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Determinants of Capital Formation in Agriculture in the Eastern Dry Zone of Karnataka

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ABSTRACT

The study focused on determinants of capital formation in agriculture in the Eastern Dry Zone of Karnataka. The results revealed that multiple linear regression model was significant as indicated by F ratios and R^2 value. The coefficient of multiple determinations (R^2) revealed that the model was a good fit as indicated by a value of 0.92. The Higher levels of these factors, higher the capital formation and vice versa. In the case of less progressive area, variables like annual income, area irrigated, area under commercial crops, distance from town and borrowed amount are positive and significantly influenced capital formation for the pooled group of farms. As annual income of the farm increases by one rupee, capital formation would go up by ₹ 0.43. In the same way for one ha rise in irrigated area, capital formation would increase by ₹ 1,07,016. As area under commercial crops increase by one ha, capital formation would rise by ₹ 1701. In the same way a rise in borrowed amount by one rupee would result capital formation by ₹ 1.21. Interestingly as distance of the farm is longer from the town, capital formation tends to be more.

Highlights

- Investment, income and savings are the major indicators of economic growth and investment is the sine-qua-none of the economic development.
- Study mainly focuses the factors influencing private fixed capital formation in agriculture in progressive and less progressive area of Eastern Dry Zone (EDZ) of Karnataka as we can find highly developed areas and most backward region in the Zone.
- The regression analysis carried out to identify factors influencing capital formation in progressive and less progressive area showed that in the case of pooled farms, the variables, borrowed amount, area irrigated, area under commercial crops, annual income and distance of farm from nearby town significantly influenced capital formation.

Keywords: Multiple linear regression model and Investment elasticities

Development of agriculture sector, first and foremost depends on three factors, viz., expansion of workforce due to change in the demographic composition, physical and human capital accumulation and modernization. Hence, capital is one of the most crucial factors in the production process. Capital formation refers to growth of real capital assets on the farm that can go a long way in increasing the efficiency of productive efforts over a period of time. Hence, at farm level continuous growth in capital assets is essential. This may get boost whenever there is greater degree of public investment in the form of infrastructural facilities.

During the period of green and post-green revolution, public and private capital formation in farming made significant contribution to the agriculture growth. Originally, farm development was mainly driven by public investment in: (i) farm infrastructure viz., power, roads, irrigation and R&D, (ii) extension services, (iii) development of markets and storage facilities, etc. next, encouraged by their increased returns owing to improvements

in infrastructure and farmers were encourage to make private investment in land development, groundwater irrigation, farm mechanization, HYV seeds, chemical fertilizers, etc. More in recent times, corporate sector also entered into the agricultural R&D, extension, marketing, contract farming and other agricultural related services. These investments have considerably supplemented to the public investment in agriculture. The private investment has increased at places where infrastructural facilities were provided by public efforts, such as irrigation and development of new techniques of production that leads to increase the return on private investment. Farmers are more and more progressive and investment conscious in these areas viz., development of irrigation infrastructure and new techniques of production (Shukla, 1965; Shah and Agarwal, 1970).

The above summarize suggests that even though agriculture is relatively a labour-intensive activity, it also requires huge amount of fixed as well as working capital to carry out various agricultural operations efficiently. In particular, timely investment is crucial as it is linked to climatic factors viz., temperature, rainfall and dry air, etc. Whereas, large and rich farmers usually have better access to capital inputs and enjoy the benefits of economies of scale. While, poor farmers belonging to the 'small and marginal farm' categories especially in the underdeveloped agricultural area, face critical scarcity of capital. Further, the majority of other cases, they do not have the ability to make investment in fixed assets. In view of this, any investment made by them cannot be economically feasible in view of their small size of land holdings and low investment capacity as reflected by study. In the countenance of this ground reality, how to make capital affordable to about 80 per cent of small and marginal farmers is the one of the key issues that needs policy attention. The larger the portion of current output invested in capital assets by the cultivating families the greater would be the increase in production and the rate of growth Murukannaiah, (2006) and Pradeep Joliya *et al.* (2017). The behavior of public and private capital formation and efficiency of capital use in Indian agriculture shows continuous improvement since the seventh plan 1985-90 (Mishra and Chand, 1995).

Capital formation in agriculture is a crucial component of agriculture growth and development. Hence, it is a priority issue and much-debated one by policy makers, researchers and others. Capital formation assumes a greater significance in view of need for infusing newer capital in agriculture because capital stock on the farm gets depleted (depreciated) over time due to various factors. In order to sustain current growth and increase the production potential of the farm, it is essential to add new capital assets and replace older ones. Hence, the state provides all kinds of support and encouragement to farmers to enhance capital formation both at micro and macro levels. At micro level, the state supports capital formation by way of subsidized credit, technology and extension service. At macro level, all states undertake direct investment for creating infrastructural facilities which are expected to have complementary effect on capital formation on individual farms.

In this context, it is very interesting to know how the capital formation has taken place in different sectors of the economy, *viz.*, public and private sector. It is evident from the study which furnishes the percentage shares of public and private sectors in total capital formation in Indian agriculture. The share of agriculture and allied sector in total gross capital formation after showing a marginal increase during 1999-00 to 2001-02 has been continuously declining. It stood at 10.2 per cent in 1999-00 and further rose to 11.7 per cent in 2001-02 and thereafter declined to seven per cent in 2006-07. The decline was mainly attributed to decline in the private sector despite increase in the share of public sector. The nexus between capital formation and agricultural growth, and agricultural growth and poverty alleviation are very well articulated in literature. Given the positive impact of agricultural growth on poverty alleviation, the role of capital formation as one of the major engines of agricultural growth has been well placed in the development policy perspective.

A several socio-economic factors influence private investment in agriculture. Some of the important factors viz., age and education of the farmer, size of family, size of holdings, type of crops grown and their productivity, credit facilities and terms of credit, type of irrigation, power supply, proximity to input and output markets, level of returns to investment, government support in the form of subsidies and other concessions are

factors influencing capital formation in agriculture (Mahantesh, 2012; Singh and Mishra, 1974). There was a very high significant correlation between size of farm and capital formation (Singh, 1970). The productivity of farms depends greatly on the availability and judicious use of farm power by the farmers. Agricultural implements and machines enable the farmers to employ the power judiciously for production purposes. Agricultural machines increase productivity of land and labour by meeting timeliness of farm operations and increase work out-put per unit time. Besides its paramount contribution to the multiple cropping and diversification of agriculture, mechanization also enables efficient utilization of inputs such as seeds, fertilizers and irrigation water. Mechanization in agriculture enhances production and productivity of crops through timeliness, better management of inputs, improved quality of work and reduction of post-harvest losses (Radhey Shyam Singh and Ramesh Kumar Sahni, 2019).

Therefore, continuous replenishment of capital stock on farms is essential to sustain the growth. The capital assets depreciate regularly due to continuous use and to some extent through obsolescence. Hence, at regular intervals capital investments are needed on the farm to augment the productivity. However, it is pertinent to identify the pattern of investment on productive assets, priorities of farmers in the matter of capital formation, source of capital and constrains faced by farmers in capital formation. A study of this type will be very useful to policy makers in the pace of declining agricultural growth. Thus, a study could provide useful inputs to policy makers in the area of capital formation in agriculture. In the present article, an attempt has been made to analyze factors influencing capital formation in agriculture across different types of farms.

MATERIALS AND METHODS

The present study was focused in the Eastern Dry Zone (EDZ) of Karnataka (Zone-5), which presents an ideal setting for the study as we can find highly developed areas and most backward region in the Zone. Hence, the Eastern Dry Zone represents all dimensions essential for the study. The Zone-5 consists of parts of Tumkur district and entire Bengaluru urban, Bengaluru rural, Chikkaballapura, Ramanagara and Kolar districts. The Zone is spread over a total geographical area of 18,08,217 ha covering 9.49 per cent of the geographical area of Karnataka state. It is situated in the Deccan Plateau with 80 per cent area having an altitude of 800-900 m above Mean Sea Level (MSL). Higher elevations of 1500 mts and more occur in certain taluks with hilly areas like Hosakote, Sidlaghatta, Gudibande and Chikkaballapura. The annual rainfall ranges from 679.1 to 888.9 mm. More than 50 per cent of it is received in pre-monsoon and southwest monsoon seasons; hence, it is predominantly a *Kharif* Zone.

The present study adopted procedure to estimate and compare the capital formation in progressive and less progressive areas, two *taluks* one representing the progressive area and the other representing less progressive area were purposively selected for the study. The following variables were considered in deciding the progressiveness of *taluks*. Cropping intensity, area under commercial crops, area under irrigation, number of credit institutions, net irrigated area, number of tractors per hectare of GCA (Gross Cropped Area) and institutional credit per hectare. For each variable considered above, scores were assigned for each *taluk* in the district. The scores were given in the ascending order, depending on the magnitude of each variable, considered separately for each *taluk*. The minimum score starts from one and maximum score of 17 was given for 17 *taluks* of the Zone on the same rationality used above. The remaining seven *taluks* of Bengaluru urban district were not considered purposely due to less agricultural activities in these *taluks*. The scores were then aggregated for each *taluk* and the *taluk* with the highest aggregated score was ranked number one and so on.

The *taluk* with the first rank was considered as progressive and that with least rank was treated as less progressive for the study. Thus, *Kolar* and *Magadi taluks* were selected for the study to represent progressive and less progressive regions, respectively. The sampling design consisted of a multistage random sampling procedure. The first stage consisted of selection of *taluks* in the Zone as described in the above section. In the second stage two to three villages were selected randomly in each *hobli* covering both small and large farms. Thus, 14 villages from seven *hoblies* of *Kolar taluk* and 12 villages from five *hoblies* of *Magadi taluk* were

selected. In the final stage, a sample of 80 farmers each from two *taluks* comprising 40 small farmers and 40 large farmers was selected. Thus a total of 160 farmers were selected for the study. A list of farmers of the selected villages was obtained from the state department of agriculture and the village accountants of the respective villages.

Analytical Tool

To identify the factors influencing private fixed capital formation in agriculture and to estimate the magnitude of their influence, the variables defined above were regressed upon capital formation. For this purpose, a multiple linear regression (MLR) model was used as shown below

$$Y_i = b_o + \sum b_j X_{ij} + u_i \ (j = 1 \text{ to } 11)$$

Where,

Y_i = Private fixed capital formation in agriculture (value in rupees),

X_1 = Size of holding (hectare)

X_2 = Annual income of the family (₹)

X_3 = Area irrigated (hectare)

X_4 = Proportion of area under commercial crops (%)

X_5 = Borrowed amount (₹)

X_6 = Family size (adults)

X_7 = Age of farmer (years)

X_8 = Education level (schooling stages)

X_9 = Cropping intensity (%)

X_{10} = Distance from town (km)

X_{11} = Membership in organization

Dummy, Member=1, Otherwise=0, b_0 and b_j = Intercept and slope coefficients of the regression model, respectively. U_i = Random disturbance. The regression function was fitted separately for each group of farms viz., small, large, rainfed, irrigated and pooled farms of both progressive and less progressive areas. The coefficient of multiple determinations (R^2) was calculated to know the goodness of fit of the model.

RESULTS AND DISCUSSION

The difference between the term capital and capital formation are associated with several concepts viz., fixed/working capital, public/private capital, investment, gross/net fixed capital formation, consumption of fixed capital, etc. Generation of data on capital and capital formation, and its usage, requires a clear idea about these concepts. The term capital means those assets which are used as inputs in the process of production to generate further goods and services. It is thus not the same as money but refers to assets for the generation of which investment of both money and human efforts are required. Next characteristic of capital is asset must have been created by human efforts and not available in a natural form. Thus, although land is the most important basic resource in agriculture, land itself is not considered as a capital. But any investment made on land development activities would be termed as capital as it satisfies the criteria of human efforts and an asset useful in the agricultural production process.

Capital formation on the other hand, is a process of building up the stock of capital assets. It is achieved by saving a part of current income of the economy and investing it in the making of capital goods viz., machines, tools, plants and equipment's, transportation, storage and communication facilities, etc. An increase in the capital stock depends on the amount of new investment made in a particular asset. It is important to note that the capital assets used in production are consumed with time which depreciates its value. This is called as 'depreciation'. Hence, if the rate of capital consumption (depreciation) is lower than the rate of additional investment made in the capital, then the stock of that capital will be increasing over time. Such investments could be for the maintenance of capital assets (which increases the life span and quality of working assets) and/or for the purchase of new assets. Capital formation thus, directly depends on the amount of investment made in the capital assets during a financial year. There is a conceptual difference between capital and investment. Investment is a flow concept measured over a period of time, usually during a financial year. On the other hand, capital is a stock concept measured at a point of time, usually at the end of a financial year.

Determinants of Capital Formation

There are certain critical factors which influence

capital formation in agriculture in general. The magnitude of capital formation on farms is influenced by various socio-economic factors, in addition to desire of farmers to live comfortably by increasing farm income. The major pathway for enhancing farm income is to increase the number and magnitude of productive assets on farms.

The present study identified the variables which influencing for the determinants of capital formation are namely, size of holding (ha), annual income (Rs.), area irrigated (ha), area under commercial crops (%), borrowed amount (₹), family size (adult number), age of farmer (years), education level (schooling stages), cropping intensity (%), distance from town (km) and membership of organization and institutions. The multiple linear regression technique was used to estimate the cause and effect relationship of these factors. The overall adequacy of the model was tested through F ratio and R^2 value, which indicated fairly good in all the categories of the farms. The investment on irrigation structures, livestock and farm machinery and implements, across all type of farms in both progressive and less progressive regions. However, magnitude of investment was different across the region. On an average, in both progressive area and less progressive area, large farmers invested greater amount on farm assets per farm followed by irrigated farmers, small farmers and rainfed farmers. In the progressive area, the irrigation development was the preferred area of investment, where as in less progressive area, it was the livestock. The small and rainfed farmers depended on borrowed funds for investing in assets. In progressive area, institution source of funds played a major role than the non- institutional source of funds and vice versa in less progressive area. On the other hand, the large and irrigated farmers, because of their resource base, made investment from their own sources (Hamsa and Umesh, 2019).

Sampling Design

The preliminary survey of two *taluks* was made before data collection with the help of officials of the state department of agriculture. The sampling design consisted of a multistage random sampling procedure. The first stage consisted of selection of *taluks* in the Zone as described earlier. In the second stage two to three villages were selected randomly in each *hobli* covering both small and large farms. Thus, 14 villages from seven *hoblies* of *Kolar taluk* and 12 villages from five *hoblies* of *Magadi taluk* were selected. Thus, summing up a sample of 160 farmers was selected for the study. In the final stage of sampling sample farmers were selected randomly from these villages to constitute a pre-determined sample size of 160 farmers. A list of farmers of the selected villages was obtained from the state department of agriculture and the village accountants of the respective villages. Further, a sample of 80 farmers each from two *taluks* comprising 40 small farmers and 40 large farmers was selected. Thus, a total of 160 farmers were selected for the study (Table 1).

Factors Influencing Capital Formation in Agriculture

Various socio-economic and personal characters influence capital formation on farms. Based on the review of literature pertaining to capital formation several causative factors were identified. Totally 11 factors were included in the present study. They are size of holding (ha), annual income (₹), area irrigated (ha), area under commercial crops (%), borrowed amount (₹), family size (adult number), age of farmer (years), education level (schooling stages) cropping intensity (%), distance from town (km) and membership of organization and institutions. A multiple linear regression function was fitted to know the relationship of these factors with the capital formation on various types of farms. The results of regression analysis are presented in tables 2. The overall adequacy of the model was tested through 'F' ratio and R^2 value, which appeared to be fairly good in all the categories of the farms except rainfed farms, where it was only 0.77. The chosen levels of significance for all the groups were one, five and 10 per cent.

Progressive Area

The magnitude of capital formation on farms is influenced by various socio-economic factors, in addition to desire of farmers to live comfortably by increasing farm income. The major pathway for enhancing farm income is to increase the number and magnitude of productive assets on farms. In this article, an attempt is made to identify socio-economic factors that determine investment on

Table 1: Sample farmers in the progressive and less progressive areas

Hoblies	Sample Villages	Number of sample respondents					
		Small farms	Large farms	Total	Irrigated farms	Rain fed farms	Total
A. Kolar taluk (Progressive area)							
1. Kasaba	1. Harahalli	3	3	6	5	1	6
	2. Begliharahalli	2	3	5	2	3	5
2. Vokkalari	1. Setiganahalli	3	3	6	5	1	6
	2. Maduvatti	3	3	6	6	0	6
3. Narasapura	1. Kendatti	3	3	6	4	2	6
	2. Chakkapura	3	2	5	4	1	5
4. Holur	1. Mallasandra	3	3	6	4	2	6
	2. Nukkanahalli	3	3	6	5	1	6
5. Huttur	1 .Kalastipura	3	3	6	3	3	6
	2. Chadamanahalli	2	3	5	3	2	5
6. Sugutoor	1. Bommasandra	3	3	6	6	0	6
	2. Kallur	3	3	6	3	3	6
7. Vemgal	1. Vemgal	3	3	6	4	2	6
	2. Rajakallahalli	3	2	5	4	1	5
Sub-total	**14**	**40**	**40**	**80**	**58**	**22**	**80**
B. Magadi taluk (Less progressive area)							
1. Kasaba	1. Varadenahally	3	2	5	2	3	5
	2. Thagachiguppa	2	3	5	2	3	5
	3. Maralamandala	3	3	6	2	4	6
2. Madbal	1. Madbal	4	4	8	3	5	8
	2. Pura	4	4	8	3	5	8
3. Tippasandra	1. Raghunathapura	3	3	6	3	3	6
	2. Kodipalya	3	2	5	2	3	5
	3. Macholi	2	3	5	3	2	5
4. Kudur	1. Malligunte	4	4	8	4	4	8
	2 .Kudur	4	4	8	5	3	8
5. Solure	1. Bandemata	4	4	8	3	5	8
	2. Gorur	4	4	8	4	4	8
Sub-total	**12**	**40**	**40**	**80**	**36**	**44**	**80**
Grand total	**26**	**80**	**80**	**160**	**94**	**66**	**160**

productive assets on the farm. For this purpose, linear regression functions were fitted with various explanatory variables as depicted in table 2.

The results of regression analysis on capital formation in progressive area is depicted in table-2. For pooled category, size of holding, area irrigated and loan amount were the factors influencing significantly capital formation in agriculture in the progressive area. Loan amount, area irrigated and size of holding were significant at one, one and 10 per cent levels. The value of the regression coefficients were 1.74, 1,62, 191.85 and 36,176.99 respectively, for the above factors. This can be interpreted that because, magnitude of contribution to the total capital formation was very high through borrowed amount as compared to other variables. Next, to the high capital investment on irrigation structures, the magnitude of capital formation on farms shows a higher value. Therefore, the contribution of irrigated land to capital formation on the farms is quite substantial as revealed by the regression coefficient. Farm size influenced positively the capital formation, as one ha increase in farm size would lead to a rise in capital formation to the extent of ₹ 36,176.99. This is obvious because in progressive area many farmers undertook huge capital investments on the farm like irrigation structure, livestock and drippers/sprinklers added to this most of the farmers were innovators and try to take advantage of urban demand for high value products which call for capital investment especially on irrigation structures. Thus, larger the farm size greater is the need for creating productive assets.

Between the small and large farms, borrowed

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Table 2: Factors influencing capital formation in agriculture in progressive area (Regression coefficients)

Holdings	Intercept	Size of holding (Ha.) X_1	Annual income (Rs.) X_2	Area irrigated (Ha.) X_3	Area under commercial crops (%) X_4	Borrowed amount (Rs.) X_5	Family size (No's) X_6	Age of farmer (Year) X_7	Education level (Schooling stages) X_8	Cropping intensity (%) X_9	Distance from town (km) X_{10}	Dummy (Member of Organization=1, otherwise=0) X_{11}	R^2	`F' ratio
Dependent variable = Capital investment in rupees per farm														
Small farms (N=40)	-73764.66 (-0.71)	-32576.12 (-0.64)	0.71* (1.71)	117096.17* (1.78)	76.13 (0.11)	2.01*** (13.39)	-16404.46 (-0.85)	3525.17** (1.96)	3727.16 (0.34)	— —	-3442.37 (-1.01)	137352.56** (2.26)	0.94	48.12***
Large farms (N=40)	176240.23 (0.66)	7089.14 (0.25)	0.40 (1.62)	57737.89 (0.97)	2612.67 (1.23)	1.60*** (8.17)	11983.40 (0.57)	-2411.65 (-0.76)	16393.87 (0.81)	— —	6166.95 (0.71)	-157622.42* (-1.77)	0.89	22.53***
Rainfed farms (N=22)	2516.55 (0.09)	1469.21 (0.16)	-0.09 (-0.39)	— —	80.07 (0.38)	1.66*** (5.26)	9621.92 (1.39)	-449.70 (-0.76)	2148.41 (0.41)	— —	1261.38 (0.97)	-25028.81 (-1.23)	0.77	4.41***
Irrigated farms (N=58)	-120275.70 (-0.45)	50806.17** (2.21)	— —	120603.11*** (2.680)	-226.04 (-0.09)	1.58*** (10.27)	14250.77 (0.82)	3074.55 (1.11)	39064.89** (2.40)	100.32 (0.11)	4539.56 (0.66)	-121178.13* (-1.72)	0.87	29.67***
Pooled farms (N=80)	-106119.64 (-0.85)	36176.99* (1.92)	— —	162191.85*** (4.63)	848.10 (0.96)	1.74*** (13.19)	22042.24 (1.51)	543.75 (0.27)	17393.05 (1.34)	— —	947.55 (0.19)	-100683.54* (-1.69)	0.90	69.08***

Note: *1. Figures in parentheses denote calculated 't' values;*

*2. ***, **, * = significant at 1, 5, 10 per cent level of probability, respectively.*

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