Determinants of Crop Diversification in West Bengal

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1. Introduction

The present article will discuss the determinants of crop diversification in West Bengal. When a farming household undertakes crop diversification, it generally moves from cultivation of less remunerative to more remunerative crops. But, the factors that propel this pattern of diversification in West Bengal need to be discussed in some details. The present article sets up a specific model to enquire about the determinants of crop diversification.
In order to examine the key determinants of crop diversification, the following model will be used:

D_C = f (TECH, INFR, KNOW, DEMA, RAIN)

where, D_C = Crop diversification, as the dependent variable, measured by diversification indices like HI, EI and MEI.
TECH = Technology includes: area under high yielding varieties of crops[1], fertilizer use (kg/ha.), and proportion of gross irrigated area.
INFR = Infrastructure includes: road length (km) [proxy variable describing INFR].
KNOW = Information includes: average size of landholding (ha.), and rural literacy (%).
DEMA = Demand includes: Urbanization (% of urban population).
RAIN = Climate includes: annual rainfall (mm).

For the present analysis (as of now), we area dropping the 'RAIN' variable from the model due to some problem with the secondary data.

Specification of Variables and their Expected Signs for Diversification

Determinants	Indicators	Expected Sign
Technology	Area under HYV crops	+
	Fertilizer use	+
	Gross irrigated area	+
Infrastructure	Road length	+
Resource and Information	Average size of landholding	-
	Rural literacy	+
Demand side	Urbanization	+
Climate	Annual rainfall	-

The Generalized Least Square (GLS) technique with random effects model will be applied in order to examine the impact of demand and supply forces on crop diversification in West Bengal. The reason for using GLS method is that it eliminates the effect of heteroscedasticity arising due to cross-sectional data and autocorrelation as a result of time series data (Gujarati, 2003). This is essential because we are using panel data for our regression analysis which have both the features of time series and cross-sectional

[1]HYV crops include Aman, Boro, Wheat, Oilseeds, Jute and Potato.

data. All the determinants will be considered with respect to West Bengal agriculture only, hence, the database will be drawn from the following sources:
1.Statistical Abstracts, and
2.District Statistical Handbooks

For all the variables concerned. The regression exercise is carried out separately for each region by taking into account all the concerned districts falling within a particular region for five years, viz., 2010-11 to 2015-16. In order to avoid the case of perfect collinearity of the independent variables, each independent variable is separately regressed on the dependent variable. Now, we proceed on with our regression results obtained separately for all the four regions.

Generalized Linear Least Square (Glls) Regression Model with Random Effects for the Himalayan Region

Table 1.1A

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
HI	TECH	A_Aman	.003**	Significant	.9968
		A_Boro	.002		
		A_Wheat	-3.12*		
		A_Jute	.0005		
		A_Potato	-.005		
		Fertilizer	.002**		
		A_Irrigated	.003**		
	INFR	Road_Lgth	.0002	Not Significant	.4141
	KNOW	Avg_Sz_LH	-.854**	Significant	.8878
	DEMA	Urban_Popn	-.029*	Significant	.9426

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.1A gives the GLLS for the Himalayan Region by taking Harfindahl Index (HI) as the dependent variable. First of all, HI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Wheat bears a significant negative relationship with HI. In addition, A_Aman, Fertilizer and A_Irrigated have significant positive relationships with HI. Thus, in Himalayan Region, crop diversification is propelled by allocating more area under aman paddy, using more fertilizer and irrigation. The TECH variable is seen to have an over all significance in explaining the causality with HI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with HI. Road_Lgth is taken as proxy variable for INFR. INFR has a positive influence on diversification, even though, over all the independent variable is not significant. R-square is also explaining only 40% of the causality between INFR and HI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is negatively related to HI and its significant. R-square is explaining nearly 89% of the causality between KNOW and HI. This result implies that when land holding becomes more fragmented its viability to diversify increases. This result lends some support to the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a significant negative relation between DEMA and HI. This result implies that the level of urbanization, which is a huge source of demand, will not generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is not in

expected lines but can be explained in terms of less population and urbanization in hilly region. R-square, in this case, explains nearly 94% of the causality between HI and DEMA.

Table 1.1B

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
MEI	TECH	A_Aman	.0001	Significant	.9718
		A_Boro	.001		
		A_Wheat	.0009		
		A_Jute	.0001		
		A_Potato	.002		
		Fertilizer	.0007		
		A_Irrigated	.003*		
	INFR	Road_Lgth	.0002*	Significant	.8889
	KNOW	Avg_Sz_LH	-.041	Not Significant	.0382
	DEMA	Urban_Popn	-.002	Not Significant	.0869

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.1B gives the GLLS for the Himalayan Region by taking Modified Entropy Index (MEI) as the dependent variable. First of all, MEI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that all the proxy variables are positively related MEI. Among these variables, A_Irrigated has a significant positive relationship with MEI. The TECH variable is seen to have an over all significance in explaining the causality with MEI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with MEI. Road_Lgth is taken as proxy variable for INFR. INFR has a significant positive influence on diversification, given that the over all the independent variable is significant. R-square is also explaining nearly 89% of the causality between INFR and MEI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is negatively related to MEI and is not significant. R-square is explaining only 3% of the causality between KNOW and MEI. This result implies that when land holding becomes more fragmented its viability to diversify increases. This result lends some support to the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a negative relation between DEMA and MEI. This result implies that the level of urbanization, which is a huge source of demand, will not generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is not in expected lines but can be explained in terms of less population and urbanization in hilly region. R-square, in this case, explains nearly 9% of the causality between MEI and DEMA.

Generalized Linear Least Square (Glls) Regression Model with Random Effects for the Western Plains Region

Table 1.2A

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
EI	TECH	A_Aman	-.002*	Significant	.9974
		A_Boro	.0004		
		A_Wheat	.012		
		A_Oilseeds	.008*		
		A_Jute	.03		
		A_Potato	.014*		
		Fertilizer	-.002*		
		A_Irrigated	.001		
	INFR	Road_Lgth	.0007**	Not Significant	.6608
	KNOW	Avg_Sz_LH	2.13**	Not Significant	.8298
	DEMA	Urban_Popn	-.085	Not Significant	.0767

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.2A gives the GLLS for the Western Plains Region by taking Entropy Index (EI) as the dependent variable. First of all, EI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Aman and Fertilizer bear significant negative relationships with EI. In addition, A_Oilseeds and A_Potato have significant positive relationships with EI. Thus, in Western Plains Region, crop diversification is propelled by allocating more area under oilseeds and potato. This result is in expected lines since the region is usually a plateau region with highlands, availability of adequate water is always not possible. Oilseeds have the ability to grow in dry conditions requiring very little water. Hence, we get a significant positive relationship with area under oilseeds in this region. The TECH variable is seen to have an over all significance in explaining the causality with EI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with EI. Road_Lgth is taken as proxy variable for INFR. INFR has a significant positive influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining nearly 66% of the causality between INFR and EI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is positively related to EI and its significant. R-square is explaining nearly 83% of the causality between KNOW and EI. This result implies that when land holding becomes less fragmented its viability to diversify increases. This result goes against the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a negative relation between DEMA and EI. This result implies that the level of urbanization, which is a huge source of demand, will not generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is not in expected lines but can be explained in terms of less population and urbanization in plateau region and lack of connectivity with the main centre. R-square, in this case, explains only 8% of the causality between EI and DEMA.

Table 1.2B

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
MEI	TECH	A_Aman	-.001*	Significant	.9974
		A_Boro	.0002		
		A_Wheat	.004		
		A_Oilseeds	.003*		
		A_Jute	.011		
		A_Potato	.005*		
		Fertilizer	-.0006*		
		A_Irrigated	.0004		
	INFR	Road_Lgth	.0003**	Not Significant	.6611
	KNOW	Avg_Sz_LH	.807**	Not Significant	.8298
	DEMA	Urban_Popn	-.032	Not Significant	.0764

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.2B gives the GLLS for the Western Plains Region by taking Modified Entropy Index (MEI) as the dependent variable. First of all, MEI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Aman and Fertilizer bear significant negative relationships with MEI. In addition, A_Oilseeds and A_Potato have significant positive relationships with MEI. Thus, in Western Plains Region, crop diversification is propelled by allocating more area under oilseeds and potato. This result is in expected lines since the region is usually a plateau region with highlands, availability of adequate water is always not possible. Oilseeds have the ability to grow in dry conditions requiring very little water. Hence, we get a significant positive relationship with area under oilseeds in this region. The TECH variable is seen to have an over all significance in explaining the causality with MEI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with MEI. Road_Lgth is taken as proxy variable for INFR. INFR has a significant positive influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining nearly 66% of the causality between INFR and MEI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is positively related to MEI and its significant. R-square is explaining nearly 83% of the causality between KNOW and MEI. This result implies that when land holding becomes less fragmented its viability to diversify increases. This result goes against the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a negative relation between DEMA and MEI. This result implies that the level of urbanization, which is a huge source of demand, will not generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is not in expected lines but can be explained in terms of less population and urbanization in plateau region and lack of connectivity with the main centre. R-square, in this case, explains only 8% of the causality between MEI and DEMA.

Generalized Linear Least Square (Glls) Regression Model with Random Effects for the Central Plains Region

Table 1.3A

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
EI	TECH	A_Aman	-.003*	Significant	.9928
		A_Boro	.001		
		A_Wheat	-.003		
		A_Oilseeds	.008**		
		A_Jute	.009*		
		A_Potato	.002*		
		Fertilizer	-.001		
		A_Irrigated	.0003		
	INFR	Road_Lgth	.00002	Not Significant	.1834
	KNOW	Avg_Sz_LH	.343	Not Significant	.0240
	DEMA	Urban_Popn	.021	Not Significant	.4308

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.3A gives the GLLS for the Central Plains Region by taking Entropy Index (EI) as the dependent variable. First of all, EI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Aman bears a significant negative relationship with EI. In addition, A_Oilseeds, A_Jute and A_Potato have significant positive relationships with EI. Thus, in Central Plains Region, crop diversification is propelled by allocating more area under oilseeds, jute and potato. This result is in expected lines since these are all commercial crops and this region is usually suitable for cultivation of these crops. Oilseeds have the ability to grow even in dry conditions requiring very little water. Hence, we get a significant positive relationship with area under oilseeds in this region. The TECH variable is seen to have an over all significance in explaining the causality with EI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with EI. Road_Lgth is taken as proxy variable for INFR. INFR has a positive influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining only 18% of the causality between INFR and EI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is positively related to EI and its not significant. R-square is explaining only 2% of the causality between KNOW and EI. This result implies that when land holding becomes less fragmented its viability to diversify increases. This result goes against the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a positive relation between DEMA and EI. This result implies that the level of urbanization, which is a huge source of demand, will generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is in expected lines and can be explained in terms of more population and urbanization in this region and its strong connectivity with the main centre of Kolkata. R-square, in this case, explains nearly 43% of the causality between EI and DEMA.

Table 1.3B

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
MEI	TECH	A_Aman	-.001*	Significant	.9909
		A_Boro	.0001		
		A_Wheat	-.002		
		A_Oilseeds	.003**		
		A_Jute	.004*		
		A_Potato	.001**		
		Fertilizer	-.0003		
		A_Irrigated	.0003		
	INFR	Road_Lgth	5.21	Not Significant	.1744
	KNOW	Avg_Sz_LH	.131	Not Significant	.0249
	DEMA	Urban_Popn	.008	Not Significant	.4267

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.3B gives the GLLS for the Central Plains Region by taking Modified Entropy Index (MEI) as the dependent variable. First of all, MEI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Aman bears a significant negative relationship with MEI. In addition, A_Oilseeds, A_Jute and A_Potato have significant positive relationships with MEI. Thus, in Central Plains Region, crop diversification is propelled by allocating more area under oilseeds, jute and potato. This result is in expected lines since these are all commercial crops and this region is usually suitable for cultivation of these crops. Oilseeds have the ability to grow even in dry conditions requiring very little water. Hence, we get a significant positive relationship with area under oilseeds in this region. The TECH variable is seen to have an over all significance in explaining the causality with MEI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with MEI. Road_Lgth is taken as proxy variable for INFR. INFR has a positive influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining only 17% of the causality between INFR and MEI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is positively related to MEI and its not significant. R-square is explaining only 3% of the causality between KNOW and MEI. This result implies that when land holding becomes less fragmented its viability to diversify increases. This result goes against the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a positive relation between DEMA and MEI. This result implies that the level of urbanization, which is a huge source of demand, will generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is in expected lines and can be explained in terms of more population and urbanization in this region and its strong connectivity with the main centre of Kolkata. R-square, in this case, explains nearly 43% of the causality between MEI and DEMA.

Generalized Linear Least Square (Glls) Regression Model with Random Effects for the Eastern Plains Region

Table 1.4A

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
EI	TECH	A_Aman	-.001*	Significant	.9924
		A_Boro	-.003**		
		A_Wheat	.003**		
		A_Oilseeds	.003**		
		A_Jute	.002		
		A_Potato	-.007		
		Fertilizer	-.001		
		A_Irrigated	-.003*		
	INFR	Road_Lgth	-.0001	Not Significant	------
	KNOW	Avg_Sz_LH	-3.19*	Significant	.7706
	DEMA	Urban_Popn	.012	Not Significant	.0513

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.4A gives the GLLS for the Eastern Plains Region by taking Entropy Index (EI) as the dependent variable. First of all, EI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Aman, A_Boro and A_Irrigated bear significant negative relationships with EI. This result is evident because of substantial shifts of area under aman and boro paddy in some districts within this region. In addition, A_Wheat and A_Oilseeds have significant positive relationships with EI. Thus, in Eastern Plains Region, crop diversification is propelled by allocating more area under wheat and oilseeds. This result is in expected lines since these are superior variety and commercial crops and this region is usually suitable for cultivation of these crops. Oilseeds have the ability to grow even in dry conditions requiring very little water. Hence, we get a significant positive relationship with area under oilseeds in this region. The TECH variable is seen to have an over all significance in explaining the causality with EI as explained by Chi-Square. The over all goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with EI. Road_Lgth is taken as proxy variable for INFR. INFR has a negative influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining very little of the causality between INFR and EI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is negatively related to EI and is significant. R-square is explaining nearly 77% of the causality between KNOW and EI. This result implies that when land holding becomes more fragmented its viability to diversify increases. This result lent support to the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a positive relation between DEMA and EI. This result implies that the level of urbanization, which is a huge source of demand, will generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is in expected lines and can be explained in terms of more population and urbanization in this region and its strong connectivity with the main centre of Kolkata. R-square, in this case, explains only 5% of the causality between EI and DEMA.

Table 1.4B

Dep Variable	Indep Variable	Proxy Variable	Coefficients	Chi-Square	R-square
MEI	TECH	A_Aman	-.0001	Significant	.9845
		A_Boro	-.0006**		
		A_Wheat	.001**		
		A_Oilseeds	.0001		
		A_Jute	.0003		
		A_Potato	-.002		
		Fertilizer	.00002		
		A_Irrigated	-.001*		
	INFR	Road_Lgth	-.00002	Not Significant	.0465
	KNOW	Avg_Sz_LH	-.785**	Significant	.7564
	DEMA	Urban_Popn	.004	Not Significant	.0735

Note: * denotes coefficient is significant at 1% level and ** denotes significance at 5% level

Table 1.4B gives the GLLS for the Eastern Plains Region by taking Modified Entropy Index (MEI) as the dependent variable. First of all, MEI is regressed on TECH (independent variable). Now, TECH variable is expressed by a number of proxy variables – A_Aman, A_Boro, A_Wheat, A_Oilseeds, A_Jute, A_Potato, Fertilizer and A_Irrigated. From the table it can be observed that A_Boro and A_Irrigated bear significant negative relationships with MEI. This result is evident because of substantial shift of area under boro paddy in some districts within this region. In addition, A_Wheat has significant positive relationship with MEI. Thus, in Eastern Plains Region, crop diversification is propelled by allocating more area under wheat. This result is in expected lines since wheat is a superior variety crop and this region is usually suitable for cultivation of these crops. The TECH variable is seen to have an overall significance in explaining the causality with MEI as explained by Chi-Square. The overall goodness-of-fit as measured by R-square is nearly one. Thus, it can be concluded with some degree of precision that TECH is one of the most important determinants of crop diversification. Now, INFR is regressed with MEI. Road_Lgth is taken as proxy variable for INFR. INFR has a negative influence on diversification, even though, over all the independent variable is not significant as measured by Chi-Square. R-square is explaining only 5% of the causality between INFR and MEI. The KNOW variable is expressed by Avg_Sz_LH, which acts as a proxy variable. KNOW is negatively related to MEI and is significant. R-square is explaining nearly 76% of the causality between KNOW and MEI. This result implies that when land holding becomes more fragmented its viability to diversify increases. This result lent support to the farm size – productivity debate as proposed by Prof. Amartya Sen. Finally, Urban_Popn is used as a proxy variable to express DEMA. There exists a positive relation between DEMA and MEI. This result implies that the level of urbanization, which is a huge source of demand, will generate positive signals for farmers to shift their production portfolio towards more remunerative and high value crops. This result is in expected lines and can be explained in terms of more population and urbanization in this region and its strong connectivity with the main centre of Kolkata. R-square, in this case, explains only 7% of the causality between MEI and DEMA.

2. Conclusion

The present article has discussed the various determinants of crop diversification. For the purpose of analysis, it has employed the GLS model with random effects, since our data has the dimensions of both cross section and time series. From the preceding analysis, it came out clearly that across all regions, technology is one of the most important propelling factors behind diversification. Within technology, the importance of irrigation, is found to be statistically significant in most regions. Infrastructure is also

found to be a positive determinant of diversification. Knowledge base and Demand factors are the two variables whose signs have shown maximum variations across regions in West Bengal.

References

1. Barghouti, S, S Kane, K Sorby and Ali Mubarik (2004): 'DOA for the Poor: Guidelines for Practitioners', World Bank/ARD Discussion Paper 1, March.
2. Bhal, S K, R S Prasher and P Mehta (1997): 'Diversification of Indian Agriculture: Issues and Perspectives', The Indian Journal of Economics, 78(308): 101-11.
3. Bhalla, S (1987): 'Trends in Employment in Indian Agriculture, Land and Asset Distribution', Indian Journal of Agricultural Economics, 42(2): 537-60.
4. Bhalla, G S and G Singh (1997): 'Recent Developments in Indian Agriculture: A State Level Analysis', Economic and Political Weekly, March 29.
5. Boyce, James K (1987): Agrarian Impasse In Bengal: Institutional Constraints to Technological Change,OxfordUniversity Press, New York.
6. Chadha, G K, S Sen and H R Sharma (2004): State of the Indian Farmer – A Millennium Study: Land Resources, # 2; Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.
7. Chand, R (1995): 'A Critique on the Methods of Measuring Economic Diversification', Paper presented for the training course on "Quantitative Techniques for Policy Analysis in Agricultural Economics", Division of Agricultural Economics, Indian Agricultural Research Institute, New Delhi.
8. _____ (1996): 'Diversification through High Value Crops in Western Himalayan Region: Evidence from Himachal Pradesh', Indian Journal of Agricultural Economics, 51(4), Oct – Dec: 652-663.
9. Chattopadhyay, M, C Neogi and S K Maity (1993): 'Growth and Instability in Crop Production in Eastern India', Asian Economic Review, Vol.35.
10. De, U K (2000): 'Diversification of Crop in West Bengal: A Spatio-Temporal Analysis', ArthaVijnana,Vol.XLII, No.2, June: 170-182.
11. Delgado, C L and A Siamwalla (1999): 'Rural economy and farm income diversification in developing countries', Proceedings of the 23rd International Conference of Agricultural Economics,California.
12. Government of India (2005): Economic Survey 2004-05, Economic Division, Ministry of Finance, New Delhi.
13. Gujarati, D N (2003): Basic Econometrics, 4th Edition, McGraw-Hill/Irwin, New York.