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Determinants and Impacts of Agricultural land conversion to Non Agricultural Uses: An Empirical evidence in Western Zone of Tamil Nadu

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ABSTRACT

Land is a finite natural national resource, directly linked with all development activities especially agricultural production. Conversion of land to non-agricultural use is unavoidable with growing population and industrial development. A study was taken to assess the determinant and impacts of agricultural land conversion in Western zone of Tamilnadu which has experienced high level of land conversion. The results indicated that nonagricultural land use concentration increases from 0.65 to 0.86 during period of 1981 to 2010-11. Regression results indicate that industrialization and urbanization are indeed the driving forces behind conversion of agricultural land to non agricultural uses. Production loss analysis revealed probable production losses in groundnut, paddy, pulses, sorghum varying from 10 to 20 percent of existing production. Losses in coconut, gingelly, sugarcane, tapioca would be about five percent of existing production levels.

Key words: *Conversion of agricultural land, Determinants and production losses*

INTRODUCTION

Land conversion is a process by which land use is changed from agricultural uses to urban and industrial uses (Nelson, 1990). Generally conversion of land to non-agricultural uses is unavoidable with growing population and industrial development. However uncontrolled conversion of agricultural land poses a threat to food security over a period (Tan et al., 2009). Tamilnadu is one of the intensive urbanized and industrialized states in India resulting in loss of arable lands for agriculture. Realizing this issue an attempt has been made to assess the determinant and impacts of agricultural land conversion in Western zone of Tamilnadu which has experienced high level of land conversion. The specific objectives of the study were i) to study the land use concentration of the study area ii) to study macro level determinants of agricultural land conversion and iii) to examine production and economic losses of agricultural land conversion.

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Western zone of Tamil Nadu comprises Coimbatore, Tirupur and Erode districts which was purposively selected with its potential for agriculture as well as urbanization and industrialization for the present study.

MATERIALS AND METHODS

Data Collection: The study was based on secondary data collected from published government reports and websites during the period 1990-91 to 2010-11.

Tools of Analysis

Location quotient analysis

To measure the concentration of land use pattern of Western zone compared to the State location quotient was employed.

Procedure: Step 1: Each individual land use category of the zone is divided by total geographical area of the zone for concerned year.

Step 2: Each individual land use category of the state is divided by total geographical area of the state for concerned year

Step 3: Proportion of zone to state level land use pattern is worked out to obtain the location quotient. It gives a clear picture about the relative concentration of specific land use is given location compared to the state. The formula applied is as follows,

$$Lc = \frac{L_{ijd} / L_{Tgd}}{L_{ijs} / L_{Tgs}}$$

Where, Lc = Location quotient

L_{ijd} = i^{th} land use classification in j^{th} time period in the Western zone

L_{Tgd} = Total geographical area of the Western zone

L_{ijs} = i^{th} land use classification in j^{th} period in the state (Tamilnadu)

L_{Tgs} = Total geographical area of state (Tamilnadu)

Location quotient of more than one implies that land use concentration more is in the location than at state level.

Regression analysis

Conversion of agricultural land to nonagricultural uses is more intense in the Western zone. The relationship between converted land area in the Western zone and different factors like urbanization, industrialization and other factors was studied using multiple regression analysis.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e_t$$

Y = Converted land area in the Western zone (in hectares)

X_1 = Urbanization (share of urban population to total population)

X_2 = Industrialization (Non agricultural GDP of zone at constant price)

X_3 = Number of agricultural labor in the zone.

Urbanization (Share of urban population in 1000 Nos): Proportion of urban population in the area to the total population as the indicator of urbanization (Meenakshimalya, 1963). Competition for land use between urbanization and agriculture is an ongoing process. To measure the extent of urbanization associated with agricultural land conversion urban population was collected for the period of 1990-91 to 2010-11 in the zone. Frank Ramsey, 1992 used this variable to found the relationship between agricultural land conversion and urbanization in Sunbelt.

Industrialization (Nonagricultural GDP of zone at constant price in crore rupees)): Like urbanization, competition for land between industrial and agricultural uses is continuously increasing. To measure the extent of industrial

expansion associated with conversion of agricultural land, non-agricultural GDP of the zone was collected for period of 1990-91 to 2010-11 and the values converted to constant prices (Azadi *et al.*, 2010)

Number of agricultural labourers (In 1000 Nos)**:** Non Availability of agricultural labourers is one of the major constraints in agricultural production. To study the relationship between agricultural labour availability in the zone total number of agricultural labourers was considered for the period of 1990-91to 2010-11.

Annual production and economic loss model (Gerhardus Schultink, 2009)

Calculation of production and economic losses due to conversion of agricultural land was done using the annual production and economic loss model. The limitation of the model is, it yield only approximate value of production and economic losses. Gerhardus Schultink (2009) used the model to estimate production and economic losses of agricultural land conversion in Michigan State for corn and soybean crop according to crop area coverage. For this study the model is modified for all crops in the study area with equal weightage for all crops.

Assumption of the model

If the total converted land, the share of each crop is based on the average share of the crop in the study area.

Steps involved in computing the production losses are as follows.

Step 1: Calculate the converted land area (C)

Step 2: Identify the basic crop mix using secondary data for dynamic period of the study area (Zone level/block level)

Step 3: Calculate average yield for dynamic period for all crops (Y)

Step 4: Calculate constant price for all crops (P)

Step 5: Find the share of each crop with existing cropping pattern (Average value for dynamic period) (S)

Step 6: Calculate the crop loss area for each crop (A= C*S/100)

Step 7: Estimate the production loss (PL = A*Y)

Step 8: Estimate the economic loss (E = PL*P)

The probable production losses are compared with existing production and this shows the intensity of losses.

RESULTS AND DISCUSSION

Land use concentration of Western zone

Location quotients were estimated out for Western zone comparing with state level land use, and are presented in table 1 below. The results revealed that Western zone has higher concentration of area under forest over the years compared to the state. Fallow land concentration in the zone has continuously increased indicating growing extent of lands being kept idle.

Table 1 Location quotient for Western zone

S.No	Particulars	1980-81	1990-91	2000-01	2010-11
1	Total Geographical Area	1.00	1.0	1.0	1.00
2	Forest	1.60	1.50	1.51	1.53
3	Barren and Uncultivable	0.28	0.30	0.30	0.24
4	Land put to non-agricultural uses	0.65	0.77	0.83	0.86
4	Permanent pasture and other grazing land	0.16	0.16	0.09	0.34
5	Land under miscellaneous tree crops	0.45	0.20	0.15	0.02
6	Cultivable waste	0.64	0.20	0.20	0.14
7	Current fallows	1.50	1.92	2.28	1.71
8	Other fallows	0.49	0.49	0.74	0.89
9	Net area sown	0.96	0.96	0.87	0.99

Nonagricultural uses concentration increased from 0.65 to 0.86 over the period. All other categories recorded lower concentrations compared to state. Barren and Uncultivable land use concentration was more than state but less in land put to miscellaneous and tree crops and cultivable waste.

Factors determining agricultural land conversion in Western zone

To analyze factors influencing the conversion of agricultural land area in Western zone, regression analysis was used. Converted agricultural land (Y) was regressed on urbanization (X_1), industrialization & service sector (X_2) and total agricultural labourers available (X_3) for the period of 1990-91 to 2010-11. The R^2 of 0.83 indicated that the model has reasonable explanatory power of 83 percent. Among the explanatory variables, the coefficients for urbanization and industrialization were found to be positively significant and that of the number of agricultural labourers non-significant. Increase in 1000 number of population in urban area increases agricultural land conversion by 28.31 hectares. One crore rupee increases in non-agricultural GDP increases agricultural land conversion by 1.67 hectares

Table 2: Determinant factors of agricultural land conversion in Western zone

S.No	Variable	Coefficient	Standard Error	t ratio
1	Constant	59413*	10092.07	5.88
2	Non agricultural GDP at constant prices (in crores)	1.67***	1.01	1.65
3	Urban population (in 1000 Nos)	28.31*	7.37	3.83
4	No of Agricultural Laboures	0.966	1.212	.0.79
5	R Square		0.83	
6	Adjusted R Square		0.81	
7	No of observations		30	

Note: * Significant at 1 per cent level *** Significant at 10 per cent level.

The results clearly indicated that industrialization and urbanization are indeed driving forces behind the conversion of agricultural land to non-agricultural uses in Western zone. Relatively large value of the coefficients for urbanization variable, may illustrate the need for policy framework to dissuade rural population from migrating to cities.

Annual production and economic losses of agricultural land conversion

Land diversion from agricultural use causes production and economic losses to farmers due to crop area reduction. Assuming that crop area losses are proportionate to existing crop area shares, the diverted land areas could be apportioned to different crop area losses and total production losses estimated.

Table 3: Annual production and economic losses for the period of 1990-91 to 2010-1 in Western zone

Total agricultural land converted from 1990-91 to 2010-11 in Western zone was 42979 hectares.

Crop	Average area	Average Yield	Share of each crop	Area loss of each crop	Production losses (AL * AY/1000	Constant price (In Rs/tone)	Economic losses (in Lakh
Paddy	68202	1900	10.08	4332.28	8231	6000	493.88
Sorghum	91974	323	13.59	5840.85	1887	6500	122.63
Maize	26844	4738	3.97	1706.27	8084	5500	444.64
Total pulses	58930	542	8.71	3743.47	2029	2200	44.64
Chillies	3426	706	0.51	219.19	155	795	1.23
Sugarcane	29522	105000	4.36	1873.88	197000	950	1870.00
Turmeric	11720	5956	1.73	743.54	4429	35000	1549.98
Banana	12386	40328	1.83	786.52	31719	3500	1110.15
Tapiaco	6089	41423	0.90	386.81	16023	2500	400.57
Onion	4568	9824	0.67	287.96	2829	5000	141.45
Cotton	23511	609	3.47	1491.37	908	2000	18.16
Groundnut	129186	1483	19.09	8204.69	12168	9500	1155.92
Gingelly	15829	560	2.34	1005.71	563	3000	16.90
Coconut	130931	10236*	19.35	8316.44	85127**	3000***	2553.81
Fodder							
Sorghum	62508	5000	9.24	3971.26	19856	---	---
Jasmine	1176	4000	0.17	73.06	292	3000	8.77

*for Coconut in terms of number of nuts/ha ** - Total nuts in 1000 Nos *** - Price of 1000 nuts

Expected Production losses against average total production in Western zone

Table 4: Percent of annual predicted losses to average total production in Western zone

	Average Total	Probable loss in	% of probable loss to total
Paddy	216482	8231	3.80
Sorghum	19794	1887	9.53
Maize	300753	8084	2.69
Total pulses	17241	2029	11.77
Chilies	600	155	25.83
Sugarcane	3675309	197000	5.36
Turmeric	68944	4429	5.42
Banana	895660	31719	3.54
Tapioca	375115	16023	4.27
Onion	69860	2829	4.05
Cotton	11317*	908*	8.02
Groundnut	63568	12168	19.14
Gingelly	9785	563	5.75
Coconut	14866*	85127*	5.73
Fodder Sorghum	--	19856	--
Jasmine	--	292	--

Note: Production data not available for fodder Sorghum and Jasmine
*total number of nuts (in 000) ** bales

The annual probable production losses due to agricultural land conversion were compared with existing production. Losses from chilies was found to be highest around 25.83 percent followed by groundnut around 19.14 percent of existing production levels. Probable production losses of pulses were around 11.77 percent and sorghum 9.53 percent. Production losses from coconut, gingelly sugarcane, tapioca were at about around five percent of their existing production levels.

CONCLUSION

The above study indicated that there was sharp increase in conversion of agricultural land in Western zone due industrialization and urbanization. Significant production losses were noticed in groundnut, paddy, pulses, fodder cholam, coconut, and sugarcane due to conversion. If this conversion continues uncontrolled huge parcels of land would go out agriculture hampering food security in the long run. Hence necessary institutional measures need to be taken. Area specific ceiling for different non-agricultural uses may be determined and imposed to regulate industrialization and urbanization would reduce uncontrolled conversion for speculative purpose and help protecting agricultural lands.

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