

# Exploration of Benefits of NDDC Road Projects on Household Income in Rivers State

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## Abstract

Development projects that support and improve the socio-economic conditions are essential because they motivate innovations, which in turn create jobs, improve quality of life and sustainable development. This belief prompted the need to evaluate the impact of rural roads on household income. This study proceeded to determine the socio-economic circumstances of the beneficiary and non-beneficiary communities of the road projects. A multistage random sampling was used to select 3007 respondents from the study area. Questionnaires were used to collect data from the respondents. Data were analyzed using descriptive statistics and propensity score matching technique. The study revealed that households in NDDC road project communities experienced increased income of about ₦ 5,768.437. Based on this, the study recommended that Niger Delta Development Commission (NDDC) should sustain the infrastructural development particularly road projects by increasing the annual budget provisions. Research efforts need to be carried out in other states of Niger Delta Region to ascertain the benefits of rural development projects. It is therefore important to further ascertain the influences of other development projects on socio-economic conditions in Rivers State. The study provides an empirical analysis of the benefits of rural road projects such as that of NDDC projects across Rivers State on the income of households. It also raised the questions what is a sustainable level of impact on average household income? Could the impact have been higher if adequate needs analysis has been carried out prior to the road construction?

**Keywords:** Propensity Score Matching, Socio-economic Conditions, Rural Road Projects, NDDC, Income

## 1. Introduction

Humans have always engaged in activities deemed to develop their condition and improve their standard of living. With the increasing divide between the rural and urban area, government across the world have tried to enhance development of the rural areas by providing the infrastructural needs of the people, especially rural roads which have been deemed as a way of enhancing the standard of living or rural dwellers.

Road is a tool to facilitate the development of a place. According to Kahn (1979), road is a physical infrastructure that has both direct and indirect impacts. Direct impact is can be felt on production and trade while the indirect impact is on productive activities, thus translating to improved income of the entrepreneurs. This increase in income, in turn make available resources for procurement of surplus goods and services. This is possible because, the component meant for payment of absent or bad road has been cleared by the development of the road, thus, the cost is therefore indirectly removed from the production cost. Therefore the intention is that road construction across rural area will bring about rural development.

The assessment of road impact is necessary as it generate social and economic development of a place. Various governments and development agencies have implemented road projects across Nigeria and Rivers State particularly. This is necessitated to develop the places where it is located to improve the living standard of people. This living standard depends on income of the people. Income is the profit realized or earned from production of goods or provision of services for the benefit or welfare of mankind.

From the foregoing, rural roads are expected to contribute to rural development; however it is important to examine the impact of such road. This study aimed at examining the impact of rural road on beneficiary communities. This study focused on the Niger Delta Development Commission (NDDC) road projects across River States, Nigeria. Often times, project has been carried out with good intention and the lofty ambition that it would contribute immensely to improving the socio-economic condition of the beneficiary communities especially in the rural area. It is thus, important to quantify the impact of road projects or other projects on the beneficiary. The relevance of such is even much more pertinent in the light of the dwindling government resources and budgetary constraint. Furthermore, it will support, decision making and policy making by identifying what is likely to have the most significant impact on the lives of the rural dwellers.

Todaro (1993) stated that development is change in socio-economic attributes of a given society. This indicates change in social system such as attitude, institution and administrative structures and change in economic system such production of good and services that will bring about the desired changes. This desired change will occur through a strategy targeted at the needs of the people that require the change. This further implies that for economic and social components to change, it requires a deliberate effort referred to as development that enhances the wellbeing of the inhabitants of a region to manifest. Development sometimes is used conterminously with economic development which presupposes the state of material prosperity, however,

the variation in spatial pattern of economic development of a region is of interest to the economic geographer. This concern here is the distribution of economic development as it manifests in the community. Evans (2003) stated that spatial economic development is existence of structure as created by agents of development.

Haggins (2009) explored the regional inequality in Nigeria focusing especially in the Niger Delta. This work examined the situation of the Niger Delta and emergence of NDDC – a body set up to address the neglected area, has been slow. It concluded that the natural resource endowments of the region have not been translated to welfare gains to the communities.

Infrastructural development have been purported to contribute to socioeconomic development of places. There are several studies that have examined the effect of infrastructure on socioeconomic development and extensive analysis which shows the effect of infrastructure on socioeconomic development. Fan (2008) asserted that investments on rural roads usually are unique in the sense that it often bringing about other investments in the form of development of other infrastructures. Dercon et al. (2007) estimated that changes in access to quality roads increased consumption growth in rural Ethiopia by 16 percent and reduced poverty by 7 percent. Escobal and Ponce (2004) used Propensity Score Matching model showed that rural road rehabilitation enhance non-agricultural wages in the rural areas of Peru.

Studies on effect infrastructure on socio-economic development have attracted the attention of researchers due to huge investments of government and governmental agencies. Provision of infrastructure facilitates socio-economic development; improve condition of living and security (Baldwin and Dixon, 2008). Infrastructural development creates concentration of resources and activities within geographic region and generates job opportunities (Gu and Macdonald, 2009). This influence goods and services, and defines spatial spread and enables connectivity.

Snieska and Brunekiene (2009) affirmed that infrastructure is a critical indicator for regional development. Martinkus and Lukasevicius (2008) stated that infrastructures are physical development that influences investment in a region and it increases attractiveness.

Grundey (2008), Burinskiene and Rudzkiene (2009) affirmed that infrastructure is the most important tool to ensure socioeconomic development. Agenor and Moreno-Dodson (2006) also affirmed that infrastructure provides the basis of health and education development of any region. Calderon and Serven (2004) confirmed that telecommunication and energy infrastructure have a positive impact on growth. Seethepalli, Bramati and Veredas (2008) stated that infrastructure is critical for socioeconomic development. Li and Li (2008) stated that infrastructure boost socio-economic development as exemplified in China growth. This implies that difference exist in socioeconomic conditions of areas with infrastructure and areas without infrastructure.

Infrastructure provides rural population access to basic services, influence economic growth and generate employment opportunities, which in turn generate incomes and social development. Asian Development Bank (2005) asserted that “good feeder roads can allow the supply of perishable foods to high-value urban markets, and the income generated can be invested in health and education to improve the productivity of eventual migrants to the cities”. Rural transport infrastructure encompasses facilities such as rural roads, which provides the rural population with opportunity to transport their goods and services for better life. It eases by reducing cost of production and making other services productive in the society. The socioeconomic conditions of the people are improved by creating infrastructure that will enable outcome variable improved. Gannon, Gwilliam, Liu and Calvo (2001) asserted that physical infrastructure such as rural road helps improve production in agricultural and facilitate non-farm employment, which in turn causes higher income. They further emphasized that roads reduce cost of transactions and directly contribute to household income.

Non-availability of road necessitates the rural inhabitants to practice “head loading” of goods. The development of rural roads reduces the burden and provides available time for people to engage in productive activities. The rural roads are expected to reduce travel time and create non-farm employment opportunities (Gannon and Liu, 2001).

Rural road enable benefits of transport, which led to enhancement in the standard of living (Gannon and Liu, 2001). Rural road can improve access to economic opportunities by eliminating cost of transportation. This will automatically lead to low price of goods and services. The various rural road impact studies have been noted in Peru, Tanzania, Morocco and Brazil (Gannon, Gwilliam, Liu and MalmbergCalvo 2001).

Rural roads diversify farmers’ income by facilitating non-farm activities and generating demand for services. This is manifested in increase by non-farm entrepreneurs. Finally, rural transport cannot have positive effect without rural road. Pinard (2004) asserted that rural roads are the primary means of transportation in Africa. However, roads are seen as factor that hinders socio-economic development in Africa. FAO (2002) indicated that Africa’s physical infrastructure generally poor. The major constraint in developing infrastructure in Nigeria has been lack of funds, particularly the rural roads.

Pankaj (2000) affirmed that investment in rural road ensures adequate transportation that supports socio-economic development which contributes to poverty alleviation. Increase in production is necessitated through cost reduction of acquiring farm implements and increasing output prices. Khandker, Bakht and

Koolwal (2006) asserted that rural road facilitates increase in agricultural production, income and reduce produce prices. Rural road projects provide significant increase in off-farm opportunities as well as employment opportunities (Lakshin and Yemtsov, 2005 in Van de Walle, 2007).

Khandker et al. (2006) noted that rural road affect average school participation by boys with 20 percent higher in areas affected by road development. Similarly, Van de Walle (2007) asserted that rural road facilitates increase in primary school completion rates in Vietnam. This implies that road construction enables transportation school pupils to school centres. In Nigeria, lack of emphasis on rural infrastructural development contributed to underdevelopment in rural areas. Institutions in rural areas suffered personnel due to absence of rural road infrastructure. These personnel live outside the rural area and lost the expenditure cost, which ordinarily would have improved the economic growth. Many communities suffered socio-economic development due to poor and inadequate infrastructure, which has implications for welfare and continuous poverty.

Furthermore, Ayoade (1982) asserted that health facilities are more concentrated in the urban area than the rural areas of plateau state. The literature cited above pointed out that health facilities needed substantial rehabilitation so that they could effectively offer the required services. The researcher also noted that a lot needed to be done so as to meet the required standards like ratio of medical doctors to a given population in order to adequately cater for the health needs of the rural people. However, the effects of rural roads facilities impact on the socioeconomic condition of rural dwellers are lacking.

The Niger Delta, including Rivers State has witnessed several development agencies for rural development. The impact of these agencies were recorded 'no meaningful development'. This suggests that projects embarked by these agencies were not evaluated. Today, NDDC has witnessed several studies to assess the impact of projects and programmes implemented. NDDC implemented projects have been in areas such as water supply, road construction, electricity, etc. this study therefore emphasized on the impact of road construction on socioeconomic conditions such as income of households in communities of Rivers State.

## **2: Materials and Method**

### **2.1: Material**

Data for this study was collated in 2015. Primary data were collected for the purpose of this study using structured questionnaires. The questionnaire was designed to capture data on socioeconomic and demographic characteristics of the sampled population. The study population is 108 road projects in Rivers State excluding Obio/Akpor and Port Harcourt City Local Government Areas. However, 30% of the road projects were selected from each local government area (i.e. 54 road projects from a list of 180 road project communities) across 21 local government areas by placing all the communities' names in each LGA in 21 different buckets. Each community name is put on a separate piece of paper and names are drawn until 54 road project communities were picked with respect to their percentage.

A sample of fifty-four (54) communities benefiting and non-benefiting from NDDC rural road projects were randomly selected across the state. The listing of the rural road projects in the state was done with the assistance of the NDDC Staff. This formed the frames from which separate samples of 1961 respondents with rural roads and 1046 respondents without rural roads were chosen, by a simple random sampling technique (i.e. 5 percent of the household population).

### **2.2: Questionnaire**

A survey instrument in form of structured questionnaire was employed in this study. The data on the socioeconomic characteristics of household heads were collected from the respondents, demographic information, education, economic activities, household income and expenditure, housing condition, properties and assets, household liability and health activities. The questionnaires were administered to two groups (1) direct project beneficiaries (2) non-project beneficiaries living outside NDDC road projects area but share similar socioeconomic and biophysical conditions comparable to the both communities. The design of this stratification allowed for determination of the changes of impact of NDDC road projects.

### **2.3: Method**

In order to examine the difference in the income of the households from the two groups of communities, a T-test statistical analysis was carried. This was implemented to test if there is any significant difference between the two groups in relation to their income.

The study adopted a quasi-experimental approach in conjunction with a cross-sectional design. And to this the Propensity Score Matching method was employed for the analysis of the benefits of NDDC road project. The non-beneficiary serves as the control and the income served as the target variable upon which effect of road was tested. The propensity score is defined as the probability of receiving treatment based on measured covariates:

$$e(x) = P(Z=1 | X)$$

Where  $e(x)$  is the propensity score,  $P$ = a probability,  $Z=1$  a treatment indicator with values 0 for control and 1 for treatment, the "|" symbol stands for conditional on, and  $X$  is a set of observed covariates. Propensity score methods according to Rosenbaum and Rubin (1983) have seen a tremendous increase in use during the last couple of years. The Propensity Score Matching (PSM) method, which matches project beneficiaries with comparable non-beneficiaries using a propensity score (estimated probability of being included in the project) and the Double-difference (DD) estimator, which compares changes in outcome measures (i.e., change from before to after the project) between project participants and non-participants, rather than simply comparing outcome levels at one point in time, was used in this study to estimate the impact of the project. The impact of NDDC rural road projects were analyzed using matched samples. Further testing of the comparability of the selected groups was done using a balancing test Dehejia and Wahba (2002). This tests for statistical differences in the means of the explanatory variables between the matched groups of NDDC road beneficiaries and non-beneficiaries.

### 3: Results and Discussion

#### 3.1 Socioeconomic Circumstance of Communities in the Study Area

This subsection explored and compared the socioeconomic conditions of the selected communities in the study area (beneficiary and non-beneficiary communities). The collation of the collected data shows that most of the household heads are male, with 97% and 93.7% for the beneficiary and non-beneficiary respectively. Further to this, the household size varies between 2 and 10 people with about 89.4% and 91.6% having between 4 and 8 people in the household for non-beneficiary and beneficiary respectively. Most of the household heads are also between the ages of 41 and 65, with about 62 belonging to this age group in the beneficiary communities and about 59 in the non-beneficiary communities. In the same vein, most of the household head are married with just about 1.2% currently divorced among the households in the non-beneficiary community. Furthermore, most of the household heads reported that they have the ability to read and write, however between 1.5% and 2.4% report they are not able to read for beneficiary and non-beneficiary communities. Probing this a little further, highest education attainment across the communities was explored, the results shows that between 40% and 42% of the household heads have at least a Senior Secondary school certificate. The next level of education attainment with high proportion is Bachelor Degree, with an average of 25% of the household heads across these communities reporting this as their highest educational attainment (Table 1).

Table 1: Highest Education Attainment of household heads across selected communities

Level of Education	Road		Without Road	
	Frequency	Percent	Frequency	Percent
Primary School	377	19.2	25	2.4
Lower Sec. School	14	0.7	42	4.0
Upper Sec. School	825	42.1	414	39.5
Technical/Vocational Sec. School	106	5.4	96	9.2
Bachelor Degree	492	25.1	260	24.8
Master's Degree Completed	30	1.5	76	7.3
Don't Know	116	5.9	134	12.8
Total	1960	100.0	1047	100.0

Source: Compiled from field data 2015.

A snapshot of the economic condition of the household was captured by the primary occupation of the household heads in the last six months (Table2). Across the two groups of communities more than half of the household heads are employed as civil servants. And significant proportions are also engaged in small businesses/trading and bricklaying (in the beneficiary group) as well as driving (commuter buses and taxis) and farming (in the non-beneficiary group).

Table 2: Primary occupation of the household heads in the last six months

Primary Occupation	Road		Without Road	
	Frequency	Percent	Frequency	Percent
Bricklayer	428	21.8	0	0.0
Business	188	9.6	0	0.0
Civil Servant	1090	55.6	632	60.4
Driving	155	7.9	128	12.2
Farming	34	1.7	132	12.6
Housewife	0	0	105	10.0
Teaching	13	.7	50	4.8
Trading	52	2.7	0	0.0
Total	1960	100.0	1047	100.0

Source: Compiled from field data, 2015.

Household heads were also asked to report their income, the income reported was grouped (Table 3) into 5 classes. This shows that majority of the household heads incomes (total) between 500,000 Naira and 2,000,000 in the last six months; in the beneficiary communities this group represents a total of 72.9% while the proportion is 73.4% in the non-beneficiary group. However, there is also a significant proportion with a total earning of between 2,000,001 and 3,000,000 Naira, this income class has between 14% and 19% of the household heads across the two communities.

Table 3: Income categories of household heads across the selected communities

Income Group	Road		Without Road	
	Frequency	Percent	Frequency	Percent
0-500,000	105	5.4	61	5.8
500,001-1,000,000	738	38.1	384	36.7
1,000,001-2,000,000	690	34.8	384	36.7
2,000,001-3,000,000	370	19.1	148	14.1
3,000,001 and above	57	2.6	70	6.7
Total	1960	100.0	1047	100.0

Source: Compiled from field data, 2015.

The examination of the food expenditure (Table 4) shows that between 75% and 76% of the household spent between 10,001 and 20,000 on food in a month while about 16% of the respondents from the non-beneficiary communities spent over 20,000 on food expenditure. Furthermore, about 22% and 8% spends 10,000 Naira or less on food for the beneficiary and the non-beneficiary community respectively.

Table 4: Household food expenditure across the selected communities

Expenditure Classes	Road		Without Road	
	Frequency	Percent	Frequency	Percent
0-10,000	421	21.5	80	7.6
10,001 - 20,000	1483	75.7	798	76.2
20,001 and above	56	2.9	169	16.1
Total	1960	100	1047	100

Source: Compiled from field data, 2015

The non-food expenditure is much higher and this expenditure was divided into six classes (Table 4). The modal class for both community groups is the 180,001 – 240,000 Naira, with 42% and 37% for community with road and those without respectively. Moreover, there are a considerably proportion of household across both communities with expenditure in the regions of 240,001 – 315,000 Naira and 120,001 – 180,000 Naira. However, in addition to these, non-beneficiary communities also have about 17% of household selected spending more than 315, 000 Naira on non-food items.



Table 5: Non-food expenditure class and distribution across the selected households in the two community groups

Expenditure Classes	Road		Without Road	
	Frequency	Percent	Frequency	Percent
15,000-60,000	66	3.4	0	0.0
60,001-120,000	21	1.1	11	1.1
120,001-180,000	373	19.0	165	15.8
180,001-240,000	826	42.1	389	37.2
240,001-315,000	636	32.4	309	29.5
315,001 and above	38	2.0	173	16.5
Total	1960	100	1047	100

Source: Compiled from field data, 2015

The housing and property condition was also examined in the field data collection and the results showcased the living condition of the households and communities surveyed for this study. Between 90 and 99% of the households are living in concrete or brick houses. The number of rooms in these houses ranges between 2 and 7, with a mode of 3 rooms (42%) for beneficiary communities and 4 rooms (46%) for non-beneficiary communities. Sources of drinking water were also considered, sources of drinking water included pipe in dwelling, hand pump/borehole, dug well and river/stream. A total of around 81% and 95% get water from pipe in dwelling and hand pump/borehole. However, around 1% of the households across the communities get their drinking water from rivers/streams, while between 4% and 18% sourced their water from dug well. In terms of sanitation, more all the households surveyed across the beneficiary group have toilet in the house while about 1% of the households in the non-beneficiary do not have such facility in the house.

The results of the T-test (Table 6) shows that there is a significant difference ( $F= 14.6, P < 0.05$ ) between the income of the household in the beneficiary and non-beneficiary community. This gives a clear indication that while the grouping presented in the Table 3 show similarity in distribution, absolute values across the groups are very much different, with mean of ₦1, 500,000 and ₦750, 000 in beneficiary and non-beneficiary community respectively.

Table 6: T-test results for comparison of income of households across the two community groups

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Total income in the last 6months	Equal variances assumed	14.579	0.000	-2.277	3005	0.023
	Equal variances not assumed			-2.141	1797.57	0.032

Source: Analysis of field data, 2015

From the result of the income comparison (Table 6), the question therefore arises, how much of the difference could be attribute to the treatment (i.e. Roads). In order, to quantify this, the PSM was employed. In matching the household across the two groups, attributes and characteristics of the households were examined using probit regression model. The iterative process, identified total number of males in the household, age of the household head, ability of the household head to write and number of rooms where use in the construction of the propensity model. This model calculates the propensity for each of the household belonging to the actual groups based on the highlighted attributes. From this the common support region was found between 0.416 and 0.759 and a mean of 0.651. In order to test the balancing property of the propensity score, the inferior bounds (i.e. ranges between which Propensity score would be considered for matching), the number of treated and the number of control for each block were examined (Table 7), the block have propensity scores ranging between 0.4 and 0.7.

Table 7: Distribution of household by propensity score and across different communities

Inferior of block of Propensity Score	Treatment		Total
	No Road	Road	
0.40	233	311	544
0.60	332	488	820
0.65	158	291	449
0.675	184	487	671
0.70	132	383	515
Total	1039	1960	2999

Source: Computation from field data, 2015

The next step in the analysis is the matching of the propensity scores, using the nearest neighbor algorithm, thus the analysis will search for the nearest neighbour of each of the households with the roads as again those without roads, from the matching operation the average treatment effect would be computed. The result is presented in Table 8, and this shows that from the propensity score only 955 out of the 1039 could be matched with the 1960 household in the group with roads based on nearest neighbor algorithm.

Table 8: Average treatment effect and bootstrapping of standard error results

Number of Treatment	Number of Control	ATE	Std. Err.		
1960	955	5768.436	32771.040		
Bootstrapping	Reps	Observed	Bias	Std. Err.	[95% Conf. Interval]
	100	5768.436	5890.039	32771.040	-59256.42 70793.29 (N)
					-48631.31 77091.29 (P)
					-60283.49 73182.87 (BC)

Key: N = normal; P=percentile; BC = bias-corrected. Source: Result from analysis of field data, 2015

Bootstrapping was employed to examine the variance of the estimated treatment effect across different approximated distribution. From this exercise, it is can be seen that the average treatment effect (i.e. effect of road on the household income) is about 5,768 Naira, thus the presence of road contributed on average roughly about 6,000 Naira to the income of the household in the communities with road when compared to similar household in the communities without roads. However, the upper limit of the 95% confidence interval for the different distribution ranges between 70,793 Naira and 77,091 Naira while the lower limit ranges between -48,631 Naira and -60,283 Naira.

From the foregoing, there is clear evidence that rural road construction by NDDC, contributed on average about 6,000 Naira increase to the household income across communities with roads. This finding is in agreement with the extant literature, for example, Gannon and Liu (2001) posit that rural roads are critical to raising living standards in poor rural areas. This could be attributed to the reduction in transport costs, increase in commercial activities, changes in input and output prices and well as enhancement of economic linkages for agricultural production. The increase in income could also be as a result of changes in land use which could lead to increase crop intensity and other changes in production decisions which could stimulate off-farm diversification and other income-earning opportunities.

#### 4: Conclusion and Recommendations

From the findings, NDDC road projects in communities in Rivers State can be said to have contributed an average of ₦ 5, 768 increases in the household income in areas with such roads. This represent the cost saved from productive activities in the areas, through transportation cost which indirectly contribute to the cost of production. This approach to project evaluation is therefore recommended to quantify project impact on beneficiaries. Thus, the quantification of other development projects on socioeconomic conditions of the beneficiaries is recommended to ascertain extent of development and its implication social and economic circumstances of the beneficiary

The study provides an empirical analysis of the benefits of rural road projects such as that of NDDC projects across Rivers State on the income of households. Thus, create a framework for the assessment of the impact and subsequent examination of sustainability of such project in relation to contribution to social and economic wellbeing of the rural populace. Benefits accrued as a result of rural road could lead to reduction in

production cost for good and services which could translate to increase disposable income for further development/improvement of socioeconomic circumstances of the household. There is also the significant potential for stimulation of other economic activities and decision which could further develop the entire rural communities' condition. However, the question remains, is the level of benefit (₦ 5,768 income increase per household) as identified by this study justified by the level of investment laid out for such roads? Could the impact have been higher if adequate needs analysis has been carried out prior to the road construction?

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