THE IMPACT OF TRAVEL PATTERN ON RURAL TRANSPORT DEVELOPMENT

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INTISARI

Jumlah penelitian di Indonesia dalam bidang transportasi perdesaan masih sangat terbatas. Kondisi ini tidak menguntungkan mengingat wilayah perdesaan yang ada sangat luas. Banyak masalah transportasi terjadi di berbagai wilayah perdesaan yang menyebabkan potensi sumber daya yang ada tidak dapat di kelola secara optimal. Program-program pembangunan perdesaan tidak selalu membawa perbaikan besar bila jaringan dan layanan transportasi perdesaan tidak tersedia. Transportasi memungkinkan jasa dan barang dapat diberikan kepada masyarakat perdesaan dan dapat mendukung pencapaian kesejahteraan. Penelitian ini mencoba menjawab sejumlah pertanyaan yang berkaitan dengan pola perjalanan dan dampaknya terhadap pengembangan transportasi perdesaan. Perjalanan terbanyak yang dilakukan masyarakat perdesaan adalah perjalanan dengan jarak dan waktu pendek dengan tujuan bekerja di sawah serta pergi ke sekolah dengan bersepeda atau berjalan kaki. Namun demikian kebutuhan potensial terhadap layanan transportasi cukup tinggi. Dengan demikian dalam kaitan dengan pengembangan transportasi diperlukan peningkatan layanan angkutan umum perdesaan baik dengan layanan formal maupun informal.

KATA KUNCI: perjalanan perdesaan, pola, pengembangan transportasi

INTRODUCTION

Enhancing the accessibility for the people in rural areas has been the agenda of rural development for some time all over the developing world. This regards to generally very poor accessibility mainly due to inadequacy of transport infrastructure, low income of rural community and lack of means of transport. To understand the definition of rural area, Tolley and Turton (1997) defines rurality in terms of population density, settlement pattern, economic structure and aspects of remoteness and accessibility. In most developing countries, at least two-thirds of the population can still be classified as rural, although the density varies considerably according to the level of economic activities.

Conventionally, planned and designed rural accessibility programs have focused on infrastructure construction and lack of an adequate consideration for rural communities' needs or aspirations. Worldwide experiences have also shown that poor rural transportation has dis-benefited women for carrying heavier, often by head-loading, and farther for collecting firewood and water. Women in developing countries spend more time in transport activities than men.

This consumes a relatively high proportion of their day. Women typically work 12-13 hours more per week than men in Africa, Asia, and the Pacific (Fernando, 2002)

Rural community is accounted for about 70% of the Indonesian people (Magribi, 2004). Considering their large number and the wealth of natural resources, when this potential is comprehensively developed, it will give a great contribution to economic development not only at the local level but also at the regional and even national level. The major problem in the current rural development is poor accessibility and mobility between rural areas or between rural and urban ones. Such a condition has direct negative impacts on movement from production centers to distribution places, and it is difficult for goods and services to penetrate village centers, let alone to reach outlying areas. Identifying a rural travel pattern and trip generation will be significantly useful for predicting rural transport demand and reviewing the problems.

Despite the neglect of rural public transport services in the literature on developing countries, the Indonesian situation as recorded in the national statistics reveals a significant increase in the availability of public transport services over a twenty-year period (Johnston, 1998). Census data from 1990 demonstrate that few rural households own motorized vehicles. The 1993 *Potensi Desa* data indicate that a wide range of vehicles including human-, animal- and motor-powered, as well as land- and water-modes have been used for public services. The availability of such transport modes has promoted particular effects on travel pattern and generation. These features greatly influenced the development of a rural transport system. Transport improvement has provided a greater opportunity to access economic, social and education facilities. In the development context, this issue is very critical since it covers a fundamental aspect of rural revitalization. The occurrence of urbanization is by and large due to the inability of a rural area to provide economic and social wealth to its residents

This paper investigates the rural travel pattern in Indonesia with a gender perspective and specifies the trip generation model in Trucuk subdistrict, Klaten regency, Central Java Province, Indonesia. It also analyzes the rural transport problems and the effects of rural trip generation on transport development.

METHODOLOGY

1. Study area

This research is carried out in 3 villages of Trucuk subdistrict , namely Karangpakel, Kalikebo and Sajen. The subdistrict's Trucuk population is 79,198 in year 2005 covering 18

villages. These three selected villages are the most populated ones in that subdistrict. Land use and population density in the areas can be seen in the following table:

Table 1. Study area characteristics

Village	Non agricultural area (Ha)	Agricultural area (Ha)	Total area (Ha)	Population (person)	Total pop./non agricultural area (personHa)
Kalikebo	164,6	93,5	258,1	7064	42,92
Karangpakel	179,7	110,5	290,2	5205	28,96
Sajen	95,2	88.8	184,0	6079	63,86

The distance of each of the villages to the sub district's capital is 5.8 km from Karangpakel, 2.6 km from Kalikebo and 3.7 km from Sajen. Such distances are assumed to be moderate distances to the nearest activity centers. Such areas are predominantly non-agricultural which reflects the alteration from agricultural villages to non agricultural ones and also indicates the diversity of people's occupations. In those areas, 31% of the population are unemployed, 14 % entrepreneurs, 14% students, only 9% farmers and the others (32%) are employees, construction laborers and civil servants. The very small percentage of farmers indicates the nature of predominantly non-agricultural areas.

2. Surveys

Some surveys have been conducted in 2005 to observe the condition of the research location and to collect data by an institutional survey, field observation and interview. The purpose of institutional survey is to collect secondary data such as location maps, demographic data and transport system data. Field observation aimed at transport infrastructure inspection, identification of public service location and distance of settlement location to public service centers. Interviews with 150 respondents representing 150 households were conducted to collect data on: (a) travel characteristics of each household which consist of trip frequency and destination, distance, travel time, means of transport, weight of load and transport cost, (b) the most demanded transport facilities, (c) transport service demand and transport system improvement

RURAL TRAVEL PATTERN

Barwel (1996) explains that a travel pattern comprises trip frequency, trip time, and means of transport used, load carried and responsibility for several trip purposes. It is also divided into three criteria: first, the transport travel patterns for internal and external purposes; second, key

transport tasks undertaken (the collection of water, trips to grinding mill, etc.); third, the intra family division of transport and travel activities.

The rural travel pattern generated by the households in Trucuk subdistrict is indicated by the number of trips per week, travel destination, travel purposes, means of transport, load weight carried, etc. Before analyzing the pattern, it will be important to review the characteristics of the respondents' income, vehicle ownership and occupations, which are presented in the following table.

Table 2. Characteristics of the respondents

Factors affected trip characteristics	Analysis results		
	Kalikebo village	Karangpakel vill.	Sajen village
Income level/month Vehicle ownership Occupation	(51%) < USD 40 (59%) bicycle (32%) unemployed (17%) entrepreneur	(45%) < USD40 (51%) bicycle (28%) entrepreneur	(63%) < USD 40 (67%) bicycle (33%) unemployed (14%) students

The majority of respondents in these three villages have a monthly income of below USD.40 with bicycle as the dominant vehicle. The proportion of vehicle ownership in the three villages indicates that 5 % of the people are car owners, 36% motorcycle owners, and 59% bicycle owners. This means that motorcycle ranks second in the vehicle ownership. This condition reflects that the use of motorized vehicles have prevailed in rural areas and there is a similar trend of urban traffic characteristic which is dominated by motorcycle for about 75% of total vehicles in the traffic stream. The dominant type of occupation of rural people is represented by the unemployed, entrepreneurs and students; meanwhile only 9% of the people in Kecamatan Trucuk were farmers. This proved that the rural areas were not purely agricultural.

Travel patterns greatly affect the number of trips generated, because they reflect the magnitude of trips made in a certain zone. All rural travels in the three villages begin from home and end at different destinations. The biggest proportion of trip destination is to school (29%) and followed by to rice fields (26 %). The other destination is market 19%; other villages 13% and the rest are other cities, governmental offices, factory etc. More than 67, 5% travel distance is less than 1 km and around 12,5 % is 1 – 5 km. Such travels are categorized as short travel that require 5 – 15 minutes long. It also indicates that internal travel is more than the external one. Internal travel usually covers some activities like going to the rice field, to the market, to a place of worship, to school and to other places which are close to people's settlement or in the inner village area. The longest time taken by 23.39 – 33.61% of the people to reach their travel

destination ranges from 5 - 15 minutes, which shows that their trips are within close proximity. Travel purposes are mostly for working 30%, education (25%) farming 18%, shopping 14% and the rest are trading and others. The main means of transport is bicycle followed by motor cycle, and the rider typically carries a load of 0.25 kg. The time of trip making is generally in the morning at 07.00 and go back home in the afternoon at 12.00 – 14.00. Morning activities start at 6.00 – 8.00 a.m. and finish at 12.00 – 14.00. As for people who cultivate farm, they usually go to the rice field at 6.00 and go back home at 12.00. After 13.00, they continue working until 18.00. The rural people's characteristics related to travel patterns are presented in Table 2.

Table 3. Rural travel pattern in Trucuk sub district

No.	Factors affecting Travel pattern	Villages		
		Kalikebo	Karangpakel	Sajen
1.	Trip origin – destination a. Origin b. Destination	(100%) home (26%) school	(100%) home (26%) farm	(100%) home (29%) school
2.	Travel distance & duration a. distance b. time duration	(74,6%) < 1km (23,39%) 10 minutes	(67,5%) < 1km (33,61%) 15 minutes	(78%) < 1km (28,57%) 5 minutes
3.	Trip frequency	(35,1%) 11-15 times/week	(36,4%) 16-20 times/week	(34,7%) 6-10 times/week
4.	Trip purpose	(27%) working (27%) education	(30%) working	(35%) working
5.	Means of transport	(46%) bicycle	(46%) Motorcycle	(40%) bicycle
6.	Load carried weight	0,25 kg	0,25 kg	0,25 kg
7.	Travel time a. out bond b. in bond	(27,42%) 07:00 (17%) 14:00	(20,17%) 07:00 (17%) 12:00	(27,68%) 08:00 (15,18%) 12:00

The travel pattern in the three villages is rather similar. It can be referred to the slight percentage difference of the travel characteristics. Most travels, indicated by the highest percentage, are conducted for working and education activities for short distance (1-5 km) with small load carried. Such pattern is due to the availability of public facilities in closer distance to their houses, such as market, government office, schools and medical service center, so that they do not have to make longer travel and have longer travel time . It is also reflected in the means of preferred transport which is usually used for short distance.The types of people's occupation, i.e.

entrepreneurs, low income laborers and jobless people could be associated with the uncertain amount of working time and small load weight.

GENDER PERSPECTIVE IN TRAVEL PATTERN

Rural household transport indicates low levels of transport ownership and significant time and energy required for transport activities. Approaches to alleviate rural transport constraints focused particularly on the constraints faced by women in accessing improved means of transport and men's tendency to appropriate the modes of transport (Bryceson, et.al, 1993). The characteristics of rural women's travel pattern indicate evidence for some constraints they faced. Based on age proportion of male and female respondents there are 17.6 % of age under 19, 27.7% of 20 – 29 years, 38.4 % of 30 – 49 years and 16.3% of the minimum age of 50 years. Several characters of their trip are presented in the following tables.

Table 4. Trip frequency per week by male and female

Trip frequency/week	Male (%)	Female (%)	Total (%)
0	19.4	19.2	38.6
1 – 5	7.8	9.2	17.0
6 – 10	22.8	21.6	44.4
Total	50	50	100

In general, trip frequency per week is dominated by those of 6 -10 followed by 0. It indicates that some villagers make travel a lot especially for working or absolutely do not travel. Comparing to the female and male perspective, trip frequency for both are relatively similar, however their trip characteristics are important to investigate the problem they face.

Table 5. Average trip distance traveled by male and female

Average trip distance	Male (%)	Female (%)	Total (%)
≤ 500 m	31.3	31.3	62.6
0.51 – 1.00 km	2.8	4.5	7.3
1.1 – 5.0 km	6.0	8.7	14.7
5.1 – 10 km	5.9	3.4	9.3
> 10 km	4.0	2.1	6.1
Total	50	50	100

The majority of villagers (62.6%) make less than 500 m trip distance or short distance that usually classified as internal trip, while only 15,4% make trip over than 5 km (longer distance). More male make long trip (over 5 kms) than female.

Table 6. Average load weight carried by male and female

Average load weight	Male (%)	Female (%)	Total (%)
0 – 1.0 kg	44.3	41.7	86.0
1.1 – 5.0 kg	1.6	5.5	7.1
5.1 – 10.0 kg	1.7	1.2	2.9
> 10.0 kg	2.4	1.6	4.0
Total	50.0	50.0	100.0

The travel patterns of male and female are somewhat similar for trip frequency generated per week, average trip distance and average load weight. The significant differences are clearly indicated by travel destination and means of transport used.

Table 7. Travel destination by male and female

Destination	Male (%)	Female (%)	Total (%)
Factory	2.3	1.6	3.9
Village office	2.0	0.5	2.5
Market, small shop	4.2	**17.2**	21.4
School	11.0	14.9	25.9
Farm	10.1	6.2	16.3
Other village	8.7	3.9	12.6
Other city	10.4	5.1	15.5
Others	1.3	0.6	1.9
Total	50.0	50.0	100

Women's travel destinations are primarily to the market and small shops which pointed out that those travels are for buying daily needs and selling something in the traditional market. Women are the ones who are mostly involved in traditional market activities in Indonesia.

Table 8: Means of transport used by male and female

Means of transport	Male (%)	Female (%)	Total (%)
Walking	8.0	9.5	17.5
Bicycle	15.8	**22.9**	38.7
Motorcycle	20.1	15.8	35.9
Car	1.4	0.3	1.7
Public transport	4.7	1.6	6.3
Total	50	50	100

The majority of transport mode used by women is bicycle followed by motorcycle and walking. Meanwhile the men used motorcycle and followed by bicycle and walking. These

findings reveal that women still have a greater burden in making movement compared with men in terms of the percentage of means of transport used, which is mainly non-motorized vehicle. In conducting activities which need transport service support, women required more energy, because the more comfortable and faster means of transport have been used by men.

TRIP GENERATION

Trip generation designates the number of trips made by a household in a week. In this research, total trip generation in three villages is classified into 5 groups as shown in the following Table 9.

The greatest proportion (34.7%) of trip generation is 11 – 15 trips per week and the smallest (8.7%) is lower than 5 trips per week. It indicates that the majority of households make at least 2 trips per day. Rural people generally make trips to the nearest town centre for working

Table 9. Trip generation characteristics

Trip generation group (trips/week)	Frequency	Percentage (%)
<5	13	8,7
6-10	44	29,3
11-15	52	34,7
16-20	20	13,3
>20	21	14,0
Total	150	100,0

According to Willumsen and Ortuzer (1990), the choices of variables used to predict (household) trip generation rates typically include household structure, family size, vehicle ownership, income, etc. The number of trips made by rural people is modeled using a mathematical model with Y (dependent variable) as the number of generated trip per household and X (independent variables) as several predicted variables which affected the dependent variable. At the beginning of the modeling process, the number of greatly affected independent variables that are predicted is ten, but the regression analysis result performed an unsatisfactory model. By further regression analysis with several reduction processes, the best mathematical model obtained is:

$$Y = 0,08128+0,186X_1+0,00088X_2+5,777X_3+3,282X_4+4,827X_5+4,904X_6 \text{ ------- (1)}$$

(t value)   (0,651)   (0,004)   (21,324) (6,678) (13,923) (6,595) $r^2 = 0,817$

Y   : the number of trip generated each household per week
X1 : the number of household members of productive age (25 – 50 years old)

X2 : bicycle ownership
X3 : the number of household members, who make working trips,
X4 : the number of household members who make shopping trips
X5 : the number of household members who make education trips
X6 : the number of household members who make other trips

That model is statistically tested for R^2 test, F test and T test. R^2 test is calculated from R to be squared. R is the result of a correlation test between the independent variables (x1, X2, x3, x4, and x5 and x6) and the dependent variable (Y). The magnitude of R^2 is 0,817 which indicates that all independent variables give impact of 81,7% to the number of trips generated, whereas the rest of 18,3% indicates the magnitude of other variables effect that impact on the number of generated trip. Based on regression analysis, it is found that F value is 106,728 and F table 2,1628 where residual df is 143 with a significance level of 5%. It could be concluded that F table (2,1628) is lower than calculated F (106,728). It indicates that the linear regression model could be adopted to predict Y value.

That model is also tested using T test to find out whether every independent variable gives a significant effect to the dependent variable. T table is 1.96 and then it is compared to t value of each independent variable, for instance:

(a) 0.651 for population of age 25 – 55 years

(b) 0.004 for non motorized vehicles ownership

(c) 21.324 for population of working trip maker

(d) 6.678 for population of shopping trip maker

(e) 13.923 for population of education trip maker

(f) 6.595 for population of others trip maker.

Using Null Hypothesis Ho = variable difference does not affect the trip number and Hi = variable difference affects the trip number. If counted t is greater than t table, then Ho is rejected. If counted t smaller than t table, then Ho is accepted. It can be seen that counted t for population of 25 – 55 years (0.651) and non motorized vehicles (0.0004) are smaller than t table of 1,96, thereby those variables are not significantly affect the trip numbers.

Using the above trip generation model, the number of trips made by rural household is affected by household structure represented in a household member's daily activities. That result of the model shows that income does not have a significant effect on the number of trip generated by a household. It is presumed that monthly income for more than 50% rural people of less than USD 40 is not a factor that encourages them to make trips. That income value is

extremely low, so whether they have such an amount or not is not the reason why they make trips. Non motorized vehicle ownership does not affect trip generation significantly either. In other words, rural trip generation is not correlated with vehicle ownership which is commonly obtained in urban trip generation.

IMPACT ON RURAL TRANSPORT DEVELOPMENT

Travel pattern in certain area can be used for indication of economic, social condition of the people and transport system performance. In general, rural people in Trucuk sub district do not face serious transport problems. They can do their daily activities, make trips for many purposes without any significant restriction. However, they propose some transport system improvements based on their assessment on transport service condition, presented in the following Table 10.

Around one third of respondents stated that the transport system performance is still good, but based on field-observation, there are several transport infrastructures and service that require improvement or additional construction. Some roads are either seriously or slightly damaged and are in need of road network improvement. Road network improvement should cover rehabilitation on road pavement construction, bridges, road alignment and road path betterment. Such improvements are important for supporting the movement of motorcycles and bicycles as dominant means of transport in conducting regular activities like working and education activities.

Table 10. The demand on Transport System Improvement

Transport Element	(%)
Rather good transport system	31.99
Improvement on public transport service	24.67
Road network improvement	42.00
Bridges rehabilitation	1.34
Total	100.00

Improvement on public transport service is proposed by a quarter respondents who indicate that the performance of public transport service is still poor. The use of public transport of 6% of total respondents is assumed to be minor, because rural people's travels are dominantly characterized by short distance (70% < 1 km), and small/light load weight (60% < 5 kg). Public transport is the one used for longer trips such as going to another village or city, which cover 28 % all trip destinations and/or for carrying loads. It is also the important transport mode for those who make external trips and who do not own any vehicle. On the other hand, walking is a widely

used mode for close distance. Even though the existing use of public transport is solely 6 % of respondents, but it is potentially developed as the role of the mode itself is very significant. It is necessary for crop distribution outside the village and for bringing in daily needs, fertilizers, and farm seeds from other bigger villages or cities.

CONCLUSIONS AND RECOMMENDATIONS

The rural travel pattern in Trucuk sub district is typically home based travel with destination of school and farm. The distance that most rural people traveled is shorter than 1 km and is reached in less than 15 minutes, which proves that the study area is located quite near to activity centers or the capital city and therefore well supported by various public facilities so that people do not have to make longer travel for their activities. The use of bicycle and motorcycle as common means also shows that the people had better accessibility and mobility than those who had to walk. These findings indicate that motorization or modernization has reached rural areas. This phenomenon has emerged in some rural areas in Indonesia which consequently affect the provision of infrastructure, motor spare parts, fuel stations, and motorcycle workshops to be supplied by the government or other institutions.

On the one hand, greater attention must be paid for keeping road service performance by supplying better road path, or track, with sufficient road traffic signs and controls. On the other hand, travel pattern with a gender perspective still reflect a greater burden to women in making trips. Means of transport used by most women, i.e. bicycle, revealed more energy consumption in contrast with the men.

Trip generation in the areas indicates that the dominant affected factor is household structure, in terms of the number of household members who regularly make trips for various purposes. So, the productive age people will be a central concern in providing and developing transport infrastructure and services. The high rate of rural unemployment is another concern to develop rural transport system and service. The hardest part will be urgent attention to be paid to the unemployed, whose life quality should be promoted so that they are capable to obtain better accessibility.

In general, transport system in Trucuk sub district does not create significant problems to the local community, but they proposed some improvements in road network condition and public transport service. Public transport will have a strategic role in connecting a rural area with other rural areas or cities for distributing crops or production of home based small industry and for bringing in material for rural people's daily basic needs and additional needs. The availability of

both official (buses/small vans) and unofficial (motorcycle taxis) services in Indonesia in rural areas have important roles for rural people. The motorcycle taxi is particularly noteworthy because although average fares per kilometer are substantially higher than those for buses, it has an important short distance function across gender, across age-groups and across trip purposes. Furthermore, the motorcycle's minimal roadway needs in terms of track width and pavement strength make it a relatively low cost option for improving transport condition.

Based on this research results, the main recommendation will be addressed to the local and central government for giving more attention to transport service provision. Developing policy in rural public transport provision will assist rural people in having better accessibility and mobility. Besides, the use of motorcycle taxis in rural areas will increase the income of some rural people who operate such public transport service and promote rural accessibility due to their capability in passing various topographical characters.

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