Cooperative Credit in Irrigated Agriculture: A Case Study of An Irrigation Project in Gujarat

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Introduction

IN traditional argiculture, finance was largely used for maintenance rather than for expansion purposes. In modern agriculture, the role of credit is far more important. It is utilised for purchase of inputs such as quality seeds, fertilizers and pesticides as well as for effecting improvements to land. Further, under conditions of assured supply of surface irrigation made possible by large public investments, the potetential gains of agriculture, through extensive introduction of high yielding varieties of crops, become realised gains only when the cultivators are helped through credit to buy critical inputs.[1]

The objectives of this paper are to examine the trends in credit availability and find out the determinants of its demand in an area falling under the command of on irrigation project in Gujarat. The paper is divided into three sections. The first section sketches a comparative picture of the credit system operating in the country and in Gujarat state, where the command area of the irrigation project is located. In the second section a simple stochastic model of demand for agricultural credit in the irrigated area is formulated and results of empirical analysis presented. The final section discusses some policy implications flowing out of the study.

I

Agricultural Cooperative Credit in India

Disbursement of farm credit in India has been in a greater measure form the cooperative institutions than from the commercial banks. The reasons are historical. The banks were urban-oriented and security-conscious. The Indian agrarian scene, where small holdings of less than two hectares size form 70% of the total holdings but occupy only 21% of the area under plough, was not found attractive by the banks. Added to this, uncertainties associated with monsoon-dependent agriculture and the consequential indebtedness of the farmers to the local money lenders and other exploitative elements forced the governments in the Indian states to enourage cooperative credit movement.[2]

However, two important events in the last decade deserve mention which are responsible for changes in the agricultural credit flows in India. The first is creation of potential ushered in by superior technology consisting of high yielding variety seeds, chemical fertilizers and improved practices, which opened up new and exciting possibilities of economic viability of small farms. The second event was the nationalisation of banks with guidelines to finance the hitherto neglected rural sector. Special development programmes since early seventies such as Small Farmers Development Agencies, Drought Prone Area Programmes and Command Area Development aiming at integrated development with subsidiaries to small and marginal farmers from the state government have also stepped up the flows of rural credit.[3]

Though commerical banks entered the rural area following their nationalisation in 1969, their impact has yet to be felt. The proportion of short-term credit from the nationalised commercial banks has been approximately about 30% of the total agricultural short-term credit (Table 1). Commercial banks have been seeking certain concessional treatment from the governments of the states on the lines accorded to the cooperatives.[4] Once these issues are settled, it is visualised the bank credit will be as impressive as the well-established cooperative credit.

For the purpose of this paper, in order to enable a meaningful time-series analysis the data from the cooperative credit structure has been relied upon. The short-term credit structure is a three-tier—

Table 1

Institutional Finance for Agriculture Development in India

(*Rs. million*)

Institutions	*1969-70*	*1970-71*	*1971-72*	*1972-73*	*1973-74*
Cooperatives					
Short-term credit	4,880	5,150	5,340	5,750	6,100
Long-term credit	2,070	2,290	2,280	2,690	3,090
TOTAL	*6,950* (79)	*7,440* (76)	*7,620* (14)	*8,440* (71)	*9,190* (68)
Commecrial Banks					
Short-term credit	—	—	1,070	1,380	1,880
Long-term credit	1,840	2,360	1,600	2,030	3,350
TOTAL	*1,840* (21)	*2,360* (24)	*2,670* (26)	*3 410* (29)	*4,320* (32)
Aggregate	8,780	9,800	10,290	11,850	13,510

NOTE:—Figures in parantheses denote percentages to the aggregate.
SOURCE:—Government of India, *Report of the National Commission on Agriculture*, Part XII, 1977, p. 84.

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federal one with the state cooperative bank at the state headquarters, the district central cooperative bank at the district headquarters and primary credit societies at the village or a group of villages level. Each primary society is supposed to be a multi-purpose society with annual credit business of Rs. 0.2 million. There are about 90,000 societies and 334 central cooperative banks covering 22 states and 9 union territories.

Resources of cooperatives consist of share capital, fees and deposits from members and reserve funds. Further, the cooperatives also receive refinance from the Reserve Bank of India.

The long-term credit for purposes of effecting improvement to land such as land levelling and land shaping, digging wells, installing pump sets and soil conservation measures is disbursed by a two-tier system of state land development bank at the state capital with branches at headquaters of Talukas, administrative units below the district, covering large groups of villages.

Table 2 presents the figures relating to short-term and long-term cooperative credit, in aggregate as well as per hectare for India and Gujarat. These figures are expressed in constant prices eliminating the influence of inflationary trends in general price level. The deflator chosen for the purpose is the wholesale price index (1970-71=100).

In the absence of self-financing, farmers have to depend entirely upon the credit availability for their purchase of inputs including seeds, fertilizers and plant protection measures. With the introduction of modren technology in mid-sixties in terms of high yielding variety seeds and increased use of fertilizers, the composition of cooperative credit has also undergone remarkable changes over the ten-year period (1965-66 to 1974-75). Table 3 highlights these changes. The component of consumption credit expressed as a proportion of total credit declined in importance over the ten-year period. But the proportion of credit used for fertilizers increased by four times (22% to 87%) at the all-India level and increased by five times (13% to 65%) in the case of Gujarat. Similarly, the proportion of credit meant for seeds also increased substantially over the period. It is also of interest to note that while in the base year there was no proportion of credit earmarked for pesticides, the proportion of credit for pestictdes was 3.4% in the case of the country and 10.8% in the case of Gujarat. This particular phenomenon confirms that modren technology in which pesticides and insecticides occupy an important place has really been ushered in.

In regard to the composition of long-term credit, irrigation was the major purpose of credit in 1975-76 as evidenced in the rise in the proportion of credit for sinking and repairs of wells. Similarly a large proportion of credit (35.8%) was for diesel engines and pumpsets in 1974-75 as against negligible proportion in 1965-66. Thus, the advent of green revolution signified by the use of seeds for high yielding varieties and of chemical fertilizers had led to investment in the most appropriate sphere, namely irrigation.

The flow of credit depends to a large extent on regularity and promptness on the part of the farmers in their repayment of loan and interest. There are provisions in the law governing cooperative societies to postpone repayment if there are vaild ground such as failure of monsoon and other adverse circumstances. However, the phenomenon of rising overdues of

Table 2

Short-term and Long-term Cooperative Credit: (India and Gujarat At constant prices)

Year	*All-India*				*Gujarat*			
	Aggregate short-term credit (Rs. million)	*Aggregate long-term credit (Rs. million)*	*Short-term credit per ha. (Rs.)*	*Long-term credit per ha. (Rs.)*	*Aggregate short-term credit (Rs. million)*	*Aggregate long-term credit (Rs. million)*	*Short-term credit per ha. (Rs.)*	*Long-term credit per ha. (Rs.)*
1966-67	N.A.	N.A.	N.A.	N.A.	560.74	104.95	54.98	10.29
1967-68	N.A.	N.A.	N.A.	N.A.	637.88	180.73	61.21	17.34
1968-69	5518.7	1621.0	34.57	10.16	711.51	243.02	69.88	23.87
1969-70	5717.3	1671.7	34.97	10.23	827.64	222.36	82.40	22.14
1970-71	6014.3	1703.6	36.28	10.28	893.40	218.80	85 15	20.85
1971-72	5819.4	1462.5	35.48	8.92	890.34	335.79	84.96	32.04
1972-73	6668.6	1564.4	41.13	9.65	1131.41	167.29	110.28	16.31
1973-74	5546.8	1301.2	32.72	7.68	910.88	71.36	86.41	6.77
1974-75	4347.9	903.9	26.55	5.52	1001.03	69.01	N.A.	N.A.

N.A.=Not available.

SOURCES:—(*1*) Government of India, *Indian Agriculture in Brief (Annual)*, Controller of Publications, New Delhi, various volumes.

(*2*) Government of Gujarat, *Annual Administration Reports of Cooperation Department*, various volumes.

Table 3

Composition of Cooperative Credit in India and Gujarat, 1965-66 and 1974-75

(*Percentages*)

	All-India average		*Gujarat*	
	1965-66	*1974-75*	*1965-66*	*1974-75*
Short-term Credit				
Seeds	2.3	3.9	2.8	11.6
Fertilisers	21.6	86.7	13.0	64.6
Pesticides	—	3.4	—	10.8
Agricultural implement	—	0.5	—	9.9
Others	76.1	5.5	84.2	12.1
TOTAL	*100.0*	*100.0*	*100.0*	*100.0*
Long-term Credit				
Debt redemption	6.0	1.0	—	—
Purchase of land	0.8	0.7	—	3.1
Land improvement	25.5	6.0	2.3	0.2
Sinking/repairs of wells	30.2	33.6	32.6	40.1
Purchase of machinery	28.6	12.3	56.2	26.8
Diesel engines and pump sets	—	35.8	—	19.3
Others	8.9	10.6	1.9	10.5
TOTAL	*100.0*	*100.0*	*100.0*	*100.0*

SOURCE:—Reserve Bank of India, *Statistical Statements Relating to Cooperative Movement in India*, various volumes.

members to cooperatives and of the latter financing agencies has been causing considerable concern to agricultural administration in the country.[5] Some of the solutions recommended by the investigating committees appointed from time to time for dealing with the problem of overdues include strengthening the supervisory machinery, recourse to regular inspection of the cooperatives, effective steps for recovery from wilful defaulters and enforcement of internal discipline among cooperative leaders such as debarring members from becoming office-holders in case of their default.[6]

However, some lasting solution would consist of greater degree of supervised credit, such as disbursement of crop loan more in kind than in cash, so that the actual purpose behind credit is realised for linking of credit with marketing. It has also been observed when cropping intensity is higher, thanks to irrigation factilities, the overdues position is less critical. The next section focusses attention on the command area under an irrigation project and analyses the demand for short-term credit in greater detail.

II

Cooperative Credit in Mahi-Kadana Project

Credit and agricultural production under irrigated conditions are vitally interlinked. Comprehensive command area development programmes with critical support to farmers in terms of credit and infrastructure facilities have been envisaged in all the World Bank assisted composite irrigation projects. The present section deals with the credit component of the programme in the Mahi-Kadana irrigation project with a dam and a reservoir at Kadana across the river Mahi in Gujarat.

The culturable command area of the project covers 0.223 million hectares, with 0.212 million hectares on the right bank and 0.011 million hectares on the left bank. The distribution system consisting of main canal and its distributories is yet to be completed on the left bank. But a larger part of the command area on the right bank has been receiving water from the distributories for quite some time due to the completion of the phase I of the project, namely the construction of weir on the Mahi river in the early sixties. Therefore, the study restricts itself only to the right bank of the project.

The soils in the area falling under the command of the irrigation project have considerable variations in fertility. The upper reaches of the distribution system have the most fertile land, sandy to sandy loam. In the middle part, the soil is of medium black type whereas the soil of the south-west part close to the sea coast is poorly drained and less fertile.

Pearl millet, paddy and pulse, especially pigeon pea, are the important kharif (rainy season) crops. Tobacco is grown as a two-seasonal crop accounting for 40% of the cropped area in the kharif. Cotton is the next leading cash crop which is also processed in the area. The exclusive rabi (winter season) crops are wheat and potatoes. In summer, pearl millet and fodder sorghum are grown.

The Gujarat Cooperative Land Development Bank with six branches in the command area is catering to the needs of farmers in the sphere of long-term investment. Specifically, the on-farm development work such as land levelling and shaping as well as construction of field channels from the government outlet of one cusec capacity were financed by Land Development Bank until a new policy was

Table 4

Cooperative Credit at Constant Prices in the Mahi-Kadana Command Area and Related Variables

Year	*Aggregate short-term credit (Rs. million)*	*Aggregate long-term credit (Rs. million)*	*Short-term credit per ha. (Rs.)*	*Long-term credit per ha. (Rs.)*	*Agril. price index lagged by year*	*Rainfall (Million metres)*	*Irrigation intensity index*	*Cropping intensity index*
1966-67	12.8	2.28	34.6	6.15	100.0	704	22.7	100.0
1967-68	17.6	3.92	47.5	10.58	121.6	109	23.5	102.0
1968-69	23.5	5.63	63.5	15.19	91.7	413	37.0	102.0
1969-70	23.2	4.89	62.7	13.18	88.2	764	67.9	102.0
1970-71	28.9	4.86	78.0	13.11	100.8	1318	82.7	132.0
1971-72	33.1	7.89	89.5	21.29	116.5	677	76.1	184.0
1972-73	39.1	11.58	105.7	31.24	96.6	384	95.3	155.0
1973-74	33.8	8.34	91.3	22.59	125.3	1094	118.5	199.0
1974-75	49.7	9.23	134.4	24.88	156.4	299	106.7	139 0
1975-76	54.0	11.06	145.9	29.71	228.9	966	128.2	142.0
1976-77	50.1	8.93	136.9	24.07	136.4	1646	82.5	160.0

evolved for financing them. Table 4 provides information in regard to per hectare long-term loan in constant prices to farmers. The loan is recoverable over a ten year period with first two years being exclusively earmarked for recovery of interest alone.

In regard to short-term credit, which meets most crucial input needs of the cultivators, there are 488 primary agricultural cooperative societies covering 496 villages with 76% of the cultivators enrolled as members. The average number of members for each of these societies is about 215 out of which 42% is the active borrowing membership. Table 4 presents details of aggregate short-term loan disbursed as well as loan per hectare at constant prices.

However, it has been observed that there has been a gap between the requirements and actual amount of crop loan disbursed by the cooperatives. A study of requirement and actual amount disbursed for some specific crops during the kharif season of 1978 shows that as against the credit requirments of Rs. 42.5 million, the actual amount disbursed was Rs. 31.85 million. Similarly in regard to tobacoo the credit requirement was Rs. 48.9 million but the amount lent was only Rs. 40.5 million. The gap was much bigger in case of cotton where the 'production credit estimated was Rs. 144.5 million but the amount disbursed was only Rs. 47.5 million (Table 5). However, over the eleven-year period, short-term credit in constant prices has increased at an annual compound rate of 14% as against the corresponding rate of 2.8% for the entire state. Per hectare credit in the command area grew at 15.1% annually as against the state average of 4.2%. This indicates that there is a high degree of correlation between production credit and irrigation facility.

Despite increased attention being paid to small farmers holding two hectare and less, flow of credit has all along been much below 20% of total credit disbursed. In 1976-77 it reached the figure of 30%.[7]

Overdues at the primary cooperatives level is about 12% of the total outstanding which is far less than the overdues of the cooperatives of the whole state, namely

Table 5

Requirements and Actual Disbursement of Credit for Certain Select Crops in Mahi-Kadana Command Area

Crops	*Per hectare requirement (Rs.)*	*Aggregate requirement (Rs. million)*	*Actual aggregate disbursement (Rs. million)*
Wheat	1,675.00	42.50	31.85
Tobacco	1,685.00	48.90	40.50
Cotton	3,350.00	144.50	47.50
Pearl millet	925.00	6.80	4.62

37%. This shows that the repaying capacity of the farmers under irrigated conditions is far better.

Demand for short-term credit is influenced by various factors. Foremost among them is the agricultural price level prevailing just before the season. An upward price trend induces application of inputs to a greater extent and in turn more recourse to credit. The behaviour of farmers is thus influenced by price lagged by one period.

Another important explanatory variable is rainfall which sets the tone for the agricultural operations during the year. However, the monsoon ends by October and thereafter it is the irrigation facilities that determines the agriculture pattern in the rest of the agricultural year. Hence, both are important explanatory variables in determining demand for short-term credit each year.

Though surface irrigation is the major source in the command area, it was not available throughout the year for some time past. Distributories were closed during the summer when lining and repair works were done by the irrigation department. But when canals and distributories were full during the monsoon, surface irrigation was not in heavy demand. It was only when rainfall was scarce and when it was not normally distributed, applications from the cultivators in substantial number for surface irrigation during the monsoon were received. In winter season alone surface irrigation is heavily depended upon since there is absolutely no precipitation during the period. Added, to canals, there is also considerable ground water exploitation in terms of wells and tube-wells during this season to supplement surface irrigation.

Irrigation facility enables the farmers to raise more than one crop. Thus, the cropping intensity defined as the ratio of gross cropped area to culturable command area would positively influence the demand for inputs such as seeds, fertilizers and pesticides. Irrigation intensity, which is defined as the ratio of gross irrigated area by flow irrigation, wells and tube-wells to culturable command area, and cropping intensity are highly correlated. Either of these variables may be taken as an independent explanatory variable affecting demand for credit.

Before building a model of demand for short-term credit it is necessary to spell out the assumptions involved. First, supply of credit is assumed to be autonomously determined having regard to availability of refinance and other such external conditions. Secondly, it is also assumed that credit actually disbursed is the equilibrium quantity demanded.

Thus, a simple model of demand for credit under assured conditions of irrigation can be formulated. Since detailed data on credit disbursement for each difference crop are not available to form a time series the demand function is estimated only in aggregative terms. In symbols:

$$C_t = f(P_{t-1}, R_t, CI_t)$$

where,

C = credit disbursed in rupees in constant prices,
P = agricultural price index,
R = rainfall in millimetres,
CI = cropping intensity index, and
t = period under consideration.

An alternative model can also be visualised by substituting irrigation intensity (II) in the above functional relationship for cropping intensity (CI) retaining the other two variables.

Both the models were applied to the time series data in the Mahi-Kadana command area as given in Table 4. Regressions were run both in linear and log linear forms.

Among the two forms, the log linear relationship emerged as a better fit in terms of higher adjusted R^2.

$$\log C_t = -0.356 + 0.503 \log P_{t-1} + 0.553 \log II_t - 0.073 \log R_t$$
$$(-0.65)\ (1.90)\qquad (4.61)\ (-0.60)$$

Adjusted $R^2 = 0.904$ $F_7^3 = 14.703$
degrees of freedom = 7

$$\log C_t = -1.801 + 0.77 \log P_{t-1} + 1.011 \log CI_t - 0.167 \log R_t$$
$$(-1.85)\ (2.10)\qquad (2.44)\ (-0.93)$$

D Adjusted $R^2 = 0.786$ $F_7^3 = 5.289$
degrees of freedom = 7

(Figures in parentheses denote 't' values).

In both the models, rainfall with theoretically unexpected sign emerged as a non-significant variable whereas price with expected sign was found significant, the level of significance chosen being 5%. The explanatory variables, irrigation intensity and cropping intensity alternatively used in the models were found to have the expected sign and significance. High 'F' ratios indicate that both the models have well-fitted equations.

These results are not surprising. In the command area of the irrigation project, irrigation was used as a protective measure during the erratic monsoon years in the kharif (monsoon) season and was less used during the normal monsoon years. But once monsoon was over, irrigation both surface and ground water came to be invariably used together during the rabi (winter) and summer season encouraging the farmers to take to more than one crop and consequently resorting them to obtain more crop loans. This is confirmed by both the models. As regards price, its influence on agricultural operations and credit demand has been clearly established.

In the first model, elasticity coefficients of credit with respect to price and irrigation intensity are 0.50 and 0.55. This means that given other things 1% rise in the price preceding the year and 1% rise in the irrigation intensity would respectively lead to 0.50% and 0.55% rise in the credit demand.

In the alternative model with the variable cropping intensity substituted for irrigation intensity, the elasticity coefficients credit demand with respect to price and cropping intensity are 0.78 and 1.01. This can be interpreted as 1% rise in the price of the preceding year and 1% rise in cropping intensity would respectively result in an increase in the demand for credit by 0.78% and 1.01%.

These results point out to the need for strengthening the cooperative societies at the primarily level to meet the growing production loan requirements in future years, once perennial irrigation following the completion of lining the canals and other repairs is assured to the farmers.

III

Summary and Conclusions

This paper focusses attention on importance of credit in agriculture development at macro- and micro-levels. While long-term credit is towards creating assets such as wells and installation of pumpsets for irrigation purposes and improvements to land, short-term credit is utilised for purchase of critical inputs like seeds and fertilizers.

Demand analysis of credit conducted in a specific geographical area falling under the command of the irrigation project showed that agricultural price level lagged by one period and irrigation intensity and cropping intensity significantly exercise a positive influence on short-term credit. It is thus apparent that intensive cropping made feasible by irrigation, through exploitation of surface and ground water in a conjunctive manner leads to substantial demand for production loan. In the absence of self-financing, cultivators look to institutional finance for enabling them to buy inputs. Though the present cooperative credit structure has been meeting the needs, there is a gap between the supply and the requirements. Involvement of commercial banks along with cooperatives has to be made much more intense.

There is another dimension to the problem. Small and marginal farmers who are numerically dominant but occupy only a small proportion of the total land under cultivation have been getting a disproportionately small slice of credit advanced. Consideration of ends of social justice as well as of recent empirical findings on the viability of small farm would justify earmarking a larger proportion of credit to the small-sized farms.

Though overdues of cooperative societies in the command area are well below the national and state level, it is necessary to keep them under check so that recycling of credit is facilitated. Measures towards this objective would include strengthening the cooperatives with secretarial assistance to keep a watch on repayment of the dues and to disburse credit partly in kind and cash so that end use of credit is ensured. But a lasting measure would be to encourage linking of credit with marketing.

References

1. Bandhudas Sen, *The Green Revolution in India: A Perspective* (New Delhi: Wiley Eastern), 1974, pp. 32-33.
2. For an extended discussion see Uma J. Lele "Roles of Credit and Marketing in Agricultural Development" in Nurul Islam (Ed.) *Agricultural Policy in Developing Countries* (London: Macmillan), 1974, pp. 414 417.
3. T.K. Jayaraman, "A Country Note on India" presented at the Regional Programme on Management of Agriculture conducted by the United Nations Asian and Pacific Development Administration Centre, Kuala Lumpur and Indian Institute of Public Administration, New Delhi, at New Delhi, November, 1978.
4. Concessional treatment towards cooperatives includes guarantee, special recovery procedure in regard to overdues of the cooperatives and exemption from stamp duty. The Government of India is examining whether such treatment can also be extended in favour of commercial banks.
5. For a detailed examination of overdues problem, see Reserve Bank of India, *Report of the Study Team on Overdues of Cooperative Institutions* (Bombay: Agriculture Credit Department, R.B.I.), 1974.
6. Overdues of cooperatives in an irrigated area have been analysed as a case study. For details, see T.K. Jayaraman, "An Analysis of Overdues of Primary Agricultural Cooperative Societies: A Case Study of Mahi-Kadana Project in Gujarat State", *Indian Journal of Agricultural Economics*, Vol. XXXIII, No. 3, July-September, 1978, pp. 21-30.
7. At the all-India level, during 1975-76 loans to small and marginal farmers having holdings less than 2 hectares in size amounted to Rs. 3,040 million and the aggregate credit disbursed was Rs. 10,230 million. Thus, in percentage terms, credit to small and marginal farmers was also at the national level about 30% of total credit.