its non-fuel timber requirement from the import of wood and wood products. India

⁶ Jain Rajni and Ramesh Chand, 2016. Technical Report of the Project on Total Factor Productivity and its Determinants in Indian Agriculture, ICAR National Institute of Agricultural Economics and Policy Research, New Delhi.

imports wood and wood products worth more than Rs. 33 thousand crore, whereas, thousands of hectare of private land remain barren. Various legal restrictions on felling of trees and setting up of timber industry and transit permit for marketing of timber are the major deterrents to raise trees on private lands.

Table 3.1 : Per ha value of output of major crops/groups in year 2013-14

S.No.	Crop	Value (Rs crore)	Area (Mha)	Productivity (Rs/ha)	Adjusted Productivity* (Rs/ha)	Share (%)	
						In total Output	In total area
1	Pulses	62135	23.23	26748	26748	4.14	11.95
2	Oilseeds	116181	98.28	44707	44707	7.74	14.68
3	Cereals	439383	28.53	40722	40722	29.26	50.56
A	Staple crops	617699	150.04	41169	41169	41.14	77.18
4	Fibre crops	95993	12.54	76549	76549	6.39	6.45
5	Sugarcane	76295	5.01	152285	109558	5.08	2.58
6	Condiments & Spices	54163	3.24	167376	120415	3.61	1.66
7	Fruits	155547	7.19	216458	155725	10.36	3.70
8	Vegetables	234219	9.57	244820	244820	15.60	4.92
B	High value crops	616217	37.54	164154	142777	41.04	19.31
C	All crops	1501464	194.4	77236	61503	100	100

Data source: Authors' estimates using CSO and DES data

*Productivity for annual crops like sugarcane, fruits and condiments and spices has been adjusted with present cropping intensity of 139%

3.4. Increase in crop intensity

India has two main crop growing seasons namely kharif and rabi, which make it possible to cultivate two crops a year on the same piece of land. With availability of irrigation and new technologies it has become possible to raise short duration crops after the main kharif and after the main rabi season⁷. Land use statistics show that the second crop is taken only on 38.9 per cent of net sown area. This implies that more than 60 per cent agricultural land in the country remains unused for half of the productive period. In most of the States, second crop is taken on less than one fourth of net sown area. Lack of access to water to meet crop requirement is said to be the main reason for low crop intensity. However, surprisingly, crop intensity on irrigated area, estimated as ratio of gross irrigated area to net irrigated area, is found to be 140, which is not much different than crop intensity under rain-fed situation. The reason for this could be that irrigation is not available throughout the year.

It looks ironical that despite so much pressure on the land, it is not used intensively. Taking the second crop on the same piece of land is a significant source to address land

⁷ Some crops like sugarcane, apple, mango etc. are perennial and they occupy land throughout the year. Their share in net cultivated area remains small.

constraint in the country and to raise income per unit of land. After 2000-01, the crop intensity in the country has increased by 0.7 percentage point per year. Large scope exists to raise crop intensity in most of the states. The emphasis on “*Har Khet Ko Pani*” and other components under “*Pradhan Mantri Krishi Sinchai Yojana*” holds promise to quickly expand irrigation, which will have very favourable effect on increasing crop intensity. Increase in crop intensity at the same rate as observed in the recent past has the potential to raise farmers’ income by 3.4 per cent in 7 years and 4.9 per cent in ten years. This can turn out to be much higher as the possibilities for taking second crop are brightening.

(b) Sources of income growth outside agriculture sector

3.5 Improving terms of trade for farmers

Income earned by farmers from agriculture depends on current prices, not constant prices (fixed base year prices). However, current prices may rise purely because of inflation. Therefore, true measure of level and change in income is the one adjusted for pure inflation. The inflation adjusted level of income, termed as real income of farmers, refer to the income deflated by appropriate deflator. Various deflators have been used to arrive at real income of farmers or agriculture sector. Some of these are index of prices paid by farmers, index of input prices and index of wholesale prices of non-agricultural commodities etc. No index is perfect and each one has its own specificities. We have used CPIAL (Consumer price index for agricultural labour) as a deflator to change nominal farm income to real farm income. CPIAL captures inflation in the goods and services in rural areas and it is closer than any other index to the inflation faced by farm households.

When prices received by farmers for agricultural produce rise faster than CPIAL, it adds to the real income, even without an increase in the volume of output. As can be seen from table 2.2, during 2011-12 to 2015-16, farmers’ income received serious blow on two counts. One, growth in value added in agriculture at constant prices was very low. Two, increase in CPIAL was 50 per cent higher than the increase in farm gate prices of agricultural produce. Several measures have been initiated by GOI to reverse this situation. An important measure targeted at better price realization by the farmers is e-NAM. The Centre is also persuading states to undertake various market reforms. Among other things, these reforms aim to reduce middle men, modernise value chain, attract modern private investments in agri market and, therefore, ensure better deal for the farmers.

No study is available on what could be the impact of various market reforms and market modernisation on prices received by farmers at national level. However, some evidence of the effect of online marketing by farmers using Unified Market Platform created by ReMS (a joint venture between government of Karnataka and NCDEX Spot Exchange Limited) in Karnataka shows big benefit to the farmers. The ReMS initiative is similar to the eNAM initiative of government of India. The UMP in Karnataka was created in 2014 and it started its operation from agricultural year 2014-15. The effect of UMP on prices received by farmers is attempted in table 3.2 by comparing increase in prices between year 2013-14, which is the year preceding the functioning of UMP, and 2015-16, which is the first year after creation of UMP in Karnataka. The increase in prices received by farmers in various mandis in Karnataka is deflated by WPI of the concerned commodity to arrive at increase in real terms.

After introduction of online trading and UMP modal prices in mandis in Karnataka witnessed much higher increase than the increase in wholesale prices of the same commodity in the country. The increase in real terms varies from 1 per cent to 43 per cent. The average increase for the 10 commodities for which data is available was 38 per cent in nominal terms and 13 per cent in real terms.

Table 3.2: Effect of online trading and UMP system on prices received by farmers in mandis in Karnataka

Commodity	Prices received by farmers Rs./quintal		Increase in 2015-16 over 2013-14 %	
	2013-14	2015-16	Nominal	Real@
Tur	3939	7672	95	16
Green gram	5308	7318	38	1
Black gram	3817	7976	109	12
Bajra	1261	1419	13	11
Copra	5189	9325	80	43
Turmeric	5937	7931	34	13
Jowar	1492	1774	19	6
Maize	1257	1356	8	6
Groundnut	3398	4346	28	14
Bengal gram	3057	4541	49	15
Weighted increase			39	13

@ Real price computed after deflating with WPI of the commodity.

Weights were taken as share of commodity in total value of all the 10 commodities at national level, year 2013-14.

Source: Personal communication with MD & CEO of ReMS.

As eNAM and other market reforms focus on crop sector, their benefit will accrue only to crop sector. Accordingly, a 13 per cent raise in crop prices translate to 9.1 per cent increase in farmers' income.

The Karnataka experience shows that small reform in the system of marketing can make a big difference to the prices received by farmers. It is also important to point out that all provisions of Unified Market Platform are not yet fully operational in Karnataka. Two changes, namely, online trading and opening market to traders outside the mandi, have made a significant difference. Full implementation of market reforms and unified national agricultural market has much larger scope to raise prices received by farmers and thus their income.

3.6 Shifting cultivators to non-farm and subsidiary activities

In rural areas, agriculture sector engages 64 per cent of the total workforce and contributes 39 per cent of total rural net domestic product (Table 3.3). This shows over-dependence of workforce on agriculture with significant underemployment. This also reveals large difference in per worker productivity between agriculture and non-agriculture sectors. The estimated worker productivity in agriculture sector was only Rs 62,235 as compared

to worker productivity of Rs1,71,587 in non-farm sectors during 2011-12 (table 3.3). Thus, non-farm sectors provide 2.76 times more productive employment than agriculture sector in rural areas.

Table 3.3: Worker productivity in farm and non-farm sectors in rural areas during 2011-12

Sector	Net Domestic Product		Workforce based on Usual Status		Worker productivity (Rs/worker)
	Rs crore	Share (%) in total	Million	Share (%) in total	
Farm	13,40,532	39	215	64	62,235
Non-farm	20,76,198	61	121	36	1,71,587
Total	34,16,730	-	336	-	1,01,567

Data source: Estimates based on CSO and NSSO data

Income of farmers can be improved substantially by shifting workforce away from agriculture. In fact, some farmers have started moving away from the agriculture sector and many are looking for suitable opportunities to leave farming.⁸ According to NSSO, workforce in agriculture sector in rural areas declined by about 34 million between 2004-05 and 2011-12, showing an annual decline at the rate of 2.04 per cent. If the same trend continues, then workforce share in agriculture will fall to 55 per cent of total rural workforce by 2022-23. The decline in workforce in agriculture is on account of both the decline in the number of agricultural labour as well as decline in the number of cultivators. The number of cultivators fell from 16.61 crore to 14.62 crore between 2004-05 and 2011-12, which marks an annual decline of 1.807 per cent.

Notwithstanding the decline in workforce in agriculture, employment diversification is slow due to following reasons: (a) requirement of skill and certain education level, particularly in manufacturing sectors; (b) the concentration of industrial units at a distance from rural habitation; (c) the limited capacity of the non-farm sector to ensure productive employment to incoming workers (Chand and Srivastava, 2014). The government's recent initiative on skill development can play a big role in improving skills of farming community, which can fetch them better employment opportunities in non-farm sectors.

If the number of cultivators keeps declining at the same rate as experienced during 2004-05 to 2011-12, it will reduce their number by 13.4 per cent between 2015-16 and 2022-23. This implies that the available farm income will be distributed among 13.4 per cent less farmers.

⁸ According to the Situation Assessment Survey 2002-03 of NSSO, 40 per cent farmers showed preference to quit farming if there was choice. Similarly, micro level studies provide strong evidence of youth not interested to work in agriculture (Himanshu et. al. 2016).

Strategy for Improving Farmers' Income

The discussion in Chapter 3 delved into the sources of increase in farmers' income by drawing mainly from the past experience and trends. The sources of growth in output and income can be put in four categories (i) development initiatives including infrastructure, (ii) technology, (iii) policies and (iv) institutional mechanisms.

4.1 Development initiatives

Some recent development initiatives of the Central government aiming to raise output and reduce cost include *Pradhan Mantri Krishi Sinchai Yojana*; Soil health card, and *Prampragat Krishi Vikas Yojana*. Another major initiative that provides insurance against crop and income loss is *Pradhan Mantri Fasal Bima Yojana*. Beside coverage of risk, it will encourage investment in farming. Interlinking of rivers is another strong initiative with high potential to raise output and farm incomes. These programmes need to be implemented in a time bound manner to get the desired effect on farmers' income.

Quality seed and optimum use of fertiliser are important pillars of growth in productivity. It is also observed that enhanced supply of power to agriculture brings efficiency as well as economy. Supply of electricity to agriculture sector is very low in most of the states. These three inputs should be promoted appropriately to raise output and farmers income.

Further, Public investments in and for agriculture have remained low as only 2.76 per cent of GDP Agriculture and allied sectors at current prices is spent for infrastructure development in agriculture (refer to year 2012-13). This must be raised to 4 per cent as recommended by the high powered committees (GOI 2007).

4.2 Technology and innovations

Sustainable growth in productivity and farmer income requires a paradigm shift from input intensive technologies, which have dominated Indian agriculture since the onset of green revolution. Emphasis is also laid on transformative rather than incremental gain from agricultural research and innovation. Breakthroughs in basic and other modern sciences offer voluminous opportunities for developing transformative technologies for agriculture. However, this has not been happening for a variety of reasons. Further, the challenges in agriculture are becoming more formidable. Addressing these challenges require a vibrant, responsive, and globally competitive research systems equipped with state of the art knowledge and scientific manpower of high calibre equipped with adequate resources. Public sector institutions comprising state agricultural universities and a large network of ICAR institutes dominate India's agricultural research system. While public sector research institutes have important strengths, they also face serious challenges in meeting future needs of Indian agriculture. Resources have been thinly spread on proliferating agricultural universities and institutions around the country with the leading research institutes, simultaneously facing a severe resource crunch. Lab-to-land connect has been weakening. Problem oriented research is not showing desired results. While public sector research shows symptom of decline, there are serious apprehensions about the role of private sector, particularly relating to pricing, protection and safety of

their technologies. Moreover, with the intellectual property rights regimes progressively tightening around the world, the scope for spill over benefits from lateral inflow of technology from developed countries is declining. There is greater and more urgent need than ever before to strengthen the system of agricultural research and development.

Public policy on agricultural R&D is facing a serious dilemma. Scientific community by and large favours the development and use of transgenic and genetically modified crops to address future agri-food demand and other challenges. However, there is strong public sensitivity towards the alleged health and environment safety aspects of these technologies in India and in most of the other countries, which cannot be ignored. It looks like this controversy is not going to settle soon. Therefore other alternatives and options need to be explored.

Genome editing has emerged as an alternative to transgenic technology. It involves engineering of desired plant traits by modifying endogenous genes, unlike GM technology which involves transfer of gene from one species to other. Such genome modification can be transmitted to next generation and can become even heritable. Public R&D institutions should be supported to develop capacity in such cutting edge areas of technologies which appear to have great potential.

Evidence is growing about scope of agronomic technologies like precision farming to raise production and income of farmers substantially. Similarly, modern machinery such as laser land leveller, precision seeder and planter, and practices like SRI (system of rice intensification), direct seeded rice, zero tillage, raised bed plantation and ridge plantation allow technically highly efficient farming. These technologies are developed by the public sector and their marketability is very poor. They require strong extension for the adoption by farmers. The emphasis should be on informing farmers of the opportunities these technologies offer, improving access to credit and creating an enabling policy environment for their adoption.

4.3 Policies

Policies affect production, price realization and farmers' income in a large number of ways. Particular attention needs to be paid to various types of reforms needed in agriculture sector. India embraced new economic policy and economy wide reforms in 1991. These reforms involved liberalisation, deregulation and removal of excessive control and restrictions on private sector, which created very favourable macro environment for the private sector participation in economic activities. In line with these changes, the union government brought a series of reforms in the agriculture sector in quick succession beginning year 2002. These included (a) Removal of (Licensing Requirements, Stock Limits and Movement Restrictions) on Specified Foodstuffs Order, 2002 and 2003. As per this order, wheat, paddy/rice, coarse grains, sugar, edible oilseeds and edible oils, pulses, gur, wheat products and hydrogenated vegetable oil or vanaspati were removed from the list of Essential Commodities Act (1955) and they did not require a permit or license for their trade, storage and movement. (b) Milk and Milk product Order of 2002 modified MMPO of 1992 and removal of restrictions on setting up of new capacity in milk processing and to do away with the concept of milkshed. (c) removal of prohibition on futures trading in any commodity, in year 2003. This was followed by the move to

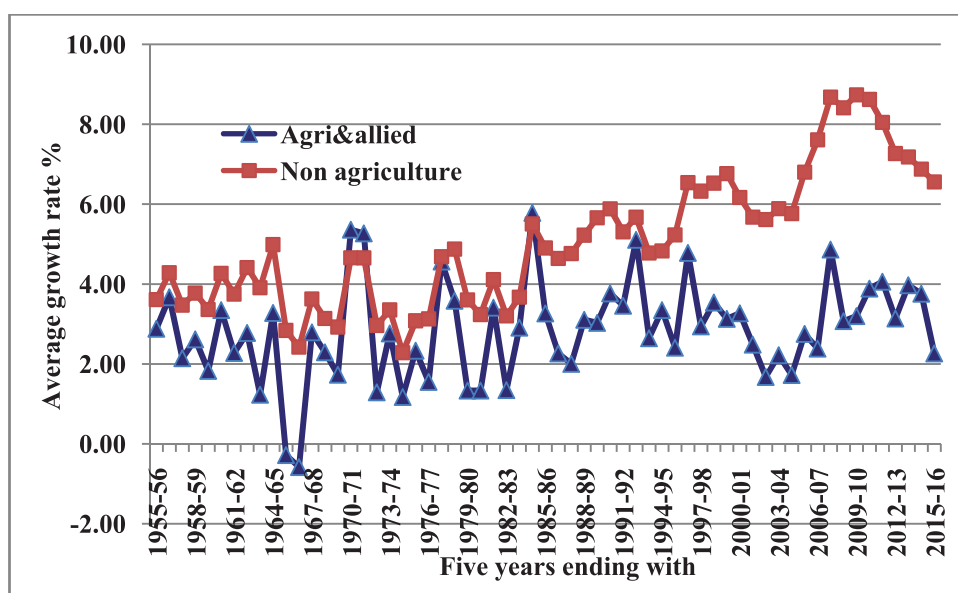
bring reforms in agricultural marketing. The Union government prepared The Model APMC Act called the State Agricultural Produce Marketing (Development & Regulation) Act, 2003, and shared it with all the states for implementation.

Changes made in ECA in years 2002 and 2003 were reversed in year 2006 and 2007. Majority of the states reported that they have adopted key area of reforms as suggested in the Model Act. However, the policy environment for agriculture sector did not see much change as the reforms in agriculture sector remained patchy, sporadic and partial. Most of the provisions of the APMC Act have been followed in a very diluted form (Chand 2016c). The net result has been that persistent effort for nearly one and half decade to reform markets have remained more or less unsuccessful.

Besides marketing, serious restrictions remain on land leasing and harvest and transit of trees and woody material raised on private land, which deprives farmers from raising their income.

The neglect of required reforms in agriculture sector has created wide disparity between agriculture sector and non-agriculture sectors. Till 1990-91, the growth rates in the two sectors moved in tandem and show very close correlation. As the reforms progressed the growth trajectories diverged. Growth rate in the non-agriculture sector, estimated from average annual rate of change in five years, accelerated from below 6.0 per cent towards more than 8.0 per cent for most of the period. However, agriculture sector moved on cyclical path around long term trend of 2.8 per cent (Fig. 5).

Fig. 4.1: Average annual rate of change in five years period in GDP agriculture and non- agriculture sectors, 1955-56 to 2015-16



The correlation between annual rate of change in the two sectors in a ten years period remained more than 0.9 till 1994-95 after which it gradually declined to below 0.5 (non-significant at 5 per cent level) in the recent decade.

It emerges from this comparison that in the absence of market reforms, the agriculture growth remained low and the sector could not keep pace with the growth in the non-agriculture sector. Opening up agriculture and removal of various restrictions on marketing, land lease and raising of forest species on farm land will enable farmers to receive higher prices for their produce and enhance economic activities both of which are part of farmers' income.

It is ironic that farm harvest prices remain lower than minimum support prices in many states and commodities. This underscores the need for competitive markets or other mechanism to ensure that prices received by farmers do not fall below the level of MSP.

4.4 Institutions

Indian agriculture is dominated by marginal and small farmers, who suffer serious disadvantage in terms of scale. Small farm size discourages many farmers to go for diversification of fruits and vegetables mainly because of the price risk and uneconomic lot for marketing. Small sized farmers are also disadvantaged in terms of bargaining power in various transactions in the input and output markets. These handicaps can be overcome by organising farmers under some institutional mechanism like the farm producers organizations (Singh 2008). SFAC has compiled case studies of successful examples of collective action by farmers working through organized institutions. It provides convincing evidence of benefits to farmers from integration with the value chain (SFAC 2013). There are several other success stories of increase in production and better returns from market through collective action through some type of group action or organization (Gupta 2015). Some such organizations have shown very impressive benefits to small farmers, women, tribal farmers, even in remote and disadvantaged areas⁹. Till June 2016, SFAC has promoted 510 FPOs with membership of 5.71 lakh farmers in 28 states of the country. Some state governments and NABARD are also promoting FPOs. However, the number and network of FPOs is very small and it needs to be expanded to enable farmers to reduce transaction costs, access technology, raise bargaining power and integrate with value chains.

9 Two such success stories are Ram Rahim Pragati Producer Company Ltd (RPCL), in Bagli, Dewas, M.P. and Producers Companies promoted under Rural Livelihoods Promotion Society's (BRLPS) Jeevika Project, in Bihar.

Prospects of Doubling Farmers' Income

Various sources of growth in farmers' income and their potential to contribute to future growth in farm income and achieving the goal of doubling farmer income have been discussed in Chapter 3. A summary of these estimates is presented in table 5.1. The combined effect of the seven potential sources of growth comes to 75.1 per cent in 7 years and 107.5 per cent in 10 years. If the factors underlying growth in farmers' income, except price factor, rise at the same rate as experienced between 2001 and 2014, farmers' income will rise by 66 per cent by 2022-23 and it will almost double in ten years i.e. by 2025-26. The increase in real farm prices has a very high scope to raise farmers' income.

Table 5.1: Prospects of growth in farm income from various sources

S.No.	Source	Scope	Contribution		Remarks
			7 years	10 years	
1	Crop productivity 70% seg	3.1	16.7	25.0	Same as in 2001-13. For crop sector (70%) ag.
2	Livestock value added 30% seg	4.5	10.8	16.6	Same as in 2004 to 2014
3	Improvement in resource use efficiency	2.26	16.7	25.0	Same as in 2005 to 12
4	Crop Intensity (70% segment)	1 percentage point	3.4	4.9	same as during 2001-12
5	Crop diversification (70% seg)	Area increase by 3.13 per cent, elasticity 0.319	5.0	7.3	
6	Better price realisation: crops only	13%	9.1	9.1	Implemented in 7 or 10 years
7	Shift to non -farm occupation	1.81%	13.4	19.6	Same as in 2005 to 12
	Total		75.1	107.5	

During 2004-5 to 2011-12, farm gate prices in real terms increased by 0.78 per cent per year and thus resulted in an increase in the real farm income of the same order. However, it had put lot of inflationary pressure on the economy. Here we are contemplating implementation of market reforms, which has a large scope of reducing middlemen and their margin and thus raising price realisation by farmers. It emerged from the Karnataka experience that application of simple modern technology to auction of farm produce using electronic platform and simple market reforms can raise price realisation by farmers in a short span by 13.4 per cent. When this factor is added to the other sources of growth in farmers' income, the increase works out to be 75.1 per cent in 7 years and 107.5 per cent in 10 years. It is concluded that if growth in factors affecting farmers' income is maintained at the level witnessed during ten years or so before 2014, then farmers' income show the prospects to double in 10 years. If this goal is to be achieved by 2022-23, then sources of growth have to accelerated by 33 per cent and it will require additional contribution of higher price realisation by farmers through various market reforms like e-NAM and implementation of various provisions of Model APMC Act.

Roadmap and Action Plan

Chapter 5 presents a quantitative framework for doubling farmers' income which has identified seven sources of growth. These are:

- (i) increase in productivity of crops
- (ii) increase in production of livestock,
- (iii) improvement in efficiency of input use (cost saving)
- (iv) increase in crop intensity
- (v) diversification towards high value crops
- (vi) improved price realization by farmers
- (vii) shift of cultivators to non-farm jobs and

The empirical evidence shows that if same level of progress in various sources of growth, as experienced in the previous 10-15 years, is maintained, it can achieve 75 per cent increase in per farmers income by 2022-23 over base year of 2015-16 with better price realisation. This falls short of doubling the income (100 per cent increase) by 25 per cent. Thus, to double farmers' income by 2022 the progress in various sources of growth has to be accelerated by 33 per cent. This change could be across the board or more in some area and less in others with overall acceleration of 33 per cent. The details are presented in Table 6.1.

Table 6.1: Sources of growth in farm income: Achievements and required growth rate for doubling farmers' income

S.No.	Source	Recent achievements		Required growth rate for DFI
		Period	Growth rate/change	
1	Crop productivity 70% segment	2001-2013	3.1	4.1
2	Livestock value added 30% segment	2005-2014	4.5	6.0
3	Improvement in resource use efficiency	2005-2012	2.26	3.0
4	Crop intensity (70% segment)	2001-2012	1 %age	1.3
5	Crop diversification towards fruits and vegetables (70% seg)	2003-2014	3.89	5.17
6	Better price realisation: Crops	Karnataka experience. Reforms	13% total (in real terms)	17.0
7	Shift to non - farm occupation	2005-2012	1.81	2.4

Crop productivity is required to increase by 4.1 per cent and livestock value added by 6.0 per cent per year to double farmers' income by 2022. TFP growth, which is mainly contributed by agricultural R&D, extension services, new knowledge, efficient practices like precision farming, is required to follow annual increase of 3.0 per cent. Indian farmers should raise area under two crops to 53 per cent from the present 40 per cent recorded in recent years. Area under high value crops is required to follow an increase of 4.4 per cent each year. Market reforms are required to enable farmers to get 17 per cent higher

prices than base level in real terms. This requires 2.26 per cent increase in prices received by farmers in real terms. Finally, total number of cultivators is required to come down by 2.4 per cent each year.

According to NSSO, number of cultivators declined from 166.1 million during 2004-05 to 146.2 million during 2011-12. This number needs to fall further to 119.5 million by 2022, which will involve shifting 2.4 per cent farmers each year to non-farm jobs.

Besides allied activities like bee keeping, forestry on farm land etc. can also contribute to growth in farm income.

The action needed in sources of growth in farm income can be grouped in three categories as under:

- A. Development initiatives
- B. Technology generation and dissemination
- C. Policies and reforms

6.1. Development initiatives

Development initiatives include increase in productivity through better technology and varieties and increased use of quality seed, fertiliser, irrigation and agro chemicals. The targeted level of these variables for crop sector, which constitutes about 70 per cent of farmers' income from crops and livestock, are presented in table 6.2.

Table 6.2: Base level and target for development initiatives to double farmers' income

Source	Base level and year	Target 2022-23
Quality seed: million tonne	3.03 (2014-15)	7.97
Fertilizer: million tonne	25.58 (2014-15)	36.24
Irrigation: million hectare	92.58 (2012-13)	110.40
Electricity for agri purposes: 000GWH	147.48 (2012-13)	307.39
Are under more than one crop: per cent	40.00 (2012-13)	53.00
Area under fruits and vegetables: million hectare	16.75 (2013-14)	26.38
Area under High Yielding Varieties: %	69.3 (2014-15)	90.0

The required targets indicate that supply of certified/quality seed should be increased to 7.97 million tonne from 3.03 million tonne during 2014-15. Fertiliser use is required to reach 36.24 million tonne, which comes to 175 kg per hectare of cropped area. This is very close to normative doses for the cropping pattern of year 2011-12 as estimated by Chand and Pavithra(2015). With cropping pattern shifting towards fruits and vegetables and area under irrigation expanding, the normative quantity of fertilisers may be slightly higher than 175 kg/ha. However, it is possible to get the same output with lower doses, if fertiliser is used more efficiently.

DFI requires area under irrigation to reach 53 per cent of GCA and crop intensity to reach 153. Highest increase is stipulated in power supply to agriculture sector, which is at dismal level in many of the states. Fruits and vegetables were grown on 16.75 million hectare area, which comprise 8.6 per cent of area under all crops in the in the country. This should increase to 26.38 million hectare by 2022-23 covering 12.7 per cent of total cropped area in that year.

Even after 50 years of green revolution, high yielding varieties cover only 69 per cent of the total area under cereal crops. In important crops like rice, high yielding varieties are grown only on 62 per cent area at country level despite some states showing 100 per cent coverage under HYVs. High yielding varieties cover 90 per cent area under wheat at country level. With better supply of certified seed, area under traditional varieties can be replaced by high yielding varieties in the states with low coverage.

Institutional credit is another very important input for enabling farmers to buy modern inputs and make investments in farm assets. While supply of institutional credit is expanding at reasonable rate, there are issues related to poor credit supply in many states and decline in share of term credit in total credit. These would need to be addressed.

6.2 Livestock productivity

Productivity of livestock is quite low in the country. Average milk yield is 4.90 kg per in-milk buffalo and 3.1 kg per in-milk cow. It is estimated that about 37 per cent growth in milk output has been due to increase in productivity of in-milk population, and, increase in number of livestock is the dominant source of growth in milk output (Birthal et. al. 2006). This type of growth associated with increase in population of livestock is not sustainable. Breed improvement, better feed and nutrition, animal health, and better herd composition are important measures for raising livestock productivity. In terms of development initiatives following targets are suggested by 2022-23:

- In India, coverage under Artificial Insemination (AI) in cattle and buffaloes is hardly 35%. The main reason for low artificial insemination is semen straws. We require 160 million doses of semen straw against current availability of 81 million to reach reasonable level of AI.
- Presently about 4 million breedable buffaloes, 1.3 million breedable cross bred cattle and 6 million breedable indigenous cattle have never calved. Out of above population, at least 2 million buffaloes, 0.8 million crossbred and 3 million indigenous cattle should have additional number for calving by 2020.
- Age of buffaloes at puberty has to be reduced by 3-4 months by 2020. At present, the puberty age of murreh buffaloes is about 33 months.

6.3 Generation and dissemination of improved technologies

Doubling farmers' income requires 3 per cent annual growth in total factor productivity for the sector through improved varieties, breeds, practices, improved knowledge and innovations, which encompass increase in productivity, lower cost of production through efficient use of inputs, better quality of produce to fetch higher prices. India has a very large network of ICAR Institutes and state agricultural universities entrusted with the

task of developing improved varieties, technologies, practices, breeds, products and formulations for sustainable growth of agriculture sector. The system has also been equipped with the network of *Krishi Vigyan Kendras* in every rural district of the country for frontline extension of technologies developed by public research institutes.

Despite a plethora of technologies developed by the scientists in National Agricultural Research System (NARS), the adoption rate for improved technology has remained low in many states. For instance, HYV cover 90 per cent area under wheat at national level but their coverage is below 62 per cent in the case of paddy. Similarly, some states show almost 100 per cent area under HYV of some crops while some states are stuck with less than one third coverage of high yielding varieties.

Second, other than varieties, seed and agro chemicals, the adoption of other technologies, particularly relating to the natural resources management, remains quite low. The focus of agricultural research has remained mainly on raising productivity, protection and efficiency in farm operations.

Third, the recommendations related to different aspects of farming are passed on to farmer in isolation rather than a package for her farm. Packages of practices published by various institutes prescribe package for individual crops or enterprises. This is important to raise production of individual items but it does not optimise use of farm resources, which is vital for raising farmer income. This requires a shift from focusing on individual enterprises to farming system.

ICAR and SAUs should develop models of farming system with focus on farm income for different types of socio-economic and bio physical settings combining all their technologies in a package. This should combine technology and best practices covering production, protection and post-harvest value addition for each sub systems with other sub systems like crop sequences, crop mix, livestock, horticulture, forestry. This would require an interdisciplinary approach to develop on knowledge of all disciplines. Research institutes should also draw from the experience of innovative farmers who are getting much higher income as compared to average farmers in their neighbourhood. Documentation by National Innovation Foundation – India (NIF) reveals that some of the innovations developed by enterprising farmers at grassroots level have lot of scope to bring efficiency in farm operations, reduce cost, raise production, and promote sustainability. Research institutes should harness such potential innovations for large scale application at farm level for raising farmers' income.

Research institutes should also come with state of the art breakthrough technologies for shifting production frontiers up for efficient use of inputs. Evidence is growing about scope of agronomic technologies like precision farming to raise production and income of farmers substantially. Similarly, modern machinery such as laser land levellers, precision seeders and planters, and practices like SRI (system of rice intensification), direct seeded rice, zero tillage, raised bed plantation and ridge plantation allow technically highly efficient farming. However, these technologies developed by the public sector have very poor marketability. They require strong extension for the adoption by farmers.

A strong feeling is developing almost everywhere about the adverse effect of (indiscriminate) use of chemicals in agriculture. It is being claimed based on some anecdotal evidences that traditional practices and indigenous and local species, which do not use inorganic fertilisers and plant protection chemicals, are yielding higher income besides being eco-friendly, resilient and safe. Such technologies and practices should also be tested by research institutions and promoted.

6.4 Policies and reforms

Policies have strong effect on farmers' income and create environment for harnessing opportunities and potential of technologies. The biggest constraint to harness potential of Indian agriculture and to raise farmers' income has been low participation of organised private sector in farming. A set of reforms has been identified to liberalise agricultural markets and to promote competition. This includes institutional measures to reform APMC Act in states as well as use of technology in marketing. Other two areas identified for short term reforms are liberalisation of land lease and relaxation on restrictions on felling/transit of trees and wood based industry. A list of various types of short term reforms and changes to boost agriculture and farmers income is provided in Table 6.3.

- A. Agricultural marketing:** The biggest market reform relates to APMC Act. This include institutional reforms (Table 6.3, 1.1 to 1.7), special treatment to fruits and vegetables and application and use of IT and e-commerce in agricultural marketing at the first point. Realizing the importance of liberalizing perishables, central government has also proposed to states to de-notify fruits and vegetables from the APMC Act. A new initiative namely E-NAM has been undertaken to encourage states to adopt e-trading platform for agricultural commodities. This is a game changer move as it involves integration of APMC mandis across the country using electronic platform. Financial assistance of Rs. 75 lakh per market is being provided for setting required infrastructure, software and assaying facilities.

Table 6.3: List of various types of reforms in agriculture sector

1	Institutional reforms: Make provisions for 1.1 to 1.7
1.1	Private mandi
1.2	Direct marketing
1.3	Contract farming
1.4	e-Trading
1.5	Single point levy
1.6	Direct sale to consumers by farmers
1.7	Single traders license
2.	Special treatment to fruits and vegetables: Denotify from APMC
3.	Participation in E-NAM

- B. Land lease:** Enact Land lease Law on the basis of Model Land Lease Law proposed by NITI Aayog
- C. Forestry on private land:** Remove restrictions on felling and transit of trees. Allow Timber and Wood based industry as per the guidelines issued by the MOEF.

NITI Aayog and DAC&FW of Ministry of Agriculture and Farmers Welfare, GOI are working together to persuade states to adopt and implement reforms and bring changes in the system of marketing, land lease law and forestry on farm land. This process of reforms needs to be completed by July 2017 so that the benefits start accruing to the farmers from next agricultural year.

6.4.1 Price incentives for producers

Experience of last five decades indicate that prices have profound impact on agricultural growth and they are significant determinant of farmers' income. It is hoped that market reforms will bring competition and efficiency in agricultural market to ensure remunerative prices for the producers and reasonable prices for the consumers. In case the reforms fail to have desired effect on prices received by farmers then government should expand price intervention to ensure that prices in the harvest season do not fall below the MSP. This should be implemented either through direct price intervention through procurement or through the system of deficiency price payment. The latter involves paying the producers the difference between MSP and farm harvest prices in representative market for the quantity of produce sold by farmers in the market.

6.4.2 Promoting responsible agricultural investments

Our farms are starved of capital and knowledge on modern methods and practices. Contract farming with modern firms help farmers in provisioning inputs and advance technology, skill transfer, guaranteed and remunerative prices, and access to reliable market. Market risk is the main hindrance in diversification towards high value products. A marketing contract can overcome this risk. A few cases where contract farming is practiced in the country show wonderful results.

Recognising the role of private sector participation to infuse modern knowledge and capital into agricultural production, sharing risk, providing attractive market for produce and promote diversification towards high value crops the Finance Minister in his speech for the budget 2017-18 stated that a model law on contract farming would be prepared and circulated among states for adoption. The Budget speech also emphasised market reforms to de-notify perishables from APMC.

Precision farming is getting popular in developed countries as it reduces cost, raises productivity significantly and improves quality. However, this is knowledge intensive and it requires high skill and handholding of farmers. Many commercial firms and corporates are now evincing interest in agri-business. There is a need to provide facilitating environment to organized private sector to engage with farmers in precision farming.

6.4.3 Promoting value chains

Agriculture in India is characterized by informal or traditional supply chains that deliver products to local middlemen and then to small local stores. Formal value chains can deliver the same product, usually in better or more uniform quality, to more commercial firms – wholesalers, supermarkets or exporters. We need to find ways to integrate small producers into more modern value chains, both domestic and export-oriented.

Bulk of the produce is sold by farmers in raw form and as such taken from field to mandi after harvest. This causes glut in the market and suppresses prices to low level. Farmers do not keep produce for sale in lean months. There is now a provision for Warehouse receipt and keeping produce in WDRA registered warehouses. Few farmers make use of this facility.

According to an estimate prepared by ICAR-CIPHET, harvest and post harvest losses for major food commodities covering crops, livestock and fish was Rs. 92651 crore during the year 2013-14 (ICAR-CIPHET 2015). For the total food sector this loss comes to Rs. 107994 crore. These estimates reveal that 5.8 per cent of food output get lost during the harvest and transit. Some estimates put post-harvest losses at a very high level. Much of this loss is preventable. It requires efficient and modern infrastructure, on farm facilities for storage and cooling, and efficient logistics.

With the rise in income, a class of consumers has emerged who are willing to pay premium price for quality traits, freshness, particular grades, ethnic products and organic produce. Even overseas demand for traditional produce and varieties is quite high. This potential is not harnessed because of the missing link between producers and potential buyers.

Price crashes are very common in the case of perishables. Absence of on farm storage facility, lack of scientific method to extend shelf life, and poor processing base in the country are some of the factors behind such price crashes.

If market reforms are implemented seriously, it will pave the way for entry of private sector in agriculture including value chains in a big way.

6.4.4 Promoting producers' alliances

Agriculture is undertaken by very small sized production units who operate on tiny land holdings and keep a few livestock. Such operational units are not economically viable on their own because of their scale factor, poor bargaining strength, and reach to market. Such producers need some sort of institutional mechanism for collective action, pooling of resources, group marketing and post-harvest value addition. At the level of Centre, SFAC and NABARD are promoting Farmers Producers Organizations (FPO) in the country. However, given the size of the country, there is a need to involve state level agencies in creating, nurturing and establishing FPOs.

Provisions have been created in law to facilitate formation of Farmers Producers Companies (FPC) to undertake agribusiness activities like other business entities. Some FPCs are showing impressive success in raising income of small holders by raising production and linking them to market. Such experiences need to be up-scaled.

6.4.5 Linking production to processing

Despite fast growth in demand for processed foods, their production is growing very slowly in the country. During 2011-12 to 2015-16, output of food processing industry increased by merely 3.6 per cent per year. An important reason for this is that farmers do not get attractive market for their produce and processors do not get assured supply. Thus, linking processors with producers (farmers) through contract farming or market

liberalisation has vast scope to raise output and farm income.

Food processing industry is also found to be much more labour intensive as compared to other industries (Rao and Dasgupta 2009). Promoting food processing in rural areas will also generate employment and help in shift of workforce from agriculture to industry.

6.4.6 Coordination and involvement of States

Various initiatives required to double farmers' income involve active and coordinated participation of various Ministries of Central government and states. While the lead role should be played by the Ministry of Agriculture Co-operation and Farmers Welfare, the other areas crucial for this goal are related to water resources, food processing, fertiliser, credit, infrastructure, and rural development. Much of the success in doubling farmers' income will rest on the action and involvement of States and UTs. All States and UTs should be persuaded to commit to the goal of raising farmers' income and prepare time bound action plan to achieve the goal of doubling farmers' income.

Conclusions

The low level of farmers' income and year to year fluctuations in it are a major source of agrarian distress. This distress is spreading and getting severe over time impacting almost half of the population of the country that is dependent on farming for livelihood. Persistent low level of farmers income can also cause serious adverse effect on the future of agriculture in the country. To secure future of agriculture and to improve livelihood of half of India's population, adequate attention needs to be given to improve the welfare of farmers and raise agricultural income. Achieving this goal will reduce persistent disparity between farm and non-farm income, alleviate agrarian distress, promote inclusive growth and infuse dynamism in the agriculture sector. Respectable income in farm sector will also attract youth towards farming profession and ease the pressure on non-farm jobs, which are not growing as per the expectations.

Doubling farmers' income by 2022 is quite challenging but it is needed and is attainable. Three pronged strategy focused on (i) development initiatives, (ii) technology and (iii) policy reforms in agriculture is needed to double farmers' income. The rates of increase in sources underlying growth in output need to be accelerated by 33 per cent to meet the goal. The country need to increase use of quality seed, fertiliser and power supply to agriculture by 12.8, 4.4 and 7.6 per cent every year. Area under irrigation has to be expanded by 1.78 million hectare and area under double cropping should be increased by 1.85 million hectare every year. Besides, area under fruits and vegetables is required to increase by 5 per cent each year. In the case of livestock, improvement in herd quality, better feed, increase in artificial insemination, reduction in calving interval and lowering age at first calving are the potential sources of growth.

Research institutes should come with technological breakthroughs for shifting production frontiers and raising efficiency in use of inputs. Evidence is growing about scope of agronomic practices like precision farming to raise production and income of farmers substantially. Similarly, modern machinery such as laser land leveller, precision seeder and planter, and practices like SRI (system of rice intensification), direct seeded rice, zero tillage, raised bed plantation and ridge plantation allow technically highly efficient farming. However, these technologies developed by the public sector have very poor marketability. They require strong extension for the adoption by farmers. R&D institutions should also include in their packages grassroots level innovations and traditional practices which are resilient, sustainable and income enhancing.

ICAR and SAUs should develop models of farming system for different types of socio-economic and bio physical settings combining all their technologies in a package with focus on farm income. This would involve combining technology and best practices covering production, protection and post-harvest value addition for each sub systems with other sub systems like crop sequences, crop mix, livestock, horticulture, forestry. Such shift requires interdisciplinary approach to develop on knowledge of all disciplines.

About one third of the increase in farmers' income is easily attainable through better price realization, efficient post-harvest management, competitive value chains and adoption of allied activities. This requires comprehensive reforms in market, land lease and raising of trees on private land. Agriculture has suffered due to absence of modern capital and modern knowledge. There is a need to liberalise agriculture to attract responsible private investments in production and market. Similarly, FPOs and FPCs can play big role in promoting small farm business. Ensuring MSP alone for farm produce through competitive market or government intervention will result in sizeable increase in farmers' income in many states.

Most of the development initiatives and policies for agriculture are implemented by the States. States invest much more than the outlay by the Centre on many development activities, like irrigation. Progress of various reforms related to market and land lease are also State subjects. Therefore, it is essential to mobilise States and UTs to own and achieve the goal of doubling farmers' income. If concerted and well-coordinated efforts are made by the Centre and all the States and UTs, the Country can achieve the goal of doubling farmers' income by the year 2022.

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Abbreviations

AI	-	Artificial Insemination
APMC	-	Agricultural Produce Market Committee
BE	-	Biennium Ending
CPIAL	-	Consumer Price Index for Agricultural Labour
CSO	-	Central Statistical Organisation
DACFW	-	Department of Agriculture Cooperation & Farmers Welfare
DFI	-	Doubling Farmers' Income
e-NAM	-	Electronic National Agriculture Market
FPO	-	Farmer Producers Organisation
GCA	-	Gross Cropped Area
GDP	-	Gross Domestic Product
GOI	-	Government of India
HVCs	-	High Value Crops
HYVs	-	High Yielding Varieties
ICAR	-	Indian Council of Agricultural Research
MMPO	-	Milk and Milk Product Order
MSP	-	Minimum Support Price
MoEF	-	Ministry of Environment & Forest
NABARD	-	National Bank for Agriculture and Rural Development
NARS	-	National Agricultural Research System
NCDEX	-	National Commodity and Derivatives Exchange Limited
NIF	-	National Innovation Foundation
NSSO	-	National Sample Survey Office
ReMS	-	Rashtriya e-Market Services
SAS	-	Situation Assessment Survey
SAUs	-	State Agricultural Universities

SEAC	-	Small Farmers Agribusiness Consortium
SRI	-	System of Rice Intensification
TFP	-	Total Factor Productivity
UMP	-	Unified Market Platform
WPI	-	Wholesale Price Index

