Energy, Communication, Health, Irrigation and Security Infrastructure and its impact on Household Poverty in Pakistan: A Case Study of District Rajanpur, Punjab

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ARTICLE INFO

ABSTRACT

Infrastructure plays a pivotal role in economic development and for reduction of Households Poverty. The present study aims at investigating the effect of various kinds of infrastructure like Energy, Communication, Health, Irrigation, and Security on Households Poverty in one of the most under-developed districts of Pakistan namely Rajanpur. The survey was conducted for this purpose in the rural and urban areas and the researchers were successful to collect primary data from 300 households. The outcome of logistic regression suggests that Infrastructure in its various kinds i.e. Energy, Communication, Health, Irrigation, and Security are found as sources of lower Households Poverty. Moreover, Age, Education, Income, and value of assets tend to reduce Households poverty while Households poverty is increasing due to large family size and in urban areas of District Rajanpur. It is suggested that Government should give special attention to the provision of 5G internet technologies, access to clean drinking water, and disbursal of soft loans for the solar systems for the under-developed districts of Pakistan.

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1. Introduction

The origin of the word poverty is a Latin word "pauper" means "poor". Poverty is one of the serious problems faced by the world. The roots of poverty are strong in developing countries incomparison with developed countries. Poverty is explained as incapacity to fulfill the basic needs in terms of money required regarding the accomplishment of essential spending needs or amount of currency mandatory to meet these needs (Abrar-Ul-Haq, Jali, & Islam, 2016).

Infrastructure is a fundamental physical and organizational need for the function of a society/ enterprise or the service/ amenities necessary for financial system to function (Soneta, Bhutto, Butt, Mahar, & Sheikh, 2011). In current years infrastructure has attained increased attention (Calderon & Servén, 2004). In early modernization theory, roads were considered to be imperative mechanism of economic development (Rostow, 1960).

Regardless of successive discrediting of modernization theory, the belief in the power of roads to drive development is largely prevailed to present (Bryceson, Bradbury, & Bradbury, 2008). Policymakers are typically concerned about distributional effects of infrastructure which

are by no means understandable. On one hand, the increased access to market and ideas should benefit all regions for fixed factor endowments (Bryceson et al., 2008).

The Governments have played significant role in the implementation of a variety of poverty program include land reforms, delivery of credit farm input and local infrastructure projects designed to enhance employment for the poor (Bardhan & Mookherjee, 2004). In Pakistan like other developing countries, public investment plays an essential role for economic growth and development (Khan & Kemal, 1996).

The survival of developing economies depends on Aids and loans for infrastructural development in Energy, Health, and communication sectors etc. This actually leads to higher agricultural and industrial production and also reduces level of poverty (Fan, Zhang, & Zhang, 2004; Hussain, Ahmad, Nawaz, & Bhatti, 2019; Latif, 2002; Thorat & Fan, 2007).

Improved roads and infrastructure can produce opportunities for economic growth and poverty decline through a range of methods. Road reduces transportation outlay and the expenditure of consumption and manufacture of goods and services (Bids; 2004). Easier access to markets and technology and better roads expand farm and nonfarm production through augmented accessibility of appropriate inputs and lower inputs costs.

The objectivie of this study is to examine the impact of various forms of infrastructure i.e. Energy, Communication, Health, Irrigation and Security on Households Poverty in one of the more underdeveloped districts of Punjab, Pakistan namely district Rajanpur. The study is organized as Introduction is given in section 1, 2nd section is about Literature Review, 3rd section gives discussion on Data and Methodology, results are presented in section 4 and conclusion is drawn in section 5.

2.   Literature Review

The issue of Households Poverty has been discussion several times with so many socioeconomic variables and few selected studies are given in this section.

R. Ahmad and Faridi (2020) analyzed the socio-economic and demographic factors of poverty in Southern Punjab. The study took cross-sectional data consisting of 785 household heads. Binary logistic regression and ordinary least square techniques were used. The outcomes of study clearly showed that variables such as the family structure, the size of the household, the incidence of the disease, and the job status of household heads are directly linked to deprivation/ poverty, while education, work experience, rural to urban migration, number of workers, job status of women, remittances, physical asset value, and household ownership are reducing poverty. High dependency ratio and low education are the major obstacles against poverty reduction.

Shah, Chaudhry, and Farooq (2020) evaluated various factors affecting poverty alleviation in Pakistan using data of different households. The results of logistic regression determined that age, education of the households, remittances and employed status declined the probability of being poverty in Southern Punjab while size of family, jobs in the primary sector, high dependency ratio, and mental illness were connected positively with poverty. It was suggested that government must initiate various programs for creation of job and for increased education in this underdeveloped region for poor households.

Sheikh, Akhtar, Asghar, and Abbas (2020) examined the economic and demographic factors of poverty in the district Multan by gathering data from 300 households using Random sampling technique. The findings of the study established that incidence of poverty in rural localities had higher as comparison with the urban localities of the district of Multan. Furthermore, size of family, mental sickness, physical handicapped persons, and profession were the major causes of poverty. On the other side, household assets possession, foreign remittances and schooling were having positive impact on poverty.

Mekore and Yaekob (2018) exposed the different variables which affect the poverty level in a rural region in Ethiopia. Primary and secondary types of data were collected during 2014 to 2015 and from 150 families in one area of Ethiopia. The results of the binary

regression model determined that the rate of contribution, land ownership by the households, high-quality seeds, family size, cattle, and the income of the family were the most vital factors that reduced the level of poverty. The poverty had a positive link with the increasing dependent members of the family. The conclusion of this study showed that an increase in the dependency rate in the household increased the occurrence of poverty.

Buba, Abdu, Adamu, and Jibir (2018) determined the socio-economic and demographic factors of poverty in Nigeria. The outcomes of this research showed that the age of household's head, education, Members in the family, household income, level of employment and women as household head were reducing poverty. Shi, Guo, and Sun (2017) took panel data from China and concluded that real GDP is increased by electricity, rail road and telephone lines but negatively affected by roads infrastructure. Sasmal and Sasmal (2016) collected panel data from 1990 to 2010 from developing countries and suggested poverty to be reduced by per capita income, expenditure in infrastructure and social services.

Amann, Baer, Trebat, and Lora (2016)examined the relationship between growth and infrastructure spending in developing countries. Using time series data from 1990-2013, the study concluded that improvement in road infrastructure may create millions of new jobs opportunities and may reduce poverty. Ahuja and Pandit (2020) analyzed the impact of public expenditure on economic growth in developing countries. Using time series data from 2000-2011, the study showed that infrastructure has a positive link with economic growth of developing economies.

Soneta et al. (2011) investigated the impact of infrastructure on the manufacturing sector of Pakistan. Using time series data over the period from 1981 to 2009, the study showed that transportation, communication, electricity, gas and per capita income had a positive and significant impact on the manufacturing sector of Pakistan. Thorat and Fan (2007) used time series data for the period of 1970-1993 and 1971-2000 and concluded that road infrastructure; power resources, irrigation system and communication system played a key role in increasing agricultural productivity.

Calderon and Servén (2004) investigated the impact of infrastructural development on growth and income distribution. The results of panel data collected from 1960 to 2000concluded that number of telephone lines, electricity generated capacity, total length of roads and quality of infrastructure had positive linkage with economic growth (Nawaz, Ahmadk, Hussain, & Bhatti, 2020). Fan et al. (2004) used the time series data from 1953 to 2000 and revealed that average year of schooling, rural telephone, electricity consumption; agricultural GDP per laborer and per capita GDP produced by the urban sector had positive link growth of China.

Ali and Pernia (2003) examined the connection between infrastructure and poverty reduction. The findings of the study concluded that investment on roads, irrigation, and electricity made a positive influence on productivity of agricultural sector, employment of agricultural sector and non-agricultural productivity and reduced poverty (T. I. Ahmad, Khan, Soharwardi, Shafiq, & Gillani, 2021). Latif (2002) investigated that household income was increased by development of roads, electrification in house, household size, ownership of land and education in Bangladesh using time series data.

3.   Data

This study uses primary source of data to investigate the objectives. Survey was conducted in the rural and urban areas of one of the most under-developed districts of Pakistan i.e. Rajanpur and the researchers were successful to collect data from 300 households. This cross-sectional data has been collected by Simple and Stratified random sampling technique in 2018. From Tehsil Jampur, 169 respondents were chosen, 96 respondents were from Tehsil Rajanpur and 36 respondents were belonging to Tehsil Rojhan. The econometric results in this study are measured using Logistic Regression Analysis.

4.   Infrastructure Models

The present study examines the effect of various important forms of Infrastructure on the Households Poverty of Pakistan especially in district Rajanpur. The important forms of Infrastructure are Energy Infrastructure, Communication Infrastructure, Health Infrastructure,

Irrigation Infrastructure and Security Infrastructure. Moreover, the econometric models are specified in the following sections.

4.1 Energy infrastructure and Poverty

Considering the objective that is to see the impact of Energy Infrastructure on Households Poverty in the district Rajanpur, the specified model is given below in functional form as well as in econometric form;

Poverty = f (Area, Age, Education, Income, Assets, Household Size, Energy infrastructure)

$$P_i = a_0 + a_1 AREA + a_2 AGE + a_3 EDU + a_4 PMI + a_5 VOA + a_6 HHS + a_7 EI + u_{1i}$$

4.2 Health Infrastructure and Poverty

Considering the objective that is to see the impact of Health Infrastructure on Households Poverty in the district Rajanpur, the specified model is given below in functional form as well as in econometric form;

Poverty = f (Area, Age, Education, Income, Assets, Household Size, Health Infrastructure)

$$P_i = b_0 + b_1 AREA + b_2 AGE + b_3 EDU + b_4 PMI + b_5 VOA + b_6 HHS + b_7 HI + u_{2i}$$

4.3 Irrigation Infrastructure and Poverty

Considering the objective that is to see the impact of Irrigation Infrastructure on Households Poverty in the district Rajanpur, the specified model is given below in functional form as well as in econometric form;

Poverty = f (Area, Age, Education, Income, Assets, Household Size, Irrigation Infrastructure)

$$P_i = c_0 + c_1 AREA + c_2 AGE + c_3 EDU + c_4 PMI + c_5 VOA + c_6 HHS + c_7 II + u_{3i}$$

4.4 Security Infrastructure and poverty

Considering the objective that is to see the impact of Security Infrastructure on Households Poverty in the district Rajanpur, the specified model is given below in functional form as well as in econometric form;

Poverty = f (Area, Age, Education, Income, Assets, Household Size, Police Station)

$$P_i = d_0 + d_1 AREA + d_2 AGE + d_3 EDU + d_4 PMI + d_5 VOA + d_6 HHS + d_7 SI + u_{4i}$$

4.5 Communication infrastructure index

Considering the objective that is to see the impact of Communication Infrastructure on Households Poverty in the district Rajanpur, the specified model is given below in functional form as well as in econometric form;

Poverty = f (Area, Age, Education, Income, Assets, Household Size, Communication Index)

$$Poverty = e_0 + e_1 AREA + e_2 AGE + e_3 EDU + e_4 PMI + e_5 VOA + e_6 HHS + e_7 CI + u_{5i}$$

In the above models, AREA shows area of residence of respondent, AGE is age of respondent, EDU is Education of respondent, PMI is Per Month Income of respondent, VOA is Value of assets of Household, HHS is Total family members in household, EI is Energy infrastructure index, HI is Health infrastructure index, CI is Communication Infrastructure index, II is irrigation infrastructure index while SI denotes security infrastructure and Pi shows Households Poverty. While a_i's, b_i's, c_i's, d_i's and e_i's are coefficients while u_i are respective error terms. The description of variables is given in table 1.

Table: 1: List of variables

Variables	Description	Measurement	Expected Relationship
Pi	Poverty Status of Household	Poor = 1 (Income less than $1.90 per day) Non Poor = 0 (Income more than $1.90 per day)	**Dependent Variable**
Independent Variables			
AREA	Area of Residence of Respondent	Urban= 1 Rural= 0	Positive
AGE	Age of Respondent	Years	Negative
EDU	Completed Years of Education of Respondent	Primary Schooling = 5, Secondary Schooling = 8, Matriculation=10, FA/FSc=12, BA/BSc=14, MA/MSc=16, M. Phil. and above=18	Negative
HHS	Family members living in a house	Numbers	Positive
PMI	Per month income of the respondent	Rupees	Negative
VOA	The market value of all Assets	Rupees	Negative
Energy Infrastructure			
AP	Using petrol in the vehicle	Yes = 1 No = 0	Negative
AW	Using woods for cooking	Yes = 1 No = 0	Negative
AE	Using electricity for home appliances	Yes = 1 No = 0	Negative
AS	Using Solar alternative to Electricity	Yes = 1 No = 0	Negative
EI	Energy Infrastructure Index	(AP + AW + AE + AS) / 4	Negative
Health Infrastructure			
AD	Access to Doctor in the Area	Yes = 1 No = 0	Negative
ALD	Access to Lady Doctor in the Area	Yes = 1 No = 0	Negative
AMF	Availability of Medical Facility	Yes = 1 No = 0	Negative
HI	Health Infrastructure Index	(AD+ ALD+ AMF) / 3	Negative
Irrigation Infrastructure			
AIW	Access to Canal Water in the Area	Yes = 1 No = 0	Negative
AUW	Access to Sweet Underground Water	Yes = 1 No = 0	Negative
NWL	Fertile/ No Water Logging Land	Yes = 1 No = 0	Negative
II	Irrigation Infrastructure Index	(AIW + AUW + NWL) / 3	Negative
Security Infrastructure			
SI	Presence of Police stations in the area	Yes = 1 No = 0	Negative
Communication Infrastructure			
ATM	Availability of Cellular/ Mobile phones	Yes = 1 No = 0	Negative
ATS	Availability of Internet/ Social Media	Yes = 1 No = 0	Negative
ATT	Availability of Television	Yes = 1 No = 0	Negative
ATC	Availability of TV Cable Service	Yes = 1 No = 0	Negative
CI	Communication Infrastructure Index	(ATM + ATS + ATT + ATC) / 4	Negative

5.   Results and Discussions

The results of Logistic Regression Model are presented in table 2 in which first column shows the names of variables, second column presents the estimates of Energy Infrastructure Model. Similarly, 3rd, 4th, 5th and 6th column displays the estimates of Health Infrastructure, Irrigation Infrastructure, Security Infrastructure and Communication Infrastructure Models

respectively. In each column, firstly the values of Marginal Effect are given and Coefficients (odd ratios) are given in small brackets for the concerning variables. Moreover, the level of significances is also provided in the results, where *** illustrates that the variable is highly significant at 1 percent level, * demonstrates that the variable is significant at 10 percent while ** exhibits that variable is significant at 5 percent level.

Considering the variable, Area of Living (Urban Area), it is analyzed that poverty is high in urban areas of district Rajanpur as predicted by positive sign of this variable. The reason may be that people belonging to rural areas of this region are mostly settled in foreign countries i.e. Saudi Arabia, Dubai etc. so they are relatively well off as compared to people of urban areas. The people of this area are mostly working in cadre of labor in Dubai or Saudi Arabia or Middle Eastern countries. They send money in form of home remittances. Similar findings were drawn previously by Fan and Chan-Kang (2008). Its marginal value may be interpreted as people living in the urban areas of District Rajanpur are having 30 percent chances of being relatively poor as compared to people living in rural areas. This value is statistically significant in Security Infrastructure model only.

Age is also an important socioeconomic variable which may reduce the poverty. The rationale may be that as households become younger or elder in age, they become more experienced & skilled and can have alternative ways to improve the work, performance and to get good income levels and can reduce their poverty level (Noshad, Amjad, Shafiq, & Gillani, 2019). The negative link is explored between age and poverty in the present study. The marginal values of Age in all the infrastructure models are statistically highly significant which propose that a household may be able to reduce the poverty by about 2 percent as they become one year more aged.

Education is one of the important variables which may reduce poverty. Education makes people more capable of finding opportunities according to their skills and education level. Well education individual can find best opportunity in the job market. It statistical marginal value suggests that poverty may be reduced by approximately 2 percent of the households as the respondent is having an additional year of schooling. Similar findings were already obtained previously by Fan et al. (2004) and Latif (2002).

As regards to Household Size of households, the significant results are obtained in the logistic regression results having positive coefficient values in almost all infrastructure models. Marginal effect value proposes that there are average chances of increasing poverty having 6-7 percent probability with each additional member in the household. Economic validation of these results is that as the household size increases, per head expenses also increases and the income of household distributed in more household members. A similar outcome was obtained in a study conducted by Chaudhry, Malik, and Imran (2006).

A highly significant result of Income variable is obtained with poverty variable in all infrastructure models proposing 2 percent average chances of reduction in poverty status of households as income increases by one thousand in the short run. The findings are economically justifiable as higher/ more income level will improve the economic status of households, they can purchase the necessities of life and can live a healthy and wealthy life with the passage of time (Gillani, Shafiq, & Ahmad, 2019). Similar result of value of assets have been found in the present study with negative coefficient value signifying few/ minor chances of lower poverty in Rajanpur district due to higher value of assets of 1000 rupees in the short-run. The outcome is consistent with the study of Chaudhry et al. (2006).

The major concern of this study is to see the effectiveness of Infrastructure in its various forms i.e. Energy, Health, Irrigation, Security and Communication on Poverty Status of households. The index of Energy infrastructure is obtained by adding the use of petrol, use of wood, use of solar, use of electricity usage. If access to energy is available to all households, so there is possibility of lower poverty in district Rajanpur. There is a possibility of reduction in poverty as access to the parameters considered in energy infrastructure index is enhanced. The value of marginal effect is statistically significant with negative coefficient proposing 86 percent probability of lower poverty due to one index unit increase in Energy Infrastructure. Access to Energy in district Rajanpur will be a source of higher production of goods and

services which may be a source of good income level of people. A similar result was drawn previously of Fan et al. (2004); Latif (2002); Soneta et al. (2011); Thorat and Fan (2007) and Calderon and Servén (2004).

In Health Infrastructure, access to medical facilities, access to doctor and access to lady doctor are considered. There is hypothesis that good Health Infrastructure will provide the people a health life in district Rajanpur, they may work in the workplace with healthy mind and can earn a handsome amount of money to improve the quality of life and reduce the poverty. The negative and statistically significant relationship between health infrastructure and poverty is found in the study. There is a possibility of 78 percent reduction in poverty status if there is one unit increase in Health Infrastructure Index. The economic justification behind the result is explained as if there are more health facilities available to people, it will have positive impact on the health of people. Healthy minds and bodies are able to actively and efficiently take part in economic activities as better human capital (R. Ahmad, Bashir, & Hussain, 2018). Work efficiency in turn increases the labor wages and income of people. Increased income of labor will reduce poverty. A similar finding was concluded by Seetanah, Ramessur, and Rojid (2009) and Hao, Shah, Nawaz, Nawazc, and Noman (2020).

Table 2: Energy Infrastructure and Poverty

Variables	Energy Infrastructure	Health Infrastructure	Irrigation Infrastructure	Security Infrastructure	Communication Infrastructure
Constant	---- (8.75)***	---- (10.99)***	---- (9.55)***	---- (9.79)***	---- (10.90)***
Area	0.1388 (0.70)	0.1779 (0.90)	0.0512 (0.12)	0.3042 (1.54)**	0.2131 (1.08)
Age	-0.0152 (-0.08)***	-0.0162 E(-0.08)***	-0.0167 (-0.09)***	-0.0147 (-0.07)***	-0.0242 (-0.12)***
Education	-0.0145 (-0.07)	-0.0251 (-0.13)*	-0.0298 (-0.13)**	-0.0225 (-0.11)	-0.0147 (-0.07)
Household Size	0.0688 (0.35)***	0.0675 (0.34)**	0.0699 (0.33)**	0.0636 (0.32)**	0.0797 (0.40)**
Income	-0.0204 (-0.10)***	-0.0230 (-0.12)***	-0.0226 (-0.10)***	-0.0224 (-0.11)***	-0.0205 (-0.10)***
Value of Assets	-0.0034 (-0.02)***	-0.0036 (-0.02)***	-0.0036 (-0.10)***	-0.0030 (-0.02)***	-0.0024 (-0.01)**
Energy	-0.8620 (-4.37)*				
Health		-0.7861 (-3.99)***			
Irrigation			-0.0528 (-0.41)		
Security				-0.7812 (-3.96)***	
Communication					-0.9329 (-4.73)***
McFadden R²	0.7667	0.7894	0.7571	0.7994	0.7941
LR Statistics	264.748	272.5959	261.4382	276.0633	274.2141
Probability	0.00	0.00	0.00	0.00	0.00
Mean Dep. Var.	0.7357	0.7357	0.7357	0.7357	0.7353

Source: Author's calculations using Data of District Rajanpur collected through Survey method

The negative linkage is found between irrigation infrastructure index and poverty Soneta et al. (2011) and Thorat and Fan (2007). However, the negative coefficient value is statistically insignificant proposing that access to canal water, access to sweet underground

water and good/ fertile land can improve the economic status of households and reduce the poverty of households.

To consider the security infrastructure in the study, the study estimates the Security Infrastructure Index based on the presence of Police Station in the area of respondent. The result of security infrastructure is highly significant with negative coefficient value which postulates that there are chances of 78 percent decline in poverty if there is increase in the index value of security infrastructure. The economic justification of the result is that law and order condition largely affect the business activities in any area. If law and order/ security situation is trust-worthy then trust level of business firms usually increase so participation in business activities also increases that may be a source of more job opportunities and so reduction in level of poverty occurs (Amjad, Ehsan, Amjad, & Gillani, 2021).

Communication Infrastructure is developed by considering the Access to Social media/ Internet, Access to TV, Access to TV Cable and Access to Mobile usage. This variable is added to check the overall impact of communication infrastructure on poverty. The findings show inverse relationship between Communication Infrastructure index and poverty with statistically significant marginal effect value. It suggests that Communication Infrastructure may create the 93 percent opportunities/ possibilities of reducing poverty in the short-run in the study area. Economic validation for this outcome is the revolution in communication sector which has largely influenced the living standard of present world with the help of internet, social media and TV/ Cable. These have been proved to be the major sources of enhancing per capita income and reducing Poverty. Similar outcomes have been drawn previously by Calderon and Servén (2004); Fan et al. (2004); Soneta et al. (2011); Thorat and Fan (2007) and Seetanah et al. (2009).

6. Conclusion and Policy Recommendations

Pakistan is facing serious issues of lack of infrastructure i.e. Energy, Health, Irrigation, Security and Communication since last few years. These types of infrastructure i.e. Energy, Health, Irrigation, Security perform fundamental role in the growth and development in Agriculture, Industrial, Growth and hence poverty reduction.

This study attempts to find out the impact of infrastructure (Energy, Health, Irrigation, Security and Communication) on poverty alleviation is district Rajanpur, Punjab, Pakistan. For this purpose, researchers collected data through survey method from 300 households of district Rajanpur using simple and stratified random sampling technique. For the purpose of analysis, logistic regression technique has been applied.

The outcome of the study concluded that energy infrastructure, health infrastructure, irrigation infrastructure, security infrastructure and communication infrastructure have been proved to reduce poverty from District Rajanpur. Moreover, other socioeconomic and demographic variables are also contributing to reduce poverty like people are poorer in urban areas as compared to rural areas; large household size also shows household status to be poor. Whereas, age, education, income and value of assets are the variables show low poverty status of households of district Rajanpur.

For the growth of economy, the provision of basic infrastructure is necessary for urban as well as in rural areas of south Punjab. Government needs to provide soft loans for the domestic as well as for commercial customers to reduce the load from electricity consumption towards solar system. There is also need to construct hospitals having all basic and advanced facilities in tehsil level to compete private sector. Irrigation system needs to be maintained well with the availability of clean drinking in rural areas especially. The provision of 5G internet technology should be ensured in rural areas as well so that online business activities may be started at village level which may increase the income level and reduce the poverty in rural areas of Pakistan.

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