Enhancing Farmers' Income:
Who to Target and How?

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Preface

Agriculture supports more than half of India's population, but the per capita income of farmers is only about one-fifth of the average per capita income of the country. Moreover, the farming community now has been experiencing a situation of distress on account of several factors, such as declining landholding size, rising cost of production, increasing frequency of extreme climatic events, viz. droughts, heat waves and floods, and poor prospects of employment outside agriculture.

In order to improve the economic status of farmers the government of India in its annual budget of 2016-17 set a policy target of doubling farmers' income by 2022, and reiterated its commitment in the budget of 2017-18 as well. This is a challenging task, but not difficult if the growth strategies are appropriately designed and targeted. By identifying target farmers and their locations; and infrastructural and institutional requirements this paper suggests pathways and policy choices for enhancing farmers' income.

I hope the findings and the implications of this research will be useful to policymakers and other stakeholders to take informed decisions regarding strategic priorities for broad-based growth of agriculture and rural economy in general and achieving the target of doubling farmers' income by 2022 in particular.

Suresh Pal
Director

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Executive Summary

Recognizing that the growing distress among farming community may disturb socio-political equilibrium and affect nation's food security the government of India in its budget of 2016-17 has set a policy target of doubling farmers' income by 2022. To achieve this, the government has announced a number of innovative measures that include improving farmers' access to institutions (i.e. credit, insurance, information, common markets), development of infrastructure (i.e. irrigation, electricity and roads), restoring soil health, improving efficiency of agricultural markets, expanding dairy processing facilities and enhancing farmers' capacity to diversify into nonfarm activities.

However, doubling farmers' income or raising it to a significant degree in a short period may require some policy reforms and need-based institutional arrangements. An important aspect of the policy stance is the identification and targeting of low-income farmers, as unless it is known who within agriculture have low income and/or are disadvantaged in terms of access to technology, markets, credit, information and infrastructure, it would be difficult to accomplish the desired goal. A better understanding of these factors would provide a menu of policy choices and pathways for enhancing farmers' income. In this paper, we identify 'who within agriculture constitute the poor or low-income farmers, where are they located and what their characteristics are?'

Our findings show that 70% of the farmers in India have annual per capita income less than Rupees 15000.[1] Only 10% of them earn more than Rupees 30000. Land size appears an important correlate of income, as more than three-fourths of the low-income farmers (≤15000 rupees) are marginal farmers who cultivate landholdings measuring less than or equal to one hectare. Nevertheless, 7% of the marginal farmers also fall in the high-income class (>30000 rupees). Amongst marginal farmers who are rich have a more diversified income portfolio in terms of the number of income sources accessed and the intensity of engagement. They cultivate their land more intensively and allocate larger area to high-value crops, and earn three-times more net income from cultivation as compared to their counterparts in the low-income class. This clearly indicates that there are prospects for enhancing farmers' income within agriculture. The high-

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[1] This almost equivalent to estimated mean per capita income of 14470 rupees for farm households.

income marginal farmers are also more engaged in animal husbandry, in nonfarm business activities and in labour market. We find education and access to credit, information and infrastructure as important correlates of farmers' income.

Approximately 80% of the low-income marginal farmers are concentrated in eastern (58%) and western (21%) regions that have been lagging behind in agricultural development on account of several factors, such as under-investment in agricultural research, poor infrastructure (electricity, markets, roads), under-development of institutions (credit, extension, insurance) and a lack of complementarity among these.

Amidst the push to double farmers' income in a short period the findings of this study have important policy implications. It is obvious that this ambitious goal would require targeted interventions and identification of strategies that are associated with higher income. The key message is that the marginal farmers, especially those in eastern and western states, should be at the forefront of the income-enhancing strategy. This has also a message that the strategy of bringing green revolution in eastern India (BGREI) need to be redesigned.

The important implications, discussed below, are generic in nature and can be modified as per the location-specific requirements.

India's net cropped area has been stagnating for quite some time, which clearly implies limited scope for income growth through area expansion. The recourse, thus, needs to be with prospects for income growth by raising cropping intensity, reducing inefficiency in production, and diversifying production portfolio towards high-value crops and animal production. The expansion in agriculture needs to exploit the intensive margin a lot more that can be done by improving farmers' access to reliable irrigation facilities and seeds of short-duration high-yielding crops/varieties, and mechanization of agricultural operations. A related implication is to improve water-use efficiency adopting sprinkler and drip irrigation systems, and resource conservation technologies including zero-tillage and laser-levelling.

A highly potent finding from the point of view of the strategy to augment farmers' income relates to their differential access to information. Note that there has been significant penetration of mobile phones in rural areas, but this means of communication has remained grossly under-exploited for dissemination of information on agricultural technologies, practices, weather advisories, programs and policies. In view of the limited outreach of the government extension system, the modern communication technologies can be a cost-effective and efficient means of information dissemination. The need is to bundle all types of information that farmers

need, and link it with the modern communication networks for its dissemination.

Further, if farmers' income has to be doubled or enhanced to a significant degree in a short period then the emphasis should be on diversification towards high-value high-growth sectors, such as horticulture and animal production; development of efficient and inclusive markets, and improvement in public infrastructure that stimulate private investment in value chains and agro-processing. Greater emphasis should be on north-eastern region that has considerable potential for cultivation of high-value horticultural crops. Animal husbandry also needs more investment, and institutional support in terms of extension services, insurance, markets and credit.

In the long run, boost to farmers' income must come from technological breakthroughs that push yield frontiers, enhance resource-use efficiency, reduce cost of production and improve resilience of agriculture to extreme changes in climate. This implies a need for greater investment in agricultural research, improvement in efficiency of research and reorientation of research agenda considering emerging challenges and opportunities in agriculture.

More importantly, doubling farmers' income would require reducing excessive employment pressure on agriculture by developing rural nonfarm sector. The profiling of high-income farmers brings out the role of nonfarm sector vividly; and suggests that nonfarm sector (including labour market, salaried employment, and businesses) can be an important pathway for enhancing farmers' income, especially of those at the bottom of land distribution. The implication is that if the constraint due to ubiquitous smallholdings were to be mitigated, strategies for broad-based growth of rural nonfarm sector would be required. Agriculture generates considerable surplus to attract investment in local manufacturing of value-added products; and hence there is considerable scope for rural industrialization. The expanding rural nonfarm sector will create multiplier effect through additional opportunities in ancillary industries related to inputs, equipment, machines and support services, and will generate income for investment in farm production. Investment in human capital or skill development and value chains will be a key to rural industrialization.

Finally, our findings clearly show that farmers' income can be enhanced by improving complementarities among different types of infrastructures and institutions, and a lack of any of the critical infrastructure and/or institution may restrict farmers benefitting from the investment in others.

In conclusion, doubling farmers' income in a short period is a challenge, but not insurmountable if the stakeholders follow a comprehensive, multi-pronged and targeted approach encompassing income opportunities and their enabling conditions including investment in agricultural research and infrastructure, and development of institutions and human resources.

Chapter

1

Introduction

The government of India in its annual budget of 2016-17 set a policy target of doubling farmer's income by 2022, and this was reiterated in the following budget of 2017-18 as well. This is indeed an important objective, as agriculture, besides being critical to nation's food security, remains one of the principal sources of livelihood for more than half of the country's population and is important to poverty reduction, especially in rural areas where most of the poor people live.

The past experiences in agriculture and rural development, however, suggest that doubling farmers' income in such a short period is a formidable task. Just for comparison, between 2004-05 and 2011-12 the real per capita farm income (from agriculture and allied activities) of cultivators increased by 64% (Chand, Saxena and Rana, 2015). Chandrasekhar and Mehrotra (2016) using data from two large-scale farm surveys conducted by the National Sample Survey Office (NSSO) of the Central Statistical Organization of the Government of India in 2002-03 and 2012-13 compared changes in farmers' real per capita income and found only a 34% increase in it during this period. If this trend is to stay, it may take about 14 years to double the farmers' income (Satyasai and Bharti, 2016).

Doubling farmers' income or raising it to a significant degree, thus, might require some re-orientation or change in the policy stance. One fundamental ingredient of the policy comprises identification and targeting of the poor or low-income farmers. Unless it is known who within agricultural sector have low income and/or are disadvantaged in terms of access to technology, markets, credit, information and infrastructure, it would be difficult to accomplish the target of doubling farmers' income in such a short period. Profiling of the poor or low-income farmers in terms of their characteristics and locations can go a long way in targeting growth strategies. This paper sets out to do exactly that by probing 'who are the poor farmers in India, what are their characteristics, and where are they located?' Knowing this would provide a menu of policy choices for pulling the poor farmers out of poverty or low-income trap. Once this profiling is done for a multitude of factors, one can begin to see the pathways for

drawing poor farmers out of poverty and doubling their income or in general raising the income.

Using household-level data from a nationally representative survey of farmers conducted in 2012-13 by the NSSO, we attempt to identify 'who within agriculture constitute the poor or low-income farmers?' For example, even though land size is a strong correlate of farmers' income other factors such as livestock income and income from nonfarm activities comprise strong differentiators. Thus, the main attributes that we investigate in terms of identifying low-income farmers are:

(i) the factors that broadly differentiate poor or low-income farmers from economically better-off ones, and

(ii) the geographical distribution or location of low-income farmers.

Next chapter briefly describes salient features of Indian agriculture in relation to the prospects for improving farmers' income. Chapter 3 describes data sources. Chapter 4 assesses farmers' income level, its components and distribution; and builds typology of farmers on joint distribution of land and income that is essential for better targeting of income growth strategies. In chapter 5 we identify important factors that differentiate low-income farmers from high-income farmers. Given the regional concentration in poverty, the next chapter identifies location of low-income farmers and examines their agro-ecological, socio-economic and institutional characteristics. Technological, institutional and policy implications of the results are discussed in the final chapter.

2
Chapter

Agriculture and Farmers' Well-being

Between 1980-81 and 2014-15, Indian economy grew at an annual rate of over 6%, but with significant inter-sectoral differences. Agriculture grew at a much slower rate of about 3% and experienced a drastic fall in its share in the gross domestic product (GDP), from 36% to about 15%. The importance of agriculture, however, transcends its income contribution. It is a source of livelihood for more than half of the country' population, and is crucial for poverty reduction. Several studies have shown that growth in agricultural sector, compared to growth in other economic sectors, has been more effective in reducing poverty in spite of its falling share in GDP (Datt and Ravallion, 1998; Kotwal, Ramaswami and Wadhwa, 2011).

However, the pro-poor effect of agriculture has diminished in the recent past (Datt, Ravallion and Murgai, 2016) on account of several factors, such as continued high employment pressure on agriculture, declining farm size and growing biotic and abiotic stresses. The average size of landholding in India has shrunk by 37%, from 1.84 hectares in 1981 to 1.16 hectares in 2011, and during the same period the number of landholdings measuring less than or equal to one hectare almost doubled, raising their share to 67% in the total holdings (GoI, 2016). The falling share of agriculture in GDP has not matched its share of workforce that declined by only 6 percentage points to 54.6% in 2011 from 60.5% in 1981. Thus, agriculture continues under pressure to provide livelihood support to majority of the rural population despite that its labour absorption capacity has reached extensive limit. This means there is a lack of employment opportunities for farmers outside agriculture because of slow expansion of the rural nonfarm sector.

Further, the technological gains realized during first three decades of Green Revolution have started diminishing—the annual growth in average yield of food grain crops has decelerated to 1.7% during 1996-97 to 2014-15 from about 3% during 1981-82 to 1995-96. The groundwater resources that irrigate 30% of the net cropped area (equivalent to 62% of the net irrigated area) are becoming unsustainable due to their higher rate of extraction than their recharge rate, mostly in the north-western and southern states.

Amidst these challenges, agriculture is now confronting frequent extreme changes in climate (i.e., droughts, heatwaves and floods) that are adversely affecting its efficiency and sustainability, leading to increased incidence of distress among farming community (World Bank, 2013).

Further, not all the farmers and all the regions have benefitted from the technological change in agriculture and allied sectors. There exist significant inter-regional and inter-personal disparities in farmers' income and income growth. The per capita income of farmers' is significantly less in eastern, north-eastern and western regions vis-à-vis northern and southern regions. Further, between 2002-03 and 2012-13 there has been a conspicuous decline in farmers' per capita income in Bihar and West Bengal; little or no change in Assam and Jharkhand; an increase to the extent of all-India average in Uttar Pradesh, Gujarat and Kerala; and an increase of 47-93% in other states, except Odisha where it more than doubled (Chandrasekhar and Mehrotra, 2016). By land class, only large farmers, i.e. those cultivating landholdings of four hectares or more, experienced near-doubling of their per capita income during this period. Farmers cultivating landholdings less than or equal to one hectare had their income increase by just 10-38%. A vast majority of the farmers belongs to this category and is from the poorer states, thus highlighting snags in doubling farmers' income as envisaged in the current policy discourse.

Notwithstanding the challenges in doubling of farmers' income, it is pertinent to indicate that Indian agriculture has been experiencing a demand-led structural transformation. This transformation is expected to have a favourable impact on farmers' income, and therefore on poverty reduction. Because of several factors, such as sustained rise in per capita income and urbanization, the food basket of Indian consumers has been undergoing a shift away from the cereals towards high-value commodities such as fruits, vegetables, and animal products (Joshi and Kumar, 2016). This has been fueling growth in production of these commodities—the share of horticultural crops in the gross value of output of agricultural sector increased from 16% in 1990-91 to 22% 2014-15 and that of animal products from 25% to 35%. Since these commodities have greater potential for higher returns per unit of land (Birthal, Roy and Negi, 2015) and for labour absorption (Joshi, Joshi and Birthal, 2006), these match nicely with the resource endowments of smallholders who, as discussed above, comprise the group that trails behind in rural income. Birthal, Roy and Negi (2015) found lower incidence of poverty among those households who grow high-value crops. Apart from high-value crops, the animal husbandry, another high-value activity, is a great equalizer since the distribution of animals is significantly egalitarian when compared to the major differentiator, i.e. land (Birthal and Negi, 2012).

When looking at the issues related to farmer's income, it is important to note that farmers are not homogeneous in several of their attributes that matter for their income, i.e. land, labour and capital; capabilities, education and experience that together comprise skills; and social capital. With potential differences along so many dimensions, farmers are likely to exhibit significant heterogeneity in their choice of activities and access to technology, infrastructure, markets and institutions. Hence, if the goal of doubling farmers' income has to be achieved by 2022, there is a need to take target group heterogeneity seriously towards which a complete picture of farmers' livelihood strategies and options needs to be mapped and understood, something that this paper strives to do.

Data

An analysis of income dynamics must be based on time series data. Unfortunately, in India no such series is available on farmers' income. The National Accounts Statistics, published by the Central Statistical Organization (CSO) of the Ministry of Statistics and Programme Implementation of the Government of India, provides estimates of the gross as well as net domestic product from agriculture and allied activities and the value of output of various agricultural commodities, but not of the incomes from sources other than agriculture and allied activities. Occasionally, it also provides estimates of rural income (not farmers' income) and its components at all-India level.

Farm household surveys conducted by the NSSO are the only source that provides information on farmers' income and its components. Until now, two rounds of such surveys have been conducted; in 2002-03 (GoI, 2006) and 2012-13 (GoI, 2014). The estimates of income and other variables from these rounds, however, are not strictly comparable due to change in definition of farmer or farm household in the latter round. In the first round, a farm household has been defined as the one who owned some land, while the second round considers a household as farm household if one or more of its members are engaged in agriculture and allied activities and earn at least Rupees 3000 a year from these.[1] We will see later that this is not a trivial lack of comparability, as based on activities the economic status of the farm households are clearly stratified.

In this paper, we confine our analysis to the data from 2012-13 survey, which is motivated by both being the latest survey as well as the breadth of activities covered in terms of livelihood strategies that are pivotal to the research questions that we address in this paper. This survey covered 35200 farm households from 4529 villages spread across the country. It contains comprehensive information on farmers' income and its components. Besides, it provides information on a number of individual- and household-level characteristics; and socio-economic, institutional and organizational aspects

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[1] For details regarding the change in the definition of a farmer or farm household, see GoI (2014). Some studies (e.g. Chandrasekhar and Mehrotra, 2016; Satyasai and Bharti, 2016) have considered only land-owning households from both the surveys in order to minimize bias in the estimates due to change in the definition.

of farming, i.e. landholding size, irrigation status, cropping pattern, crop yields, cost of crop production; and demographic and social characteristics of households, and their access to credit, markets and information.

Our focus is on farmers' income, its components and correlates. Farmers obtain incomes from a number of sources that are aggregated into four broad categories, viz. cultivation of crops, farming of animals, wages and salaries, and nonfarm business activities. These income sources are defined as follows:

Income from cultivation of crops: includes value of main output of crops and their by-products minus the cost of their production.

Income from farming of animals: is net income (gross income minus cost of production) that households obtain from production of milk, meat, eggs, wool and fish, and from sale of live animals.

Wages and salaries: include earnings by any of the household member from labour market, and from regular or temporary employment in public and private sectors.[2]

Income from nonfarm business activities: includes earnings from nonfarm business activities adjusted for the operational costs of carrying out these activities.

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[2] The survey does not provide separate estimates for farm, non-farm wages, and salaries.

Chapter

4

Identifying Low-income Farmers

An important ingredient of the policy comprises identification and targeting of the poor or low-income farmers. Hence, for better targeting of policy it is important to know 'who within agricultural sector have low incomes and/or are disadvantaged in terms of access to technology, markets, credit, information and infrastructure'. In this chapter we probe 'who are the poor farmers in India and what their characteristics are?'

4.1 Level and distribution of income

Figure 1 shows cumulative density function of annual per capita income of farm households. It clearly reveals significant disparities in income distribution among farmers. An overwhelming majority of the farmers stays at the bottom of income distribution—about 70% of them earn per capita income less than Rupees 15000 (which is about the same as the farmers' average per capita income of Rupees 14470). For another 20% of the farmers, it is in the range of Rupees 15000 to 30000; and only 10% of the farmers have per capita income exceeding Rupees 30000.

Figure 1: Cumulative distribution of per capita income of farmers, 2012-13
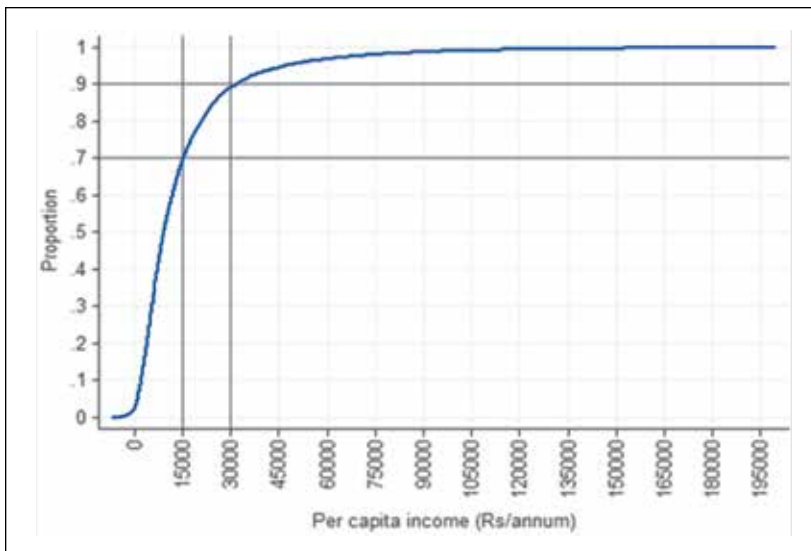
A salient variation in farmers' income is with respect to the size of landholding. Table 1 shows per capita income of farmers by land class. It varies significantly across land sizes. The per capita income of marginal farm households, who cultivate landholdings less than or equal to one hectare and comprise about 70% of the total farm households, is estimated to be slightly more than Rupees 11000. Small farmers (1-2ha) comprise 17% of the total farm households and their per capita income is 1.4 times than that of marginal farmers. The land class of 2 to 4 hectares involves more than 9% of the farmers and they have per capita income almost twice of that of marginal farmers. Large farmers (≥4ha), who comprise only 4% of the total farmers, are economically much better off; their per capita income is 3.1 times that of marginal farmers, 2.1 times that of small farmers, and 1.6 times that of medium farmers. Farmers' income is, thus, highly positively correlated with land size.

Table 1: Annual per capita income of farmers by land class, 2012-13

Variables	Marginal (≤1.0 ha)	Small (1.0-2.0 ha)	Medium (2.0-4.0 ha)	Large (>4.0 ha)	All
% of total households	69.77 (0.62)	17.12 (0.40)	9.22 (0.27)	3.89 (0.21)	100.00
Per capita income (Rs/annum)	11346 (243)	16399 (419)	22142 (606)	34941 (1568)	14470 (244)
Size of landholding (ha)	0.42 (0.01)	1.38 (0.01)	2.57 (0.02)	6.51 (0.17)	1.02 (0.02)

Figures in parentheses are standard errors.

An important point to note is that farmers also obtain income from many other sources besides agriculture. Hence, a feasible and sustainable income-growth, i.e. doubling farmers' income, strategy must be built upon the joint distribution of land and income and not on the distribution of land alone. We, therefore, classify farm households based on their income levels into three broad categories i.e. low-, middle-, and high-income classes. The households earning less than or equal to the mean per capita income (we take Rupees 15000 as cut-off, which is almost the same as the mean per capita income of an average farm household) are classified as low-income or poor households. Those earning in the range of Rupees 15000 to 30000 are considered in the middle-income class and the rest are classified as high-income or rich households.

Table 2 shows typology of farm households built on the joint distribution of land and income. Such a distribution provides (i) composition of an income class by landholding size; and (ii) distribution of farmers of a land class across income classes.

Composition of an income class by landholding size is shown in panel (a) of Table 2. In the low-income class, approximately three-fourths of the farmers have landholdings less than or equal to one hectare, i.e. marginal farmers. These farmers, by virtue of their dominant position in the agrarian structure also prevail among the middle-, and high-income classes that contain 20% and 11% of the total farmers, respectively. Only 7.2% of the medium and 2.4% of the large farmers fall in low-income class, as compared to their corresponding share of 21.3% and 17.4% in high-income class.

Panel (b) of Table 2 shows distribution of farmers across income classes. More than 77% of the marginal farmers stay in the low-income class, but at the same time about 7% of them also have per capita income exceeding Rupees 30000. A similar pattern is observed in the distribution of small and medium farmers. Unequivocally, large farmers are equally distributed on the income continuum—39% of them belong to high-income class and 35% to low-income class.

Table 2: Distribution of farmers by their status in land-income class, 2012-13

Land class	Low-income (≤ 15000 rupees)	Middle-income (15001-30000 rupees)	High-income (> 30000 rupees)	All
(a) : within income classes				
Marginal	74.54	55.60	41.71	69.77
Small	15.91	23.11	19.63	17.12
Medium	7.17	14.71	21.29	9.22
Large	2.38	6.58	17.37	3.89
All	100.00	100.00	100.00	100.00
(b) : across income classes				
Marginal	77.30	16.10	6.61	100.00
Small	62.74	25.44	11.82	100.00
Medium	49.35	28.28	22.38	100.00
Large	34.69	26.71	38.60	100.00
All	69.84	19.50	10.66	100.00

Table 3 compares per capita income of farmers as per their position in the joint distribution of land and income. On average, farmers in the high-income class, irrespective of the land class they belong to, have income level almost nine times higher than those in the low-income class. Even the marginal farmers in the high-income class exhibit a similar difference in their income level over their counterparts in the low-income class.

Interestingly, there is no significant variation in per capita income in any of the income class irrespective of the land size, except large farmers in the high-income class who earn 25-35% more than other categories of farmers in this class.

Table 3: Per capita income of farmers by their status in land-income class (rupees/annum), 2012-13

Land class	Low-income	Middle-income	High-income	All
Marginal	6067 (95)	20639 (199)	50478 (1279)	11346 (243)
Small	7191 (162)	21026 (180)	55318 (1282)	16399 (419)
Medium	7717 (190)	21436 (250)	54842 (1387)	22142 (606)
Large	7366 (413)	22574 (433)	68284 (2278)	34941 (1568)
All	6395 (83)	20972 (128)	55450 (832)	14470 (244)

Figures in parentheses are standard errors.

These findings clearly bring out the importance of land size in farmers' income. Yet, all the smaller farmers are not poor, and all the larger farmers are not rich. This is possible because of their differential access to nonfarm income opportunities, markets, credit, information and infrastructure; and the differences in their levels of schooling, skills, irrigation status and cropping pattern.

4.2 Income sources across land and income classes

On average, farm households obtain 48% of their income from cultivation of crops, 32% from wage and salaried employment, 12% from animal husbandry and 8% from nonfarm business activities (Table 4). The share of wage and salaried employment as a contributor to income is particularly striking.

Expectedly, marginal farmers are more dependent on labour market as the wages and salaries account for close to half (47%) of their income (panel a of table 4). This stylized fact could be partly attributable to the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)[1] that assures 100 days of employment to a household in a year. Crop production contributes 30% to their total income, and is followed by animal husbandry (14%) and nonfarm business activities (9%). However, as landholding size increases, the crop production becomes dominant income source; and the share of nonfarm activities, i.e. wages and salaries, and nonfarm business activities declines. Income share of animal husbandry also declines with

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[1] Farmers earn wages by working on and off the farms. Now, the share of nonfarm wages and salaries in farmers' income is 33% as compared to 20% in 2002-03 (Birthal et al., 2014) i.e. before implementation of the employment guarantee scheme.

increase in landholding size, but not as drastically as that of nonfarm business activities. Large farmers obtain close to 80% of their income from crops, but only 11% of it from nonfarm activities including wages, salaries and nonfarm business.

Table 4: Framers' income sources by land and income class (%), 2012-13

Land/income class	Wages & salaries	Cultivation of crops	Farming of animals	Nonfarm business	Total
(a) by land class					
Marginal	46.75	30.10	13.77	9.38	100.00
Small	23.15	56.94	12.07	7.84	100.00
Medium	15.90	69.04	10.73	4.33	100.00
Large	8.63	79.64	8.10	3.63	100.00
All	32.86	47.20	12.32	7.62	100.00
(b) by income class					
Low	38.43	44.85	10.69	6.03	100.00
Middle	33.48	45.13	13.37	8.02	100.00
High	28.25	50.41	12.82	8.52	100.00
All	32.86	47.20	12.32	7.62	100.00

The other way to look at the variation in the contribution of income sources is by the income level of farmers. Crop production, irrespective of the landholding size and income level, appears largest component of farmers' income and is followed by wage and salaried employment (panel b of Table 4). Low-income farmers obtain as much as 83% of their income from these two sources— 45% from cultivation of crops and 38% from wage and salaried employment. Farmers in the high-income class receive about half of their income from cultivation of crops and 28% from wage and salaried employment. Share of nonfarm business activities increases with income level; it is 8.5% for high-income households and 6.2% for low-income households. On the other hand, we find a little difference in the contribution of animal husbandry across income classes because of its egalitarian distribution as discussed above (Birthal et al., 2014).

From a comparison of the patterns in distribution of income sources by land size and income level it follows that nonfarm activities are more important at the lower-end of land distribution and can be a potential entry point for land-constrained households to move up the income ladder. The key factors (e.g. skills, education, and access to credit and infrastructure) that may facilitate this transition are discussed in the following chapter.

Chapter

5

Principal Differentiators of Farmers' Income

Farmers are heterogeneous based on several factors that bear on their access to income opportunities and earnings. These include resource endowments (physical and human capital), innate capabilities, social capital, and access to technology, infrastructure, markets and institutions.

Table 5 compares key characteristics of the farmers belonging to different income classes. Farmers in the high-income class, irrespective of landholding size, have a more diversified income portfolio in terms of counts of income sources as well as intensity of their engagement. Towards this, 17% of the high-income farmers have reported income from nonfarm business activities, compared to just 7% of the low-income households. Animal husbandry, though more equally distributed, has comparatively high concentration among high-income farmers. Note that participation of high-income farmers in wage and salaried employment is no different than for others. A comparison of income shares and participation rates across income classes, however, indicates that low-income farmers are more engaged in low-paid wage activities, and high-income farmers in well-paid salaried jobs. A higher rate of possession of job cards under the MGNREGS for low-income households substantiates this conjecture.

Again, land size is a strong correlate of farmers' income. Average size of landholding of farmers in the high-income class is about 2.5 times larger compared to those in the low-income class. They have comparatively good access to irrigation, and practice intensive agriculture—their cropping intensity[1] is about 20% higher than that for low-income farmers. Their cropping pattern is also more diversified towards fruits, vegetable, spices, condiments and plantation crops that generate higher returns to land, compared to cereals or other widely grown crops. They allocate 12% of their cropped area to such high-value crops, which is almost twice of the allocation by low-income farmers.

Crop productivity, measured as net returns per hectare, is higher for high-income farmers. They harvest 2.8 times more net returns per

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[1] In absence of information on net cropped area in the sample we estimate cropping intensity as : total cropped area divided by landholding size.

Table 5: Key characteristics of farmers of different income classes, 2012-13

Variables	Low-income	Middle-income	High-income	All
Landholding size (ha)	0.80 (0.02)	1.20 (0.04)	1.92 (0.06)	1.02 (0.02)
Gross cropped area (ha)	0.98 (0.03)	1.62 (0.06)	2.78 (0.10)	1.33 (0.03)
% cropped area irrigated	60.98 (1.12)	58.22 (1.49)	64.05 (1.70)	60.80 (0.94)
Gross returns (Rs/ha)	42255 (2081)	59665 (3194)	87428 (3316)	51405 (1660)
Net returns (Rs/ha)	22890 (1954)	38238 (2153)	63645 (2947)	31073 (1474)
Cost of cultivation (Rs/ha)	19364 (620)	21427 (1431)	23782 (782)	20333 (551)
% area under high-value crops	6.15 (0.33)	8.12 (0.56)	12.04 (0.81)	7.21 (0.30)
% area under food grains	72.10 (0.80)	57.34 (1.42)	52.11 (1.33)	66.61 (0.71)
% households engaged in livestock production	47.57 (1.08)	58.75 (1.59)	61.56 (1.64)	51.60 (0.88)
% households engaged in non-farm business	7.27 (0.48)	13.89 (1.12)	16.80 (1.21)	9.81 (0.44)
% households receiving wages & salaries	50.17 (1.10)	58.27 (1.66)	50.46 (1.62)	51.89 (0.87)
Number of income sources per household	1.91 (0.02)	2.18 (0.02)	2.20 (0.02)	2.00 (0.01)
% male headed households	90.83 (0.59)	93.08 (0.79)	93.71 (0.64)	91.65 (0.44)
Caste of the households (%)				
Scheduled tribes	13.97 (0.74)	13.49 (1.00)	11.13 (1.07)	13.53 (0.63)
Scheduled castes	17.95 (0.83)	14.47 (1.19)	10.25 (1.08)	16.30 (0.65)
Other backward castes	45.73 (1.16)	45.23 (1.77)	44.01 (1.82)	45.42 (0.96)
Upper castes	22.35 (0.89)	26.80 (1.43)	34.61 (1.65)	24.76 (0.76)
Family size (number)	5.32 (0.05)	4.81 (0.06)	4.49 (0.07)	5.11 (0.04)
Number of adult workers per household	3.17 (0.03)	3.27 (0.05)	3.20 (0.05)	3.20 (0.05)
Education level of the household-head (%)				
Illiterate	45.15 (1.04)	38.58 (1.64)	28.83 (1.62)	41.81 (0.82)
Primary school	25.00 (0.87)	25.83 (1.32)	23.31 (1.29)	24.97 (0.65)
Middle school	14.46 (0.61)	13.00 (0.91)	16.60 (1.11)	14.42 (0.48)
Secondary school	8.21 (0.47)	11.31 (0.95)	13.72 (1.04)	9.53 (0.41)
Higher secondary school	3.77 (0.39)	5.67 (0.78)	7.29 (0.63)	4.59 (0.31)
Graduate and above	2.58 (0.27)	4.91 (0.72)	9.86 (0.72)	3.95 (0.26)
% households with job card	46.19 (1.10)	46.31 (1.71)	32.16 (1.73)	44.51 (0.91)
% household with ration card	86.65 (0.76)	90.00 (1.05)	89.78 (1.27)	87.73 (0.63)
% households having outstanding loans	48.21 (1.08)	57.82 (1.62)	60.36 (1.67)	51.68 (0.09)
% households having access to information	41.54 (1.14)	50.97 (1.77)	60.40 (1.74)	45.79 (0.96)

Figures in parentheses are standard errors.

unit of land as compared to those at the bottom of income distribution in spite of the difference in cost of cultivation being not so large. This indicates that marginal returns to input usage are quite attractive, but the low-income farmers seem to be constrained by their poor access to institutional credit, information, markets and infrastructure, and low-level of management skills or education to adopt improved technologies and quality inputs. Birthal et al. (2015) have reported that farmers who have access to information on modern agricultural technologies realize 12% higher net returns over those who do not have such access. Likewise, farmers who avail credit from financial institutions have been reported to realize 19% more profit from cultivation over their counterparts who borrow from informal sources (Kumar et al., 2017).

A part of the variation in farmers' income, both from farm and nonfarm sources, can be explained by the differences in their demographic and social attributes. Though the average household size of high-income farmers is smaller; the number of effective workers is pretty much same across all income classes. Human capital seems to be crucial for income generation. In the high-income class about 30% household-heads have attained education equal to or more than secondary level, a number almost double of that for the low-income class. This suggests a crucial role that human capital can play in raising farmers' income. Several studies have shown that even small gains in educational attainment may bring significant improvements in farmers' income (Lanjouw and Lanjouw, 2001; Foster and Rosenzweig, 2004).

Social status, based on caste, religion and ethnicity, can also differentiate farmers in their income *via* ownership of resources, and access to technology, information and credit. Batte and Arnholt (2003) and Ali (2012) have shown that early adaptors of technologies and innovations usually belong to upper strata of society and have a higher endowment of resources and access to extension services. Kumar (2013) and Birthal et al. (2016) have also observed that socially-disadvantaged farmers face discrimination in accessing institutional credit and public extension services. It has also been observed that socially-disadvantaged farmers are less likely to find employment in well-paid jobs (Himanshu et al., 2011).

In rural India, caste is an important indicator of social status with scheduled caste (SC) and scheduled tribe (ST) households at the bottom of social hierarchy, followed by other backward castes and upper castes in that order. We find a higher incidence of low-caste farmers in low-income class and of upper-caste farmers in high-income class. Yet, this ordering is not monotonic with respect to social hierarchy. The households falling in the middle rung, i.e. those belong to 'other backward castes' have almost an equal representation in all the income classes.

Though, land size seems to be an elemental correlate of farmers' income, yet within a land class there are significant income differences. Table 6 shows key characteristics of marginal farmers, who are largely homogeneous in their land ownership but differ widely in their income. We again find the same set of factors differentiating marginal farmers in their incomes level as in the case of overall pool of farmers. Further, among marginal farmers who are relatively more engaged in nonfarm business activities, in labour market, in animal husbandry and in high-value agriculture tend to harvest more profit from cultivation despite being comparatively constrained in their access to credit, information and other infrastructure.

By reducing cost of accessing markets and services, infrastructure and institutions can have significant bearing on farmers' income. Several studies have shown that the farmers located nearer to roads and urban centres are more engaged in cultivation of high-value crops and in animal husbandry due to their better access to demand centres and lower cost of trade (Parthasarathy Rao, Birthal and Joshi, 2006; Birthal, Joshi and Gulati, 2005). Shamdasani (2016) has reported that rural roads create incentives for farmers to allocate more land to high-value crops, to use improved technologies and farm inputs, and to move out of agriculture to nonfarm sector.

To assess importance of infrastructure and institutions in farmers' income we estimated correlation coefficients between the proportion of farm households in an income class in different districts and the proportion of villages in these districts with access to various types of infrastructure (Table 7).[1] There is a negative and significant association between incidence of low-income farmers and infrastructural variables, i.e. electricity, telephone lines, mobile connectivity, pucca road, all-weather road, commercial bank and cooperative bank. This implies that low-income farmers have a greater concentration in the districts that are deficient in infrastructure and institutions. On the other hand, the correlation coefficients are positive and significant for higher income classes. Further, a related finding is that the farmers who have better access to infrastructure and earn more have a more diversified income portfolio—they allocate larger area to high-value crops, and are more engaged in animal husbandry and nonfarm business activities (see Table 5 and Table 6). Not only that, they also obtain significantly more profits from crop production than those having poor access to infrastructure. This suggests a crucial link between infrastructure and farmers' income.

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[1] For this purpose, we scaled up both village-level data on infrastructure from Census 2011 and household data from 2012-13 survey to the district-level.

Table 6: Key characteristics of marginal farmers by their income level, 2012-13

	Low-income	Middle-income	High-income	All
Landholding size (ha)	0.41 (0.01)	0.44 (0.02)	0.45 (0.02)	0.42 (0.01)
Gross cropped area (ha)	0.59 (0.01)	0.65 (0.03)	0.73 (0.09)	0.61 (0.01)
% cropped area irrigated	65.47 (1.22)	61.36 (2.05)	57.45 (3.05)	64.17 (1.08)
Gross returns (Rs/ha)	46230 (2706)	70047 (5136)	105149 (6865)	54686 (2332)
Net returns (Rs/ha)	25655 (2554)	45683 (3617)	79420 (6299)	33084 (2122)
Cost of cultivation (Rs/ha)	20575 (762)	24364 (2088)	25729 (1299)	21602 (702)
% area under high-value crops	6.30 (0.40)	8.91 (0.78)	14.59 (1.33)	7.41 (0.36)
% area under food grains	73.68 (0.89)	54.95 (2.10)	49.73 (2.23)	68.49 (0.84)
% households engaged in livestock production	47.14 (1.27)	58.33 (2.24)	59.32 (2.80)	50.08 (1.08)
% households engaged in non-farm business	7.77 (0.59)	16.48 (1.65)	20.72 (2.08)	10.33 (0.54)
% households receiving wages & salaries	52.08 (1.30)	69.44 (2.31)	73.59 (2.17)	56.84 (1.08)
Number of income sources per household	1.91 (0.02)	2.25 (0.03)	2.36 (0.04)	2.01 (0.02)
% male headed households	89.89 (0.73)	91.60 (1.27)	93.02 (1.09)	90.44 (0.66)
Caste of the household (%)				
Scheduled tribes	12.52 (0.77)	13.63 (1.34)	12.96 (1.83)	12.75 (0.69)
Scheduled castes	20.21 (1.02)	17.06 (1.78)	16.53 (2.22)	19.36 (0.86)
Other backward castes	45.66 (1.34)	43.95 (2.58)	43.09 (3.08)	45.16 (1.16)
Upper castes	21.60 (1.02)	25.36 (1.94)	27.42 (2.31)	22.72 (0.88)
Family size (number)	5.13 (0.06)	4.48 (0.08)	4.18 (0.13)	4.94 (0.05)
Number of adult workers per household	3.02 (0.03)	3.10 (0.07)	3.08 (0.08)	3.04 (0.03)
Education level of the household-head (%)				
Illiterate	45.98 (1.26)	40.61 (2.45)	33.50 (2.98)	44.05 (1.06)
Primary school	25.45 (1.05)	26.08 (1.99)	22.79 (2.32)	25.35 (0.86)
Middle school	14.23 (0.74)	11.41 (1.24)	15.34 (1.91)	13.82 (0.62)
Secondary school	7.78 (0.56)	11.07 (1.46)	12.01 (6.77)	8.69 (0.53)
Higher secondary school	3.70 (0.48)	5.29 (1.19)	6.77 (1.00)	4.23 (0.42)
Graduate and above	2.21 (0.31)	5.10 (1.14)	9.41 (1.22)	3.28 (0.33)
% households with job card	45.74 (1.28)	48.35 (2.50)	37.97 (2.94)	45.60 (1.11)
% household with ration card	86.03 (0.90)	89.59 (1.51)	88.05 (2.48)	86.82 (0.79)
% households having outstanding loans	45.22 (1.25)	55.37 (2.38)	51.06 (3.03)	47.48 (1.11)
% households having access to information	39.44 (1.30)	44.71 (2.47)	50.50 (2.95)	41.24 (1.14)

Figures in parentheses are standard errors.

Table 7: Correlation coefficients between proportion of farmers in an income class and infrastructural variables in a district

Variables	Low-income	Middle- income	High-income
Electricity	-0.408***	0.325***	0.298***
Telephone lines	-0.424***	0.338***	0.309***
Mobile connectivity	-0.323***	0.262***	0.231***
Pucca road	-0.172***	0.163***	0.102**
All-weather road	-0.231***	0.239***	0.118***
Commercial bank	-0.353***	0.236***	0.300***
Cooperative bank	-0.318***	0.205***	0.276***
Mandi/market	-0.038	0.027	0.032

Note: Information on infrastructure was extracted from 2011 census.
*** denotes significance at 1%.

Note, the correlation coefficient on market access is insignificant. This, however, should not be interpreted that agricultural markets are perfectly competitive. Farmers sell produce to formal (regulated markets, government agencies and cooperatives) as well as to informal channels (local private traders, processors and input dealers) at varying rates, i.e., prices. In Table 8 we show sales pattern of paddy and wheat and prices farmers receive from different market channels. Approximately 61% of the paddy sales are associated with informal channels, and the opposite is true for wheat. Local traders dominate informal channels—they account for 47% and 29% of the total paddy and wheat sales, respectively. Input suppliers account for 8-9% of the sales of both paddy and wheat. About 45% of the marketed surplus of wheat and 26% of paddy is sold in the regulated markets. The government agencies and cooperatives procure 14% of the marketed surplus of paddy and 19% of wheat.

Farmers receive higher prices when they sell to government agencies and cooperatives. Note that the government fixes minimum support prices that are uniform for all the farmers. The price realization from sales to informal channels is significantly less for both paddy and wheat. The prices that farmers receive in regulated markets/mandies are also lower than the government-administered prices despite the common claim of these being transparent in price discovery. A similar observation was made by Meenakshi and Banerji (2005), who found traders in regulated markets often colluding and forcing farmers to sell at a price below the minimum support price.

Table 8: Market channels and prices of paddy and wheat, 2012-13

	Local traders	Mandies / markets	Input dealers	Coopera-tives and government	Processors and others	Total
Paddy						
% farmers selling	58.6	17.9	8.4	8.2	6.9	100
% share in sales	46.6	25.9	8.9	14.2	4.4	100
Price received (Rs/kg)	11.5	12.9	11.6	13.1	11.4	11.9
Wheat						
% farmers selling	48.5	34.3	9.3	6.6	1.3	100
% share in sales	28.6	44.5	7.5	18.8	0.6	100
Price received (Rs/kg)	12.8	13.8	12.6	14.2	13.2	13.2

Chapter 6

Regional Distribution of Low-income Farmers

From the evidence so far, it is clear that marginal farmers have to be at the forefront of any strategy aimed at enhancing farmers' income. In this section, we identify location of the low-income farmers and analyse the agro-ecological, economic and institutional factors that obviate their raising of income.

## 6.1 State-wise distribution of low-income farmers

Figure 2 and Table 9 show location of the poor or low-income farmers. More than half (52%) of the low-income farmers are located in eastern region (including Uttar Pradesh).[1] Uttar Pradesh alone accounts for more than a quarter (26%) of them, followed by Bihar (11%), West Bengal (7%), Odisha (5%) and Jharkhand (3%). Another 27% of them are located in western states of Rajasthan, Maharashtra, Madhya Pradesh, Chhattisgarh and Gujarat. These low-income farmers comprise around 80% of the total farmers in eastern states; and their share in western region ranges from 51% in Gujarat to 78% in Chhattisgarh.

Southern region, comprising Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Kerala, accounts for about 12% of the total low-income farmers in the country. They make up around 60% of the total farmers in this region, except in Kerala where their proportion is just one-third. Rest of the low-income farmers are distributed almost equally between northern and north-eastern regions. In north-eastern region, they make up 60-70% of the total farmers, except in Meghalaya (43%). In northern states, except Uttarakhand (76%), the proportion of low-income farmers is comparatively low (32-57%).

Table 9 also shows distribution of marginal farmers belonging to the low-income category. We find almost a similar pattern in their regional concentration as for the overall pool of low-income farmers. But, now the share of eastern region in the total low-income marginal farmers rises

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[1]Agriculture in western part of Uttar Pradesh is as developed as in Punjab and Haryana, while in the eastern part it is under-developed. We, therefore, presume that a majority of the low-income farmers in Uttar Pradesh lies in its eastern part.

Figure 2: Spatial distribution of low-income farmers (%), 2012-13

(a) Distribution of
low-income farmers across states

5.935 - 26.37
2.89 - 5.935
.805 - 2.89
.2 - .805
.02 - .2
0 - .02

(b) Distribution of
low-income farmers within states

76.625 - 86.2
64.18 - 76.625
59.455 - 64.18
55.165 - 59.455
42.65 - 55.165
9.89 - 42.65
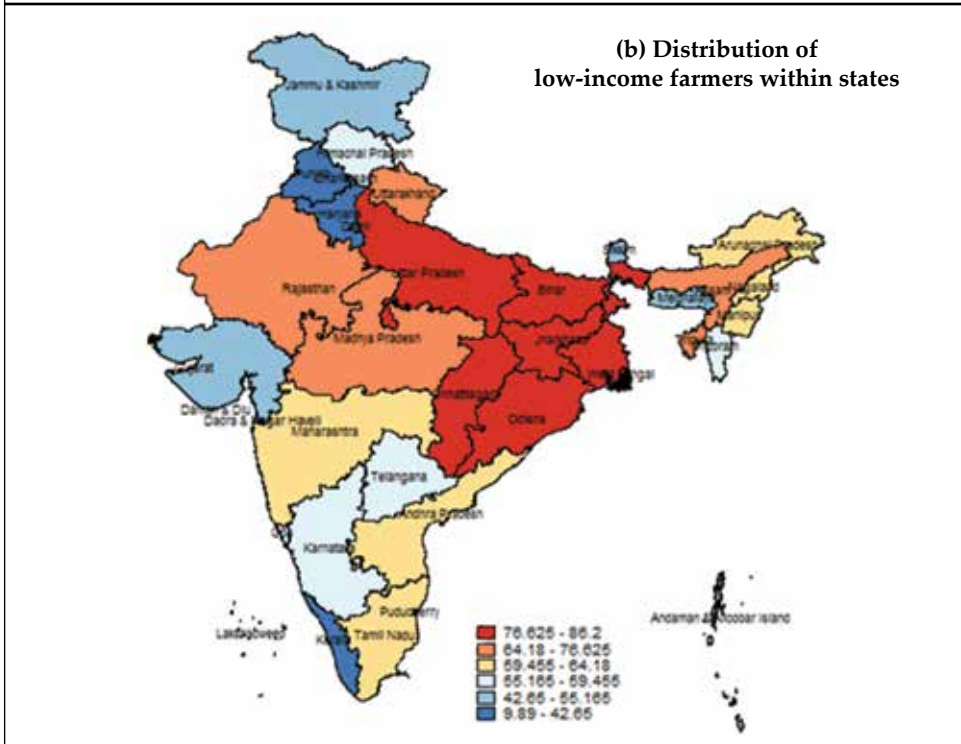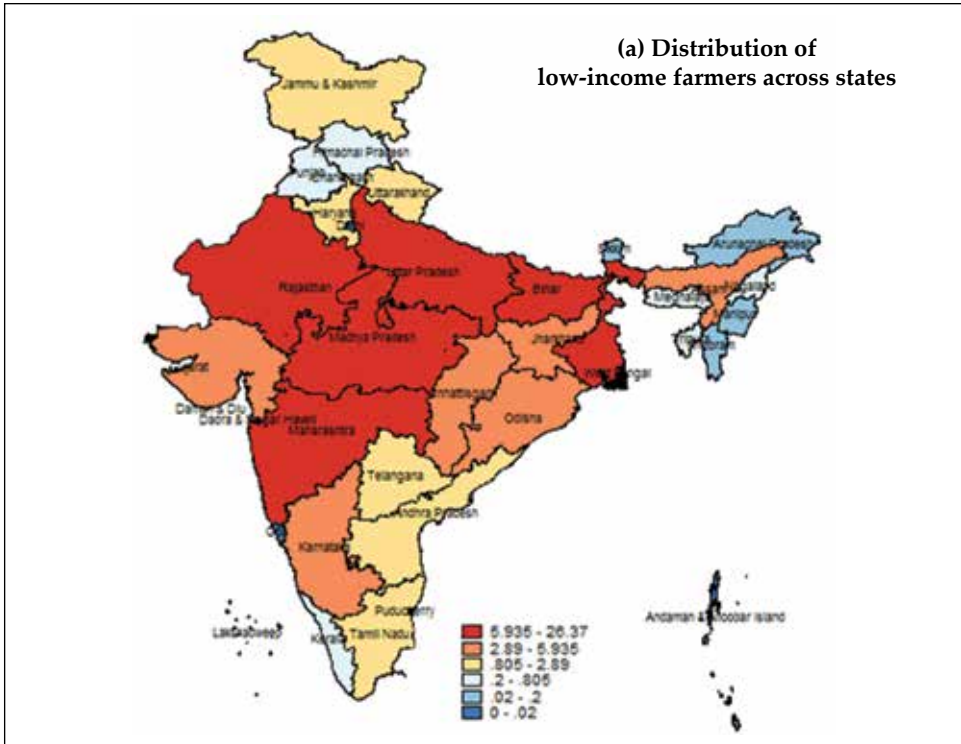
to 58% and that of western region declines to 21%. In most states, the proportion of marginal farmers in the overall pool of low-income farmers is comparatively high. This difference is particularly stark in Punjab, Haryana, Rajasthan, Madhya Pradesh and Assam.

Table 9: Spatial distribution of low-income farmers, 2012-13

States	Low-income farmers (LIF)		Low-income marginal farmers (LIMF)		Per capita income (rupees)	
	% of all-India	% of total farmers in the state	% of all-India	% of total low-income farmers	LIMF	All farmers
Bihar	10.5	86.2	11.4	88.0	5204	8626
Uttar Pradesh	26.4	81.7	27.4	86.0	5098	11131
Uttarakhand	1.2	75.9	1.6	80.4	6088	11597
West Bengal	6.9	79.0	9.9	79.1	6327	11599
Jharkhand	3.0	81.7	3.2	78.3	6351	12836
Chhattisgarh	3.2	78.4	2.5	84.7	6796	12897
Odisha	5.0	77.3	6.3	79.8	6653	14047
Tripura	0.2	69.2	0.3	70.0	7446	15568
Madhya Pradesh	7.0	70.4	5.3	80.2	7061	15745
Assam	3.5	65.6	3.9	76.1	6608	16854
Rajasthan	7.0	65.3	5.8	74.8	7679	17301
Maharashtra	6.8	62.0	4.3	64.7	6788	18561
Gujarat	3.3	51.2	2.6	50.8	8241	19311
Manipur	0.2	60.3	0.2	69.5	4672	19481
Andhra Pradesh	2.8	63.1	2.5	61.4	7271	19671
Telangana	2.0	58.7	1.7	61.0	7101	19878
Sikkim	0.1	55.0	0.1	52.0	7881	20800
Tamil Nadu	2.5	60.2	3.1	61.0	6977	21913
Mizoram	0.1	55.5	0.1	61.9	7311	22436
Karnataka	3.7	55.8	2.9	58.0	6154	22476
Nagaland	0.3	61.1	0.2	51.6	7234	23768
Arunachal Pradesh	0.1	61.3	0.1	75.0	5088	24505
Himachal Pradesh	0.7	57.3	1.0	58.7	7455	25829
Meghalaya	0.3	43.5	0.2	41.3	9178	26506
Jammu & Kashmir	0.9	44.3	1.0	43.6	7202	30058
Haryana	1.2	41.8	1.0	52.7	6961	31176
Kerala	0.6	33.0	0.9	36.2	5407	35553
Punjab	0.7	32.2	0.8	44.7	5682	43941

Table 9 also presents estimates of per capita income of low-income marginal farmers vis-à-vis average income of all the farmers in a state. Interestingly, there is no significant regional variation in it. In other words, low-income marginal farmers in better-off states are as worse-off as ones in the worse-off states. The per capita income of low-income marginal farmers ranges between Rupees 5000-6000 in Punjab, Uttar Pradesh, Bihar, Arunachal Pradesh and Kerala; Rupees 6000-7000 in Uttarakhand, Haryana, West Bengal, Jharkhand, Odisha, Chhattisgarh, Maharashtra, Karnataka and Tamil Nadu, and it is more than Rupees 7000 in other states, except Manipur where it is less than Rupees 5000.

6.2 Differences in infrastructure and institutional development across states

A number of factors including agro-ecological conditions, technology, infrastructure and institutions can give rise to differences in farmers' income and income opportunities across states. In this section, we examine differences in (i) the income portfolio, and (ii) the factors that could be responsible for such differences in farmers' incomes across states.

Table 10 shows variation in income portfolio across states. In eastern region, grain-based cropping system is the main source of income in Bihar and Uttar Pradesh; and wage and salaried employment in West Bengal, Odisha and Jharkhand. High-value crops are relatively more important in West Bengal and Jharkhand. Animal husbandry is as important source of income as crop production in Jharkhand and Odisha. Nonfarm business activities with a share of 17% and 11% in the total household income are important in West Bengal and Odisha, respectively. In western states as well, grain-based cropping system makes up the largest component of household income, followed by wage and salaried employment, and animal husbandry. Nonfarm business is not an important income source in this region, except in Maharashtra and Rajasthan where it contributes 11.4% and 9.8% to the total income of farmers, respectively.

Overall, income portfolio is more diversified in southern region. Nonfarm activities are important in Andhra Pradesh, Kerala and Tamil Nadu. In these states, agriculture is also more diversified towards high-value crops. In north-eastern region too, income portfolio is more diversified. Crop production is the main income source in Assam, Arunachal Pradesh, Meghalaya, Mizoram and Tripura; and wage and salaried employment in Nagaland, Sikkim and Manipur. High-value crops and animal husbandry contribute a sizable share to the total income in many states in this region. Nonfarm business activities are relatively more prominent in Sikkim, Arunachal Pradesh and Meghalaya. In northern region, there is

considerable variation in income sources across states. Nonfarm activities do not contribute much to the household income, except in hill states of Jammu & Kashmir and Himachal Pradesh. Grain-based cropping system is the dominant income source in Punjab, Haryana and Uttarakhand. Animal husbandry is also generally an important income-generating activity.

Table 10: Farmers' income sources in different states, 2012-13

	Wages and salaries	Cultiva-tion of crops	Farming of animals	Nonfarm business activities	% share of food grains in crop income	% share of high-value crops in crop income
Bihar	36.9	47.7	8.8	6.5	89.5	3.2
Uttar Pradesh	23.2	57.8	11.1	7.9	60.1	8.0
Uttarakhand	23.0	53.9	17.8	5.3	40.6	5.9
West Bengal	53.2	24.6	5.5	16.7	60.6	26.0
Jharkhand	37.8	29.9	27.3	5.0	73.1	24.1
Chhattisgarh	35.5	64.8	-0.3	0.0	96.4	1.3
Odisha	34.6	28.4	26.3	10.7	89.2	8.1
Tripura	40.2	51.0	5.8	3.0	71.5	25.3
Madhya Pradesh	21.4	64.6	12.0	2.1	58.2	4.8
Assam	21.5	63.2	11.5	3.8	59.3	35.3
Rajasthan	34.1	42.3	13.8	9.8	49.9	3.6
Maharashtra	28.5	52.4	7.7	11.4	29.7	10.4
Gujarat	33.8	37.1	24.5	4.7	32.1	9.6
Manipur	44.2	33.8	15.4	6.6	81.6	17.8
Andhra Pradesh	42.0	34.0	17.6	6.4	53.3	20.4
Telangana	22.9	67.2	5.8	4.1	45.7	6.1
Sikkim	45.8	24.9	14.5	14.7	34.7	60.7
Tamil Nadu	40.7	27.1	16.1	16.1	41.9	20.3
Mizoram	40.1	50.1	9.6	0.3	28.1	67.1
Karnataka	30.3	55.5	7.1	7.1	39.0	28.8
Nagaland	53.7	31.9	13.9	0.6	72.0	27.1
Arunachal Pradesh	19.1	61.1	11.5	8.4	76.4	19.4
Himachal Pradesh	45.6	33.1	12.1	9.2	20.7	78.0
Meghalaya	32.0	54.6	5.7	7.6	13.7	80.3
Jammu & Kashmir	57.9	24.0	6.2	11.9	47.8	44.9
Haryana	24.2	54.5	18.3	3.0	64.4	0.3
Kerala	43.7	29.6	4.9	21.8	7.1	79.9
Punjab	26.5	60.2	9.2	4.0	80.0	2.5

Table 11 shows inter-state differences in infrastructure and institutional development which is considered critical for broad-based growth of agriculture and rural transformation. Agro-ecological conditions of eastern and western regions are characterized by extremity. Western region has semi-arid and arid climate with low levels of precipitation and under-developed irrigation, while eastern region has humid climate with higher precipitation. Some states, like Uttar Pradesh, Bihar and West Bengal also have a higher proportion of their area under irrigation. Nonetheless, agriculture in both the regions is prone to frequent climatic risks; droughts in western region; and drought as well as flood in most eastern states.

Average size of landholding in eastern region is much smaller than in western region. Cropping intensity, in general, is low in both the regions, except in a few states. Farm productivity is also low on account of number of factors viz. poor adoption of modern technologies and lack of infrastructure and institutional support.

Agricultural research is a high payoff activity in terms of agricultural growth and poverty reduction (Fan, Gulati and Thorat, 2008; Birthal et al., 2014). Unfortunately, in most states in eastern as well as western regions the level of spending on agricultural research and education is low. For instance, it is less than Rupees 300 per hectare of net sown area in Rajasthan, Madhya Pradesh, Chhattisgarh, Odisha and West Bengal. Moreover, in states where investment in agricultural research is comparatively high, the supporting infrastructure and institutions are under-developed. For example, the landholding size and level of irrigation are relatively smaller in Jammu & Kashmir, Himachal Pradesh, Kerala and Karnataka even though they have higher investment in agricultural research. The compensating variation in these states comes from greater diversification towards high-value crops and nonfarm activities that sustains farmers' income there.

In most eastern states, rural roads and marketing infrastructure appear to be developed, but these are poor in power supply that hinders farmers capturing benefits of roads and markets. For example, electricity consumption in agriculture hardly exceeds 65KWh/ha in Odisha, Bihar and Jharkhand. Most north-eastern states are acutely deficit in all types infrastructure. On the other hand, most western states have better road connectivity and power supply, but under-developed markets. In northern region, hill states of Uttarakhand, Himachal Pradesh and Jammu & Kashmir have low-level of infrastructural development.

Institutional support to agriculture and rural development is generally poor in north-eastern and eastern regions. Banking facilities are available in a small proportion of villages in these regions, except in Assam and Bihar. Kumar, Singh and Sinha (2010) have found poor flow of institutional credit

Table 11: Indicators of infrastructure and institutional development in different states

States	Land holding (ha), 2012-13	Irrigation (%), 2013-14	Cropping intensity (%), 2012-13	Research & education spending (Rs/ha), 2013-14	Electricity consumption KWh/ha), 2013-14	Market density (No/1000 sq.km), 2013-14	% area insured, 2014-15	% farmers accessing information All sources	% farmers accessing information Govt. sources	% villages connected with pucca road	% villages having commercial bank	% villages having cooperative bank	% villages having telephone lines	% villages having mobile phone connectivity	Rural literacy (%)	Urban population (%)
Bihar	0.60	67.9	144	826	64	19.1	48.0	43.4	6.1	75.4	19.1	11.6	38.6	59.0	59.8	11.3
Uttar Pradesh	0.66	78.8	156	671	556	16.8	8.0	30.2	5.2	75.1	8.2	5.5	40.0	78.4	65.5	22.8
Uttarakhand	0.49	49.5	159	1949	550	1.2	4.6	26.2	11.2	58.4	9.1	10.5	61.3	94.9	76.3	30.6
West Bengal	0.44	58.9	186	267	239	39.8	10.3	52.7	10.1	52.2	13.8	7.6	60.2	88.7	72.1	31.9
Jharkhand	0.63	14.2	118	584	60	10.1	14.8	32.1	3.2	95.7	8.8	6.3	12.8	53.2	61.1	24.1
Chhattisgarh	1.24	30.7	122	187	539	8.4	33.1	54.7	27.3	76.6	5.3	8.0	36.6	71.3	66.0	23.2
Odisha	0.74	29.1	116	261	36	9.9	33.4	36.7	16.5	76.6	1.9	2.8	71.5	97.6	70.2	16.7
Tripura	0.72	26.8	144	38	155	52.8	0.1	32.5	29.1	88.8	13.0	9.8	60.4	79.4	84.9	26.2
Madhya Pradesh	1.44	41.2	151	127	650	4.3	45.9	42.7	9.9	69.9	8.2	11.0	40.2	80.8	63.9	27.6
Assam	0.90	9.1	149	669	12	14.5	0.7	57.1	25.1	50.2	12.6	8.3	32.2	80.3	69.3	14.1
Rajasthan	1.78	37.8	137	93	1048	2.2	49.7	30.4	9.2	55.0	36.3	37.4	87.0	99.9	61.4	24.9
Maharashtra	1.56	19.5	126	401	1272	14.2	22.3	42.5	17.5	91.1	24.5	29.2	92.9	98.4	77.0	45.2
Gujarat	1.28	47.6	122	584	1454	1.7	11.0	52.8	17.6	97.9	22.8	14.5	93.0	98.1	71.7	42.6
Manipur	0.86	18.2	100	123	3	5.3	2.1	30.4	9.3	62.1	1.7	0.8	35.1	86.8	76.2	30.2
Andhra Pradesh	1.48	50.4	123	544	1793	3.3	4.0	68.2	30.9	97.1	32.4	15.7	93.5	96.4	67.4	29.6
Telangana	1.53	50.3	118	665	—	—	—	37.9	5.9	98.2	23.8	15	86.8	96.9	57.3	38.9
Sikkim	0.67	8.6	194	15	neg	2.7	Neg	0.5	0.1	87.9	12.5	4.2	85.9	99.9	79.0	25.0
Tamil Nadu	0.90	56.1	113	1232	2475	7.5	16.3	49.9	25.7	98.5	16.3	24.3	94.9	98.8	73.5	48.5
Mizoram	1.04	14.2	100	1043	1	5.5	Neg	34.4	21.9	48.2	8.8	2.5	29.5	75.3	84.1	51.5
Karnataka	1.65	33.5	120	504	1754	4.9	12.3	69.9	42.2	95.7	19.2	8.3	98.0	92.6	68.7	38.9
Nagaland	1.11	20.0	129	410	neg	11.6	Neg	21.7	5.8	37.5	3.1	0.1	23.7	93.0	75.4	29.0
Arunachal Pradesh	1.68	19.3	132	548	neg	1.0	Neg	22.7	15.6	37.2	4.7	1.5	33.9	54.1	59.9	22.7
Himachal Pradesh	0.56	21.2	174	2908	138	1.4	5.6	42.9	29.2	72.6	12.9	13.8	89.1	91.0	81.9	10.0
Meghalaya	1.06	37.0	119	386	1	5.5	0.4	23.5	15.1	55.2	4.3	2.5	23.0	75.6	69.9	20.1
Jammu & Kashmir	0.50	42.9	156	5132	398	0.1	Neg	53.0	36.4	61.4	11.9	5.6	45.2	84.2	63.2	27.2
Haryana	1.41	88.2	181	741	2357	10.7	Neg	43.6	21.1	97.3	22.9	22.4	94.7	100	71.4	34.8
Kerala	0.60	17.9	127	1719	94	35.1	1.7	66.0	40.7	100	86.4	96.8	100	100	93.0	47.7
Punjab	1.53	98.5	190	809	2597	35.7	Neg	46.9	29.9	92.9	18.5	21.2	89.1	98.7	71.4	37.5

Note : Data on irrigation, cropping intensity, and electricity consumption are from (RBI: https://rbi.org.in/Scripts/AnnualPublications.aspx?head=State%20Finances%20A%20Study%20of%20Budgets); on research and education spending from GoI (2016); rural literacy and urban population from 2011 Census; and on all others from GoI (2014).

to these regions, compared to others. Agricultural service delivery system is also under-developed. Barely one-third of the farmers in Uttar Pradesh, Jharkhand, Odisha and north-eastern states have access to information on modern agricultural technologies and practices, and they mostly depend on sources other than the government sources (extension workers, Krishi Vigyan Kendras, veterinary departments and research institutions). Only 10% of the farmers in Bihar, Uttar Pradesh, Jharkhand and West Bengal have access to information from government sources.

Most western states have better banking infrastructure (except Chhattisgarh and Madhya Pradesh) and public extension systems (except Rajasthan and Madhya Pradesh). The banking infrastructure and public extension system are relatively better-developed in southern and northern regions. In these regions, access to information through mass media (television, radio, newspaper, mobile and internet) is also greater, perhaps due to higher rate of literacy there.

Further, both the western and eastern regions are more prone to climatic risks. Expectedly, penetration of crop insurance is also higher in these regions, except in Uttar Pradesh, West Bengal, Jharkhand and Gujarat where area coverage under crop insurance hardly exceeds 15%.

Note that, one or the other indicator of infrastructure or institutional development is fairly robust in many of the low-income states. For example, there is a good network of rural roads in Bihar, but poor power supply restricts farmers capturing incentives that roads create for agriculture and rural development. This suggests the need for a multi-pronged, integrated strategy encompassing agricultural research, infrastructure and institutions to bridge the income gap between poor and rich states.

Several studies have brought out the role of urbanization in improving farmers' income and rural development (Lanjouw and Murgai, 2009; Himanshu et al., 2011). It creates employment and income opportunities for rural people in both nonfarm and farm sectors. Rapidly expanding urban demand for high-value food is an incentive for farmers to invest in productivity-enhancing technologies and inputs. However, urbanization is extremely low in many of the low-income states — 11% in Bihar, 14% in Assam, 17% in Odisha, 22% in Uttar Pradesh, and around 25% in Rajasthan, Chhattisgarh and Madhya Pradesh. Moreover, human capital is an important factor in rural industrialization and growth of nonfarm sector, but rural literacy is also low in these states.

Chapter

7

Conclusions and Policy Implications

The identification of poor farmers, their location and characteristics has important policy implications amidst the push to double farmers' income in a short period of time. It is obvious that this ambitious goal would require targeted interventions and identification of strategies that are associated with higher income. Towards this, it is also important to understand how different activities and occupations bear on income changes. The implications of this study are generic in nature, but can be modified suiting to the location-specific requirements.

What are the main takeaways from the point of view of the strategy for doubling farmer's income in a short period of time? The findings of this study clearly reveal that marginal farmers who comprise about 70% of the total farmers and more than three-fourths of whom stay at the bottom of income distribution should be at the forefront of the development strategies if the goal of doubling of farmers' income is to be achieved by 2022. Further, the focus should on eastern and western states that are home to about 80% of the low-income marginal farmers and are lagging behind in agricultural and economic development.

There is limited scope for income growth through area expansion, as our net cropped area has stagnated at around 140 million hectares. In such a situation, the recourse needs to be with prospects for income growth by raising cropping intensity, reducing inefficiency in production, and diversifying production portfolio towards high-value crops and animal production. The expansion in agriculture needs to exploit the intensive margin a lot more. At present, only 38% of the net cropped area is cultivated more than once, and there is significant variation in the cropping intensity across farms and states. This can be raised by improving farmers' access to reliable irrigation facilities and seeds of short-duration high-yielding crops/varieties, and mechanization of agricultural operations (Agarwal, 1984; Dhawan, 1991; Jin et al., 2012; Sekhar and Bhatt, 2014).

A related message that emerges is in terms of enhancing water-use efficiency. Given that irrigation is such a differentiator, the importance of improving water-use efficiency for raising farmers' income cannot be underestimated. At present, only about 8 million hectares is under

micro-irrigation systems (sprinkler and drip) as against the potential of 42 million hectares (Palanisami et al., 2011). In the same vein, conservation technologies, such as zero-tillage and laser-levelling, have potential to save irrigation, improve fertilizer-use efficiency, and enhance crop yields as well as cropping intensity.

A highly potent finding from the point of view of the strategies to augment income relates to farmers' differential access to information and credit. In many ways, access to information pitches farmers among technology adopters more than the ones driven by large-scale programmes for input subsidies and crop insurance. The mobile connectivity is widespread in rural areas, yet the potential of mobile phones for dissemination of information related to agriculture has remained under-exploited. In view of limited outreach of the government extension system, the modern communication technologies can serve an important vehicle for dissemination of information. The need is to bundle all types of information that farmers need, and link it with the modern communication networks for its dissemination.

Another important message that emerges is that if farmers' income has to be doubled or enhanced to a significant degree, status quo in terms of primacy of cereals has to give way to significant diversification towards high-value crops and animal production. Sustained income growth and expanding urbanization are triggering rapid growth in demand for high-value food commodities including animal products (Joshi and Kumar, 2016), and there exists considerable potential for expanding agro-processing and building competitive value chains from producers to urban centres and export markets. This is an opportunity for farmers to diversify their production portfolio and capture benefits of value addition. The policy should provide for greater allocation of resources to these high-value high-growth sectors, development of efficient and inclusive markets and value chains, and investment in public infrastructure that stimulate private investment in marketing and food processing.

The potential of these sectors notwithstanding, the policy focus on these has not been commensurate with their economic and social importance. For example, animal husbandry shares only about 5% of the total public investment and also institutional credit to the agricultural sector as against its share of over 25% in the agricultural GDP (Birthal and Negi, 2012). Livestock production remains constrained by poor breeding, health and extension services and inadequate supply of feeds and fodders. An example that best captures the dichotomy is that of dairy cooperatives. Despite significant growth, dairy cooperatives have remained concentrated in a few states viz., Gujarat, Karnataka, Maharashtra and Tamil Nadu leaving eastern and north-eastern states less-covered. Similarly, insurance and

extension support to high-value agriculture, especially animal husbandry is also negligible.

Amid these policy prescriptions, it is clear that in the long run boost to farmers' income must come from technological breakthroughs that push yield frontiers, enhance resource-use efficiency, reduce cost of production and improve resilience of agriculture to climate change. This implies more investment in agricultural research, improvements in efficiency of research and reorientation of research agenda taking into consideration the emerging challenges and opportunities in agriculture. Currently, India spends only about 0.6% of its agricultural GDP on agricultural research and development, much less than that in developed as well as many developing countries (Beintema et al., 2012).

More importantly, doubling farmers' income would require reducing excessive employment pressure on agriculture by expanding the nonfarm sector for absorbing the surplus labour force in agriculture. The profiling of high-income farmers especially marginal farmers brings out the role of nonfarm sector vividly. The findings indicate that nonfarm sector (including labour market, salaried employment, and businesses) can be important pathway for smallholder farmers to raise their income. The implication is that if the constraint due to ubiquitous smallholdings were to be mitigated, strategies for broad-based growth of rural nonfarm sector would be required.

There is considerable scope for rural industrialization, as agriculture generates considerable surplus to attract investment in local manufacturing of value-added products to respond to local, regional and export demand. Experiences of some Latin American countries show that such activities allow accumulation of physical, human and financial capital that ease constraints on speeding up of the process of rural industrialization (Berdegué et al., 2000). The expanding rural nonfarm sector will also create opportunities for investment in ancillary industries related to inputs, equipment, machines and support services, and generate income for investment in farm production. Investment in human capital or skill development and value chains will be a key to rural industrialization.

Finally, on the importance of complementarities among different types of infrastructures and institutions in the strategies for doubling farmers' income. The evidence clearly shows that if farmers' income has to be raised significantly there is a need to focus on creating complementarities among these, and a lack of any of the crucial infrastructure and/or institution may restrict farmers capturing benefits from investment in others. A typical case is that of Bihar and Uttar Pradesh, where despite better road connectivity farmers are unable to benefit from it because of poor electricity supply for agriculture.

In conclusion, doubling farmers' income in a short period is a challenge, but not an insurmountable if stakeholders follow a comprehensive, multi-pronged and targeted approach encompassing income opportunities and their enabling conditions such as agricultural research, infrastructure, institutions and human resources that are crucial for agricultural growth and diversification of rural economy. Towards this, the government of India has announced a number of innovative approaches, and accordingly allocated sufficient budgetary resources with emphasis on enhancing farmers' access to institutions (e.g. credit, crop insurance and information, common markets), improving infrastructure (e.g. irrigation, electricity and roads); restoring soil health, improving efficiency of agricultural markets, expanding dairy processing facilities, skill development, and employment guarantee among others having indirect influence on agriculture and rural development.

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