

The Volume and Impact of Agricultural Institutional Finance in Agricultural Production in Sikkim

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Abstract

Institutional credit greatly boosts agricultural productivity by providing the resources needed for input investment, which, when combined with gross sown area and suitable rainfall, improves output. However, credit allocation differs by district, owing to physical considerations such as location and topography. This unequal distribution can result in differences in agricultural development and output across regions. Areas with tough conditions frequently earn less credit, limiting their agricultural potential. To achieve more equitable development and maximise the benefits of institutional credit, it is critical to address regional imbalances through tailored policies and support systems. Study has used log linear regression model to analyse the data and it has been found that institutional credit, gross sown area and annual rainfall are statically significant with the agricultural production.

Key Words: Agricultural Finance, Primary Agriculture Society, Self-help Group

Introduction

For a long time, agriculture has been the foundation of many economies, especially in developing countries where it is essential to maintaining livelihoods and guaranteeing food security. Nonetheless, the agricultural industry frequently faces a diversity of difficulties, such as limited access to contemporary technologies, expensive input prices, and erratic weather patterns. The availability of institutional credit is a key component that can mitigate these issues and promote agricultural growth. Farmers rely heavily on institutional lending from banks, cooperatives, and other financial institutions to finance their investments in superior crops, fertilizers, irrigation systems, and cutting-edge equipment. This money infusion encourages innovation and sustainable farming methods, in addition to increasing output. Agriculture, as a fundamental pillar of human sustenance and it has been considered as the matter of extensive research and development globally. In regions like Sikkim, a north-eastern state in India, where the terrain is rugged and the economy predominantly agrarian, the role of agriculture is paramount. In recent years, the focus has shifted towards understanding the importance of agricultural institutional finance to determining the

landscape of the agricultural production. This study undertakes an in depth or comprehensive exploration of the determinant and extend of agricultural institutional finance on agricultural production within the distinctive context of Sikkim. The agriculture sector require minimum level input like fertilizer, technology, seed etc. to attain the optimum level of production. Financial institution can play a vital role to fill this gap by providing credit facility to the farmer at micro level. (Zumberi, 1989), examine the production function of the agricultural sector and found that farmers utilise financial credit to financing the seeds, fertilizer and other input which are required in the production. (Pitt & Khandker, 1996.), opined that welfare of the household like holding of asset, labour supply and education are highly associated with the availability of the institutional agricultural finance. . Similarly (Binswanger & Khandker, 2007), found the positive association between institutional credit with agricultural productivity and income which lead to enhance rural development. (Hussain &Thapa, 2012), revealed the shift of conventional agricultural practice like foods crops to commercial practices like fruits, cottons, sugarcane, poultry etc. after they availed the credit. In regions like Sikkim, a north-eastern state in India, where the terrain is rugged and the economy predominantly agrarian, the role of agriculture is paramount. In recent years, there has been a more emphasis on how institutional agricultural finance effect the agricultural production scenario. This study provide the insight into depth analysis of extend and effects of institutional agricultural finance on agriculture production in Sikkim.

Sikkim's agricultural sector is characterized by small landholdings, limited arable land, and a predominant reliance on rain fed farming. The state's topography, featuring steep slopes and varying altitudes, further accentuates the challenges of agricultural production. However, Sikkim's government has proactively promoted organic farming practices, making it the first fully organic state in India. This transition to organic agriculture has not only differentiated Sikkim's produce but also highlighted the importance of sustainable practices in agriculture. The question of how agricultural institutional finance intersects with Sikkim's unique agricultural landscape and its transition to organic farming forms the crux of this study. Understanding the impact and volume of credit in this context can provide a depth into the potential driving effect of finance on agricultural production.

Review of literature

The majority of people in developing nations like India rely on agriculture, either directly or indirectly, for their living. The majority of them work in the agriculture industry indirectly by converting agricultural products into semi-finished and finished commodities. So far, a number of initiatives have been carried out to advance agriculture and generate foreign exchange through the export of agricultural products. Despite these initiatives, the most of the developing nations have shown a steady fall in agricultural productivity along with a decline in the cost of agricultural goods. As a

result, the bulk of agricultural producers, smallholder farmers have relatively little motivation to increase production. Inadequate infrastructure and rising agricultural input and technology costs make this worse. According to (Chand et al., 2015), instead of difference in regional development and availability of informal credit, the demand of agricultural institutional credit has been improved. And further study found that the initiative taken by the government for strengthening financial inclusion in real terms is showing a positive sign. Study also examine that asset ownerships, education level of the household, gender and caste are found to be significant influence on the access to formal institutional agricultural credit. (Chaiya et al., 2023) analyse the role, impact and utilization of formal credit. Study found that credit has the significant impact in the production whereas misuse of credit has been notice. The availability of agricultural finance, enabling farmers to purchase improved infrastructure and new technologies, is determined by the efficiency of the farming community.

(Laha, 2011), examine the role of credit on land leasing and opined that there is a progressive association between land leasing and access to formal agriculture institutional credit. They found that production and efficiency has direct association with credit. (Bashir et al., 2010), analyse the role of formal institutional credit in productivity of wheat by collecting primary data in different district of Pakistan. Result show that availability of credit transform the agriculture sector by raising the farmer's participation in the production process. (Riaz et al., 2012), examine the used of credit availing for the agricultural purpose and found that agricultural credit has been utilised for livestock and poultry. (Burgess & Pande, 2005), examine the role of expansion of bank branches in reduction of rural poverty and production of goods in rural areas and found that with establishment of banks branches in rural areas helps to reduce rural poverty and lead to improvement in the agricultural production. (Boucher et al, 2014), analyse the credit constraints on farm productivity and found that credit constrained has significant and negativity effect on the farmers productivity whereas non-credit constrained are statistically significant and positively rely with the productivity of the agriculture. (Ojo et al, 2019) examine the impact of credit on productivity of rice in south west Nigeria on the basic of demand side and revealed that variables like asset of household, access to services, climate are statistically significant in the variation in the productivity of rice. Further it has been found that location, income from rice, experience of farming, distance from source of credit and interest positively impact the amount of credit the farmers are demanding. (Shah et al., 2007) provide the comprehensive overview of development and challenges face by rural credit. Study found that nationalisation of banks has positive impact on credit availability and rural development. The author suggest the role of SHG (Self Help Group) bank linkages to model to aid in fostering disadvantage group.

Objective

- To analyse the extent of institutional agricultural financing in Sikkim
- To examine the impact of institutional agricultural finance in agricultural production in Sikkim

Methodology

Secondary information from sources such as the Census of India- 2011, Directorate of Economics and Statistics- Sikkim, Sikkim Human Development Report- 2023, Statistical Handbook of Sikkim - 2023, Banking and Statistical Returns of RBI- 2023, State Level Bankers Committee- Sikkim, Status of Microfinance Programme in India- NABARD. Descriptive statistics, bar graph and trend line has been used to see formal credit flow to agricultural sector from financial institution like commercial banks, cooperative banks and regional rural banks.

Analytical tools

In analyse the impact of formal institutional agricultural credit in agricultural production or output, Log Linear regression model has been used to see the long run relationships. Agricultural credit from the institutional sources, gross sown area, rainfall and net irrigated area are being treated as the independent variables and production of agricultural has been treated as the dependent variables.

Impact of Agricultural institutional finance, Gross sown area, Net sown area and Annual rainfall of agricultural production has been calculated by using log linear regression model. The log-linear model equation with the value of output (Y) as the dependent variable and Rainfall (X_1), Institutional Credit (X_2), Gross Sown Area (X_3), and Net Irrigated Area (X_4) are considered to be independent variables. The equation can be represented as follows:

$$\ln(\text{Value of agricultural Output}) = \beta_0 + \beta_1 \text{Agriculture institutional Finance} + \beta_2 \text{Net sown area} + \beta_3 \text{Gross sown area} + \beta_4 \text{Rainfall} + \varepsilon$$

Therefore required equation to run the log linear regression model is

$$\ln(Y_0) = \beta_0 + \beta_1(X_1) + \beta_2(X_2) + \beta_3(X_3) + \beta_4(X_4) + \varepsilon$$

Rainfall is a critical determinant factor for agricultural production, particularly in regions reliant on monsoons. Lobell et al. (2008) examine that variability in rainfall due to climate change is a major contributor to fluctuations in crop yields of a region. Additionally, Kumar et al. (2011) noted a positive correlation between sufficient rainfall and increased agricultural output, while highlighting that extreme weather events such as droughts or floods significantly reduce yields. Farmers who has invested in productivity enhancing inputs such as fertilizers, improved seeds and various modern equipment with the access of formal credit. Binswanger and (Khandker, 1995) showed that institutional credit leads to significant improvements in agricultural production by enabling better resource allocation. (Dev, 2006) demonstrated that regions with access to high institutional credit experienced higher level of farm income and crop

yields. (Hazell, 1985) emphasized that there is a progressive correlation between output and increase in net sown area. This approach is particularly applicable in areas with under cultivated land resources. However, intensification is considered as the increasing in crop productivity and believe to be sustainable solution because of limited geographical land. Irrigation provides a reliable source of water, significantly boosting agricultural productivity, especially in semi-arid and rain-fed regions irrigation provides a significant help to boost the agricultural productivity. . Rosegrant and Evenson (1993) demonstrated that investment in irrigation lead to higher and more stable yields, regardless of rainfall variability. Fan et al. (2000) increase in the irrigation facility enhance the capacity of the farming and help farmers to practise multiple cropping cycles.

Result and Discussion

Volume of institutional Agriculture Finance in Sikkim

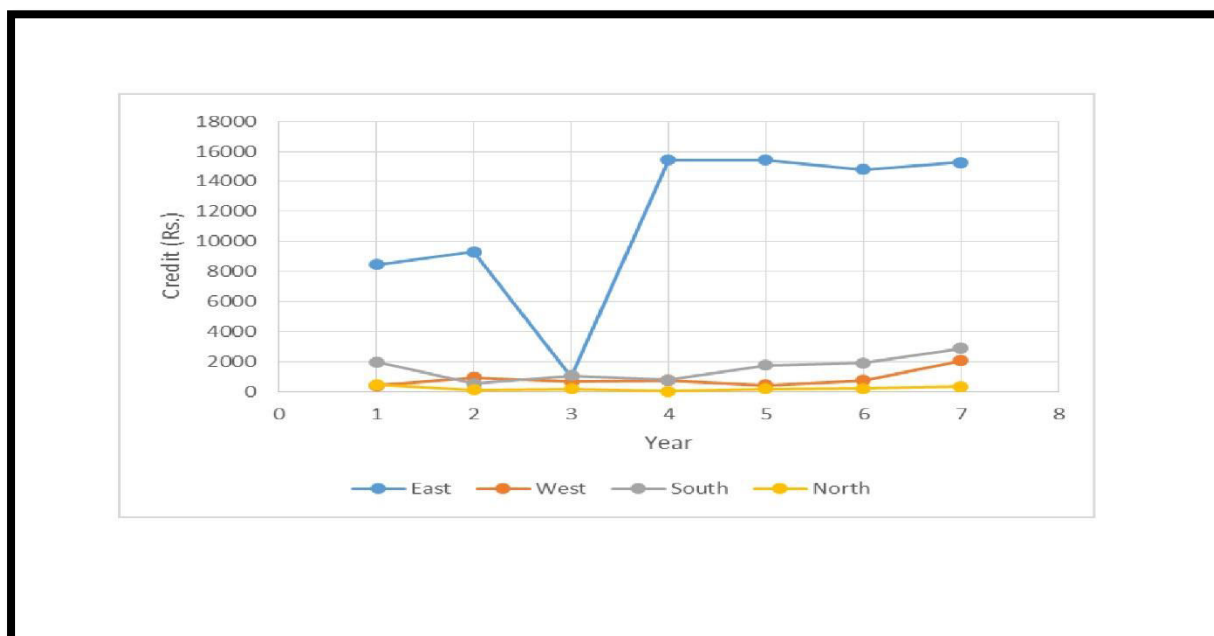
The volume of institutional finance in Sikkim's agricultural sector has been a significant determinant of the state's agricultural growth and development. This financial support, provided by various financial institutions such as banks, cooperatives banks, and rural financial agencies plays a determining role in improving agricultural productivity, endorsing sustainable practices, and driving rural monetary progress.

In Sikkim, there are several institutional credit agencies which played a critical role in providing credit assistance to support to farmers and promoting rural sector growth. These agencies offer credit services tailored to the specific needs of agricultural activities, ensuring that farmers have access to the funds necessary for investments, input procurement, and overall agricultural growth. Some prominent institutional credit agencies in Sikkim include:

- **State Cooperative Bank:** The Sikkim State Cooperative Bank is a key financial institution that provides credit and banking services to farmers and rural communities. It offers various agricultural loan product which includes crop loans, term loan for agribusinesses, and loan for the development of rural infrastructure.
- **District Central Cooperative Banks (DCCBs):** Sikkim has DCCBs operating at the district level, which extend credit facilities to farmers through a network of cooperative societies. These banks provide agricultural loans, credit for farm mechanization, and other financial services to the agricultural community.
- **Nationalized Banks:** Nationalized banks which are destined in Sikkim are State Bank of India (SBI), Punjab National Bank (PNB), and Bank of Baroda and providing services to rural masses by opening up their branches which offer agricultural credit and related financial services to farmers and rural entrepreneurs.

- Regional Rural Banks (RRBs): RRBs, such as Sikkim Rural Bank, are specialized institutions focused on rural credit and development. This bank has a significant role in providing credit and financial assistance to the farmers.
- NABARD: The National Bank for Agriculture and Rural Development (NABARD) is a key institution that supports farmers and provides funding for the rural development in Sikkim. NABARD provides financial assistance, refinancing, and capacity-building programs to various financial institutions and stakeholders involved in the rural credit market.
- Primary Agricultural Credit Societies (PACS): PACS are the grassroots-level credit cooperatives that serve as the primary point of contact for farmers seeking credit. These societies are linked to DCCBs and provide credit services at the local level.
- Microfinance Institutions: Several microfinance institutions (MFIs) operate in Sikkim, providing financial services to small and marginal farmers who may not have easy access to traditional banking channels. These MFIs offer microloans and other financial products to support agricultural activities.
- Sikkim State Cooperative Agricultural and Rural Development Bank (SCARDB): SCARDB is a specialized financial institution in Sikkim that focuses on rural development and provides credit to agriculture and allied sectors.

Figure 1: District Wise Credit Flow to Agricultural Sector



Sources: SLBC Report, Sikkim

Data on four districts of Sikkim: East, West, South, and North across several fiscal years from 2015–16 to 2021–22 are shown in the above figure. The East district continually had the largest credit flow on the agricultural sector. The West district has considerable

fluctuation in terms of agricultural credit. In general, the South area saw an increase in value, peaking at 2,890.79 in 2021–2022. The North region has always had the lowest numbers; the highest significant value was 464.18 in 2015–16, and the highest point was 333.96 in 2021–2022. All things considered, the East region continues to be the key player in the dataset. The significant growth has been observe in South and West Sikkim and relative less growth in North Sikkim.

Impact of institutional agricultural finance

Impact of institutional agricultural finance, and various variable in agricultural production are examine with the help of log linear regression model. The log-linear model equation with the value of output (Y) is being treated as the dependent variable and variables Rainfall (X_1), Institutional Credit (X_2), Gross Sown Area (X_3), and Net Irrigated Area (X_4) are treated as independent variables. The equation for the log linear regression model are shown below:

$$\ln(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where:

$\ln(Y)$ is the natural logarithm of the dependent variable (Value of Output).

β_0 is the intercept term which represents the estimated value of the dependent variable when all independent variables are zero.

$\beta_1, \beta_2, \beta_3, \beta_4$ are the coefficients corresponding to the independent variables which are given above.

X_1, X_2, X_3, X_4 are the values of Rainfall, Institutional Credit, Gross Sown Area, and Net Irrigated Area respectively and ε represents the error term capturing unexplained variability.

The coefficients ($\beta_1, \beta_2, \beta_3, \beta_4$) represent approximate percentage variation in the expected value of the natural logarithm of the output for a unit change in the corresponding independent variable, while holding other variables constant.

Cook-Weisberg test for heteroskedasticity/Breusch-Pagan

Ho: Constant variance

Variables: fitted values of $\ln v$

Table:1.1: Heteroskedasticity Test

$\chi^2(1)$	1.27
Prob> χ^2	0.2591

The table summarizes the Breusch - Pagan / Cook-Weisbergheteroskedasticity test. The test is run to determine whether there is any indication of non-constant variance (heteroskedasticity) in the residuals of a regression model associated with it. The (Ho)null hypothesis assumes that the errors have constant variance (homoskedasticity). The value 1.27 represent test statistic that represent calculated

chi-square statistic for the test. The probability value (p-values) associated with the chi-square test statistic is 0.2591. This value indicates the probability of obtaining a test statistic as extreme as the calculated one, assuming that the null hypothesis is true.

Consequently, we can make a decision about the null hypothesis by comparing the p-value to a chosen significance level (e.g., 0.05). Since the p-value (0.2591) is greater than 0.05, there is insufficient indication to reject the null hypothesis. This suggests that there is no significant indication of heteroskedasticity in the residuals of the regression model. In other words, the assumption of constant variance of errors is not violated, and the model's residuals exhibit homoskedasticity.

Table: 1.3
Regression R
esult

Variables	Coefficient
icl	0.1233651
	(0.018479)*
nith	.0085991
	(0.779)
gsath	.0115687
	(0.01624)*
arrrm	.0000697
	(0.01923)*
Constant	9.795989
	(0.000)
No. of observation	10

Source: Estimated based on field survey

The coefficient for the variable "icl" (institutional credit) is 0.1233651. The above information suggests that for each one-unit increase in "icl," i.e. institutional credit, there is an estimated increase of approximately 0.1233651 units in the dependent variable. The associated standard error, indicated in parentheses as (0.018479), is relatively small, implying that the coefficient estimate is precise. The asterisk (*) indicates that this coefficient is statistically significant.

The coefficient for the variable "nith" (Net Irrigation in 000 H) is 0.0085991, which stated that for each one-unit increase in "nith," there is an estimated increase of approximately 0.0085991 units in the dependent variable. The associated standard error (0.779) is relatively large, suggesting that the coefficient estimate may be less precise. The lack of an asterisk indicates that this coefficient is not statistically significant.

The coefficient for the variable "gsath" (Gross sown area in 000 H) is 0.0115687. This implies that for one-unit increase in "gsath," there is an estimated increase of

approximately 0.0115687 units in the dependent variable. The associated standard error (0.01624)* is relatively small, and the asterisk (*) which implies that this coefficient is statistically significant.

The coefficient for the variable "armm" (annual rainfall in mm) is 0.0000697, which suggests that for each one-unit increase in "armm," there is an approximately increase in the dependent variables by 0.0000697. The associated standard error (0.01923)* is relatively small, and the asterisk (*) indicates that this coefficient is statistically significant.

Constant: The constant term is 9.795989, which represents the expected value of the dependent variable when all independent variables are considered to be zero. The associated standard error (0.000) is very small, and the constant is statistically significant.

Limitation and Future Scope of the Study

- Various digital facility like digital wallet, mobile banking, and block chain technology may improve the access to institutional agricultural finance for farmers. Researchers may analyse the how this variables can effect agricultural finance and how these technological changes remove the barriers in digital literacy especially among the farmers.
- Research could be carried forward or investigate the whether the schemes like crop insurance, direct benefit transfer reach to the beneficiary or not. Further it can be analyse to whether this schemes really benefitted the rural masses or not.
- Further study can be conducted to role of gender in the agricultural activity and various factor which effect the access to institutional credit and how women participation can be improve to raise the economic status of rural women.
- Investigator can analysis the various determinant factor from the supply side of institutional agricultural finance.
- Researcher may analyse the role of government and RBI on the implementation of the various scheme for the development of institutional agricultural finance. Research could focus on introduction of loan waiver to the farmers.
- Comparative analysis could be conducted with respect to formal and informal credit and how the services provided by the institution effect the demand for credit from the formal institution.

Conclusion

Institutional credit is vital to increasing agricultural output since it gives farmers the money that they need to invest in inputs like machinery, fertilizer, and high yielding variety of seeds. Research has demonstrated that there is a progressive co-relationships between the availability of credit and agricultural production.

Specifically, more access to credit leads to higher productivity as farmers are able to implement more advanced technology and techniques. In addition to credit, other important elements are rainfall and gross sown area. The entire land area under cultivation is represented by the gross sown area, and an increase in this area typically results in increased agricultural output. Rainfall has a direct impact on crop yield since it is essential to crop growth; timely and sufficient rainfall can greatly increase crop productivity. Nonetheless, there is regional variation in the effect of institutional lending on agricultural productivity. The allocation of credit among the four districts varies significantly throughout the state under analysis. Land type, geography, and location are examples of geographical characteristics that might be used to explain these differences. For example, because of the perception of greater risks and lower possible returns, places with difficult topography or unfavorable climatic conditions may be given less credit. Different districts may have different levels of agricultural growth as a result of this unequal loan allocation.

Implications

Limitations and future scope of the study

References

1. Bashir, M. K., Yasir, M., & Sarfraz, H. (2010). Impact of agricultural credit on productivity of wheat crop: evidence from Lahore, Punjab, Pakistan. *Pakistan Journal of Agricultural Sciences*, 47(4), 405–409.
2. Binswanger, H. P., & Khandker, S. R. (2007). The impact of formal finance on the rural economy of India. *The Journal of Development Studies*, 0022-0388, 234-262.
3. Boucher, S., Barham, T., & Carter, M. R. (2014). Credit constraints and productivity in Brazilian agriculture. *Journal of Development Economics*, 106, 103-119.
4. Burgess, R., & Pande, R. (2005). Do rural banks matter? Evidence from the Indian social banking experiment. *American Economic Review*, 95(3), 780–795.
5. Chaiya, C., Sikandar, S., Pinthong, P., & Saqib, S. E. (2023). The Impact of Formal Agricultural Credit on Farm Productivity and Its Utilization in Khyber Pakhtunkhwa, Pakistan, *Sustainability*, 1217(15), 2-14.
6. Fan, S., Hazell, P., & Thorat, S. (2000). Government spending, growth, and poverty in rural India. *American Journal of Agricultural Economics*, 82(4), 1038-1051.
7. Hussain, A. and Thapa, G.B. (2012). Smallholders' access to agricultural credit in Pakistan, *Food Security*, Vol. 4 No. 1, pp. 73-85..
8. Kumar, A., Singh, R.K.P., Jee, S., Chand, S., Tripathi, G., & Saroj, S. (2015). Dynamics of access to rural credit in India : Patterns erminants Dynamics of Access to Rural Credit in India : Patterns and Determinants. *Agricultural Economics Research Reiew*, 28, 151-166.

9. Kumar, N., & Parikh, J. (2011). Indian agriculture and climate sensitivity. *Economic and Political Weekly*, 46(6), 68-75.
10. Laha, A. (2011). Determinants of financial inclusion: A study of some selected districts of West Bengal, India. *Journal of Financial Inclusion*, 5(2), 45-60.
11. Lobell, D. B., Burke, M. B., Tebaldi, C., Mastrandrea, M. D., Falcon, W. P., & Naylor, R. L. (2008). Prioritizing climate change adaptation needs for food security in 2030. *Science*, 319(5863), 607-610.
12. Mahendra Dev, S. (2006). Agricultural growth and rural development in India: Emerging issues. *Indian Journal of Agricultural Economics*, 61(3), 241-258.
13. Ojo, T. O., Baiyegunhi, L. J. S., & Salami, A. O. (2019). Impact of credit demand on the productivity of rice farmers in South West Nigeria. *Journal of Economics and Behavioral Studies*, 11(1), 166-180.
14. Pitt, M. M., & Khandker, S. R. (1996). Household and Intrahousehold Impact of the Grameen Bank and Similar Targeted Credit Program in Bangladesh. *World Bank Discussion Paper*, 0-8213-3594-4.
15. Riaz, A., Khan, G. A., & Ahmad, M. (2012). Utilization of agriculture credit by the farming community of Zarai Tariqati Bank Limited (ZTBL) for agriculture development. *Pakistan Journal of Agricultural Sciences*, 49(4), 557-560.
16. Rosegrant, M. W., & Evenson, R. E. (1993). Agricultural productivity and sources of growth in South Asia. *American Journal of Agricultural Economics*, 75(3), 764-768.
17. Shah, M., Rao, R., & Shankar, P. S. V. (2007). Rural credit in 20th century India: Overview of history and perspectives. *Economic and Political Weekly*, 42(15), 1351-1364.
18. State Level Banker Committee Report. (2013). Government of Sikkim.
19. State Level Banker Committee Report. (2014). Government of Sikkim
20. State Level Banker Committee Report. (2019- 20). Government of Sikkim
21. Zuberi, H. A. (1989). Production function, institutional credit and agricultural development in Pakistan. *The Pakistan Development Review*, 28(91), 43-56.