

Growth and Structural Transformation of Agriculture in Bihar

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Background

Despite the presence of rich natural resources in Bihar, the state, until recently, remained backward in agricultural development. Although the economy of Bihar has started growing significantly since its bifurcation in 2000, it still remains one of the poorest states in India. Among the poorer states, Bihar scores very high in the under-development index¹. Its combined poverty level was as high as 33.7 per cent, as compared to the national average of 21.9 per cent, during 2011–12. The rural poverty level was even higher at 34.1 per cent. The state also has the dubious distinction of recording low health and educational outcomes².

The economy of Bihar is dominated by agriculture, which contributes over a quarter of the state's income and accounts for employment of about 70 per cent of the rural workforce. Hence, robust growth of the agriculture sector holds the key to the economic and social development of the state. Keeping this in view, the Government of Bihar has launched many initiatives for improving productivity growth in the crop and livestock sectors. These include the development of irrigation, strengthening the input supply and extension programmes, and introduction of market reforms and farm mechanisation, among others. These initiatives are being implemented under

different phases of the agriculture roadmaps, laid down by the Government of Bihar as follows: the first agriculture roadmap (2008–09 to 2011–12); the second agriculture roadmap (2012–13 to 2016–17); and the third agriculture roadmap (2017–18 to 2022–23). These roadmaps focus on the holistic development of agriculture with an emphasis on increasing productivity growth and improving farmers' income (see Box 1).

In this context, the UK Department for International Development (DFID) in India has commissioned the National Council of Applied Economic Research (NCAER) to undertake an agricultural sector diagnostic study in the Indian state of Bihar to identify the economic, political, natural, and technological barriers that beset agricultural productivity and inclusive growth in Bihar (see Box 2).

This policy brief has been prepared as a part of this study to highlight the salient features of the prevalent agricultural situation in Bihar.

Structural Changes and Relative Performance of Agriculture in Bihar

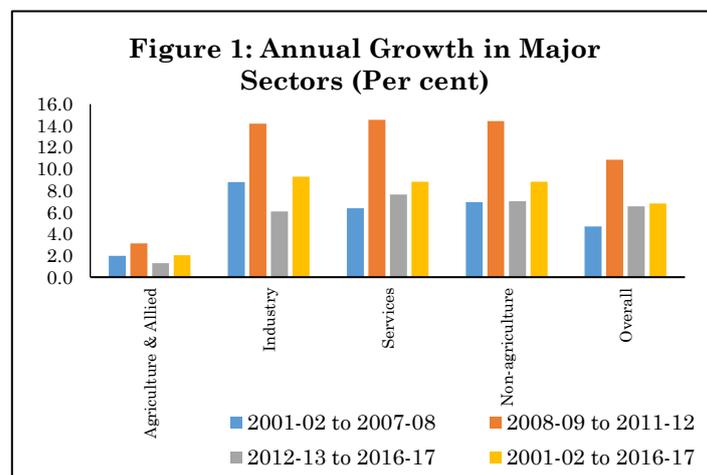
The bifurcation of the erstwhile Bihar state in 2000 resulted in the formation of a new state of Jharkhand. Following this

¹ Government of India (2013). *Report of the Committee for Evolving A Composite Development Index of States*, Ministry of Finance, New Delhi.

² Government of Bihar (2016). *Economic Survey 2016-17*, Finance Department, Patna.

bifurcation of Bihar, the part endowed with rich mineral resources went to Jharkhand while the fertile agricultural land and water resources were left in Bihar. Thus, agriculture holds the key to the overall development of the Bihar economy, and consequently policymakers have laid a lot of emphasis on agricultural development through implementation of various initiatives under the agriculture roadmaps (see Box 1)

The average annual growth of agriculture and allied activities during the pre-agriculture roadmap (2001-02 to 2007-08) was only about 2.0 per cent (Figure 1). During the period of the first agriculture roadmap, the growth rate accelerated to 3.1 per cent, which was almost equal to the national average agricultural growth. However, this high growth in agriculture could not be sustained in the long run. During the overall period 2001-02 to 2016-17, the average agricultural growth was only 2.0 per cent, which was much below the corresponding national figure of 3.1 per cent. However, the industry and services sectors registered excellent growth during all the



periods. Consequently, Bihar still remains one of the fast growing states in India.

The high economic growth, changes in consumption patterns, entry of multinational corporations, and rising urbanisation act as catalysts of transformation within agriculture. Changes in the composition of agricultural output reveal the pattern of structural changes over time (Table 1). The contribution of

Box 1: Bihar Agriculture Roadmaps			
Year of Launch	2008-09 First	2012-13 Second	2017-18 Third
Objective			
Rainbow Revolution	✓	✓	✓
Focus			
• Seed Sector	✓	✓	✗
• Road Connectivity	✗	✓	✗
• Food Security	✓	✓	✗
• Organic Farming	✓	✗	✓
• Power Sector	✗	✓	✓
Funds Allocated (₹ in crore)	6135.79	1.49 lakh	1.54 lakh
Schemes Launched			
• Seed Extension Scheme	✓	✗	✗
• Seed Gram Scheme	✓	✗	✗
• A 1500 MW Power Network	✗	✓	✓
• Agriculture Research University	✗	✓	
• Development of Organic Corridors	✗	✗	✓
• An 11 KV Agriculture Feeder	✗	✗	✓
• Three-layer Bihar Vegetable Processing and Distribution Cooperation	✗	✗	✓
• Expenditure on Mid-day Meal Scheme	✗	✗	✓
Awards			
<i>Krishi Karman Award</i>	✓	✗	✗

Box 2: Contours of NCAER's Work on *Agricultural Diagnostics for Bihar*

The main aim of the NCAER study, which is aligned with the Bihar agriculture roadmaps laid down by the Government of Bihar (GoB), is to develop practical, evidence-based policy options for supporting sustainable growth in this sector. The purpose of the diagnostic study is to identify both the drivers of and barriers in its growth, as also other aspects such as social inclusivity, the regional dimensions of growth, and the future growth trajectory. Specifically, the key objectives of the study are to:

- Assess the drivers of agricultural productivity and growth in Bihar;
- Understand and rank the obstacles to inclusive growth; and
- Identify implementable policy action points to increase the agriculture sector's productivity and promote inclusive growth to help the sector achieve a sustained path of higher growth.

agriculture (crop sector) to the overall output declined from 66.3 per cent in 2002-03 to 53.6 per cent in 2015-16. Within agriculture, horticulture accounted for a little less than a quarter of the output, while field crops constituted roughly one-third of the agricultural output. The output from field crops and horticulture registered remarkable growth during the period of agriculture roadmaps as compared to the pre-agriculture

roadmap period. Interestingly, the decline in agricultural output was offset by a considerable rise in the contribution of the livestock sector. Livestock rearing emerged as an important activity, accounting for about 34 per cent of the total output during 2015-16. Fishery and forestry activities also registered commendable growth during the entire period of analysis.

Table 1: Changes in the Composition of Agriculture and Allied Activities (%)

Particulars	% Share			Trend Growth Rate (%)		
	TE 2002-03	TE 2007-08	TE 2015-16	2000-01 to 2007-08	2008-09 to 2015-16	2000-01 to 2015-16
Agriculture	66.3	56.4	53.6	-0.69	3.63	3.03
<i>Field crops</i>	34.7	32.4	31.0	1.53	4.29	4.00
<i>Horticulture</i>	31.6	24.0	22.7	-3.51	2.85	1.85
Livestock	25.4	30.3	33.8	6.39	6.22	6.16
Forestry	4.4	9.5	6.1	18.90	1.75	5.84
Fishery	4.0	3.8	6.5	2.43	9.62	8.15
Overall	100.0	100.0	100.0	2.57	4.66	4.29

Source: Authors' compilation.

Note: TE: triennium ending.

Changes in Land Use, Cropping Pattern and Irrigation

Bihar has highly fertile land falling in the Gangetic plain. Unfortunately, however, a significant part of the area is prone to floods while at the same time, some other parts of Bihar are subject to drought. Bihar has 9.4 million hectares of reported geographical area. Out of this, over 55 per cent of the land is utilised for cultivation.³ However, during recent years, the net sown area has declined due to an increase in the fallow land and the area under non-

agricultural uses. The increase in fallow land is generally due to the lack of adequate irrigation water, labour shortage, and waterlogging due to floods. However, the rise in the proportion of fallow land is an issue of concern as there is a tendency to convert the fallow land into planation crops or non-agricultural uses.

Various factors such as land market dynamics, changes in land use policy, and demographic pressure affect the land use pattern. As compared to other states, Bihar has highly fragmented landholdings and has

³ Source: Land Use Statistics, DES, Ministry of Agriculture and Farmers Welfare.

experienced increasing sub-division of land over time. The partial implementation of land reforms and demographic pressure are responsible for this uneven distribution of landholdings. At the national level, marginal holdings constituted about 68.5 per cent of the total holdings in 2015-16, whereas the corresponding figure in Bihar was 91.2 per cent, pointing to a high incidence of marginalisation of landholdings in the state.⁴ Landholdings of less than 2 hectares in size accounted for 97 per cent of the total landholdings, and this has shown an upward trend over time. Consequently, the average size of the operated area came down considerably from 0.43 hectares in 2005-06 to 0.39 hectares in 2015-16. The average size of the operated area of Bihar is 60 per cent less than the operated area of India as a whole.

The increase in the number of landholdings with a size of less than 1

hectare and reduction in the average size of the operated area are among the important challenges facing Bihar's agriculture sector. The shrinking size of landholdings affects the economic viability of farming and its capacity to support the livelihoods of farmers. The size of landholdings also influences the type of crops grown, adoption of technology, price realisation, and effective bargaining in the output and input markets. Farmers in Bihar were found to have mostly used cultivable land for growing cereals, which constituted about 80 per cent of the total cropped area (Table 2). With the area share remaining more or less constant, there was an area substitution among the cereals, particularly among paddy, wheat, and maize. These three crops account for about 70 per cent of the total cropped area and 40 per cent of the total value of the crop output.

Table 2: Relative Share of Crop Area and Value of Output (%)

Particulars	% Share of Crop Area			% Share Of Value Of Output		
	TE 2002-03	TE 2007-08	TE 2016-17	TE 2002-03	TE 2007-08	TE 2016-17
Paddy	45.3	44.5	43.0	20.4	19.7	20.8
Wheat	26.5	27.2	27.8	13.7	16.1	13.0
Maize	7.6	8.4	9.3	3.6	4.5	5.9
Total Cereals	80.1	80.7	80.4	37.9	40.3	39.9
Moong	2.4	2.3	2.2	1.1	0.8	1.1
Lentil	2.2	2.1	2.0	1.2	1.1	1.5
Khesari	1.9	1.3	0.8	0.4	0.3	0.3
Total Pulses	8.8	7.9	6.8	4.3	3.6	3.9
Total Foodgrains	88.9	88.6	87.3	42.2	43.9	43.8
Jute	1.8	1.7	1.2	0.8	1.1	1.2
Total Fibres	2.2	2.0	1.5	0.9	1.2	1.4
Rapeseed & mustard	1.2	1.1	1.1	0.6	0.7	0.8
Total Oilseeds	1.8	1.8	1.5	1.0	1.2	1.0
Sugarcane and Gur	1.3	1.5	3.2	2.1	1.6	3.4
Potato	1.8	1.9	4.2	2.1	2.7	2.4
Fruits and Vegetables	5.1	5.4	6.0	47.5	42.3	42.0
Horticulture	5.2	5.6	6.2	47.7	42.5	42.3
Others	0.3	0.3	0.2	7.0	10.8	9.5
Overall	100.0	100.0	100.0	100.0	100.0	100.0

Source: DES, Ministry of Agriculture and Farmers Welfare.

⁴ Source: Agricultural Census, Ministry of Agriculture and Farmers Welfare.

The importance of paddy among the farmers seems to have come down marginally. This is evident from decline in its area from 45.3 per cent in the triennium 2002-03 to 43.0 per cent in 2016-17. The area under paddy is being shifted to the cultivation of maize, which farmers prefer to grow due to its commercial importance. There is a growing demand for maize to be used in the food processing industry and as poultry feed. Similarly, the area under wheat has increased, constituting over a quarter of the total cropped area at the time of the study. The decline in area under *Rabi* coarse cereals was compensated by a rise in the cultivated area under wheat.

The area under pulses declined by over 20 per cent between 2002-03 and 2016-17. Green gram (*moong*), lentil, lathyrus (*khesari*), and gram are the important pulses grown in Bihar. Despite a significant rise in the minimum support prices of pulses during the past few years, the decline in their area and value of output is worrisome. Unlike cereals and pulses, oilseeds are not among the major crops cultivated by farmers in Bihar. In fact, the area under oilseeds has remained more or less stagnant over time. Jute is grown in the heavy rainfall regions of northern Bihar but the area under jute declined considerably from 1.35 lakh hectares to 0.91 lakh hectares between 2002-03 and 2016-17. The lack of a proper policy and institutional support, and weak markets are responsible for the decline in jute cultivation.

Interestingly, the area under sugarcane has increased considerably during the recent years. The share of sugarcane in the total cropped area rose from 1.3 per cent to 3.2 per cent between 2002-03 and 2016-17. Most of the cultivated area under sugarcane is concentrated in the north western region. The availability of groundwater water and increase in the number of sugar mills are partly responsible for the increase in the area under sugarcane.

Its favourable climatic conditions and availability of natural resources have made Bihar highly suitable for the cultivation of fruits and vegetables. Although the area under fruits and vegetables constituted only

about 6.0 per cent of the total cropped area, they contributed over 40 per cent of the total value of output. Potato constituted a major vegetable grown in 4.2 per cent of the total cultivated area. However, the lack of proper marketing arrangements, poor infrastructure, and inadequate institutional support act as deterrents to increased diversification towards the cultivation of fruits and vegetables.

Irrigation plays an important role in rising crop productivity. The state of Bihar has rich groundwater as well as surface water resources. The irrigation sector in the state, however, faces the twin challenges of periodic occurrence of floods in the northern region and poor development of facilities for groundwater storage in the southern region. Despite these challenges, however, the total irrigated area has increased considerably over time due to the concerted efforts of both the Central and state governments in implementing irrigation and flood control programmes. In absolute terms, the total irrigated area increased from 34.3 lakh hectares in 2000-01 to 52.7 lakh hectares in 2014-15, at an average growth rate of 2.4 per cent.

Irrigation acts as a catalyst for the adoption of new technologies such as improved crop varieties, fertilisers, crop protection measures, and other management techniques. The adoption of these new technologies helps increase both the crop output and income of farmers. However, the efficiency of irrigation water usage determines the extent of increase in the crop output. In this context, irrigation elasticity, as a measure of water use efficiency can be estimated. Irrigation elasticity is defined as the ratio of growth in the value of crop output to growth in the gross irrigated area. Table 3 shows that irrigation elasticity was negative during the pre-agriculture roadmap period. There was thus an increase of 1.38 per cent in the efficiency of irrigation water usage during the period of the agriculture roadmaps. However, irrigation elasticity for the entire study period was low, at only 1.21 per cent. This points to the need for improving efficiency of irrigation water usage in the state.

Table 3: Irrigation Elasticity in Bihar

Particulars	2000-01 to 2007-08	2008-09 to 2015-16	2000-01 to 2015-16
Growth in Gross Irrigated Area	4.21	2.99	2.48
Growth in Value of Crop Output	-0.69	4.14	3.01
Irrigation Elasticity	-0.16	1.38	1.21

Source: Authors' estimate.

Changes in Agricultural Production and Income

Among foodgrains, growth in the production of maize was the highest, at 4.37 per cent, followed by rice, at 3.78 per cent, and wheat, at 1.90 per cent, during the period 2001-02 to 2016-17 (Table 4). The higher growth in the production of these crops was largely contributed by the growth in yield. The average growth in the yield of rice was appreciable at 4.40 per cent, and in that of maize, at 3.05 per cent. Despite a positive growth in the yield of barley and ragi, negative growth in the cultivated area led to a fall in their output growth. Among pulses, the growth in output was positive for gram and lentil only due to a higher growth in yield over the area growth. This was not so in the case of other pulses. In the case of oilseeds, the output growth of rapeseed and mustard was positive, at 2.77 per cent, which was mainly contributed by its yield growth. There was a significant average growth in the production of sugarcane, at 10.00 per cent, which was largely due to a correspondingly remarkable growth in the area under sugarcane cultivation, at 7.85 per cent.

The expansion in area seems to have been limited to only a few crops. Barring wheat, maize, sugarcane, and potato, the growth in the area under other crops was negative during the period 2001-02 to 2016-17. Among all the crops, the largest reduction in area was observed in the case of *ragi*,

khesari, linseed, and *urad*. The area under coarse cereals and pulses has been replaced by maize, to a large extent, and wheat, to some extent. Sugarcane seems to have replaced the area under oilseeds and other commercial crops in the northern region of Bihar. Overall, it appears that farmers have re-allocated the cultivable area mostly in favour of commercial crops such as maize and sugarcane.

The farmers' choice of crops is determined by several factors such as use of inputs, access to markets, and the availability of finance. The trends in the cost of cultivation and net income from major crops provide an idea of the comparative performance of these crops. A higher agricultural income can be realized through reduction in the cost of production concomitant with an increase in the value of output. The Cost of Cultivation Survey, conducted annually by the Ministry of Agriculture, Government of India, has been utilised for the estimation of cost and crop income. This survey collects detailed information on inputs, output, and prices at the farm level for different crops across major states. In the case of Bihar, consistent information is available for six major crops, viz., paddy, wheat, maize, gram, lentil, and potato. These crops account for about 87 per cent of the total cropped area in the state.

Table 4: Trends in the Growth in Area, Production and Yield of Field Crops: 2000-01 to 2016-17 (%)

Crops	Area	Production	Yield
Rice	-0.59	3.78	4.40
Wheat	0.13	1.90	1.77
Maize	1.28	4.37	3.05
Barley	-5.01	-3.52	1.57
<i>Ragi</i>	-8.50	-5.13	3.69
Total Coarse Cereals	0.92	4.20	3.26
Total Cereals	-0.17	3.14	3.31
<i>Tur</i>	-4.91	-2.05	3.01
Gram	-1.46	0.11	1.59
<i>Urad</i>	-5.55	-3.86	1.79
Horse Gram	-4.75	-3.34	1.47
<i>Moong</i>	-1.06	-0.14	0.94
Lentil	-0.91	1.31	2.24
<i>Khesari</i> (Lathyrus)	-6.36	-4.40	2.10
Total Pulses	-2.29	-0.64	1.70
Total Foodgrain	-0.36	2.98	3.35
Jute	-3.01	2.32	5.50
Mesta	-0.20	6.55	6.76
Linseed	-5.65	-4.95	0.74
Rapeseed and Mustard	-0.12	2.77	2.90
Sunflower	-1.91	-1.42	0.50
Total Oilseeds	-1.42	0.81	2.27
Sugarcane	7.85	10.00	1.99
Potatoes	7.34	15.31	7.42

Source: DES, Ministry of Agriculture and Farmers Welfare.

Details of the average real cost, output, and income of major crops are given in Table 5. The net income obtained from all these crops, except paddy, was positive. There are considerable variations in the average value of output and cost among the crops, which affect the average incomes in the state. In the case of field crops, the average net income was relatively high for gram, at Rs 18,730 per hectare, and for maize, at Rs 18,286 per hectare. In the case of paddy, the rate of increase in the total cost was much higher than the rise in the gross value of

output. This resulted in negative income in paddy cultivation not only during the pre-agriculture roadmap period, but also during the periods of the agriculture roadmaps. This could be due to various reasons, including low market price, use of poor technology, and the over-use of inputs. Further, a continuous rise in the cost of material inputs and wages, and the high cost of finance have contributed to a rise in the cost of cultivation.

Table 5: Changes in Average Real Cost, Output and Income of Major Crops in Bihar (Rs/ha)

Particulars	Gross Value of Output		Total Cost		Net Income	
	2000-01 to 2007-08	2008-09 to 2015-16	2000-01 to 2007-08	2008-09 to 2015-16	2000-01 to 2007-08	2008-09 to 2015-16
Maize	36,816	45,809	24,820	27,523	11,996	18,286
Paddy	22,863	25,661	22,994	26,432	-131	-771
Gram	31,695	39,980	17,847	21,250	13,848	18,730
Lentil	25,754	25,857	17,221	18,245	8533	7612
Wheat	28,283	34,429	25,296	27,147	2988	7282
Potato	65,939	70,840	55,696	50,262	10,242	20,579
Overall (Weighted)	23,091	28,315	20,807	23,935	2284	4381
Coefficient of Variation (%)	10.24	8.21	6.75	14.85	145.88	60.68

Source: CACP, Ministry of Agriculture and Farmers Welfare.

Conclusions

- Agriculture holds the key to the overall development of Bihar's economy. The agriculture roadmaps implemented during different phases since 2008-09 have been intended to promote the holistic development of the sector, with a focus on increasing productivity growth and improving farmers' income. Consequently, the agricultural sector has apparently seen a turnaround in its performance, registering excellent growth rate during recent years.
- The contribution of the crop sector to the overall agricultural output stood at 53.6 per cent in 2015-16. Horticulture accounted for a little less than a quarter of the output, while field crops constituted roughly one-third of the agricultural output. In terms of the growth in the value of output, field crops and horticulture registered remarkable growth rates during the periods of the agriculture roadmaps as compared to the pre-agriculture roadmap period.
- The cropping pattern in Bihar is not very diversified. Three crops, viz., paddy, wheat, and maize have largely constituted over 70 per cent of the total cropped area in the state. However, area substitution has recently been taking place among cereals, in favour of maize and wheat.
- The aggregate net income from crop cultivation has increased over time, but it had remained low on a per hectare basis.
- Given the prevalence of suitable agro-climatic conditions in the state, there is a need to promote crop diversification. A shift from low-value to high-value horticultural crops would considerably enhance farmers' incomes. However, farmers need to be effectively linked to markets in order to derive optimal benefits of growing high-value crops.
- There is a need to provide better rural infrastructure, market facilities, information about prices, and effective crop insurance to motivate farmers to adopt new crop varieties and technologies.

Disclaimers: *The findings, interpretations and conclusions expressed are those of the authors and do not necessarily reflect the views of the Governing Body or Management of NCAER.*

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