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Institutional Changes in Delivery of Agricultural Inputs and Services to Farm Households in India

P. Venkatesh* and M.L. Nithyashree

Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi-110 012

Abstract

This paper has examined the major institutional changes in agricultural input markets and use of inputs across the farming community of the country in the previous decade. More specifically, it discusses the three aspects of inputs: (i) trend in major agricultural inputs use, (ii) their accessibility to small farmers, and (iii) institutional changes in the delivery of input and services. The study has sourced the data from various government reports mainly from NSSO, input survey and CACP. A significant growth in input-use has been recorded in the previous decade and a noticeable change has been observed in the shares of public and private sectors in the factor markets. Accessibility to institutional credit has been limited for marginal and small farmers; however, chemical fertilizer and pesticide use has been found highest among these farmers vis-a-vis other category of farmers. About 40 per cent of the farmers have access to information on modern technology from any source and progressive farmers have emerged as the major source. Easing procedural norms in accessing institutional credit is essential for inclusion of marginal and small farmers in the formal credit system. In addition, extension system should be rejuvenated with recent developments of information and communication technologies for better dissemination of farm information, particularly among the remotely located farm households.

Key words: Agricultural input, input markets, institutions, smallholders, accessibility, services delivery

JEL Classification: Q11, Q12, Q13, Q18

Introduction

Indian agriculture is presently faced with the challenge of feeding a billion plus population of the country with little scope for increasing the acreage. To promote agricultural growth the only option left is to increase productivity through use of inputs and improved technology. In this context, understating the pace of growth in inputs use, nature of factor market development and identifying its key players are imperative to accelerate agricultural growth. Many studies have highlighted that limited accessibility of farm households to markets, especially smallholder farmers and in particular factor markets and extension services, are impeding the growth of farm productivity and profitability (Swaminathan, 1991; Goyal, 2010 ; Babu *et al.*, 2013 ; Girabi and Mwakaje, 2013). In this context, institutions play a critical role in improving the farming conditions. Institutions are a set of formal (laws, contracts, political systems, organizations, markets, etc.) and informal (social norms, traditions, customs, etc.) legal ground rules that establish the basis for production, exchange and distribution (North, 1990).

The institutional change in input and service delivery is vital for the development of smallholder agriculture. During the past one decade or so, the government has taken a series of policy reforms for better availability of inputs by improving factor markets. For example, enactment of the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA) in

* Author for correspondence
Email: venkatesh1998@gmail.com

2001 for attracting private sector to seed industry by protecting breeder's rights, nutrient-based subsidy scheme for improving judicious use of fertilizer, and launching of Kisan Credit Card (KCC) scheme in 1998 for improving credit delivery are some of these reforms. In the face of these developments, following questions are raised in the context of agro-input industry: Has there been any significant change in inputs use and has use of inputs and services changed in favour of smallholder farmers? Are there changes in the shares of public and private sectors in factor markets and which institutional reforms have made these changes? This paper has attempted to address some of these questions.

Data and Methodology

The data were sourced from various government published reports. The data on seed production and shares of public and private sectors were compiled from the internet: http://seednet.gov.in/ and http://www.indiastat.com/ websites. The information on production of fertilizer and pesticides was collected from *Agricultural Statistics at a Glance* (2013), and on machineries from the Tractor Manufacturers Association of India. The agency-wise flow of institutional credit to the agricultural sector was compiled from the Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India (GoI). In addition, data on use of agricultural inputs by land-size were compiled from various rounds of agricultural census on input survey, Agricultural Census Division, DAC, (GoI). The information on access to modern technology to farmers was obtained from the National Sample Survey Organization (NSSO) report on Situation assessment survey of farmers – Access to Modern Technology. Simple tabular and percentage analysis was employed for interpretation of the data. The compound annual growth rate (CAGR) was estimated for the period 1999-00 to 2011-12 for major inputs. The current values of institutional credit were converted into real terms at 2004-05 prices by using GDP deflator.

Results and Discussion

Trends in Use of Agricultural Inputs

The expansion in use of agricultural inputs is most important for improving agriculture productivity. The trend in use of major agricultural inputs such as seeds, fertilizers, pesticides, machineries and credit in the recent past decade is presented in Table 1. Seed is the basic input in agriculture and its potential determines the productivity of other inputs. Therefore, it assumes primary importance in agricultural inputs. The usage of quality seeds in the early-2000s was about 86 lakh quintals and it increased to 127 lakh quintals in 2005-06. However, in late-2000s, the seed usage has witnessed a remarkable expansion and it doubled between 2005 and 2010. This surge in seed-use could be attributed to the recent initiatives of Indian Council of Agricultural Research (ICAR) seed production programme and PPVFRA. The PPVFRA provided the much needed confidence to the private sector to venture into the seed market and paved the way for public-private partnerships in multiplication of public seed varieties (Venkatesh and Pal, 2014).

The fertilizers, another major input to realize the potential of high-yielding varieties (HYVs), showed a moderate growth in their consumption during the previous decade. In 2000-01, fertilizer (in terms of NPK nutrients) use was about 90 kg/ha and it raised to 106 kg/ha in 2005-06. However, during the second half of the 2000s a notable change in fertilizer consumption was recorded. During the first half of 2000s, the consumption increased to the tune of 6 kg/ha, whereas in the latter half it decreased by 35 kg/ha. The other major chemical input used in agriculture is pesticides which reduce the losses in terms of both quantity and quality of farm produce from various weeds, insects, pests and diseases. On an average, the pesticides consumption was about 220 g/ha in 2000-01 and it dropped to 200 g/ha in 2005-06 and then increased to 210 g/ha in 2010-11. These figures clearly indicate that the pesticide consumption in India observed an uneven trend. It may be mentioned in India, cotton crop shares a large part of pesticides consumption and introduction of Bt cotton in the early-2000s reduced the consumption of pesticides in the previous decade (Qaim *et al*., 2006).

The sale of tractors and power tillers was considered to depict the growth in agricultural machinery. The combined sales data showed that this industry had experienced a robust growth during the latter half of the 2000s. In 2000-01, the machinery sales was about 270 thousand and it raised to 313 thousand in 2005-06, and since then it has nearly doubled

Table 1. Trends in use of major agricultural inputs in India

Inputs	2000-01	2005-06	2010-11	CAGR (%)
Seeds (lakh quintals)	86.27	126.75	257.11	11.86
Chemical fertilizers (NPK/ha)	89.63	105.50	140.15	4.09
Pesticides (g/ha)*	219	200	210	1.27
Machinery ('000 No.)**	267.96	313.98	596.52	10.82
Institutional Credit (in crore ₹)	70931	175098	292424	17.09

Note: *Based on 2010-11 gross cropped area and **Sum of tractors and power tillers sold in India.
Source: Agricultural Statistics at a Glance, GoI (2013) and Tractor Manufacturers Association, New Delhi.

reaching about 600 thousand numbers by the end of 2000-decade. The data on availability of agricultural equipments (per 1000 ha) in India, (www.indiastat.com) indicated that there were about 17 tractors, and 2 power tillers available in India in 2007. The highest availability was of manual seed drill and seed-cum-fertilizer drill with the figure of 153/1000 ha, followed by animal drawn leveller with 85/1000 ha. The availability of capital with the farmers is most essential for the adoption of modern inputs. In this perspective, the amount of agricultural credit could indicate modernization of agriculture. The institutional credit for the agricultural sector in India at 2004-05 prices showed that the amount of credit had increased enormously during the previous decade. The overall credit amount was about ₹ 71,000/- crore in 2000-01 and it jumped to ₹ 2,92,000/- crore in 2010-11. The institutional credit for agriculture increased by more than one lakh crore rupees in the first half of the 2000-decade and similarly, latter half also witnessed a substantial escalation. The acceleration in the growth of institutional credit possibly attributed to the expansion of self-help groups (SHGs) and KCC in the previous decade.

Overall, during the first half of the 2000s, the Indian agricultural input industry witnessed a sluggish growth for all the inputs; however the trend reversed during the other half of the decade and registered a substantial improvement in all the inputs-use. In the 2000-decade, the growth rate indicated that credit grew highest among the agricultural inputs with 17 per cent growth per annum, followed by seeds with 12 per cent growth. The machineries also recorded a substantial growth of 10 per cent per annum. The chemical inputs growth is low with a rate of less than 5 per cent.

Smallholders' Access to Agricultural Inputs

The study has adopted the input survey classification of farm-size groups. In India, smallholders (< 2 ha) shared 85 per cent of the landholdings and their share is further multiplying (*Agricultural Census, 2010-11*). Although the overall agricultural input-use has increased to a large extent, its distribution across the different size-categories of farmers assumes a greater significance. The farm-size-wise usage of agricultural inputs has been presented in Table 2. As far as seed-use is concerned, one-third of

Table 2. Use of inputs by size of holdings

Farm-size group	Percentage of operational holdings using				Percentage of area treated with			
	Certified seeds		Institutional credit		Chemical fertilizers		Pesticides	
	1996-97	2006-07	1996-97	2006-07	1996-97	2006-07	1996-97	2006-07
Marginal	30.4	32.0	9.5	19.6	64.1	73.6	17.3	73.6
Small	37.5	43.8	17.6	32.8	62.7	76.6	16.3	76.6
Semi-medium	40.7	49.8	19.9	34.5	60.8	75.5	14.1	75.5
Medium	43.4	54.2	23.1	39.4	57.4	71.5	12.4	71.5
Large	39.3	52.4	23.0	40.1	45.0	58.1	11.5	58.1
All groups	34.0	37.5	13.4	25.0	58.8	72.6	14.4	72.6

Source: Input Survey (various years), Agriculture Census Division, DAC, Ministry of Agriculture, Government of India, New Delhi.

Table 3. Number of households using farm implements by land-size

(in million numbers)

Farm-size group	Hand-operated implements		Animal-operated implements		Power-operated implements		Share of hired machine hours (%)	
	1996-97	2006-07	1996-97	2006-07	1996-97	2006-07	Paddy	Wheat
Marginal	218.3	150.8	160.1	107.0	17.3	51.0	92	96
Small	83.6	47.6	75.9	47.1	9.9	23.7	83	89
Semi-medium	59.2	29.4	58.9	30.2	10.4	19.8	57	63
Medium	33.5	14.1	35.7	14.1	8.4	13.3	49	43
Large	9.8	2.8	10.7	2.2	2.6	3.0	33	27
All groups	404.4	244.7	341.4	200.5	48.6	110.8	-	-

Note: The share of hired machine hours was worked out for five large paddy and wheat growing states (Punjab, Uttar Pradesh, Haryana, West Bengal and Bihar).

Source: Input Survey, Agriculture Census Division and plot level summary data under cost of cultivation, Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi.

marginal farmers were using certified seeds in 1996-97 and not much change was found even in 2006-07. The proportion of semi-medium, medium and large farmers using certified seed was wobbling around 40 per cent in 1996-97 and it rose to more than 50 per cent in 2006-07. The use of institutional credit was very low and no farmer category crossed 23 per cent share in 1996-97. A significant increase in the institutional coverage was found in the case of large and medium farmers and it reached 40 per cent in 2006-07. However, the disparity in access to institutional credit was more prevalent across farm-size groups, and only 10 per cent of marginal farmers had access to institutional credit in 1996-97 which rose to 20 per cent in 2006-07. This result is in line with Swaminathan (1991) who reported that large farmers were having higher formal credit sources as they had more collateral assets.

In the case of chemical fertilizers usage, the highest percentage share of area was found to be marginal farmers in 1996-97 and small farmers in 2006-07. The percentage of area using chemical fertilizers decreased as farm-size increased. The pesticide-usage was found to be low (less than 18 %) across the farm-size in 1996-97; however, the share of farmers using pesticides increased significantly in 2006-07 and reached more than 70 per cent on all farm-sizes, except on large farms. A closer look at Table 2 revealed an inverse relationship between farm-size and input-use for chemical fertilizers and pesticides and a direct relationship for institutional credit and to some extent it was true for certified seed-use also. The minimum access to informal credit and maximum share in use of chemical fertilizers and pesticide was observed in the case of marginal and small farmers. It clearly indicates their greater dependency on informal credit sources.

The trend in farm implements clearly indicated that the number of households using hand and animal operated implements had decreased during 1996-97 to 2006-07 and just reverse was true for power-operated implements (Table 3). Across the farm-size, marginal farmers (218 million numbers) were using more hand-operated implements and these numbers decreased with the increase in farm-size during both the reporting years (1996-97 and 2006-07). A similar trend was observed for the other type of implements; it could be plausible due to a large number of marginal and small farmers. However, in terms of ownership of machineries, large farmers had the visible advantage, owing to higher incomes. The figures of share of hired machine hours in the case of paddy and wheat for five major states clearly elucidated that marginal and small farmers were highly dependent on custom- hiring services for machineries. The marginal farmers' reliance on custom-hiring for machineries was 92 per cent in 1996-97 and it increased to 96 per cent in 2006-07. The dependency on hired machinery was increasing for the lower three farm-size groups, viz. marginal, small and semi-medium, whereas for medium and large farmers, it declined over the reporting period. Venugopal (2004)

Table 4. Share of public and private sectors in quality seed production: 2003-04 to 2011-12

Year	Private sector share (%)	Public sector share (%)	Total quality seed production (lakh quintals)
2003-04	47.5	52.5	132.3
2004-05	44.2	55.0	140.5
2005-06	46.8	53.2	148.2
2006-07	41.0	59.0	194.3
2008-09	39.8	60.2	250.4
2009-10	38.9	61.1	279.7
2010-11	48.5	51.5	321.4
2011-12	48.9	51.1	353.6

Source: Compiled by authors from http://seednet.gov.in and http://www.indiastat.com.

has also observed that small and medium farmers had more on-farm tractor-use and small farmers had hired the tractor services.

Institutional Change in Delivery of Agricultural Inputs and Services

To study the various players that have contributed to the growth of inputs, the role of public and private sectors in production and delivery of major agricultural inputs was investigated. During the 2000-decade, quality seed production remarkably increased from 132 lakh quintals in 2003-04 to 354 lakh quintals in 2011-12 (Table 4). However, there was not much change in the institutions' share. The seed market was almost equally shared by both private and public sectors, and this proportion was found maintained in both 2003-04 and 2011-12. However, a small increasing role of public sector was seen during the mid-2000s and subsequently, the private sector regained its original share of 48 per cent in 2011-12. A perusal of data on the share of seeds of major crops indicated a different picture with clear-cut dominance of the private sector in most of the crops (Table 5). However, the private sector concentrated mainly on cross-pollinated and hybrid dominated crops (sunflower, 97 %; cotton, 96 %; maize, 95 %; and bajra, 90%), indicating profitability to be the major factor which could influence the selection of crops as far as private sector was concerned. The remaining high-volume and low-value crops (pulses, 70%; and groundnut, 65%) were left with the public sector.

Among the three major nutrients, only two nutrients, viz. nitrogen and phosphate based fertilizers, are produced in India. Due to lack of resources, potash is not produced and its entire demand is met through imports (GoI, 2012). The nitrogen production was about 12,000 thousand tonnes, as high as three-times of phosphate production in 2012-13 (Table 6). In the 2000-decade, the nitrogenous fertilizer production showed a moderate increasing trend and phosphate production increased in the mid-2000s, but decreased marginally in 2012-13. The sector-wise figure showed that the private sector was the dominant player in both types of fertilizers. In the case of nitrogen, about 50 per cent of the production was from the private sector and remaining was more or less equally shared by public and cooperative sectors. However, in a recent period, the contribution of private sector has come down by 4 percentage points and this share was

Table 5. Sector-wise share of seeds of major crops in 2011-12

Major crops	Private sector share (%)	Public sector share (%)
Paddy	42.5	57.5
Wheat	53.4	46.6
Maize	94.8	5.2
Bajra	89.7	10.3
Jowar	80.6	19.4
Pulses	30.5	69.5
Soybean	42.1	57.9
Groundnut	34.7	65.3
Sunflower	97.0	3.1
Rapeseed and Mustard	25.9	74.1
Cotton	96.6	3.5

Source: Compiled by authors from http://www.indiastat.com

Table 6. Sector-wise production of chemical fertilizer in India: 2001-02 to 2012-13

('000 tonnes nutrient)

Sector	2001-02		2005-06		2012-13	
	Production	Share (%)	Production	Share (%)	Production	Share (%)
			N			
Public	2776	26.0	2948	26.0	3206	26.2
Private	5222	48.9	5468	48.3	5438	44.4
Cooperatives	2692	25.2	2916	25.7	3594	29.4
Total	10690	100	11332	100	12237	100
			P_2O_5			
Public	377	9.8	293	7.0	224	5.9
Private	2667	69.5	2927	69.8	2315	60.5
Cooperatives	793	20.7	976	23.2	1285	33.6
Total	3836	100	4196	100	3823	100

Source: Fertilizer Statistics (various years), Fertilizer Association of India, New Delhi.

absorbed by the cooperative sector. Some notable changes have occurred in the phosphate fertilizer production. The private sector was dominant in production of phosphate fertilizers, however its share declined by 10 percentage points during the 2000-decade. The public sector share was less than 10 per cent and its share also continuously declined. The cooperative sector's share was 1/5th in production of phosphate fertilizer in the start of the previous decade and it gained a reasonable share and reached to one-third by the end of the decade. Overall trend showed that although private sector was the major player in the fertilizer industry, its contribution continuously declined in the 2000-decade.

The data on institutional credit to the agricultural sector indicated that the volume of institutional credit (at 2004-05 prices) tremendously increased (about six-times) in the previous decade with the disbursement of a large proportion (63%) of advances for production purposes (Table 7). In production credit, a slight decline was noticed in the mid-2000s, but a marked reversal occurred in 2011-12 and its share reached 78 per cent. The commercial banks were the major player in both production and term credits and enormous volume expansion (7.7-times) was seen during the study period. The share of commercial banks substantially increased from 53 per cent in 1999-00 to 72 per cent in 2012-13. In the early- 2000s, the cooperative banks had played a significant role in production credit and their share was 51 per cent in 1999-2000. It is to be noted that despite three-time increase in the volume of credit during the previous decade, the cooperative banks witnessed a sizeable decline in their share which was dropped to mere 21 per cent in 2011-12. The regional rural banks were the other agency which contributed about 10 per cent of agricultural credit and their role was seen more in production credit than in term credit.

The most important input for any venture is the "information" which plays a crucial role in adoption of modern technology and improving efficiency of operation. Table 8 shows the information accessibility of farm households and their sources during 2003. A perusal of Table 8 showed that only 40 per cent of the farmers in India had accessed information on modern technologies and the majority of farm households (60%) had not accessed any type of information. There were about more than fifteen types of information sources available to the farm households. The progressive farmers were the lead source (16.7%) for farm information for the farmers, and input dealers (13.1 %) and radio (13.0%) emerged as the next key information sources for the farming community. All other information sources contributed less than 10 per cent. The mass media sources like television and newspapers shared 9.3 per cent and 7.0 per cent, respectively. It is to be noted that public extension agencies like extension worker (5.7%), government demonstrations (2%) and KVKs (0.7%) had played a minimum role in information dissemination on modern technologies. However, the information sources have

Table 7. Agency-wise flow of institutional credit to agriculture sector

(in crore ₹)

Particulars/Agency	1999-00	Share (%)	2004-05	Share (%)	2011-12	Share (%)
Production (Short-term) credit						
Cooperative Banks	18121	51	27529	37	52255	21
Regional Rural Banks	2972	8	10147	14	30269	12
Commercial Banks	14350	40	37298	50	170455	67
Other Agencies	91	0	105	0	0	0
Sub-total (A)	35534 (63)	100	75080 (59)	100	252979 (78)	100
Medium/Long-term credit						
Cooperative Banks	4280	20	4130	8	3917	5
Regional Rural Banks	919	4	2427	5	4501	6
Commercial Banks	15992	75	45301	87	64936	89
Other Agencies	36	0	90	0	0	0
Sub-total (B)	21227 (37)	100	51948 (41)	100	73355 (22)	100
Total credit						
Cooperative Banks	22401	39	31659	25	56172	17
Regional Rural Banks	3891	7	12574	10	34771	11
Commercial Banks	30342	53	82599	65	235392	72
Other Agencies	126	0	196	0	0	0
Grand-total (A+B)	56761	100	127028	100	326334	100

Note: Figures within parentheses indicate percentage share of the credit in total credit.
Source: Credit Division, Department of Agriculture and Cooperation, Government of India, New Delhi.

Table 8. Source-wise access of farm households to agricultural information

Sources of information	Percentage of households
Mass media	29.3
Public agencies	13.1
Other agencies	17.8
Progressive farmers	16.7
Others	3.7
Any source	40.4

Source: Compiled from National Sample Survey Organization (NSSO) 59th round on Situation assessment survey of farmers (2005), Ministry of Statistics and Programme Implementation, Government of India.

observed a major change with the ICT revolution. Mittal *et al.* (2010) have reported that mobile-phone enabled service was the key information source for agriculture and more than 60 per cent of the farm households accessed information through these services.

Summary and Conclusions

This paper has analysed the expansion of input use in Indian agriculture in the recent period. It also examined the accessibility of the inputs across the farm-size and the contribution of public and private sectors in input markets. It has been observed that input-use has expanded to a large extent in the previous decade, especially in the second half of the 2000s. The input-use and farm-size have indicated a mixed relationship. Interestingly, the chemical fertilizers and pesticide use has shown an inverse relationship that is as farm-size increases input use declines, whereas, in case of institutional credit it is just the opposite. The number of farm households using power-operated implements has increased in large numbers and the use of hand and animal operated implements has declined. The role of public and private sectors has been found to vary from input to input. The role of private sector was more pronounced in seed (in particular on high value-low volume crops) and fertilizer production, whereas commercial banks were the key players in institutional

credit. The pesticide and tractor industries were completely in the hands of private sector.

In the recent period, the cooperative sector's share has increased in fertilizer production, accompanied by a decline the private sector's share. In contrast, with the increasing share of commercial banks in credit sector, the role of cooperative banks has declined. In India, only about 40 per cent of the households accessed the agriculture information and progressive farmers have been found the major source of information. The public extension system has not been found an important information source. These findings imply that inclusion of small and marginal farmers under institutional credit coverage by simplifying application procedures and special attention of extension system to reach the unreached farmers are necessary for advancement of Indian agriculture.

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