

## **Influence of Transportation and Accessibility to Basic Services in the Socio-Economic Development in the Province of North Cotabato**

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**Abstract:** Transportation and accessibility to basic services provided in a province is of great importance in municipal or provincial and even in regional planning division to insure that these services can reach and serve the community. Transportation services in a province can significantly influence its socio-economic status. This study was aimed to establish the relationship between transport services and the poverty incidence among families in North Cotabato Province. This study aims to determine if (a) the road access and access to public transportation have relationships to the total enrollment of public elementary and secondary schools; and (b) what transport variables can influence the socio-economic development of the province. Analysis showed the significant influence of distance of public elementary schools to its enrollment. Access to basic services can significantly influence the poverty level of the province. The location of schools, hospitals and economic centers in terms of its distance from the population center is of great importance to maximize its service area. Furthermore, the quantity of road access needs to grow parallel with the land area to lessen the poverty incidence among families. These results are useful for future planning to alleviate poverty in the province.

**Keywords:** Transport, Socio-economic profile, shortest path, road density, road pavement

### **1. INTRODUCTION**

The province of North Cotabato is located in Region XII composed of 17 municipalities and one city with a total of 543 barangays. With more than 1.2 Million residents (Phil. Statistics Office, Census of Population and Housing, 2010), home of various tribes with diverse cultures, the province is continuously aspiring to be the best province in the region. The province is an agricultural based community producing rice, corn, banana, rubber, oil palm and vast variety of fruits such as mangosteen, durian, lanzones, rambutan, water melon and pomelo. Famous tourist destinations in the province include the Majestic Mount Apo, the Asik-asik Falls, Pisan Caves and New Israel Eco-Park. However, the poverty incidence among families almost doubled from 25.6% in 2006 to 44.8% in 2012 (Province of Cotabato Socio-economic Profile, 2015).

Poverty can be attributed to several factors. Factors being considered are the availability of public transportation, quality and quantity of road access, and location of basic services such as education, health and economic centers in terms of access distance.

Transportation is vital in the socio-economic development of the province. This study aims to determine the influence of transportation services in the province on its socio-

economic status develop a regression model to establish the variables that can alleviate poverty in the province.

## **2. METHODOLOGY**

### **2.1 Data Gathering**

Mode of transportation and available public transportation were gathered through field surveys, interviews as well as actual observation on the field. The shortest path to public elementary schools and secondary schools were estimated using the transportation modeling software, EMME4. Maps were generated using QGIS.

Socio-demographic and economic profile were gathered from the socio-economic profile of the Province. Data on population was taken from Philippine Statistics Office, Census of Population and Housing (2015), while data on education were from the Department of Education Cotabato Division and Kidapawan City Division (2017). List of licensed government and private hospitals as of 2011 was from the Department of Health.

### **2.2 Statistical Analysis**

Significant relationships between variables were determined using Chi-square Test and Linear Regression Model. For school population, sum of enrollment were taken for each barangay and was analyzed using Cross Tabulation. Chi-Square determines the significant influence between variables.

## **3. LITERATURE REVIEW**

Transportation services can be associated with the economic development of a region. Poor public transportation services are critical obstacles in the improvement of the socio-economic conditions of persons below poverty line (Sanchez, 2008)

Increase in transportation is important for alleviation of poverty, especially in developing countries. Sustainable mobility requires increase access to goods, services, education and economic opportunity (Wachs, 2010). Government investments on education and rural infrastructure such as road, have substantial impact in reducing rural poverty (Fan, et al., 2002).

Transport infrastructure acts as constraint on the local economy, which may result in low competitiveness relative to adjacent regions (Banister and Berechman, 2000). Improving transportation services in rural areas need to be given priority in order to provide residents opportunity to change their living conditions and overcome poverty. ( Ripplinger and Wang, 2007).

Access to basic services is very essential in the economic development of a developing countries. Education can be considered as an important reducing element of high poverty (Mihai, et al., 2015). Less health services reaches the poor communities. There is a need to develop strategies on delivery methods and educating the poor about healthy behavior (Wagstaff, A., 2002). Poverty rate is higher in rural areas far from metropolitan areas (Partridge and Rickman, 2008).

Geographic information system can be utilized to map poverty and for geographical targeting to allocate resources for poverty alleviation (Bigman and Fofack, 2000).

## 4. DISCUSSION

### 4.1 Socio-Demographic Profile

The province has a total of 1,379,747 populace as of 2015 (Phil. Statistics Office, Census of Population and Housing, 2015) with an increase of 12% from 2010. The most populated municipalities are Pikit, Midsayap and Kidapawan City while Antipas has the least population. As expected, large population can be found along Davao-Cotabato highway, where mobility and accessibility to transport services is highly concentrated.

Based on the land area, Midsayap is the most dense municipality with 649.89 persons per square kilometer and Magpet as the sparsely populated at only 77.78 persons per square kilometer.

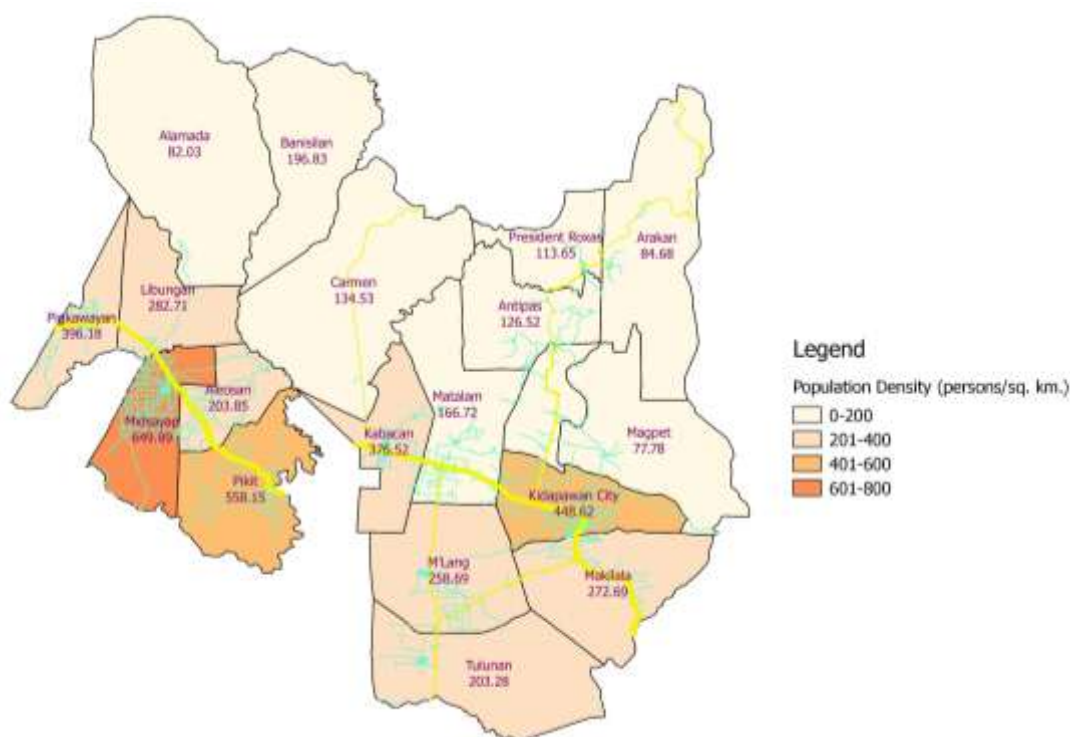


Fig. 1. Population Density of each municipality

### 4.2 Public Elementary Schools, Secondary Schools and School Transportation

Table 1 shows that the total enrollment in public elementary schools is significantly affected by the distance of the school to population centers. Most of the school with less than 200m path to school has the highest enrollments and least enrollment in schools with more than 500m distance. Large number of schools has total enrollment of 6,000-8,000 students, with the largest enrollment was in Kidapawan City with almost 18,000. The farther the school to population centers, the lesser the enrollment in public elementary schools.

The total enrollment in secondary schools was not affected by the distance of school to population centers. However, enrollment in secondary school is much lower compared to the expected graduates from elementary schools. This means that many elementary graduates did not proceed to secondary schools, only those who may be academically motivated proceed to secondary schools no matter how far it is.

Table 1. Correlation between the shortest path to public elementary schools and the total enrollment of public elementary and secondary schools.

	Elementary Schools			Secondary Schools		
	Value	df	Asymp. Sig. (2-sided)	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.821 <sup>a</sup>	36	.043	25.893 <sup>a</sup>	28	0.579
Likelihood Ratio	37.627	36	.395	27.584	28	0.487
Linear-by-Linear Association	0.482	1	.488	1.433	1	0.231
N of Valid Cases	18			18		

Significant at 5% Level

The mode of public school transportation differs with the location of schools. Schools located near the Davao-Cotabato National Highway are accessible by bus, L300 van, PUJ and *tricycle*. Local name for PUJ is *multicab*, and *tricycle* is a motorcycle with a cab attached on its side. While the common public transportation in barangays is *habal-habal/skylab*, a motorcycle with attached wooden piece at the back as an extension to carry more passengers. In mountainous areas that are not accessible by motorcycles, horses were used to transport students, while in lowland areas they are using motorized boats. Motorized boats are locally called *pump boat*.



Fig. 2a



Fig. 2b



Fig. 2c



Fig. 2d



Fig. 2e



Fig. 2f

Fig. 2. Mode of transportation. (2a) multicab at Carmen, (2b) tricycle at Kidapawan City, (2c) habal habal at Pigcawayan, (2d) habal habal station at Aleosan, (2e) pump boat at Barangay Sambulawan, Midsayap, (2f) pump boat at Barangay Paidu Pulangi, Pikit

### 4.3 Socio-economic Status

The province has its over-all poverty incidence of 44.8% in 2012, which is ranked second highest in Region XII as shown in Table 2. The poverty incidence among families in the province is quite alarming, which increased from 2006. Poverty incidence among families gives the percentage of population whose annual per capita income falls below the annual per capita poverty threshold of Php 18,737 for Region XII in 2012.

Table 2. Region XII Poverty Incidence among Families (%)

Province	2006	2009	2012
North Cotabato	25.6	23.4	44.8
Saranggani	41.7	47.5	46.0
South Cotabato	26.1	25.7	25.8
Sultan Kudarat	44.3	41.6	40.4
Cotabato City	27.5	29.9	34.5

Carmen, Matalam, Pigkawayan, President Roxas and Tulunan increased their poverty incidence from Mildly Poor in 2006 to Moderately Poor in 2012. While Kidapawan City has a poverty incidence in 2006 of Least Poor and became Mildly Poor in 2012. None of the municipality in the province had improved its poverty incidence from 2006 to 2012. Moderately poor municipalities has poverty incidence of 40.01% to 60%, while mildly poor has poverty incidence of 20.1% to 40%.

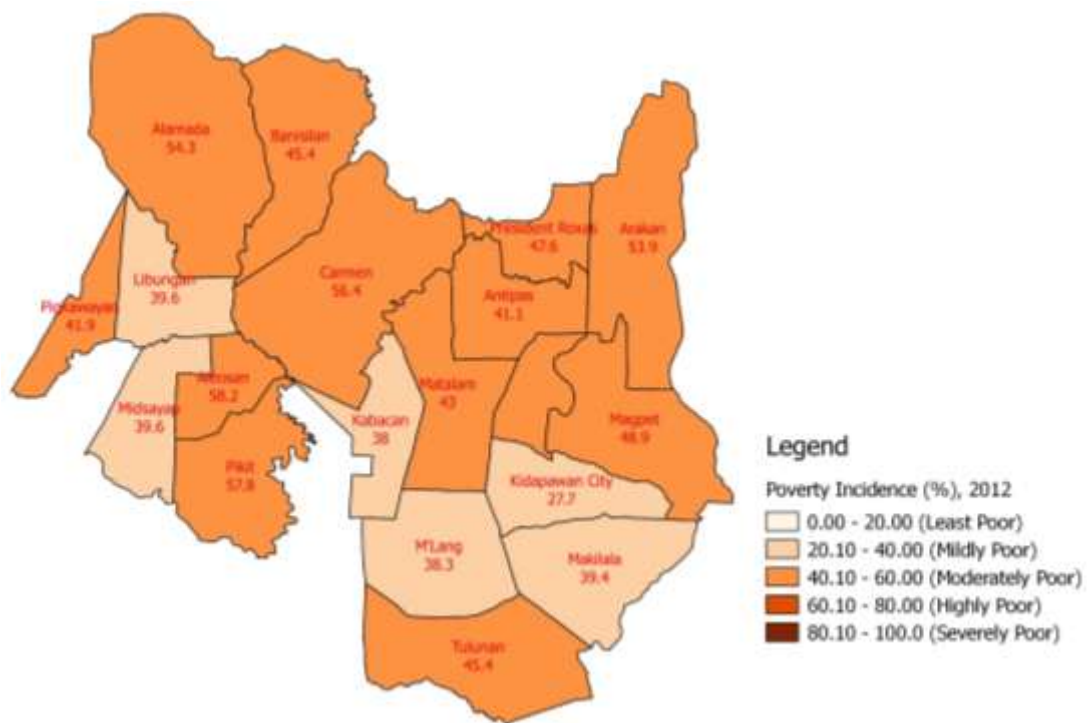


Fig. 3. Poverty incidence among families in 2012 (Province of Cotabato Socio-economic Profile, 2015)

#### 4.3.1. Shortest Path to Public Secondary Schools

Socio-economic development can be supported by strengthening education, especially in provinces where human capital is one of the main contributors in the development process. Strengthening education does not only pertains to the quality of education and state of the art facilities provided in schools, but transportation services that provide access to these schools that exist in the community especially in rural areas.

Statistical analysis (Table 3) reveals that distance of public secondary schools has a significant contribution to improve the poverty incidence of the province. Most secondary schools in municipalities with “Mildly Poor” poverty incidence are within 3km from barangays, while in those municipalities with “Moderately Poor” poverty incidences are within 5km.

Table 3. Correlation between the shortest path to public secondary schools and poverty incidence.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.768 <sup>a</sup>	4	.029
Likelihood Ratio	12.674	4	.013
Linear-by-Linear Association	7.307	1	.007
N of Valid Cases	18		

Significant at 5% Level



### 4.3.2. Shortest Path to Hospitals

From the list of licensed government and private hospitals of the Department of Health, there are ten (10) hospitals in the province as of 2011. Figure 4 shows the hospital service area, serving not only the community in its location but also nearby municipalities. Strategic location of hospitals in terms of its distance from the community is very important to maximize the services delivered to the community.

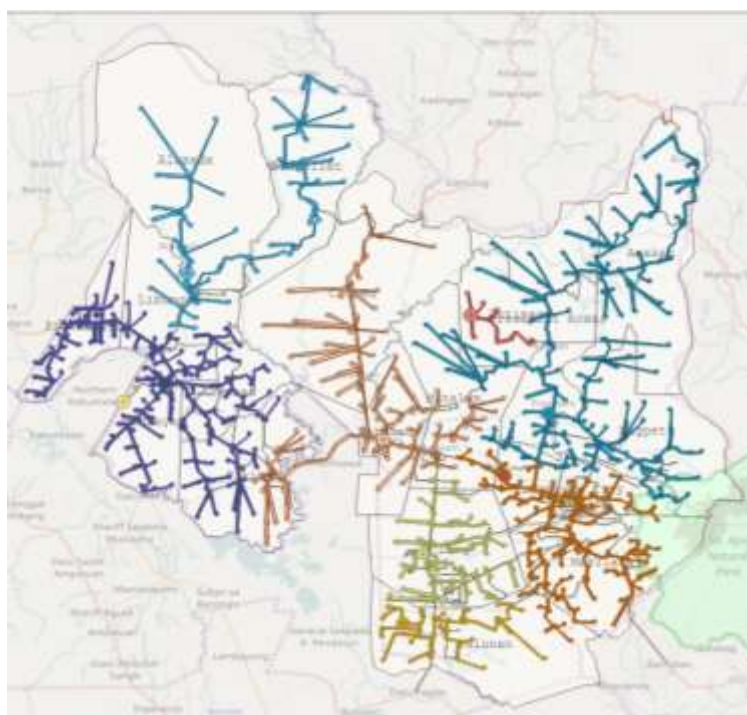


Fig. 4. Shortest path from population centers to hospitals

Correlation between the shortest path from the population centers to hospitals shows significant difference on poverty incidence. Municipalities with poverty incidence of “Mildly Poor” are located within 15 km from hospitals as compared to those with poverty incidence of “Moderately Poor” that are located 15-30 km away from hospitals. Providing hospitals nearer to the community could help in alleviating poverty level.

Table 4. Correlation between the shortest path to hospitals and poverty incidence.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.571 <sup>a</sup>	2	.023
Likelihood Ratio	8.260	2	.016
Linear-by-Linear Association	4.690	1	.030
N of Valid Cases	18		
Significant at 5% Level			

### 4.3.3. Shortest Path to Economic Centers

Economic centers in this study were identified as municipalities with significant number of business and commercial establishments in the province. There are four (4) municipalities identified: Midsayap, Kabacan, Mlang and Kidapawan City. The figure5 shows that people from Arakan, Banisilan, Pigkawayan and Aleosan may travel to Midsayap, being the nearest, to purchase their necessities. Carmen, Pikit and Matalam may travel to Kabacan, while Tulunan may travel to Mlang. Kidapawan City, considered as the center of economic activities in the province, is serving Arakan, Makilala, President Roxas and Antipas.

Figure 5 shows the extent of service area of each identified economic center. Kidapawan City has the largest service area followed by Midsayap.

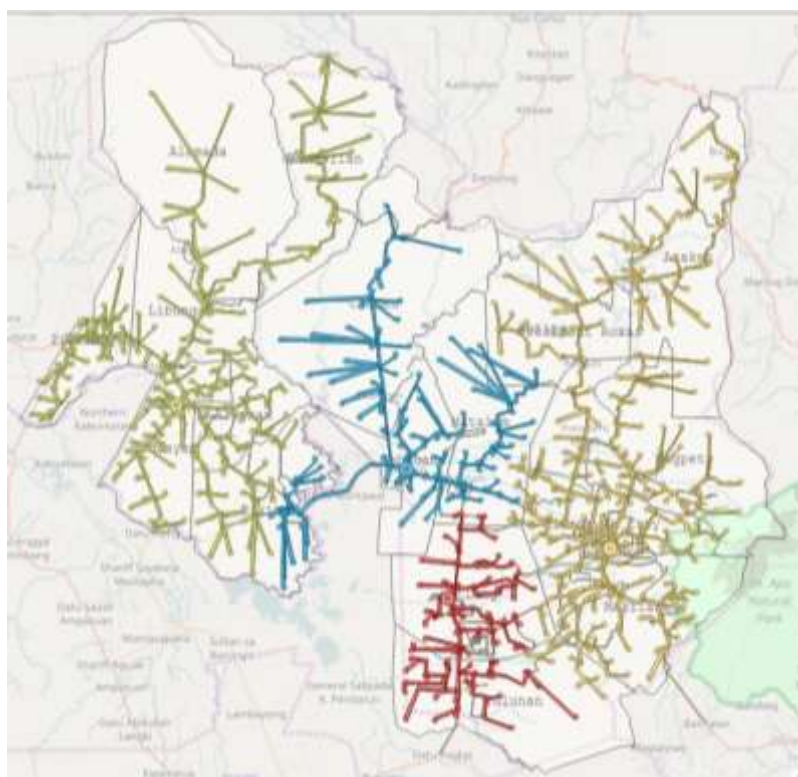


Fig. 5. Shortest path from population centers to economic centers.

Analysis as shown in Table 5 reveals that the shortest path to economic centers significantly influenced the poverty level of the province. Municipalities with “Mildly Poor” poverty incidence are located within 20km from economic centers while those with poverty incidence of “Moderately Poor” are located within 20-30km away from economic activities.

Table 5. Correlation between the shortest path to economic centers and poverty incidence.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.600 <sup>a</sup>	6	.050
Likelihood Ratio	16.184	6	.013
Linear-by-Linear Association	6.227	1	.013
N of Valid Cases	18		
Significant at 5% Level			



4.3.4 Road Pavement and Road Densities

Road pavement in this analysis was classified as concrete, asphalt, gravel and earth. Regression analysis was done to develop a regression model on the influence of road pavement in terms of its length to the poverty incidence of the province. The total length of road pavement used in the analysis includes provincial roads, municipal roads and barangay roads.

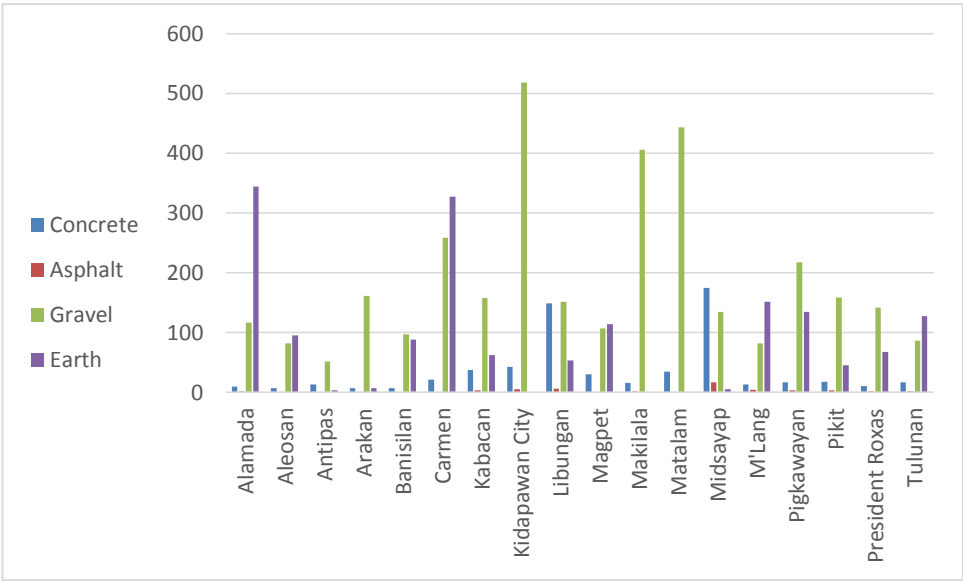
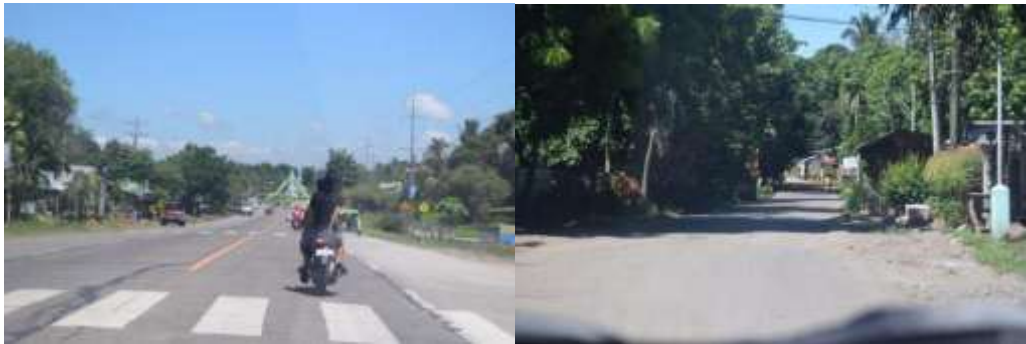


Fig. 6. Road Pavement length in kilometers (Socio-Economic Profile, Province of North Cotabato 2015)



6(b)



6(c)

Fig. 6. Road Pavement. (6a) concrete road at Matalam, (6b) asphalt road at Libungan, and (6c) gravel road at Alamada

Road densities were computed based on the land area and population. Figure 7 shows that Libungan has the densest road in terms of land area, and Kidapawan City in terms of population.

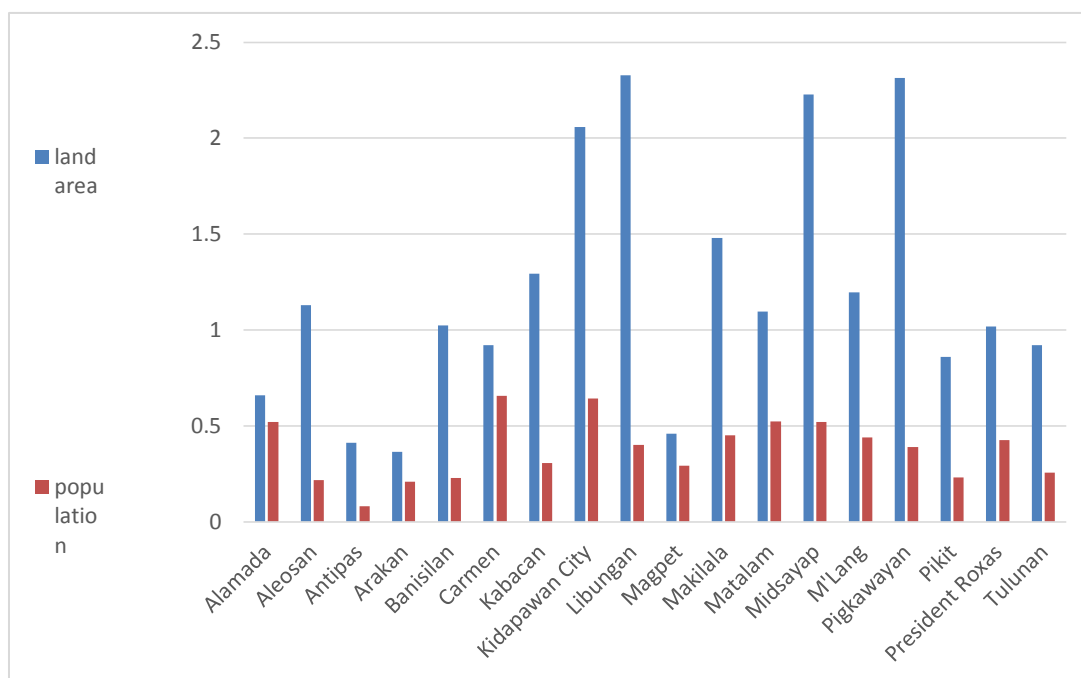


Fig. 7. Road Densities based on land area (length/land area) and population (length/population).  
(Socio-Economic Profile, Province of North Cotabato 2015)

Regression analysis using stepwise method was used where variables with lesser influence were eliminated. The analysis revealed that road density in terms of land area significantly influence the poverty incidence of a municipality at 5% level of significance. The model reveals that an increase in road density in terms of municipality land area, decreases its poverty incidence.

Table 6. Regression analysis between poverty incidence of 2012, road pavement and road densities.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	58.054	3.281		17.693	.000
Road_den_area	-9.717	2.416	-.709	-4.021	.001

Significant at 5% Level,  $R^2 = 0.472$

$$PovertyIncidence = -9.717 RDLandArea + 58.054$$

## 5. SUMMARY OF FINDINGS

Initial findings of this study shows the importance of transportation services and its role in the economic development of Cotabato Province.

Distance of public schools to the population center has influence to the total enrollment in elementary schools, while it has no effect in the total enrollment of secondary schools. However, enrollment of secondary schools is far beyond the expected number of enrollment based on the expected graduates from elementary schools, this is because not all elementary graduates proceeds to secondary.

Poverty incidence among families is significantly influenced by the shortest path of secondary schools, hospitals and economic centers. Poverty incidence of farther path is higher compared to municipalities nearer to these services.

The location of schools, hospitals and economic centers in terms of its distance from the population center is of great importance to maximize its service area. The result could be of help for future planning.

Road density in terms of land area is highly significant variable to help reduce poverty incidence in the province. Increasing the road density in terms of municipality land area will tend to decrease its poverty incidence.

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