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Transport Modeling at Macro Level: Some Results for Odisha

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Abstract: The central motive of this article is to study adopting multiple regression technique to reflect the effects of some socio-economic indicators on transport system. It is found that socio-economic indicators like agriculture, forest, fishing and storage as independent factors have good impact over the dependent factor transport.
Keywords: transport, agriculture, forest, fishing and storage

INTRODUCTION

Industrial welfare only can be ensured only when infrastructural facilities will be properly made of and rightly utilized. The ongoing economic reforms attach tough priority to development of roads and transport infrastructure.

Roads and transport is the major means of communication and channel of distribution of needful products produced in various industrial premises to different selling units. Government has accorded high priority for all round development in roads and transport. Prudent exploitation of optimal utilization of roads and transport yet to be achieved subject to resource constraints. The basic and urgent need and use of infrastructural development in roads and transport is mainly for export or import of industrial products, agricultural products and mineral products [1-2].

The present paper is a part from the industrial policy, 2001 of Odisha, whose purpose is to develop a long term transport planning model for Odisha keeping in view, the State's industry, agriculture, fisheries, forestry, mining, banking and insurance, electricity, hotel, construction, real estate, road length, communication, storage, consumer price, number of vehicles and amount spent on roads with locational opportunities [3].

In present article, judicious consideration and impact of agriculture and animal husbandry, forestry, fisheries and storage over transportation is studied through multiple regression model. Again the impact of three socio-economic indicators like mining and quarrying, construction and real estate over transportation is studied by applying the multiple regression technique for dynamic and development results.

Once again the impact of five socio-economic parameters like manufacturing units, electricity, hotel and restaurant, communication and banking and insurance over transportation is studied by adopting the multiple regression model for vibrant results.

Main Focus

Transport modeling is a means for strategic decision making. Optimization technique is a premier global technique which leads to socio and economic progress and prosperity [4]. The objective of transport modeling is to make the best use of resources in a changing socio-economic scenario. Transport modeling stimulates thinking about prospective future. The author maintains that the approach could substantially improve interest in and comprehension of mathematical transport modeling and provide a useful supplement to the transportation science curriculum. The article attempts to examine the opportunities and challenges of transportation development in Odisha. The State is found to have an enormous potential for transport development. The study reveals transportation development can bring huge economic benefits to the State, but it calls for proper planning and management to avert negative impact on its environment [5, 10].

RESULTS AND INTERPRETATION

The relationships as well as impact on transportation by the selected socio-economic parameters have been presented in the following [3, 6].

Relationship between Transport and Agriculture

Table-1: Mean and Standard Deviation of transportation and allied aspects with some social parameters during the period from 2003-04 to 2012-13

Social Parameters	Mean	Std. Deviation
Transportation (Rs. In Lakh)	1141511.20	598623.78
Road Length (In Kms.)	2440.26	1341.80
Amount spent in Road (Rs. In Crore)	917.47	673.57
No. of Vehicles (In 000)	2314.81	688.09
Agriculture & Animal Husbandry (Rs. In Lakh)	2513458.40	961149.29
Forestry (Rs. In Lakh)	341347.00	83787.00
Fisheries (Rs. In Lakh)	172483.60	63959.46
Storage (Rs. In Lakh)	15302.00	8551.02

Table-1 above presents the mean and standard deviation (SD) of transport and allied aspects and some social parameters of Odisha state during the period 2003-04 to 2012-13. The figures for transportation, length of roads constructed, amount spent in road construction and number of vehicles are in lakh, kms, crore and thousand respectively where as the same for other parameters are in lakh.

Table-2: Correlation between transportation and allied aspects with some agricultural parameters.

Social Parameters	Total Transport	Road Length	Amount spent in Roads	No. of vehicles
Agriculture & Animal Husbandry	0.696	0.872*	0.897*	0.903*
Forestry	0.689	0.883*	0.840*	0.952*
Fisheries	0.735*	0.851*	0.822*	0.913*
Storage	0.764*	0.831*	0.812*	0.915*

*N.B.:- GSDP – Gross State Domestic Product, * - Significant at 5% level (P<0.05)*

Table-2 presents the correlation coefficients between the transportation and allied aspects with some social parameters, The correlation coefficients more than 0.71 are significant and have been marked with "*" . Accordingly, agriculture and animal husbandry and forestry are weakly correlated with transportation but significantly correlated with road length, amount spent in road construction and number of vehicles. But fisheries and storage are significantly correlated with transportation as well as allied aspects. Although it establishes acceptable linear relationship between selected agricultural parameters with transportation, still it is of further inquisitiveness to look for the simultaneous impact of these parameters over transport. Accordingly, transport has been taken as the dependent variable (Y) and agricultural parameters as independents (X). Now the data have been put to the multiple regression model for the cited purpose [8].

Table-3: Results on multiple regression between transportation (Y) with some agricultural aspects (X)

	Coeff. Of X's	Std. Errors	t-values
Constant	875474.045	1327092.124	0.660^{NS}
Agriculture & Animal Husbandry	-0.182	0.700	-0.260^{NS}
Forestry	-0.319	9.901	-0.032^{NS}
Fisheries	-5.456	21.837	-0.250^{NS}
Storage	115.856	155.091	0.747^{NS}

N.B.- $R^2 = 0.603$, NS- Not Significant at 5% level (P>0.05)

In above Table-3 the R^2 value 0.603 indicates the acceptance of the multiple regression implemented for taking transport as dependent (Y) and agriculture, forest, fishing and storage as independents (X_1, X_2, X_3 and X_4 respectively). By this it is evident that 60.3% of the data subjected to regression is explained where the rest unexplained part 39.7% is minority. Here, some of the factors relating to agricultural sciences have been considered for predictors whose simultaneous effect on transport is studied. The non-significant t-values indicate that all the predictors have almost similar impact over the dependent variable transport (Y). Hence, these factors give rise to the situation of development in transport during the period 2003-13 [8, 9] . The forecasting model in this regard in reference to the above table will be

Transport (Y) = 875474.054 – 0.182 * Agriculture – 0.319 * Forestry – 5.456 * Fisheries + 115.856 * Storage---- (1)

Relationship between Transport and Real Estate

Table-4: Mean and Standard Deviation of transportation and allied aspects with real estate aspects during the period from 2003-04 to 2012-13

Social Parameters	Mean	Std. Deviation
Transportation (Rs. In Lakh)	1141511.20	598623.78
Road Length (In Kms.)	2440.26	1341.80
Amount spent in Road (Rs. In Crore)	917.47	673.57
No. of Vehicles (In 000)	2314.81	688.09
Mining & Quarrying (Rs. In Lakh)	1399819.40	759168.63
Construction (Rs. In Lakh)	1368434.00	529561.15
Real Estate (Rs. In Lakh)	856150.50	378146.79

Table-4 above presents the mean and standard deviation (SD) of transport and allied aspects and some social parameters of Odisha state during the period 2003-04 to 2012-13. The figures for transportation, length of roads constructed, amount spent in road construction and number of vehicles are in lakh, kms, crore and thousand respectively where as the same for other parameters are in lakh [4, 6].

Table-5: Correlation between transportation and allied aspects with some real estate parameters

Social Parameters	Total Transport	Road Length	Amount spent in Roads	No. of vehicles
Mining & Quarrying	0.735*	0.877*	0.861*	0.908*
Construction	0.778*	0.849*	0.856*	0.916*
Real Estate	0.752*	0.851*	0.824*	0.921*

*N.B.:- GSDP – Gross State Domestic Product, * - Significant at 5% level (P<0.05)*

Table-5 presents the correlation coefficients between the transportation and allied aspects with some real estate related parameters, The correlation coefficients more than 0.71 are significant have been marked with "*" [7]. Accordingly mining, construction and real estate are significantly correlated with transportation as well as allied aspects. Although it establishes acceptable linear relationship between selected real estate parameters with transportation, still it is of further inquisitiveness to look for the simultaneous impact of these parameters over transport. Accordingly, transport has been taken as the dependent variable (Y) and real estate parameters as independents (X). Now the data have been put to the multiple regression model for the cited purpose [8, 7] .

Table-6: Results on multiple regression between transportation (Y) with some real estate aspects (X)

	Coeff. Of X's	Std. Errors	t-values
Constant	-670337.898	769039.476	-0.872^{NS}
Mining & Quarrying	-1.192	1.271	-0.938^{NS}
Construction	2.307	1.848	1.249^{NS}
Real Estate	0.377	1.559	0.242^{NS}

N.B.- R^2 = 0.656, NS- Not Significant at 5% level (P>0.05)

In above Table-6, the R^2 value 0.656 indicates the acceptance of the multiple regression implemented for taking transport as dependent (Y) and mining, construction and real estate as independents (X_1, X_2 and X_3 respectively). By this, it is evident that 65.6% of the data subjected to regression is explained where the rest unexplained part 34.4% is minority. Here, some of the factors relating to real estates have been considered for predictors whose simultaneous effect on transport is studied. The non-significant t-values indicate that all the predictors have almost similar impact over the dependent variable transport (Y).[9, 7] Hence, these factors give rise to the situation of development in transport during the period 2003-13. The forecasting model in this regard in reference to the above table will be

Transport (Y) = -670337.898 – 1.192 * Mining + 2.307 * Construction + 0.377 * Real Estate---------- (2)

Table-7: Mean and Standard Deviation of transportation and allied aspects with some industries during the period from 2003-04 to 2012-13.

Social Parameters	Mean	Std. Deviation
Transportation (Rs. In Lakh)	1141511.20	598623.78
Road Length (In Kms.)	2440.26	1341.80
Amount spent in Road (Rs. In Crore)	917.47	673.57
No. of Vehicles (In 000)	2314.81	688.09
Manufacturing units (Rs. In Lakh)	1879955.50	897408.71
Electricity, Gas & Water Supply (Rs. In Lakh)	377646.50	97613.81
Hotel & Restaurant Trade (Rs. In Lakh)	1760100.20	898683.65
Communication (Rs. In Lakh)	149768.10	61709.34
Banking & Insurance (Rs. In Lakh)	490424.70	260188.39

Table-7 above presents the mean and standard deviation (SD) of transport and allied aspects and some industries of Odisha state during the period 2003-04 to 2012-13. The figures for transportation, length of roads constructed, amount spent in road construction and number of vehicles are in lakh, kms, crore and thousand respectively where as the same for industries are in lakh [3, 6].

Table-8: Correlation between transportation and allied aspects with some industries

Social Parameters	Total Transport	Road Length	Amount spent in Roads	No. of vehicles
Manufacturing units	0.745*	0.808*	0.822*	0.902*
Electricity, Gas & Water Supply	0.718*	0.380	0.294	0.545
Hotel & Restaurant Trade	0.790*	0.861*	0.845*	0.919*
Communication	0.761*	0.859*	0.836*	0.914*
Banking & Insurance	0.747*	0.838*	0.804*	0.901*

*N.B.:- GSDP – Gross State Domestic Product, * - Significant at 5% level (P<0.05)*

Table-8 presents the correlation coefficients between the transportation and allied aspects with some social parameters, The correlation coefficients more than 0.71 are significant have been marked with "*" [8]. Accordingly, manufacturing units, electricity, hotel and restaurant trade, communication and banking and insurance are significantly correlated with transportation as well as allied aspects. Although it establishes acceptable linear relationship between selected industries with transportation, still it is of further inquisitiveness to look for the simultaneous impact of these parameters over transport. Accordingly, transport has been taken as the dependent variable (Y) and industries as independents (X). Now the data have been put to the multiple regression model for the cited purpose [7].

Table-9: Results on multiple regression between transportation (Y) with some industries (X)

	Coeff. Of X's	Std. Errors	t-values
Constant	2182385.324	1643608.184	1.328^{NS}
Manufacturing units	-2.393	0.989	-2.419^{NS}
Electricity, Gas & Water Supply	-0.103	2.154	-0.048^{NS}
Hotel & Restaurant Trade	7.014	2.765	2.537^{NS}
Communication	-1.771	5.009	-0.354^{NS}
Banking & Insurance	-53.282	38.581	-1.381^{NS}

N.B.- R^2 = 0.872, NS- Not Significant at 5% level (P>0.05)

From above Table the R^2 value 0.872 indicates the acceptance of the multiple regression implemented for taking transport as dependent (Y) and manufacturing, electricity, hotel, banking & insurance and communication as independents (X_1, X_2, X_3, X_4 and X_5 respectively). By this it is evident that 87.2% of the data subjected to regression is explained where the rest unexplained part 12.8% is minority. Here, some of the factors relating to industries have been considered for predictors whose simultaneous effect on transport is studied. The non-significant t-values indicate that all the predictors have almost similar impact over the dependent variable transport (Y). Hence, these factors give rise to the situation of development in transport during the period 2003-13. The forecasting model in this regard in reference to the above table will be [9, 7].

***Transport (Y) = 2182385.324 – 2.393 *Manufacturing – 0.103 * Electricity + 7.014 * Hotel – 1.771 * Communication – 53.283* Banking & Insurance*---------- (3)**

CONCLUSION

It is concluded from above multiple regression model that the socio-economic indicators like agriculture, forest, fishing and storage as independent factors have good impact over the dependent factor transport. The above independent factors are essential for improvement in transportation during the period 2003-13. Hence, the development of such socio-economic parameters have tremendous and spontaneous effect for the development of transport system in Odisha.

In second multiple regression model, it is finalized that the socio-economic indicators like mining, construction and real estate as independent variables have positive impact (i.e. better impact than earlier model) over the dependent variable transport. The above independent variables are good predictors for sustainable growth in transportation during the period 2003-13. Hence, the overall development of above indicators have increasing effect for the mushroom growth and expansion of transport system.

In third multiple regression model, it is synthesized that the socio-economic indicators have influential impact (i.e. the best impact among three models) over the dependent variable transport. The above independent variables are the best predictors for strong, stable and dynamic growth in transportation during the period 2003-13. Hence, the augmentation of cited socio-economic indicators have caused the development of transport sector of Odisha State.

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