

## Institutional Credit and Capital Formation in Mountain Agriculture: Evidences from Jammu & Kashmir

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### ABSTRACT

*This paper investigates the pattern and magnitude of private capital formation in relation with institutional credit at farms in different agro-climatic zones in Jammu & Kashmir state. The study help us in establishing that borrowers of institutional credit are better positioned to invest more on farm capital. Additionally, the growth of capital stock in the reference year remains higher for borrowers than non-borrowers. This implies that credit has a crucial role to generate farm capital. The regression estimates confirm that institutional credit significantly contributes to improve the capital stock on farm. These results suggest that government should play an active role to increase credit to the farmers directly. Furthermore, the location specific loan schemes are to be encouraged for specific production environments. Finally, supervised agricultural credit schemes are required to prevent the mis-utilization of institutional credit and its timely repayment.*

**Keywords:** Institutional credit; Capital formation; Mountain agriculture;

The growth and development of any enterprise and that of economy are determined essentially by the level of technology and the efficiency of market mechanism. However, it is the use of capital that makes the above two factors operational. The importance of capital in economic progress has been recognized by economists long back (Baba *et al.*, 2010a). The new technology responsible for substantial increase in agricultural production is by and large capital-embodied, implying thereby, that the growth of agricultural sector depends substantially on the rate of capital formation (Baba, 2006).

The gradual sophistication of agricultural technology in India has forced the adoption of increasing quantities of capital items. The use of different types of fertilizers, chemicals, improved seeds, implements and machinery demands higher capital deployments. It has been observed that borrowers of credit were able to invest more in crucial inputs than non-borrowers that in turn resulted in higher average ha-1 net returns for borrowers (Baba *et al.*, 2010b). Therefore, the adequacy of individual farmer's financial resources has to be augmented from external sources for efficient and optimum utilization of inputs. Although the creation of cooperative banks, RRBs and NABARD has improved

the share of institutional credit in total rural credit, the informal sector is still accounting for major proportion of credit to cultivators (RBI, 2008). Moreover, there are wide disparities in the disbursement of institutional agricultural credit across different regions that correspond to varying performance of agricultural capital formation across these regions of the country. Moreover, agriculture in hill and mountains is entirely different than that of plains due to various specificities. Therefore, it is imperative to examine the entire gamut of interrelationships among the level of capital formation in relation with institutional credit to agricultural sector in a hill state like Jammu & Kashmir. In this backdrop, the present paper intends to investigate the magnitude/pattern of institutional credit and analyze its impact on capital formation in state agriculture to qualify the hypothesis that institutional credit has a significant role in capital formation in farm sector.

### METHODOLOGY

The study is based upon primary data collected from sample farmers on well-designed/pre-tested household schedule, through personal contact method during 2009-10 and 2010-11. Multi-stage stratified random

sampling technique was employed for the selection of sample respondents. In the first stage of sampling, one district from each agro-climatic zone was selected randomly considering maximum area under cultivation. In the second stage of sampling, two blocks from each district were selected on the basis of more cases of credit from the financial institutions. Later a complete list of agricultural loan borrowers was prepared in consultation with concerned officials of financial institutions operating in and around a village cluster in each block. In the final stage of sampling, a sample of 50 borrowers were randomly drawn from the list of borrowers in each agro-climatic zone; in this way forming a sample of 200 borrowers in each zone. In the selected study area, 50 non-borrowers were also selected randomly for comparative study, forming a total sample of 200 non-borrowers in all the agro-climatic zones. The categorization of selected farm households revealed dominance of small holders within both borrowers and non-borrowers categories. However, the information obtained from two farm categories was pooled for comparative study in four different agro-climatic zones. The primary data that has been collected from sample respondents include information on land, source-wise institutional credit, capital formation at farms and other indicators like literacy and expenditure on variable input, etc.

*The Model: Specification and structural form:* To study the impact of institutional direct agricultural credit on capital formation under different agro-climatic zones, a regression model of following structural form was developed and estimated for each agro-climatic zone separately in linear form employing ordinary least square procedure.

$TCS_i = f(INSCRDi, GFRI, EVC_i, IRA_i, HOLD_i, LIT_i, OFINCi, U)$   
Where,

- $TCS_i$  = Present value of total capital stock on farm in ith agro-climatic zone (Rs.ha-1)  
 $INSCRDi$  = Institutional credit to agricultural sector in ith agro-climatic zone (Rs.ha-1)  
 $GFRI$  = Gross farm returns in ith agro-climatic zone estimated by adding up the value of main as well as bi-products of all the farm enterprises (Rs.ha-1)  
 $EVC_i$  = Expenditure on variable inputs in ith agro-climatic zone estimated as the sum total of value of variable inputs like fertilizers, chemicals, labour, etc (Rs.ha-1)  
 $HOLD_i$  = Size of operational holding in ith agro-climatic zone (ha)  
 $LIT_i$  = Literacy rate in ith agro-climatic zone (%)

$OFINCi$  = Dummy for off-farm income in ith agro-climatic zone (1 if off-farm income and 0 for no such income)

$IRA_i$  = Operational area irrigated in farm under ith agro-climatic zone (%)

$U$  = Error term

To arrive at the present value of total capital stock generated at farm, its monetary value was deflated employing life of stock item in years and depreciation rates. The capital requires long lead time for coming into actual production process. Therefore, lags of investment are generally used to capture this lag lead time. But, lags of investment could not be obtained in cross sectional data, therefore, per hectare total capital stock on farm (present value of total capital stock in agriculture) was specified as an endogeneous variable in the model.

## RESULTS AND DISCUSSION

A cursory glance at Table 1 revealed that the borrowers of institutional credit farmers under all agro-climatic zones were having relatively larger land holdings as compared to non-Borrowers. The proportion of operational holding was found higher under sub-tropical zone (SBTZ) compared to other agro-climatic zones in the state. The proportion of operation area was lower in temperate zone (TMZ). In consonance to this the average size of operation holding is higher under SBTZ giving an idea that this zone may have higher endowment of capital resources. It was observed that over 99 and 94 per cent of the operational holding in cold-arid zone (CAZ) has irrigation facilities at borrowers and non-borrowers farms, respectively. It indicates that this zone has comparatively higher endowment of water resources in comparison to other zones. However, this region received a harsh climate during most part of the year that accordingly hamper intensification of agriculture in this zone as evident from lower cropping intensity in relation with per cent irrigated operation area. The major crops grown in this area are wheat and alfa alfa. Although irrigation and other resource favour cultivation of vegetables in this area but their resource intensive nature discourage farmers to manage large area under vegetable crops. Considering climate and available resources, study area in SBTZ is more endowed that resulted in higher intensification of cropping in this zone. Comparatively temperate (TMZ) has lower proportion of irrigation operation area that encourages farmers to cultivate apple on major proportion of operation area followed by paddy.

*Source-wise credit advanced in different agro-climatic zones:* Credit is advanced to agricultural sector either by institutions or by non-institutional agencies. Institutional agencies include cooperatives, public sector banks, private sector bank and rural banks. Different banks have differential role in different agro-climatic zones with respect

**Table 1. Land utilization pattern of sample farm households in different agro-climatic zones**

Particulars	Borrowers		Non-borrowers	
	Area*	%	Area	%
<b>IMZ</b>				
Cultivated area	7.9	92.2	7.1	93.7
Cultivated area irrigated (%)	29.0	-	44.0	-
Residential/wasteland	0.7	7.8	0.5	6.3
Total holding	8.6	100.0	7.5	100.0
<b>SBTZ</b>				
Cultivated area	43.2	97.6	20.3	97.4
Cultivated area irrigated (%)	98.6	-	98.9	-
Residential/wasteland	1.0	2.4	0.5	2.6
Total holding	44.3	100.0	20.9	100.0
<b>CAZ</b>				
Cultivated area	18.0	87.3	12.6	88.6
Cultivated area irrigated (%)	99.8	-	93.8	-
Residential/wasteland	2.6	12.7	1.6	11.4
Total holding	20.7	100.0	14.2	100.0
<b>TMZ</b>				
Cultivated area	29.9	94.9	10.3	97.2
Cultivated area irrigated (%)	34.3	-	45.4	-
Residential/wasteland	1.6	5.1	0.3	2.8
Total holding	31.5	100.0	10.6	100.0

B = Borrowers, NB = Non-Borrowers, SBTZ = Sub=tropical zone, IMZ = Intermediate zone, CAZ = Cold-arid zone, and TMZ = Temperate zone; \*Area in kanals,

to advancement of agricultural credit (Table 2). The analysis of credit advanced to sample farmers in IMZ revealed an important role of cooperatives and public banks. Cooperatives credit in this zone alone constituted 47 per cent of total credit per farm followed by public banks (41.61%). Private sector banks in this zone were found to have advanced only 11 per cent of total farm credit.

In SBTZ, rural banks were formed to have a major role with total credit advance of about 76 per cent of total farm credit. Private banks in this zone advanced about 18 per cent of total credit while credit advanced by cooperatives and public banks constituted less than 5 per cent of total farm credit. In CAZ, as high as 89 per cent of total credit received by farm households per farm was advanced by private banks. In this zone 7.2 and 3.0 of credit was advanced by cooperatives and public bank respectively where as the role of rural banks in advancing credit was found absent. Like in CAZ, private bank credit contributed about 83 per cent while rural banks and cooperative credit respectively constitute 11 to 6 per cent to total farm credit. However in this zone the role of public banks was totally absent, that should be the cause of concern for concerned authorities.

*Capital formation* : With an intention to find out the level of capital formation at borrower and non-borrower farmers, in order to ascertain the influence of institutional credit, the value of capital generated at their farms under all the agro-climatic zones were estimated and discussed in ensuing section.

*Capital formation in the form of farm implements and machinery* : The capital formation in the form of

**Table 2. Source-wise credit advance to agricultural sector in different agro-climatic zones (Rs./farm)**

Zone		Cooperatives		Public banks		Private banks		Rural banks		Total
		No.	%	No.	%	No.	%	No.	%	
IMZ	Cases (No.)	34	68.9	7	13.3	9	17.8	0	0.0	50
	Amount	22888	47.3	20146	41.608	5386	11.1	0	0	48419
	Overdues (%)	(58.8)		(30.2)		(13.1)		(0.0)		(41.8)
SBTZ	Cases (No.)	1	2.0	2	4.0	17	34.0	30	60.0	50
	Amount	4000	2.7	5400	3.6	26960	17.9	113800	75.8	150160
	Overdues (%)	(3.77)		(2.16)		(1.5)		(1.21)		(1.36)
CAZ	Cases (No.)	4	8.0	4	8.0	42	84.0	0	0.0	50
	Amount	3400	7.2	1700	3.6	42360	89.3	0	0	47460
	Overdues (%)	(9.97)		(1.27)		(0.0)		(0.0)		(0.76)
TMZ	Cases (No.)	8	15.2	0	0	40	80.4	2	4.3	50
	Amount	13622	6.3	0	0	177407	82.6	23784	11.1	214813
	Overdues (%)	(24.99)		(0.0)		(4.63)		(0.75)		(5.5)

Figures within parentheses indicate overdues in percentage terms.

implements and machinery per farm in different agro-climatic zones presented in Table 3 revealed higher capital formation at the farms of institutional credit borrowers compared to non-borrowers. This scenario signifies significant role of institutional credit in the generation of this kind of capital. The capital stock in the form of implements and machineries at borrowers' farms ranged from Rs. 0.86 lakhs in TMZ to Rs. 3.28 lakh per farm in SBTZ. Among non-borrowers, SBTZ has significantly higher capital accumulation compared to non-borrowers in other zones of the state. Except in SBTZ, tractors and accessories are totally invisible at farms of non-borrowers. Tractor & its accessories constitute higher proportion of capital stock at all borrowers' farms.

**Capital formation in form of livestock:** It is apparent from documented figures in Table 4, that borrowers have higher capital formation in the form of livestock compared to non-borrowers although there are few inconsistencies with respect to few animal species. In SBTZ borrowers farms have almost 3 times more capital

formation in livestock than non-borrowers. Capital formation in the form of buffaloes constituted higher proportion of total capital stock in SBTZ which is mainly due to better performance of buffalo and preference for buffalo milk in this zone (*Baba et al, 2011*). However this animal was totally invisible at farms (both borrowers' and non-borrowers') in other zones. Another important animal in capital stock were cross-bred cows in this zone. Higher absolute value was accumulated in cross-bred cows at borrowers' farms in all the zones. Few sheep/goats were also found visible in the study area and their proportion in total capital formation in the form of livestock was found high in cold-arid zone (CAZ) and at borrower's farm of this zone in particular.

**Farm capital formation:** In the study area of SBTZ pattern of total capital stock indicated higher capital formation at borrowers' farms. Implements & machinery constituted higher proportion of total capital value at both the farm categories. Livestock and farm buildings (that include cattle sheds, store/implement shed, poultry shed, etc) constitute other items of capital stock

**Table 3. Capital formation in the form of farm implements and machinery under different agro-climatic zones (Per cent)**

Implements	IMZ		SBTZ		CAZ		TMZ	
	B	NB	B	NB	B	NB	B	NB
Plough	18.9 (1.1)	25.1 (0.9)	0.0 (0.0)	0.1 (0.1)	4.9 (1.1)	73.1 (0.6)	0.9 (0.4)	11.5 (0.1)
Planker	1.3 (0.0)	0.0 (0.0)	0.1 (0.7)	0.6 (0.3)	0.3 (0.6)	2.3 (0.2)	0.3 (0.3)	0.0 (0.0)
Cutting & harvesting tools	25.4 (3.7)	31.1 (3.3)	0.8 (2.1)	5.4 (1.8)	0.6 (1.8)	9.4 (1.5)	1.0 (7.3)	39.4 (3.4)
Tractor & accessories	0.0 (0.0)	0.0 (0.0)	79.6 (1.1)	65.2 (0.1)	92.4 (0.1)	0.0 (0.0)	86.9 (0.3)	0.0 (0.0)
Digging & hoeing tools	7.8 (2.4)	14.0 (2.3)	0.2 (2.0)	0.4 (1.5)	1.1 (2.1)	13.7 (1.4)	0.4 (2.6)	17.3 (1.7)
Thresher	0.0 (0.0)	0.0 (0.0)	4.6 (0.2)	3.8 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Sprayer/duster	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.1 (0.3)	0.0 (0.0)
Water pump	19.0 (1.0)	0.0 (0.0)	7.0 (1.2)	16.7 (0.5)	0.0 (0.0)	0.0 (0.0)	2.4 (0.1)	0.0 (0.0)
Other*	27.6 (3.4)	29.8 (2.0)	7.6 (0.4)	7.8 (0.2)	0.6 (0.8)	1.5 (0.2)	2.9 (5.0)	31.9 (1.0)
Total (Rs./farm)	100.0 2342	100.0 1228	100.0 328981	100.0 41720	100.0 35968	100.0 967	100.0 86507	100.0 1197

B = Borrowers, NB = Non-Borrowers, SBTZ = Sub tropical zone, IMZ = Intermediate zone, CAZ = Cold-arid zone and TMZ = Temperate zone; \* includes waterpumps, ladders, baskets, etc.; Figures within parentheses indicate absolute numbers.

in this zone. However, capital formation in the form of miscellaneous items was totally absent under farms of SBTZ (Table 5).

In IMZ while livestock formed higher proportion of farm capital value at borrowers' farms, livestock accounted for higher proportion of total capital formation at farms of non-borrowers. Under this zone, due to unfavourable climate for supporting fruit cultivation capital formation in the form of orchard and plantation was total invisible.

Higher absolute capital was accumulated in the form of implements & machinery followed by farm building and livestock at farms of borrowers in CAZ. Though higher capital stock was generated at farms of borrowers' but higher proportionate capital was generated in the form of livestock and farm buildings, respectively at farms of non-borrowers.

Implements & machinery, farm building and livestock form major items of capital stock in TMZ in that order. As high as 2.65 per cent of total capital stock was accumulated in the form of orchards and plantation at farms of borrowers' in TMZ. It could be inferred

**Table 4. Capital formation in the form of livestock under different agro-climatic zones (Per cent)**

Animals	IMZ		SBTZ		CAZ		TMZ	
	B	NB	B	NB	B	NB	B	NB
Cross-bred cow	33.8 (0.8)	51.7 (0.6)	0.2 (0.9)	0.3 (0.6)	67.5 (1.5)	62.5 (0.7)	69.1 (1.1)	55.6 (0.5)
Milch	31.8 (0.7)	34.3 (0.4)	0.2 (0.8)	0.2 (0.4)	61.2 (1.3)	54.2 (0.6)	61.3 (0.9)	47.6 (0.4)
Dry	2.0 (0.1)	17.4 (0.2)	0.0 (0.1)	0.1 (0.2)	6.3 (0.2)	8.3 (0.1)	7.8 (0.2)	8.0 (0.1)
Local cow	7.0 (0.3)	15.7 (0.4)	0.0 (0.1)	0.1 (0.3)	5.8 (0.3)	17.8 (0.5)	8.2 (0.2)	16.9 (0.3)
Milch	7.0 (0.3)	10.5 (0.3)	0.0 (0.1)	0.0 (0.2)	5.1 (0.2)	15.2 (0.4)	8.2 (0.2)	11.6 (0.2)
Dry	0.0 (0.0)	5.2 (0.1)	0.0 (0.0)	0.0 (0.1)	0.8 (0.0)	2.6 (0.1)	0.0 (0.0)	5.3 (0.1)
Heifers	2.8 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	5.6 (0.2)	7.1 (0.6)	6.9 (0.5)	2.1 (0.0)
Calves	4.3 (0.6)	6.3 (0.6)	0.0 (0.3)	0.0 (0.2)	5.0 (0.7)	10.6 (1.2)	3.5 (0.4)	9.1 (0.5)
Sheep goat	1.9 (0.4)	8.0 (0.8)	0.0 (0.0)	0.0 (0.1)	12.9 (2.1)	0.0 (0.1)	4.5 (0.6)	1.0 (0.1)
Horse/mule	47.8 (0.7)	12.4 (0.1)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	3.8 (0.1)	9.4 (0.1)
Buffalo & draught animals	0.0 (0.0)	0.0 (0.0)	0.7 (0.9)	0.6 (1.2)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Others*	2.3 (0.3)	6.0 (0.7)	0.0 (14.0)	0.0 (0.0)	3.1 (0.2)	1.9 (0.1)	4.0 (0.1)	5.8 (0.3)
Total (Rs./farm)	49151	19358	89772	33400	35240	21099	31211	16130

\* includes poultry, etc ;

Figures within parentheses indicate absolute numbers

**Table 5. Total Capital formation at farms under different agro-climatic zones (Per cent)**

Particulars	IMZ		SBTZ		CAZ		TMZ	
	B	NB	B	NB	B	NB	B	NB
Land improvement	1.3	0.5	0.1	0.1	1.0	0.9	0.3	0.1
Farm buildings	37.1	51.0	22.7	21.4	21.7	28.6	33.4	49.5
Livestock	56.2	45.6	16.5	34.9	31.9	50.0	15.7	38.6
Implements & machineries	2.7	2.9	60.6	43.5	32.5	2.3	43.6	2.9
Irrigation structures	0.3	0.0	0.1	0.1	8.0	13.4	0.1	0.1
Orchards & plantation	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.1
Miscellaneous	2.5	0.0	0.0	0.0	4.8	4.7	4.2	8.9
Total	100.0 (87.5)	100.0 (42.5)	100.0 (543.1)	100.0 (95.8)	100.0 (110.5)	100.0 (42.2)	100.0 (198.5)	100.0 (41.8)

Figures within parentheses indicate value of total capital stock (000' Rs./farm)

B = Borrowers, NB = Non-Borrowers, SBTZ = Sub-tropical zone,

IMZ = Intermediate zone, CAZ = Cold-arid zone and TMZ = Temperate zone

\* includes fencing, etc

from above discussion that capital accumulation at farms' of borrowers was significantly higher compared to non-borrowers. Institutional credit advances help to generate capital stock at their farms that was observed to have significant impact on improvement of gross farm returns in mountain regions (*Baba et al., 2010b*). It is accordingly suggested that institutional credit need to be extended to farmers with a proper policy and supervisory services.

*Pattern of farm household capital investment:* Farm investment is an important indicator of capital formation and progress in agriculture. An attempt has been made in this section to estimate the farm investment made by the private (farm households) sectors. The pattern of agricultural investment made by farm households on various items has been combined and presented in Table 6. The land has not been considered because it was mostly acquired as ancestral property. Private agricultural investment at farms of borrowers and non-borrowers has been detailed in ensuing section.

Under SBTZ, the pattern of total capital stock indicated higher capital formation in case borrowers. The capital stock generated at borrowers' farms in SBTZ was Rs. 4.25 lakhs more than non-borrowers of institutional credit. This difference with respect to per hectare capital formation revealed higher capital formation at borrowers' farm to the tune of Rs. 0.91 lakhs. Since the loans were made available to borrowers only recently, therefore, an attempt to estimate the value of gave a capital generated during 2009-10 that gives close approximation about the net capital investment in farm business. It was observed that Rs. 1.36 lakhs

were invested in capital goods by borrowers during 2009-10 with is significantly higher that capital investment at made by non-borrowers. About 26 per cent of capital was added to existing stock during 2009-10 at farms of borrowers as against 4.44 per cent at non-borrower farms.

Similarly there is a huge difference between capital generated at borrowers and non-borrower farms in all the agro-climatic settings. The absolute capital accumulation on irrigation was higher in CAZ in comparison to other zone. This is in consonance with the higher proportion of irrigated area under VFS in comparison to other farming systems. In progressive farms with available water supply for irrigation, the investment on irrigation system was higher in comparison to investment on other items. Looking across borrowers in various zones, the capital was generated by higher proportion (37.33%) in TMZ followed by borrowers in IMZ. Higher amount of capital generated at farms of borrowers was clearly in consonance with improvement of financial position of farmers as a result of institutional credit advanced to the farms in these agro-climatic zones (Table 2). Although the magnitude of institutional credit was higher in TMZ but it has lower stock of capital and investment in it during 2009-10 which could nicely be attributed to the fact that a good proportion of the credit is advance for marketing of fruits in this zone.

*Model estimates:* The estimates of regression model for

SBTZ have been presented in the Table 7. Capital stock equation turned out to be best fit equations on the basis of estimated F-value. The estimates of the capital stock equation indicated that per hectare institutional credit (INSCRD) and per hectare gross returns (GFR) were the significant and positive determinants of total capital stock. The regression coefficient for per hectare expenditure on variable inputs (EVC) turned out to be -0.07, which indicated that further increase in expenditure over this variable would reduce capital stock significantly.

In IMZ, the calculated F-value for per hectare capital stock was significant indicating the estimation to be a best fit. The estimates of capital stock equation revealed that per hectare institutional credit (INSCRD), average size of operational holding (HOLD), gross farm returns (GFR) and proportion of operation area irrigated (IRA) significantly affected the level of capital stock in agriculture (Table 7).

In CAZ, the equation was a best fit as the calculated F-value turned out to be significant at given probability level (Table 7). The coefficients of institutional credit (INSCRD), average size of holding (HOLD) and the literacy rate (LIT) revealed that they were strong determinants of total capital stock under this farming system. Expenditure on variable inputs (EVC) have negative effect on total capital stock in agriculture. The coefficients of these variables indicated that increase in family size and variable cost would significantly reduce

capital accumulation in agriculture.

As far as the regression estimates for the TMZ are concerned, clearly institutional credit appeared as a positive significant determinant of capital formation. Improvement in holding size, farm returns, literacy and irrigation facilities would improve capital accumulation on farms of this zone. The F estimates revealed that the exogeneous variables specified in the model explain around 80 per cent of variation in total capital stock.

To sum up in all the locations, institutional credit came out to be a significant determinant

**Table 6. Total capital stock and pattern of capital investment under different agro-climatic zones ( Rs. in lakhs)**

Agro-climatic zones		Capital stock		Capital investment during 2009 & 2010		Investment as % of total capital stock	
		Per farm	Per ha.	Per farm	Per ha.	Per farm	Per ha..
IMZ	B	0.9	2.0	0.3	0.7	32.3	32.3
	NB	0.4	1.1	0.0	0.1	5.4	5.4
	Difference	0.4	0.9	0.3	0.6	26.9	26.9
SBTZ	B	5.4	2.5	1.4	0.6	26.1	26.1
	NB	1.0	0.9	0.0	0.0	4.4	4.4
	Difference	4.5	1.5	1.4	0.6	21.7	21.7
CAZ	B	1.1	1.1	0.3	0.3	30.9	30.9
	NB	0.4	0.6	0.0	0.0	7.4	7.4
	Difference	0.7	0.5	0.3	0.3	23.6	23.6
TMZ	B	2.0	1.3	0.7	0.5	37.3	37.3
	NB	0.4	0.8	0.0	0.1	10.8	10.8
	Difference	1.6	0.5	0.7	0.4	26.6	26.6

B = Borrowers, NB = Non-borrowers, SBTZ = Sub-tropical zone, IMZ = Intermediate zone, CAZ = Cold-arid zone and TMZ = Temperate zone

**Table 7. Regression estimates of capital formation**

Variable	SBTZ	IMZ	CAZ	TMZ
INSCRD	1.91* (4.00)	1.77* (3.15)	2.81* (2.69)	2.79* (4.14)
HOLD	5532.08 (0.66)	19066.18* (4.20)	9356.54* (3.55)	5551.05* (3.61)
LIT	1819.23 (1.24)	-12596.37 (1.08)	18193.16* (3.40)	1312* (2.91)
EVC	-0.12* (3.66)	-1.09 (1.05)	-1.22* (4.43)	0.91 (0.21)
GFR	1.97* (4.63)	1.79* (2.91)	1.00 (0.55)	1.39* (2.91)
IR	7891.65 (1.02)	6498.08* (3.00)	-8344.10* (5.37)	4212.5* (3.59)
R <sup>2</sup>	0.8234	0.7926	0.8111	0.7821
F(cal)	43.44*	55.67*	47.51*	39.21*

\*denote significance at 0.05 or better probability levels

Figures within parentheses indicate t-value of regression coefficients

contributing to the improvement of capital formation. The estimates of variable costs suggested that the cost on various inputs need to be rationalized to improve farm capital. Farm returns would improve financial position of farmers, which in turn encourage them to invest more on capital in the farming business. However, more expenditure on variable inputs certainly reduced the surpluses with the farmer and thus, affects the farm investment negatively. Though, the coefficient of expenditure on variable inputs was not statistically significant in IMZ. Average size of the operational holding was other variable, which have positive and significant effect on level of capital stock under all the farming systems. This is due to the fact that small sized holdings prohibits the application of big machineries like tractor,

which in turn resulted in less accumulation of capital on farm. Literacy was found to be an another determinant of total capital stock, educated farmer can make out the possible benefits of capital in farming business and could invest more on farm capital.

## CONCLUSION

This study was undertaken to find out the pattern of farm capital formation in relation with institutional credit in farms of different agro-climatic zones of J&K. Micro level analysis clearly indicated that borrowers of institutional credit were well endowed to invest more on farm capital. Accordingly, the capital formation on farms of borrowers for credit was significantly much higher than non-borrowers, implying a crucial role of credit in the generation of capital at farms. The regression estimates also indicated that institutional credit has significantly contributed in the improvement of capital stock on farm. On the basis of the findings, it could be inferred that the investment in agriculture has been the principal source of agricultural growth. Government should play an active role in the form of enhanced direct credit to farmers in view of its role in improving private capital investment and in turn farm returns. Private capital expenditure in agriculture could be encouraged by providing the incentives and necessary support like cheap power, tube-well subsidy, etc. with necessary policy environment. Location specific loan schemes need to be launched where in due care needs to be taken on specific production environment that favour different crop/ agricultural enterprises.

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