ECONOMIC IMPACTS OF RURAL ROADS : A CASE STUDY OF HOSHIARPUR DISTRICT OF PUNJAB

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Abstract

The establishment and existence of a well-functioning and efficient basic infrastructure is essential for economic development and growth. For any economy to grow and prosper, it is necessary that the factors and agents of growth with in the economy are facilitated by basic infrastructure like power, roads, schools, primary health facilities, storage, market yards etc. Infrastructure investments contribute to economic growth and improvement in quality of life. The role of infrastructure is crucial for agricultural, industrial and overall economic development. Roads have generally been viewed as the most important economic infrastructural development. Economic benefits such as increased income, employment, productivity gain, better income distribution and opportunity for diversification can be generated through rural roads. In rural areas it has wide ranging impact on individuals, households and communities; both in terms of income as well as other indicators of quality of life. The present study aimed at assessing the economic impacts of investment in rural roads, constructed under RIDF in Hoshiarpur district of Punjab. Multi-stage sampling has been done for the purpose of collection of data. Primary data has been collected through survey in the project area and by conducting direct interviews of the beneficiaries in the project area, with the help of pre-designed questionnaire. To evaluate the impact of roads, this study used "before and after" method and Percentage analysis, Arithmetic Mean, Paired t-test for testing the significance of difference between means has been used for analysis of data.

Key Words
Development, Infrastructure, NABARD, RIDF, Rural

Introduction

Roads have generally been viewed as the most important economic infrastructural development. Economic benefits such as increased income, employment, productivity gain, better income distribution and opportunity for diversification can be generated through rural roads. In rural areas it has wide ranging impact on individuals, households and communities; both in terms of income as well as other indicators of quality of life. Benefits of roads for poor rural areas include: lower transportation costs of goods and passengers, lower prices, increased returns to farmers in the final realization of farm produce, thereby increasing their welfare; and expanded extension services. Roads bring better access to markets, higher prices for produce, and better access to health and educational facilities. Rural roads allow farmers better access to agricultural inputs like fertilizers and allow them to better market their surpluses. Well-functioning transport networks also promote the diffusion of modern

technology to rural areas. A key objective of rural infrastructure investments is to raise the economic status of the rural poor through increased income and improved consumption patterns. The enhanced mobility of labour induced by opening up of rural roads, helps the rural poor in commuting to work and traveling to jobs where the wages are relatively higher. Good transport infrastructure also improves access to institutional credit and leads to increased demand for credit. In a multitude of ways through these mechanisms, transport contributes to economic growth.

Review of Literature

Bansal and Patil (1979) studied the socio-economic impact of roads on village development in India. Their study was based on a survey of 1662 villages in India. Results of the study revealed that the effect of accessibility was greater for unimproved than for improved roads and in bringing about socio-economic change, the existence of some kind of trafficable route is of major importance; its quality is a second-order consideration. **Singh (1983)** studied the effect of infrastructure development on rural development, especially on agriculture. He found positive correlation between infrastructure and agricultural development. Among the various infrastructural facilities, agricultural development was strongly correlated with agricultural infrastructure index, followed by index of transport and communication. **Tewari (1984)** concluded that inadequacy of infrastructural facilities have been the major obstacles in the path of progress of developing states. In a state level analysis for two points of time, viz, 1970-71 and 1980-81, he observed a positive impact of infrastructure on development. **Ahmed and Hossain (1990)** conducted a survey of 129 villages of Bangladesh. Villages with better access were found to be significantly better off in a number of areas including agricultural production, household income, wage income of landless labour, health and the participation of women in the economy. They found that development of infrastructure had a positive effect on the marketing of agricultural produce and led to an increase in crop income among small farmers. **Biswanger, Khandkur and Rosenzweig (1993)** revealed that road infrastructure investment contributed directly to the growth of agricultural output. The study was pioneering in making the effort of constructing counterfactual scenarios to study the welfare impact of rural infrastructure. **Jacoby (2000)** suggested that roads play a central role in rural development. The empirical analysis, using data from Nepal, revealed that among other benefits from extending roads into remote rural areas, rural roads provided cheaper access to both markets for agricultural output and for modern inputs, schools and health facilities and, more generally to a greater variety of consumer goods. **Majumdar (2002)** on the basis of regression analysis of the state level cross section data for each of the years from 1971 to 1995 indicated that among various physical infrastructures, it was the transport infrastructure that significantly affected the agricultural output level and the agricultural development index. **Mohanan, Srivastava and Rao (2002)** explained that rural road connectivity is an extremely important aspect of rural development. Inadequate rural connectivity and lack of mobility pose serious constraints to accelerated rural development. The critical role played by roads in economic development is now being realized and Pradhan Mantri Gram Sadak Yojana (PMGSY) is an example of this healthy development. **Singh (2006)** in an analysis of incidence of poverty across Indian states indicated that poverty is very closely linked to the absence of economic and social infrastructure. Investment in rural infrastructure has been reported to have a significant impact on increase in economic activities in the area and consequent reduction in poverty. It was also observed that availability of infrastructure goes a long way in redressing the issues of regional imbalance.

From review of existing literature it is clear that there is a positive link between development of rural infrastructure and its likely impact on growth and productivity.

Significance of the Study

The present study attempts to assess the economic impact of investment in rural roads through quantitative analysis and also to appraise that to what extent these roads have actually benefited the rural segment of the society for which these were constructed.

Scope of the Study

In the present study the economic impact of investment in ten rural roads constructed between 1995- 2005, in Hoshiarpur district of Punjab, under RIDF of NABARD has been assessed. For this purpose, impact of road construction on following 4 indicators and a total of 12 variables, covered under those 4 indicators, has been observed to assess the economic impact of selected road projects:

1) Impact of Road Construction on Financial Status of the Households

1.1 Total monthly household income (in Rs.)
1.2 Total household borrowings (in Rs.)

2) Impact of Road Construction on Physical Capital of the Households

2.1 Buildings (e.g. House, plot etc.)
2.2 Household assets (e.g. T.V., Refrigerator etc.)
2.3 Live stock
2.4 Number of vehicles owned

3) Impact of Road Construction on Distance to Various Places (in Kms.)

3.1 Distance to Grain market
3.2 Distance to Veterinary hospital
3.3 Distance to Health centers

4) Impact of Road Construction on Transportation Time and Cost

4.1 Time taken to reach market (in mins.)
4.2 Fuel expenses in a month (in Rs.)
4.3 Maintenance cost of vehicle in a month (in Rs.)

Objectives of the Study

The present 'ex-post' evaluation study is an attempt to evaluate the economic benefits of ten rural roads, constructed under RIDF, in Hoshiarpur district of Punjab. This broad objective is simplified as following:

- To evaluate the economic impact of investment in rural roads in terms of change in income, borrowings, physical capital of households, distance to various places, transportation time and cost in the project area.

Hypotheses of the Study

In accordance with the objective of the study following hypotheses have been formulated:

- H_1 : There is no significant improvement in financial status, in terms of income and borrowings of the respondents in the project area due to investment in rural roads.
- H_2: There is no significant increase in physical capital of the households in the project area due to investment in rural roads.
- H_3: There is no significant decrease in distance to various places in the project area due to investment in rural roads.
- $H_{4:}$ There is no significant change in transportation time and cost in the project area due to investment in rural roads.

Research Methodology

- **Sample Design:** Multi-stage sampling has been done for the purpose of collection of data. Efforts have been made to collect data from different categories of users, like farmers, traders, small/village transporters and other general users of the road from different age groups, income level and educational level.
  Total number of road projects = 10
  Number of villages surveyed for each road project = 05
  Number of respondents for each village = 10
  Total sample size = =10 * 5 * 10= 500
  A survey has been conducted to collect data from a sample of total 500 beneficiaries from the project area.

- **Sources of Data:** In order to know the true economic impact of investment in rural roads under RIDF of NABARD, primary data has been collected through survey in the project area and by conducting direct interviews of the beneficiaries in the project area, with the help of pre-designed questionnaire.

- **Pilot Survey :** The main objective of the study is to capture the economic impact of investment in rural roads. Therefore, the qualitative stage preceded the survey to identify the dimensions to be included in the questionnaire. A pilot survey of 50 respondents was conducted. The responses were carefully reviewed and subsequent changes were made in the questionnaire.
- **Scale – Reliability :** The reliability of the scale was tested for questionnaire used in the present study with the help of Cronbach's coefficient alpha. The value of Cronbach's coefficient alpha was 0.711(as shown in the box below), which is greater than 0.6 and falls between permissible limit of 0.6 to1.

Cronbach's Alpha	No. of Items
0.711	46

- **Analysis of Data:** To evaluate the impact of roads, this study used "before and after" method, which is a very powerful method of detecting change. This, of course, assumes that changes in other parameters remain the same, during the study period in the project area. The data collected from primary sources has been edited, classified and tabulated to make it fit for further analysis. The data so tabulated has been analyzed using appropriate statistical tools like: Percentage analysis, Arithmetic Mean and Paired t-test for testing the significance of difference between means. Mean value for different variables before and after road construction, has been calculated and then Percentage analysis has been employed to determine level of change in a particular variable. Paired t-test has been used to test the significance of difference in mean values of different variables, before and after road construction. Analysis of data for the present study has been done by using computer software Microsoft Excel and Statistical Package for Social Sciences (SPSS).

Results and Discussion

1) Impact of Road Construction on Financial Status of the Households

Impact of road construction on financial status of households in the project area has been assessed in terms their income and borrowings. Financial status of the people in project area mostly improves, after the construction of new road, due to increased job opportunities, access to extended markets and better prices for their products, easy availability of loans and improved and easy access to banks and financial institutions. Impact of road construction on financial status of the households is shown in Table - 1 and it is clear from the table that construction of the roads has significantly influenced the financial status of the households in the project area, in terms of their income and borrowings. For all of road projects covered in the present study, there is more than 30% increase in the average income of the people in the project area, after construction of road. Results of paired t-test also reveal that the increase in average income is statistically significant at 5% level of significance, for all of road projects covered in the present study as the p- value for all of them is less than 0.05. It is also clear from the Table - 1 that for all the road projects covered in the present study, there is increase in the average borrowings of the people in the project area, after construction of road. For eight road projects, paired t-test results show that increase in average borrowings of respondents after construction of the respective roads, is statistically significant at 5% level of significance, as the p- value for all of them is less than 0.05.

Therefore, H_1 of no significant improvement in financial status, in terms of income and borrowings; of the respondents in the project area due to investment in rural roads is rejected for all the ten road projects with regard to income and for eight road projects with regard to borrowings.

The reasons for significant increase in average income after road construction are improved access to job opportunities, increased access to seasonal job opportunities in farther areas, increase in production of cash crops, increased productivity due to more use of High yielding variety seeds (HYVS), fertilizers and pesticides, extended market for the sale of produce, increase in net farm gate price and increase in non- farm activities/services in the project area.

Table - 1
Impact of Road Construction on Financial Status of the Households

Sr. No.	N= 50	Total monthly income (in Rs.)		Total Borrowings (in Rs.)	
		Before Road	After Road	Before Road	After Road
1. Dasuya-Hajipur Road	Mean	11680.00	15800.00	38540.00	65540.00
	%age Increase/Decrease		35.27		70.06
	t - value		-9.88*		-3.34*
	p - value		0.00		0.00
2. Dasuya-Miani Road	Mean	11850.00	15936.20	37320.00	74100.00
	%age Increase/Decrease		34.48		98.55
	t - value		-11.59*		-2.23*
	p - value		0.00		0.03
3. Mahilpur-Phagwara Road	Mean	12989.00	17480.00	12989.00	17480.00
	%age Increase/Decrease		34.58		34.58
	t - value		-8.72*		-8.72*
	p - value		0.00		0.00
4. Garhshankar – Santokhpur Road	Mean	9952.00	12948.00	20320.00	64900.00
	%age Increase/Decrease		30.10		219.39
	t - value		-9.71*		-5.85*
	p - value		0.00		0.00
5. Hariana Dholbaha -Bruhi Jhir di Khuhi Road	Mean	11620.00	15904.00	22100.00	60760.00
	%age Increase/Decrease		36.87		174.93
	t - value		-11.45*		-4.55*
	p - value		0.00		0.00
6. Bullowal – Bhogpur Road	Mean	12040.00	16048.00	50500.00	180100.00
	%age Increase/Decrease		33.29		256.63
	t - value		-10.58*		-1.91
	p - value		0.00		0.06
7. Begowal – Miani Road	Mean	10386.00	13770.00	33360.00	74900.00
	%age Increase/Decrease		32.58		124.52
	t - value		-9.76*		-4.78*
	p - value		0.00		0.00
8. Dasuya – Miani Road to village Kokhar link Road	Mean	12386.00	16930.00	38460.00	56400.00
	%age Increase/Decrease		36.69		46.65
	t - value		-10.95*		-1.87
	p - value		0.00		0.07
9. Dasuya to Thakkar crossing link Road, near village Saggal Panwan	Mean	12850.00	17004.20	28320.00	80660.00
	%age Increase/Decrease		32.33		184.82
	t - value		-10.58*		-2.78*
	p - value		0.00		0.01
10. Sallowal to Ladhpur Road	Mean	10694.00	14170.00	34980.00	85940.00
	%age Increase/Decrease		32.50		145.68
	t - value		-9.23*		-3.21*
	p - value		0.00		0.00

NOTE: (i) $t_{(0.05, 49)} = 2.0096$
(ii) * denote a significant difference at 5% level of significance.

The significant increase in borrowings after road construction may be due to easy availability of loans and improved and easy access to banks and financial institutions, made possible by the newly constructed road, as good transport infrastructure and services provides improves access to institutional credit and leads to increased demand for credit.

2) Impact of Road Construction on Physical Capital of the Households

Rural road connectivity leads to better income levels of the households in the road influenced area, which in turn results in increase in physical capital of households. In this study impact of road construction on physical capital of households in the project area has been assessed in terms of buildings, household assets, live stock and number of vehicles owned by them.
Table - 2 presents the impact of road construction on physical capital of the households. It is clear from the table that construction of the roads has significantly influenced the average physical capital of the households in the project area, in terms of buildings, household assets, live stock and number of vehicles owned by them. Percentage analysis shows that there is increase in the average physical capital of the households in the project area, in terms of all four parameters i.e. buildings, household assets, live stock and number of vehicles owned by them, after construction of road, for all the road projects covered in the present study.

Results of paired t-test reveal that the increase in average physical capital of households in terms of buildings is statistically significant at 5% level of significance, for all the road projects covered in the present study, except for one road project, i.e. Dasuya – Hajipur road, as the p- value is more than 0.05. It is also clear from the results of paired t-test that for all road projects covered in the present study, there is significant increase (at 5% level of significance), in the average household assets such as T.V., refrigerator, washing machine etc. and number of vehicles owned by them. However in case of live stock, the paired t-statistic value for is not statistically significant at 5% level of significance, for two road projects viz. Mahilpur - Phagwara Road and Bullowal – Bhogpur Road, as the p- value for them is more than 0.05.

Therefore, H2 of no significant increase in physical capital of the households in the project area due to investment in rural roads is rejected, for all the ten road projects with regards to household assets and number of vehicles owned by them, and for nine and eight road projects respectively with regards to buildings and live stock.

The significant increase in average physical capital of households after road construction, as compared to average physical capital of households before road construction may be due to improvement in income level of households after the newly constructed roads.

Table - 2
Impact of Road Construction on Physical Capital of the Households

Sr. No.	N= 50	Buildings		Household Assets		Live Stock		Number of Vehicles Owned	
		Before Road	After Road	Before Road	After Road	Before Road	After Road	Before Road	After Road
1. Dasuya-Hajipur Road	Mean	1.16	1.22	1.56	2.68	0.88	1.12	0.86	1.34
	%age Increase/Decrease		5.17		71.79		27.27		55.81
	t - value		-1.77		-8.85*		-2.37*		-5.85*
	p - value		0.08		0.00		0.02		0.00
2. Dasuya-Miani Road	Mean	1.16	1.40	1.54	2.54	1.36	1.84	0.88	1.48
	%age Increase/Decrease		20.69		64.94		35.29		68.18
	t - value		-2.87*		-8.49*		-2.44*		-6.33*
	p - value		0.01		0.00		0.02		0.00
3. Mahilpur- Phagwara Road	Mean	1.12	1.34	1.76	2.56	1.86	2.10	0.84	1.64
	%age Increase/Decrease		19.64		45.45		12.90		95.24
	t - value		-3.35*		-6.11*		-1.13		-7.00*
	p - value		0.00		0.00		0.27		0.00
4. Garhshankar – Santokhpur Road	Mean	1.08	1.36	1.02	2.02	1.44	2.00	0.80	1.78
	%age Increase/Decrease		25.93		98.04		38.89		122.50
	t - value		-3.26*		-7.64*		-2.41*		-9.01*
	p - value		0.00		0.00		0.02		0.00
5. Hariana Dholbaha -Bruhi Jhir di Khuhi Road	Mean	0.94	1.38	1.30	2.34	1.34	2.38	0.62	1.06
	%age Increase/Decrease		46.81		80.00		77.61		70.97
	t - value		-3.83*		-7.77*		-3.82*		-5.76*
	p - value		0.00		0.00		0.00		0.00
6. Bullowal – Bhogpur Road	Mean	1.12	1.24	1.54	2.36	2.02	2.16	0.84	1.88
	%age Increase/Decrease		10.71		53.25		6.93		123.81
	t - value		-2.58*		-6.03*		-0.53		-8.36*
	p - value		0.01		0.00		0.60		0.00

7. Begowal – Miani Road	Mean	1.00	1.26	1.36	2.56	0.88	1.32	0.74	1.40
	%age Increase/Decrease		26.00		88.24		50.00		89.19
	t - value		-3.07*		-8.57*		-3.35*		-6.51*
	p - value		0.00		0.00		0.00		0.00
8. Dasuya – Miani Road to village Kokhar link Road	Mean	1.08	1.40	1.38	2.46	1.68	2.26	0.66	1.46
	%age Increase/Decrease		29.63		78.26		34.52		121.21
	t - value		-3.18*		-8.95*		-2.62*		-7.00*
	p - value		0.00		0.00		0.01		0.00
9. Dasuya to Thakkar crossing link Road, near village Saggal Panwan	Mean	1.12	1.28	1.40	2.24	1.26	1.80	0.88	1.46
	%age Increase/Decrease		14.29		60.00		42.86		65.91
	t - value		-2.68*		-7.76*		-2.48*		-6.39*
	p - value		0.01		0.00		0.02		0.00
10. Sallowal to Ladhpur Road	Mean	1.10	1.30	1.30	2.24	1.38	1.88	0.80	1.54
	%age Increase/Decrease		18.18		72.31		36.23		92.50
	t - value		-2.65*		-6.95*		-2.07*		-6.97*
	p - value		0.01		0.00		0.04		0.00

NOTE: (i) $t_{(0.05, 49)} = 2.0096$
(ii) * denote a significant difference at 5% level of significance.

3) Impact of Road Construction on Distance to Various Places (In Kms.)

Construction of new rural roads, besides improving connectivity, also leads to shorter distances to various places and facilities in most of the cases. In present study impact of road construction on distance to various places in the project area has been assessed in terms of average distance to grain market, veterinary hospital and health centers after construction of roads. Table - 3 depicts the impact of road construction on distance to various places in the project area. It is clear from the table that construction of the roads has significantly influenced the average distance to various places in the project area after construction of roads.

Percentage analysis shows that there is decrease in the average distance to grain market, veterinary hospital and health centers, after construction of roads, for all road projects covered in present study. While the range for percentage decrease in average distance to grain market is 1.33% to 50.45%, 2.19% to 51.14% for average distance to veterinary hospital and 1.69% to 43.9% for average distance to health centers after construction of roads.

Results of paired t-test reveal that in case of average distance to grain market there is statistically significant decrease, after road construction at 5% level of significance for six of the road projects covered in the present study, as the p- value for these road projects is less than 0.05. In case of average distance to veterinary hospital there is statistically significant decrease, after road construction for six of the road projects, however in case of average distance to health centers, there is statistically significant decrease, after road construction for seven of the road projects covered in the present study.

Therefore, H_3 of no significant change in distance to various places in the project area due to investment in rural roads is rejected, for six road projects with regards to average distance to grain market and veterinary hospital; and for seven projects with regards to average distance to health centers.

The significant decrease in distance to various places may be due to easy and cheap access to transport facilities available after the newly constructed roads, which may have helped in commuting to various places easily and at cheaper rates.

4) Impact of Road Construction on Transportation Time and Cost

Impact of road construction on transportation time and cost in the project area has been assessed in terms of average transportation time, monthly fuel expenses and maintenance charges per vehicle. It is mostly observed that due to reduced distance to various places, better quality of road, easy and cheap access to transport facilities available after the newly constructed roads, there is decrease in transportation time.

Table - 3
Impact of Road Construction on Distance to Various Places (In Kms.)

Sr. No.	N= 50	Grain Market		Veterinary Hospital		Health Centers	
		Before Road	After Road	Before Road	After Road	Before Road	After Road
1. Dasuya-Hajipur Road	Mean	7.95	7.69	5.96	5.78	6.71	6.53
	%age Increase/ Decrease		-3.27		-3.02		-2.68
	t - value		1.99*		1.70		1.70
	p - value		0.05		0.09		0.09
2. Dasuya-Miani Road	Mean	5.11	4.05	3.93	3.73	4.49	4.31
	%age Increase/ Decrease		-20.74		-5.09		-4.01
	t - value		1.76		1.87		1.70
	p - value		0.08		0.07		0.09
3. Mahilpur-Phagwara Road	Mean	7.29	4.79	3.27	2.77	7.35	6.85
	%age Increase/ Decrease		-34.29		-15.29		-6.80
	t - value		2.77*		4.68*		4.52*
	p - value		0.01		0.00		0.00
4. Garhshankar – Santokhpur Road	Mean	4.93	4.61	3.21	2.84	4.92	4.54
	%age Increase/ Decrease		-6.49		-11.53		-7.72
	t - value		2.76*		3.56*		3.70*
	p - value		0.01		0.00		0.00
5. Hariana Dholbaha -Bruhi Jhir di Khuhi Road	Mean	8.24	7.40	5.28	3.24	5.74	3.22
	%age Increase /Decrease		-10.19		-38.64		-43.90
	t - value		1.41		3.05*		3.50*
	p - value		0.16		0.00		0.00
6. Bullowal – Bhogpur Road	Mean	12.13	6.01	2.55	2.43	7.09	6.97
	%age Increase/ Decrease		-50.45		-4.71		-1.69
	t - value		4.41*		1.45		1.95
	p - value		0.00		0.15		0.06
7. Begowal – Miani Road	Mean	7.13	6.99	4.76	4.61	6.72	6.56
	%age Increase/ Decrease		-1.96		-3.15		-2.38
	t - value		1.73		1.91		2.06*
	p - value		0.09		0.06		0.04
8. Dasuya – Miani Road to village Kokhar link Road	Mean	8.34	5.56	4.40	2.15	7.39	4.69
	%age Increase/ Decrease		-33.33		-51.14		-36.54
	t - value		2.68*		3.40*		3.79*
	p - value		0.01		0.00		0.00
9. Dasuya to Thakkar crossing link Road, near village Saggal Panwan	Mean	6.03	5.95	4.57	4.47	5.04	4.87
	%age Increase/ Decrease		-1.33		-2.19		-3.37
	t - value		1.66		2.33*		2.69*
	p - value		0.10		0.02		0.01
10. Sallowal to Ladhpur Road	Mean	7.32	6.72	4.53	4.12	4.76	4.37
	%age Increase/ Decrease		-8.20		-9.05		-8.19
	t - value		2.12*		3.34*		3.19*
	p - value		0.04		0.00		0.00

NOTE: (i) $t_{(0.05, 49)} = 2.0096$
(ii) * denote a significant difference at 5% level of significance.

While increase in average number of vehicles per person, increased number of visits to markets/ relatives due to better connectivity and increased prices of petrol/diesel lead to increase in fuel expenses; the maintenance cost decreases because of improved quality of roads and shorter routes in road influenced areas.

Impact of road construction on transportation time and cost in the project area is presented in Table - 4 and it is clear from the table that construction of the roads has significantly influenced the average transportation time and cost in the project area, after construction of roads. Percentage analysis shows that there is decrease in the average transportation time, after construction of roads, for all road projects covered in the present study, except one, i.e. Hariana Dholbaha -Bruhi Jhir di Khuhi road. While the average monthly fuel expenses have decreased for all of the projects after construction of respective roads, the maintenance charges per vehicle have increased in case of seven road projects and decreased in other three.

Results of paired t-test reveal that in case of average transportation time there is statistically significant decrease, after road construction at 5% level of significance for all road projects covered in the present study except in case of Hariana Dholbaha -Bruhi Jhir di Khuhi road where there is statistically significant increase in average transportation time, after road construction. In case of average monthly fuel expenses there is statistically significant increase, after road construction at 5% level of significance for all the road projects, However in case of average maintenance charges per vehicle, there is statistically significant decrease, after road construction at 5% level of significance for just one road project covered in the present study i.e. Dasuya – Hajipur road, as the p-value for this road project is less than 0.05. There is increase in average maintenance charges per vehicle for seven road projects, but results of paired t-test show that none of these increases is statistically significant.

Therefore, H_4 of no significant change in transportation time in the project area due to investment in rural roads is rejected, for all the road projects with regards to average transportation time as there is significant decrease in transportation time in case of nine road projects and significant increase in transportation time in case of Hariana Dholbaha -Bruhi Jhir di Khuhi road.

It has been observed that H_4 of no significant change in average monthly fuel expenses in the project area due to investment in rural roads is rejected, for all the road projects and H_4 of no significant change in average maintenance charges per vehicle monthly in the project area due to investment in rural roads is rejected for just one road project i.e. Dasuya – Hajipur road.

Table - 4
Impact of Road Construction on Transportation Time and Cost

Sr. No.	N=50	Time taken to reach market (in mins.)		Monthly Fuel expenses (in Rs.)		Monthly Maintenance cost per vehicle (in Rs.)	
		Before Road	After Road	Before Road	After Road	Before Road	After Road
1. Dasuya-Hajipur Road	Mean	26.62	13.27	369.00	1175.00	153.00	112.80
	%age Increase/ Decrease		-50.15		218.43		-26.27
	t - value		8.63*		-3.60*		2.09*
	p - value		0.00		0.00		0.04
2. Dasuya-Miani Road	Mean	13.14	9.54	536.00	1397.00	136.00	122.00
	%age Increase/ Decrease		-27.40		160.63		-10.29
	t - value		2.83*		-3.81*		1.01
	p - value		0.01		0.00		0.32
3. Mahilpur-Phagwara Road	Mean	29.33	16.46	395.00	1361.00	141.00	134.00
	%age Increase/ Decrease		-43.88		244.56		-4.96
	t - value		8.14*		-4.29*		0.32
	p - value		0.00		0.00		0.75
4. Garhshankar – Santokhpur Road	Mean	28.06	15.04	383.40	1091.00	128.00	201.40
	%age Increase/ Decrease		-46.40		184.56		57.34
	t - value		11.95*		-8.81*		-1.50
	p - value		0.00		0.00		0.14
5. Hariana Dholbaha - Bruhi Jhir di Khuhi Road	Mean	5.30	10.52	372.00	1087.00	65.00	71.00
	%age Increase/ Decrease		98.49		192.20		9.23
	t - value		-12.07*		-11.86*		-0.69
	p - value		0.00		0.00		0.49
6. Bullowal – Bhogpur Road	Mean	35.40	19.44	477.20	1505.60	139.40	149.00
	%age Increase/ Decrease		-45.08		215.51		6.89
	t - value		16.89*		-4.54*		-0.28
	p - value		0.00		0.00		0.78
7. Begowal – Miani Road	Mean	30.66	15.01	286.40	966.00	121.00	140.00
	%age Increase/ Decrease		-51.04		237.29		15.70
	t - value		10.29*		-8.69*		-0.46
	p - value		0.00		0.00		0.65
8. Dasuya – Miani Road to village Kokhar link Road	Mean	20.44	15.14	421.00	1163.00	90.00	98.80
	%age Increase/ Decrease		-25.93		176.25		9.78
	t - value		3.30*		-10.02*		-0.54
	p - value		0.00		0.00		0.59
9. Dasuya to Thakkar crossing link Road, near village Saggal Panwan	Mean	20.54	12.49	446.00	1068.00	155.00	168.40
	%age Increase/ Decrease		-39.19		139.46		8.65
	t - value		6.23*		-11.32*		-0.36
	p - value		0.00		0.00		0.72
10. Sallowal to Ladhpur Road	Mean	20.73	12.46	421.00	1222.00	122.00	126.00
	%age Increase/ Decrease		-39.89		190.26		3.28
	t - value		6.20*		-3.54*		-0.21
	p - value		0.00		0.00		0.84

NOTE: (i) $t_{(0.05, 49)} = 2.0096$
(ii) * denote a significant difference at 5% level of significance.

The significant decrease in transportation time may be due to reduced distance to various places, better quality of road, easy and cheap access to transport facilities available after the newly constructed roads, which may have helped in commuting to various places in lesser time. Increase in fuel expenses, after road construction may be due to increase in average number of vehicles per person in the project area and also due to increased number of visits to markets/ relatives due to better connectivity and increased prices of petrol/diesel. While decrease in maintenance cost may be due to improved quality of roads and shorter routes, the increase in maintenance cost in some of road influenced areas may be due to increased number of vehicles owned by the respondents.

Conclusion

To conclude, we can say that all weather connectivity contributes to significant reduction in cost of transportation of goods and the development of economic activities by enhancing mobility and thus providing more opportunity for growth within the rural economy. The benefits from the road improvement identified by local respondents from the villages studied included: year-round access, elimination of health hazards from dusty roads, improved mobility (e.g. children were able to go to school in the rainy season), and an increase in household purchases of motorbikes. Through improvement in all these variables, there is improvement in economic status of respondents in the study area.

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