IS THE USE OF INFORMAL PUBLIC TRANSPORT MODES IN DEVELOPING COUNTRIES HABITUAL? AN EMPIRICAL STUDY IN DAVAO CITY, PHILIPPINES

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ABSTRACT

Many cities of developing countries are characterized by the presence of its unique kind of public transportation often described as informal. It is often noted that the lower income category of people are usually the ones who rely on informal public transport services. There is an assumption that public transport dependency on certain mode is due to lack of option. Using Davao City, Philippines as the case study area, the paper explored the concept of public transport dependency to the different road-based public transport modes in emerging city, using both concepts of rational behaviour and planned behaviour. Empirical results using structural analysis shows the strong public transport dependency to jeepneys and tricycles in the case study area where half of the household population has vehicles. It confirms the role of rational behaviour such that one's socio-economic factors affect modal decision. Likewise, the study also shows interesting findings wherein the quality of service evaluation played a direct role in the dependency perspective to formal modes (buses, taxis) and informal mode ("habal-habal" or motorcycle taxis) but an indirect role in the actual use. The study shows the relationship of personal dependency assessment or "habit" and the use of indigenous modes (PUJ, tricycles) and supports theory which suggests t role of habits and "mere exposure" effect. This indicator is validated by the actual use of public transport modes especially tricycles and "habal-habal" (motorcycle taxis) for short-distance trips as well as on the result of how an individual view one's own dependency vis-à-vis how one

sees his/her household and community dependency to a certain public transport mode. Habits are not easily altered as shown in many studies, these findings suggest that careful review of key detailed issues such as the overall quality of service level and the associated items regarding indigenous and or informal public transport modes is necessary before suggesting specific policy or planning interventions.

Keywords: habit, modes, informal

INTRODUCTION

Public transportation in developing countries in Asia is usually represented by a unique type of public transport mode. For instance, "motos" (or motorcycle taxis) are popular in Viet Nam, "tuktuks" (motorcycle with attached cabs) are quite known in Thailand and the "public utility jeepneys" (PUJs) are a common sight in the Philippines. The cities and towns in developing nations are usually heavily dependent on road-based public transport for their mobility. They are often described as informal public transport modes and they are known to play a major role in meeting the travel needs of the poor.

In the case of the Philippines, even the government acknowledged that public utility jeepneys (PUJs) and tricycles compete very effectively with other forms of transport (DOTC, 2006) or if not, plays a complementary role to other available forms of public transportation.

The most common assumption is that public transport dependency on a certain mode (particularly the informal modes) in developing countries is due to the lack of modal choice and/or very cheap. Such is the case often used in explaining the theory of rational behaviour by most engineers. The theory of planned behaviour, or habits, as an alternative explanation is usually provided by psychologists and social scientist. In this paper, the latter is used as a complementary theoretical basis to understand the case of public transport dependency in a developing country.

To date, most of the studies in developing nations are usually about the important role informal public transport services provide for the poor. Some anecdotal references showed that low-income groups were prepared to pay a premium fare to ride regular mini-bus when faced with irregular overcrowded bus (Allport, R., 2000). But there is conflicting evidence as to whether or not the poor spend a higher proportion of their income on transport than other groups (Kranton, R., 1991). Moreover, it is difficult to find studies on how other social income groups in developing countries view their public transport dependency.

Some of the studies that explored the concept of dependency centred on private vehicle especially automobile and/or car dependency (Wicham, J., 1999) or on the efforts to shift from automobile dependency to public transport vehicle (Taniguchi, A.

etal., 2005, 2007). Efforts to understand public transport dependency from a subjective view are also quite limited. Recent pioneers of these this type of studies have been from the psychological perspective such as the role of habit in behaviour prediction (Verplanken,B. and Wood, W, 2006, Aarts,H and Dijsterhuis, Ap, 2000, Fujii S and Garling,T, 2005, and Fujii, S and Taniguchi, A., 2005) and were mostly based from case studies done in Europe and in Japan. These studies generally assessed automobile dependency and offered new insights on mobility management. Some of these studies took account of environmental issues. Others took note of the mobility needs of the elderly. Many of the studies in the United States are about travel-related attitudinal, personality and lifestyle cluster studies that characterized individual's personalities with their mobility and related the findings to automobile dependency (Redmond, L., 2000, Mokhtarian,P. and Salomon, I.,2002).

In developing countries, there were various anecdotal studies about informal public transport modes which try to address issues of public safety and welfare (congestion and accidents), environmental issues (air pollution) and its role as a complementary (feeder) mode, low-cost and adaptable market responsiveness (Cervero, R. 1999, Guillen,2002, Iwata,1989,Ocampo, 1986). In the Philippines, examples include a study on informal public transport modes like tricycle and motorcycle taxis that concluded its appropriateness as public transport in some areas of the Philippines like Siquijor Province (Rahman, M.D., 2007). There were also earlier initiatives on incorporating the effect of perception and feeling variables on mode choice behaviour. A study in Metro Manila, Philippines showed that objective explanatory variables are more powerful than subjective ones and those precise measured level of service (LOS) variables could yield better model estimations. It suggested that disaggregate logit mode could be more powerful in explaining mode choice behaviour (Ishida, H. and Kurokawa, T., 1991). A recent study in Indonesia also showed some important factors and attributes to explain user's perceptions and priorities regarding the service and suggested the likely continuation of using paratransit despite its dissatisfaction with several of its aspects (Joewono, T., and Kubota,H., 2007).

There is a common assumption that informal public transport exist since the general public has no other option for mobility and that it is cheaper than other formal public transport mode. However, there seems to be a consensus that users are generally not happy with the quality of service of these modes. Previous study that showed that most of the users are dissatisfied with several of its service aspects and yet there are loyal users (Tri, J. and Kubota, H., 2007).

The concept of public transport dependency using objective and subjective measures has never been fully explored and undertaken, more so in the case of different kinds of informal public transport modes found in many emerging cities of developing countries. Thus, the study is motivated by the need to understand informal public transport modes, what really drives people to use it and the need to rationally plan for, and regulate it in

order to maximize its inherent psychosocial and economic advantages vis-à-vis the formal public transport like buses as well as understand the associated issues.

Objectives of the Study

In general, this paper tries to understand public transport dependency in an emerging metropolitan city of a developing country. Specifically, it aims to provide additional insights on how the community view informal public transport modes. It seeks to give another perspective by looking at the hierarchical classification of public transport modes from the perspective of the community. The objective (use of mode) and subjective (dependency perceptions) approaches in understanding public transport dependency given the assumptions that all types of road-based public transport modes are available, cheap, accessible and that not all public transport users belong to the low-income group in the study area.

RESEARCH FRAMEWORK AND METHODOLOGY

In order to assess the public transport dependency, the available road-based public transport services in the study area were classified into three groups: (1) formal modes defined as the traditionally, technically and legally accepted modes like the bus and taxis; (2) indigenous modes described as a domestic innovation, alternative, but legally accepted modes (PUJs, tricycles) and the informal modes or those that are not traditionally, technically and legally-accepted modes such as the "habal-habal" or motorcycle taxis.

Public transport dependency is defined by assuming that the frequency of actual public transport use (objective measurement) is equal to the perception of public transport service need.

To understand the public transport dependency concept in the Philippines, a developing country, the paper utilized the results of the household travel survey case study conducted by the authors in 2007 in Mintal- Tugbok, Davao City where all types of road-based public transport modes can be observed.

Public transport dependency is analyzed using a number of statistical tests utilizing the Statistical Program for Social Sciences (SPSS)software as illustrated in Figure 1.

The first part (I) look at the descriptive analysis of the respondents' actual transport use on a daily basis and the one week trip recall from the day of the completion of the trip diary. The second part (II) is the subjective measurement of public transport dependency using the results of how respondents view their dependency to the

different public transport modes in the area. The public transport dependency scale ranges from 1 (not dependent) to 4 (very dependent).To check the variability of responses at the personal, household and community level perceptions across the modes, the results were tested using the coefficient of variance (CV). CV measures the consistency of dependency response across all respondents-subjects and shows the cognitive gap on how individual think of one's own dependency vis-à-vis to that of his/her household and community. The third (III) part tries to compare and validate the gap between actual transport use vis-à-vis public transport dependency perceptions and uses the statistical t-test of independency. This test was utilized to test the differences between two means of those who actually use the public transport and those who didn't use the public transport, thus understanding whether this affect how respondents asses their dependency. This is based on the assumption that public transport use has an effect on how they view their public transport dependency.
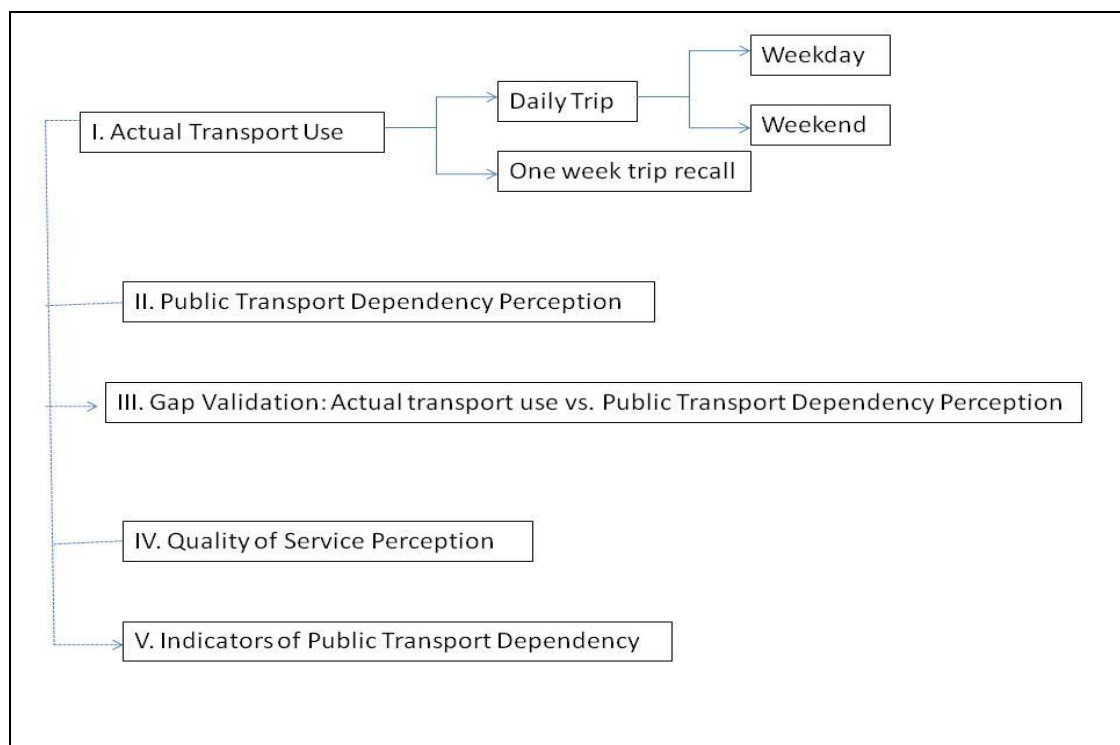

Figure 1. Analytical Framework for Understanding Public Transport Dependency

The fourth (IV) part provides an evaluation on the public transport service quality shown in Figure 2. The service quality items used were based from previous literature review and used the measurement scale range from 1 (very bad) to 4 (very good). The cronbach alpha statistical tool was used to analyze the reliability of these items as an indicator of the overall quality of public transport service. The fifth (V) and last stage

involves testing for indicators of public transport dependency using SPSS-AMOS (Analysis of Moment Structures) program to obtain the structural equation model that capture the causal influences of the exogenous (independent variables) on the endogenous (dependent) variables and the causal influences of the endogenous (dependent) variables upon one another as well as identify predictors of the use of public transport mode.
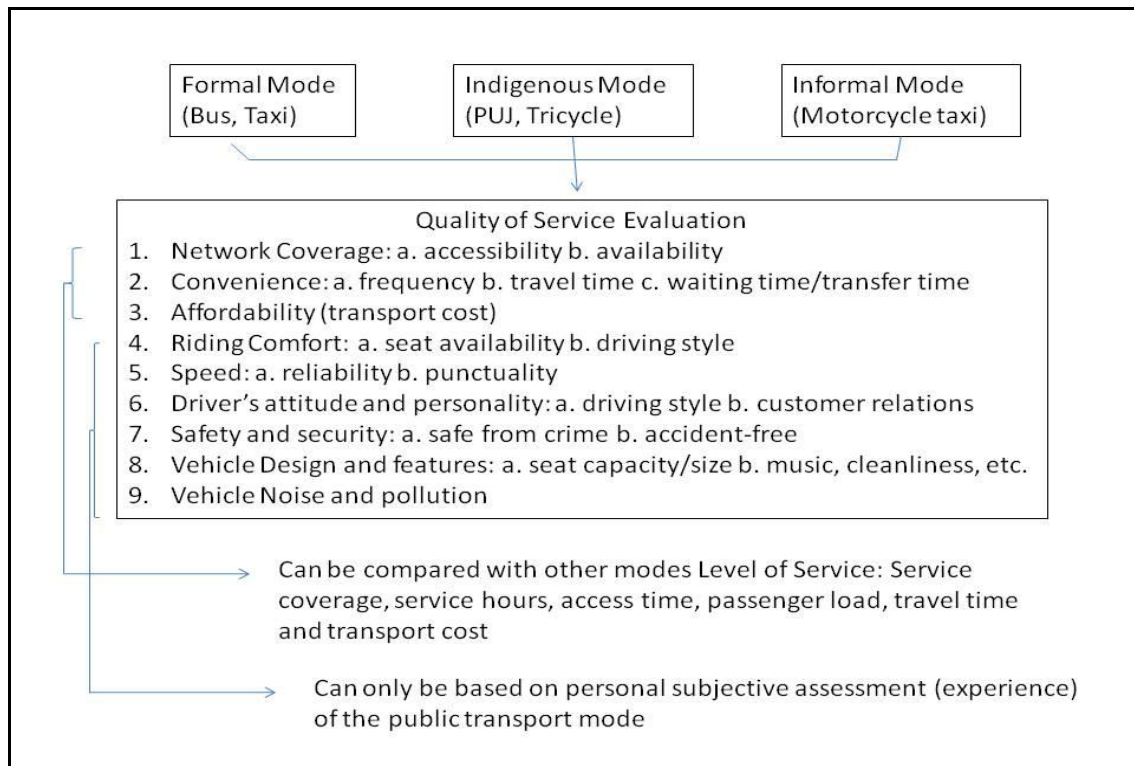

Figure 2 Service Quality Evaluation Items

THE STUDY AREA: DAVAO CITY, PHILIPPINES

Davao City (Figure 3) is chosen as the study area for this research because of its significant contribution to the economic development of Mindanao and being one of the major cities in the Philippines that is highly dependent on road-based public transport modes. It is strategically located in the Asia-Pacific rim and is a key player in the flourishing trade hub called the Brunei-Indonesia-Malaysia-Philippines East ASEAN Growth area or BIMP-EAGA. It is considered as Mindanao's center of commerce, trade and services. However, when compared to Metro Manila, the capital of the Philippines and other metropolitan cities; Davao City is relatively a young city.
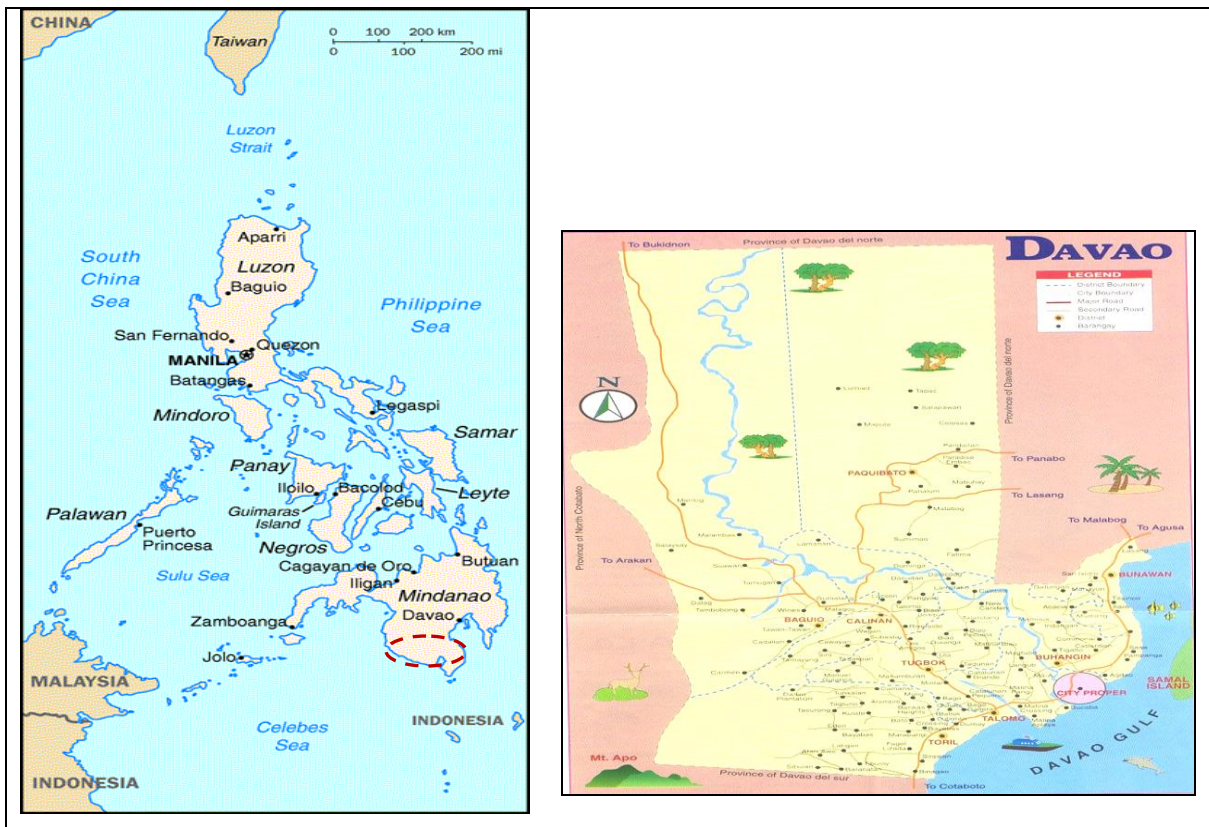
Figure 3. Map of the Philippines[1]and Davao City[2]

Source: [1]htttp://www.gov.ph;[2]Davao Map and City Guide, 2004

Davao City is the gateway to the Philippine South and has regular air, sea and land linkages to major points of the country. It is the capital of the Davao Region (Region XI), one hour and forty minutes by plane from Metro Manila. It is bounded by the province of Davao del Norte, Davao del Sur and partly in the East. It faces the expanse of the Davao Gulf and the Island Garden City of Samal. Its boundary line passes through the peak of the country's tallest mountain, Mt. Apo (3,142meters above sea level) and is located outside a storm-free zone. It enjoys good tropical weather all- year round with climatic elements that are distributed evenly. Temperature ranges from 15C-34C.

Davao City has maintained its competitive position in attracting investments and in penetrating new foreign markets owing to its resilient exports base, peaceful business climate, better quality of life and rich pool of skilled workforce. Given these conditions, Davao City's population boomed from 850,000 in 1990 to 1.4 million in 2009[1].In terms of infrastructure development, aside from a significant number of buildings and telecommunication facilities, the total road network of the city is stretched at around 1,772kms.Most of the roads connect directly to other provinces and neighbouring cities.

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[1] Estimates based on the 2.41 average annual growth rate. Available at
http://www.davaocity.gov.ph/Downloads.aspx?cid=2

These and other factors have contributed to the rapid growth of transportation in the city.

As an emerging metropolitan city, it has both the urban and rural population which tends to encounter problem ranging from lack of transport services to traffic congestion at the central business district (CBD). This is attributed to the concentrated population and increasing motor vehicle ownership in the urban areas. While in rural areas, the problem is due to poor road condition and road availability. They only have road-based public transport service modes to rely on.

Davao City's Transport Infrastructure

Road network and highway in Davao City are classified and maintained according to the hierarchical classification. The Department of Public Works and Highway (DPWH) is in charge of national road (260km), the office of the City Engineer (local government unit) is in-charge of the city roads (626km) and the city government and respective local units maintain the baranggay roads (840 km.).

Table 1.Road Hierarchy,Road Length, Agencies in charge and MV Speed Limits

Road Hierarchy	Road length (km)	Agency-in-charge of road maintenance	Speed Limit (km/hr) DC Highway Patrol	
			Cars/MC Taxi	Buses/Truck
National Road	260	DPWH	80	50
City Road	626	Office of City Engr.	30-40	30
Brgy. Road	839.7	Brgy. & City Govt.	30-40	30

Moreover, there have been an increasing number of utility vehicles (including jeepneys) and motorcycles as shown in Figure 4:
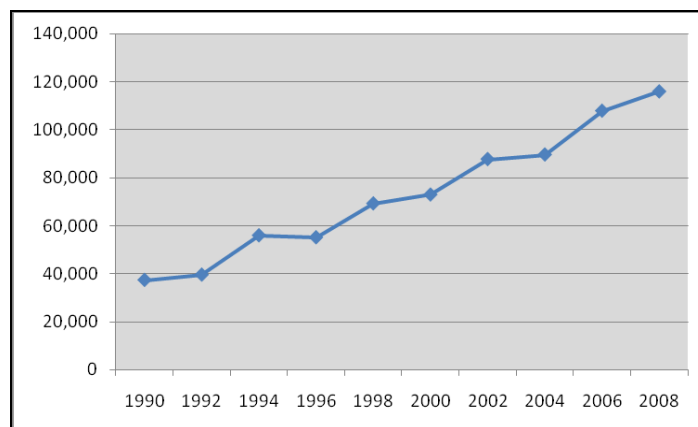

Figure 4. Number of Motor Vehicles in Davao City from 1990-2008,

Source of Data: DOTC-LTO Region XI, 2009

An Overview of the Past and the Present Development and Transport Plans of Davao City

An increase of public transport demand by 2.6 times in terms of number of passengers and 3.8 times using passenger-kilometer was projected for the year 2000.This is to be attributed to the projected expansion of Davao City's urban scale. It recommended the development of city bus service as major means of urban transportation given that the public transport modal share is expected to be dominated by public utility jeepneys or PUJs (Fig.5).Such was also expected to be used as the basis for the development of rail transit in the city. Table 2 shows an overview of the comparative development and transport studies done in Davao City since 1981.

Table 2. An Overview of the Development & Transport Plans of Davao City

	Davao City Urban,Transport Comprehensive Land Use Study (JICA,1981)	Comprehensive Development Plan of Davao City (1996-2021)	Transportation & Traffic Management Plan for Davao City Final Report (NCTS Foundation, 2000)
Socio-economic Framework	Role of Davao City Projected Labor Force	National Framework Plan (1996-2021)	
Urban Development Pattern	Recommendation: Multi-center development plan	Urban Settlement hierarchy	
Land Use Plan	Expand urban area from 3500hectares to 9700hectares	Spatial or multi-nucleus development strategy	
Transportation Demand and Public Transport System	Year 2000: increase demand for public transport Recommendation: Improvement of public transport terminals, city bus and then rail	Road Network Improvements Issues: Traffic congestion in CBD	Specifically CBD

Note: CBD-Central business district

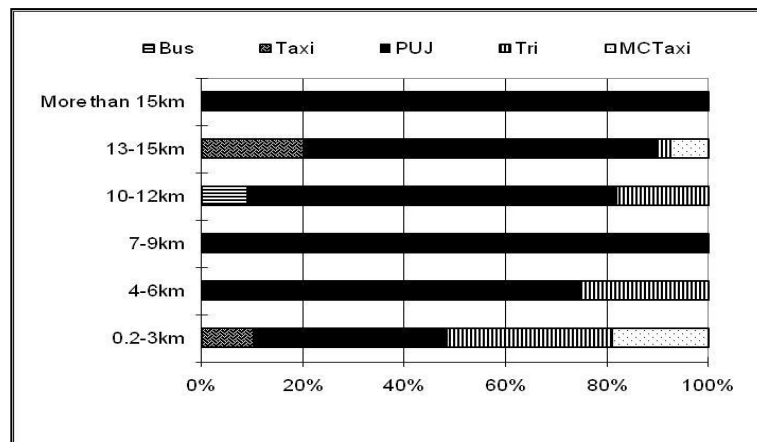Figure 5 shows the predicted public transport modal share per trip length.

Figure 5. Projected Modal Share (%) of Public Transport Mode by Trip Length in 2000

*Data Source: Japan International Cooperation Agency (JICA):Davao City Transport Cum Land Use Study
Final Report,1981*

In 2000, the transportation study focused mainly on recommending necessary traffic management schemes and measures to address the existing transportation and traffic problems. Its main concern was alleviating traffic congestion in city center. It suggested various options on re-routing of PUJs and signal implementation in the CBDs. Its recommendation was consistent with Davao City's development vision of having a transportation system that is environmentally-friendly and sustainable transportation network based on an efficient multi-modal transportation system and road network and could meet the growing urbanization and development of the city (UPNCTS Foundation, 2000).
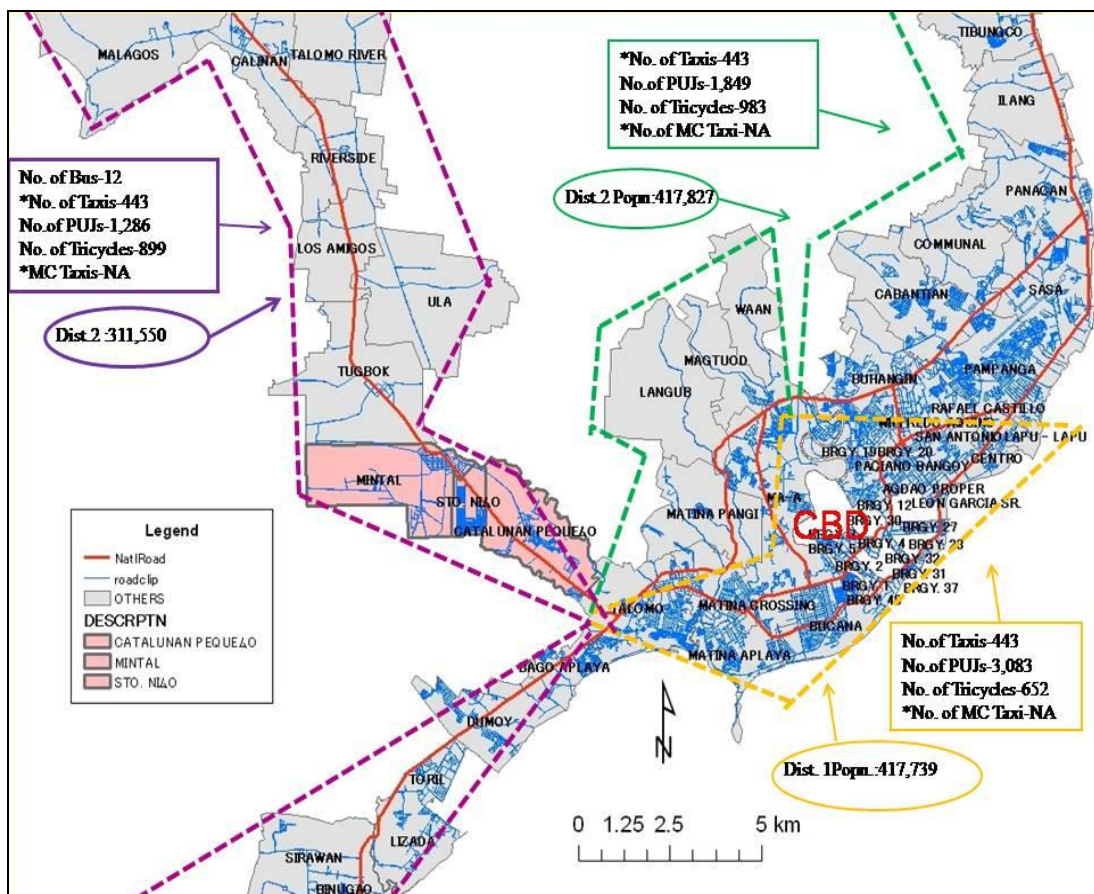
Figure 6. The Public Transport Modal Distribution in 3 Districts of Davao City.

Notes:District 1=yellow dotted line; District 2=green dotted line; and District 3= purple dotted line. National road=red line the secondary and tertiary roads=blue lines. The color pink represents the baranggays along the national road where the household samples were selected.

*∗*According to newspaper reports (2007) and interview (2008), MC taxis population is estimated to be 14,000 in Davao City

Source: District population statistics is based on Davao City Census 2000 report; number of public transport mode is based on LTFRB 2005 data.

Figure 6 shows the present public transport modal distribution in Davao City. It shows that the city of Davao is divided into three administrative political districts (dotted lines). To date, there is no bus that plies inside the CBD. For Davao City, there is only one approved route for city buses. This is the route from the CBD (District 1) to Calinan (District 3) and it uses the Mintal-Tugbok National road. Tricycles only ply within tertiary routes.

The Survey Area: Mintal-Tugbok-Calinan Route

Interestingly, among the many routes, only Mintal-Tugbok-Calinan National Road is identified as the only route where all city public transport modes are available. This is based from the city records provided by Office of the City Planning and Development and Land Transportation Franchise and Regulatory Board (LTFRB Region XI), in-depth interviews with local officials and ocular investigation. It is the only route which has a city bus plying from the central business district (CBD) to other "barangays" (or a village, the smallest administrative area in the Philippines) considered either rural or residential and where all other types of public transport modes can be observed. This area was in the 1996-2021 spatial development plan of Davao City. The plan suggested that Calinan be built as the new center for agriculture-based industrial activities and Mintal-Tugbok area as centre for technology, research and development programs. Based from ocular inspection and Housing and Land Urban Regulatory Board (HLURB) residential developers list, this is also the area where most of the middle-class (define as the income group who could afford to own a house and/or vehicle) private residential areas/villages can be found. There are two PUJ Terminals (Mintal and Calinan) and one bus terminal in Calinan servicing passengers to and from CBD. In most entrances of residential villages, tricycles and motorcycle taxis' waiting stops can be found.

Davao City's spatial development strategy categorized the hierarchy of urban settlements in Davao City into: (1) baranggay urban centers or baranggays mostly located within the city's agricultural or production areas; (2) district urban centers or urban centers wherein the primary role is to act as second level service center for the city's rural population; and (3) Main Urban Center ("Poblacion" or the Central Business District, CBD). Residential areas along this route were selected for conduct of household and personal trip survey. The three baranggays; Catalunan Pequeno, Sto.Nino and Mintal were specifically chosen since these three has the highest number of household residential communities. Moreover, the other criterion for choosing the survey area is that entrance of each residential area has tricycles and motorcycle taxis terminal. One of the major issues in administering home visit surveys in a developing country like the Philippines is the representativeness of the sample due to the absence of household address records as well as household listings per income level; sampling estimation of 20% (288 respondents) of the selected study site and questionnaire design was based from the statistical results of earlier pilot survey research in 2006.

SURVEY RESULTS AND INTERPRETATION

Profile of the Mintal-Tugbok Community

Survey results showed that eighty eight percent (88%) either fully-owned (44%) or are still paying (44%) their houses (amortization). The rest of the household respondents either rent or have other arrangements with house owners. Davao City Census estimates that about twelve percent (12%) owned motorized vehicles (Census of population and Housing, 2000). Table 3 shows the proportion of vehicle ownership between non-motorized (bicycles) and motorized vehicles. The motorized vehicles are classified into motorcycles and cars. 27% owned motorcycles type of vehicles, 20% have car or four wheel vehicle and only 14% have bicycles.

Table 3. Type and No. of Vehicles in a Respondents' Household

No. of Units	HHs w/Bike	%	HHs w/MC/Tricycle	%	HHs w/Car/four wheel vehicle	%
0	332	85.57	282	72.68	308	79.38
1	40	10.31	94	24.23	65	16.75
2	13	3.35	11	2.84	13	3.35
3	1	0.26	1	0.26	2	0.52
4	2	0.52	0	0	0	0
Total	388	100	388	100	388	0

Note: HH-household   Source: Guillen, M.D, 2007

Majority of the households belong to the PhP 8,000-15,000 income class category. To be able to support a family of five for food and other needs in Region XI, the average poverty threshold is PhP10, 503 (NSCB Technical Paper No.2000-002, 2000). The survey results show that the average household size is five and this figure is comparable to that of the Davao City latest census data.

At the individual level, out of 288 respondents aged 13 years old and above, 56 percent is female and 44 percent is male and the median age is 34 years old. Most of the respondents interviewed are either household head or spouse and the majority is married. The survey shows that most of the respondents either completed college or has college level education and that the majority of the respondents are either employed on full-time status, followed by students and housewives (Table 4).

Table 4. Respondents' Schooling/employment Status

Employment Status	Enrolled in School			Total	%
	YES	NO	NR		
Full-time	1	132	1	134	34.54
Part-time	1	9	0	10	2.58
Self-employed	3	55	1	59	15.21
Unemployed	1	44	0	45	11.60
Housewife/husband	0	63	0	63	16.24
Student	62	0	4	68	17.01
NR	10	2	0	12	2.84
Total	78	308	6	389	
%	20.10	79.38	1.55		

Note: NR=No response   Source: Guillen,M.D., 2007

Respondents' Commuting Patterns

Table 5 shows the estimated distance from the residential area of those respondents who are in school or are employed. Majority of those working full-time and students go to the CBD of Davao City and the distance varies from 9 to 15 km. The available public transport modes use to reach the CBD are the taxis, buses or PUJs. Most of the respondents (78%) are public transport users and that twenty six percent (26%) of the respondents have driver's license.

Table 5. On Respondent's Workplace/School Location

Status	Place of Work/School						NR	NAP	Total	%
	Mintal	CBD	3rd Dist	2nd Dist	1st Dist	Out-side				
Km from Origin	3-8km	9-15km	10-18km	18-20km	20-25km	25 or more				
Full-time	41	52	4	8	3	3	3	10	124	32
Part-time	0	2	0	0	1	2	5	0	10	3
Self-employed	16	20	3	0	1	1	14	2	57	15
Not employed	0	0	0	0	0	0	0	45	45	12
Housewife/husband	0	0	0	0	0	0	0	63	63	16
Student	32	37	5	0	1	0	1	0	76	20
NR	0	0	0	0	0	0	2	11	13	3
Total	89	111	12	8	6	6	25	131	388	
%	23	29	3	2	2	2	6	34		

Note: Dist.=:District; NR=No Response;NAP=Not applicable Source:Guillen, M.D., 2007

Respondents' Transport Use 1 Week Recall

Table 6 presents the respondents' estimated frequency of vehicle use over the last one week from date of survey. For private use, motorcycle has the highest percentage (48%) and for public transportation use, PUJs (89%) and tricycles (77%) have the highest percentage. This is in terms of respondent's estimated vehicle use over the last one week.

Table 6 Estimated Frequency of One week use of Vehicle for Transport,2007

Transport Vehicle Use	N	%	Ave. Gross Transport Estimated Use	Net Vehicle Estimated Use	Max. estimated Transport Use
Motorcycle	48	13.40	0.70	4	20
Car	23	6.40	0.26	8	14
Private Jeep	8	3.10	0.12	4	12
Bus	104	27.00	0.60	2	12
Taxi	164	42.40	0.90	2	13
PUJ	346	89.20	4.95	5	22
Tricycle	299	77.10	4.32	5	18
MC Taxi	127	32.66	1.57	4	14

Source:M.D. Guillen, 2008

Respondents' Actual Trip Information (Weekday & Weekend)

With regards to actual trip made by the respondents, table shows the weekday (Wednesday or Thursday) and weekend (Saturday or Sunday) trip rates. Naturally, there were more trips made on a weekdays than on weekend.

Table 7. Actual Trip Information: Weekday & Weekend, 2007

	Weekday Trip Rate		Weekend Trip Rate	
	Net Trip Rate	Gross Trip Rate	Net Trip Rate	Gross Trip Rate
Mean trip	2.14	1.64	2.1	0.76
Minimum trip	2	0	1	0
Maximum trip	6	6	4	4

Source: M.D.Guillen, 2008

Figure 7 and figure 8 showed the modal split by trip purpose. On both days, PUJs are usually use for most trips. Motorcycle taxi use increase for "to-home" trips. Interestingly, it was never use for "to-study" or school trips.
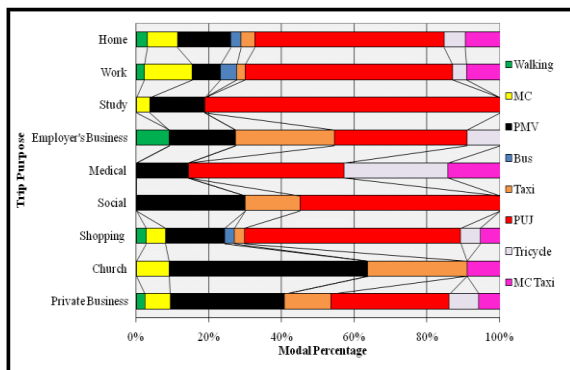

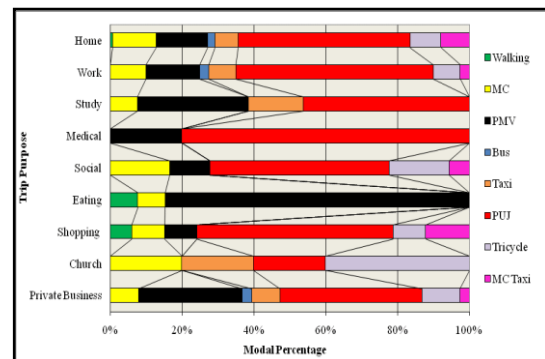Figure 7. Survey Area's Weekday Modal Split by Trip Purpose

Figure 8. Survey Area's Weekend Modal Split by Trip Purpose

Source:M.D.Guillen, 2008

Figure 9 shows estimated trip length made per transport mode. This figure shows that buses and PUJs are mostly used for long distance trips (10km or more) and tricycle and MC taxis are usually used for short-distance trips. It is interesting to note that not many respondents in the study area walked.
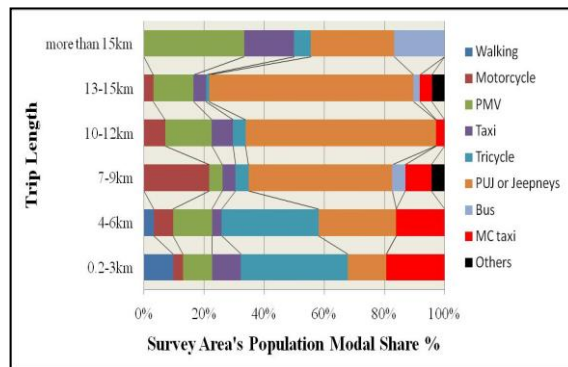
Figure 9. Estimated Trip Length made by respondents

Source:M.D.Guillen, 2008

Access modes are also known as feeder-modes or vehicle use for short-distance trips (1 to 3km) on the way to accessing or reaching major mode of transportation such as bus or PUJ terminals. In the case of the Philippines, access modes are very common and they usually service residential areas. Figure 10 shows the response of respondents when asked if they use access modes to reach their major mode of public transport.
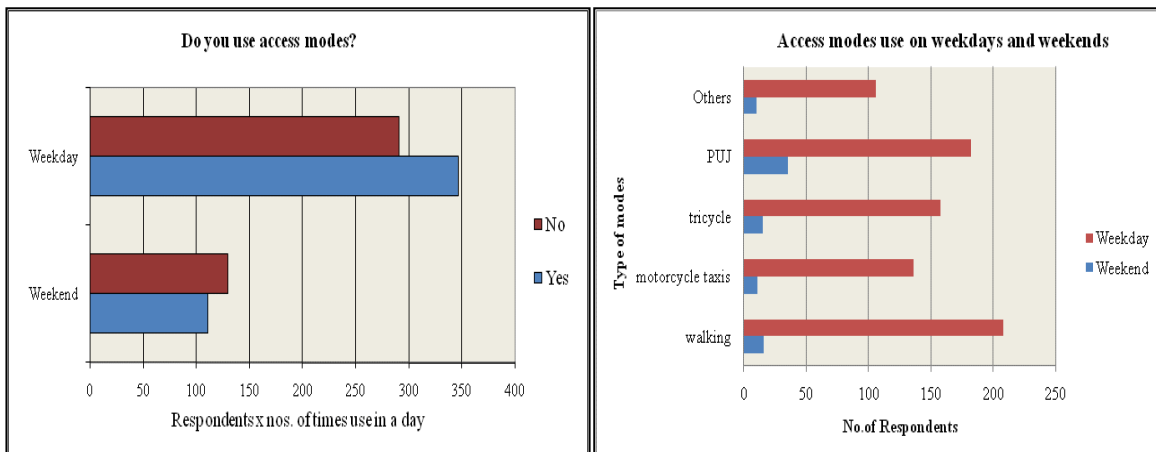

Figure 10 Use of Access Modes

Source:M.D.Guillen, 2008

More respondents use access modes on weekday than on weekend. Majority of the respondents walk to their next major mode. In the case of "others" mode, this would mean that other respondents, may take a private vehicle going to their next major mode.

Respondents' Public Transport Quality of Service Evaluation

Respondents were asked to evaluate the quality of service of the different public transport based on nine (9) items indicators from 1 to 4 (very bad to very good). The quality of service indicators are 1.) Network coverage; 2.) Convenience;

3.) Affordability; 4.) Riding Comfort; 5.) Speed; 6.) Driver's Attitude and Personality; 7.)Safety and security; 8.) Vehicle Design and Features and 9.) Vehicle Noise and Pollution as explained in the methodology.

Public Transport Dependency: Respondents' Actual Transport Trip Recall

One-week transport use recall as well as actual weekday and weekend transport use was used in confirming the public transport dependency of the community. Table 8 shows that PUJs and tricycles are the most frequently use public transport service in the community with the net average use of 5 times a week).

Table 8. Trip Recall:Frequency of One Week Use of Public Transport Mode

Public Transport Mode Use	N	%	Ave. Gross Transport Estimated Use	Net Vehicle Estimated Use	Max. estimated Transport Use
Bus	104	27.00	0.60	2	12
Taxi	164	42.40	0.90	2	13
PUJ	346	89.20	4.95	5	22
Tricycle	299	77.10	4.32	5	18
MC Taxi	127	32.66	1.57	4	14

Source: M.D.Guillen, 2008

This result confirms that majority of respondents are public transport users even if almost half of respondents' households owned vehicle. This can be explained by the figures that show that the average household size in the study area is five and that individual household members make their own trips. In terms of mobility, this could imply that household members do not car pool or share the vehicle for their trips and usually rely on the available public transport mode in the area, which would most likely be the PUJ. It is also important to note that for short-distance trip like 0.2-3 kms., the survey showed that most respondents take public transport mode unlike in developed countries such as Japan where the tendency is to use a bicycle or walk.

Public Transport Dependency Perception: Testing Various Relationships to Understand Public Transport Dependency

Coefficient of Variance (CV): Testing the Consistency of Respondent's Public Transport Dependency Perception (Personal, Household and Community)

In testing the consistency of respondents' public transport dependency perception, the coefficient of variance test was used to determine if the community have varied or similar assessment of dependency towards certain public transport mode. CV is used to check the consistency of dependency response across all respondents-subjects. A high CV value reflects inconsistency of dependency perception among the samples within a group. Table 9 shows the CVs among different modes and at different levels

(personal, household and community).CVs consistently decrease from personal, to household and to community level across modes. This can indicate the consistency of the measurement that perception of dependency to particular public transport mode which is higher than the personal level. For example, respondents generally have lower dependency assessment to formal modes like bus but personal evaluation of how a respondent think of his/her household members and community dependency increases.

Table 9. Coefficient of Variation Per Public Transport Modal Classification

Respondent's Dependency Perceptions	Mean	SD	CV	CV%
Formal Public Transport Personal Dependency	2.27	0.777	0.342	34.23
Formal Public Transport Household Dependency	2.44	0.750	0.307	30.74
Formal Public Transport Community Dependency	2.67	0.755	0.283	28.28
Indigenous PT Personal Dependency	3.03	0.826	0.273	27.26
Indigenous PT Household Dependency	3.08	0.787	0.256	25.55
Indigenous PT Community Dependency	3.23	0.754	0.233	23.34
Informal PT Personal Dependency	2.27	1.086	0.478	47.84
Informal PT Household Dependency	2.25	1.051	0.467	46.71
Informal PT Community Dependency	2.49	1.034	0.415	41.53

Note: SD –Standard Deviation, CV-Coefficient of Variance PT- Public Transport Source:M.D.Guillen,2008

As expected based on detailed CV results per public transport mode, indigenous public transport mode has the lowest CV% of public transport dependency perception indicating the consistency of how respondents view their dependency to these modes and confirms the dependency or the habit of using PUJs, and tricycles. Varying perceptions for informal mode is quite clear given the high CV%. These results imply the cognitive gap between personal opinions and how an individual think about his/her household and community needs regarding public transport. The mean or average results of dependency perception shows that public transport dependency differs but generally increases as an individual think of community's dependency. In particular the result of the informal mode where in the average household dependency is lower than personal and community dependency indicates the varying perceptions on the dependency to informal modes like "habal-habal" or motorcycle taxis. This suggests questionable need at household level but is considered important at community level. This kind of results indicates the need for policy makers to strongly address this issue.

Actual Public Transport Use vs. Subjective Public Transport Dependency Perception: Testing the Independency of Personal, Household and Community Public Transport Dependency with Public Transport Use over the week: t-test

This test shows that the independency of respondents' perception of dependency and how this affects his/her household and community perception from the respondent's actual use of the available public transport mode in the area. Table 10 shows that

indigenous and informal public transport use has an effect on how an individual perceive his/her dependency to these modes. Given the significant values (> 0.5) in the formal modes, it presents that the use of the formal modes (bus and taxis) does not affect how dependency perception is evaluated. This result suggests that respondents think that the need for formal modes (bus, taxis) remains even if they do not necessarily use it. This kind of result has a direct policy implication on how policy makers considers bus system improvement and or reconsider how to address informal public transport modes such as MC taxis.

Table 10. Public Transport (PT) Users vs Non-users:PT Category t-test Results

		N	Mean	Std. Deviation	t-test	Sig. (2-tailed)
Formal PT Dependency	Formal Public Transport (PT) User					
Formal PT Personal Dependency	>= 1	195	2.31	0.6730		
	< 1	185	2.23	0.8740	1.07	0.0283
Formal HH Dependency	>= 1	195	2.37	0.6950		
	< 1	186	2.52	0.8000	-1.85	0.065
Formal Community Dependency	>= 1	194	2.61	0.6980		
	< 1	185	2.73	0.8090	-1.5	0.135
Indigenous PT Dependency	Indigenous Public Transport (PT) User					
Indigenous PT Personal Dependency	>= 1	350	3.11	0.7830		
	< 1	33	2.27	1.0890	5.77	0.000
Indigenous PT HH Dependency	>= 1	350	3.12	0.7550		
	< 1	33	2.67	0.9900	3.2	0.005
Indigenous PTCommunity Dependency	>= 1	348	3.27	0.7280		
	< 1	33	2.88	0.9270	2.85	0.000
Informal PT Dependency	Informal Public Transport (PT) Dependency					
Informal PT Personal Dependency	>= 1	126	2.79	1.0090		
	< 1	227	1.98	1.0220	7.11	0.000
Informal PTHH Dependency	>= 1	126	2.61	1.0120		
	< 1	227	2.05	1.0210	4.94	0.000
Informal PT Community Dependency	>= 1	125	2.98	0.8030		
	< 1	254	3.04	0.8490	6.59	0.000

Note: >=1 Public Transport (PT) Mode User; <=1 Not Public Transport (PT) Mode User; HH-household
Source:M.D.Guillen, 2008

Quality of Service Evaluation

Given the proposed classification of these modes in this study such as buses and taxis belong to the formal public transport modes, PUJs and tricycles to the indigenous public transport modes and motorcycle taxis for the informal public transport mode, the reliability of the quality of service to use this classification was also tested . Table 11

shows high cronbach's alpha index that shows the reliability of the items to assess the quality of service of each category where the public transport mode belongs

Table 11. Test of Reliability for Quality of Service (QoS) Evaluation

Categories of Road-based Public Transport Modes	Cronbach's Alpha
Formal Public Transport modes (Bus, taxi)	0.835
IPTS modes (PUJ, tricycle)	0.901
Informal modes (MC taxis	0.930

Source:M.D.Guillen, 2008

Figure 11 shows how the respondents evaluated the road-based public transport modes when the modes in each category are combined. As shown, the rating for informal public transport (mc taxis) is not very favourable.
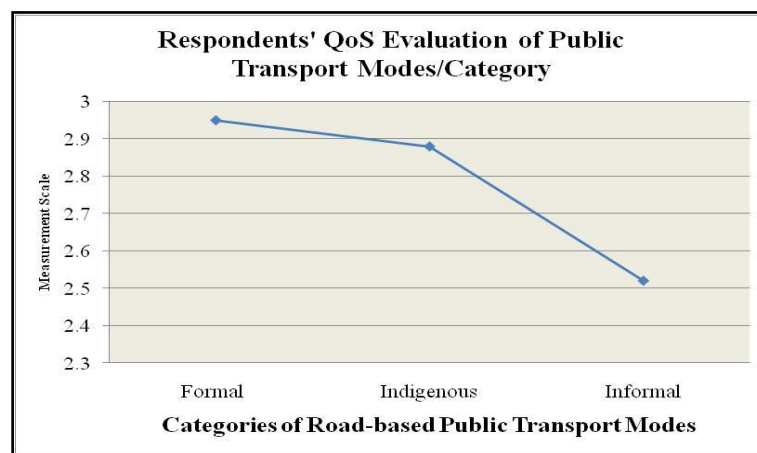

Figure 11. Respondents QoS Evaluation of Public Transport Modes/Category

Source:M.D.Guillen, 2008

Testing the Hypothetical Framework of Public Transport Dependency Indicators

Testing the relationships in the hypothetical framework proposed is shown by using AMOS (Analysis of Moment Structures) software for the structural equation modeling which presents the regression and path analyses.

In this analysis, 1) the overall quality of service scores per category after testing its reliability, 2) the personal dependency perceptions and the 3) average number of the one week frequency of use for each public transport mode category were used.

The following variables were used as the independent or exogenous variables: respondents' socio-economic variables such as estimated household monthly income, household size, number of vehicles in a household, age, dummy variables (0,1) such

as gender and driver's license and the attitude towards the overall-all quality of service of each public transport modal categories (formal, indigenous, informal). The endogenous (dependent) variables that this model attempted to explain are the public transport dependency or "habit" (as considered in this study) of using formal public transport modes, indigenous public transport modes and informal public transport modes and that of predicting the actual frequency of use of the formal, indigenous and informal modes.

This analysis yielded the following path and regression analysis with a model fit summary of CFI (Comparative Fit Index): 0.755 and RMSEA (Root Mean Square Error of Approximation): 0.043. These results indicate good model fit. AMOS path analysis (Figure 12) shows the parameters that estimate the direct affect of one variable has on the other and the indirect effects or the influence of one variable may have on another that is mediated through a third variable as shown in the arrows. The path analysis shows that gender has direct effect (0.12) on the use of formal public transport mode (bus and taxi) and can be interpreted that women are most likely to use formal public transport mode like taxis. On the other hand, age has negative direct effect (-0.11) on the "habit" or of using IPTS or perceived dependency to (PUJ and tricycle) as well as on the actual use of informal public transport mode (mc taxis). The older the person, the less likely will he/she have the habit of using IPTS or informal modes.For the quality of service evaluation, formal (0.15) and informal public transport modes (0.16) has direct effect on the habit of using it. Positive or negative evaluation on the quality of service in these modes has an effect on the dependency perception (habit) of a person towards a particular mode.
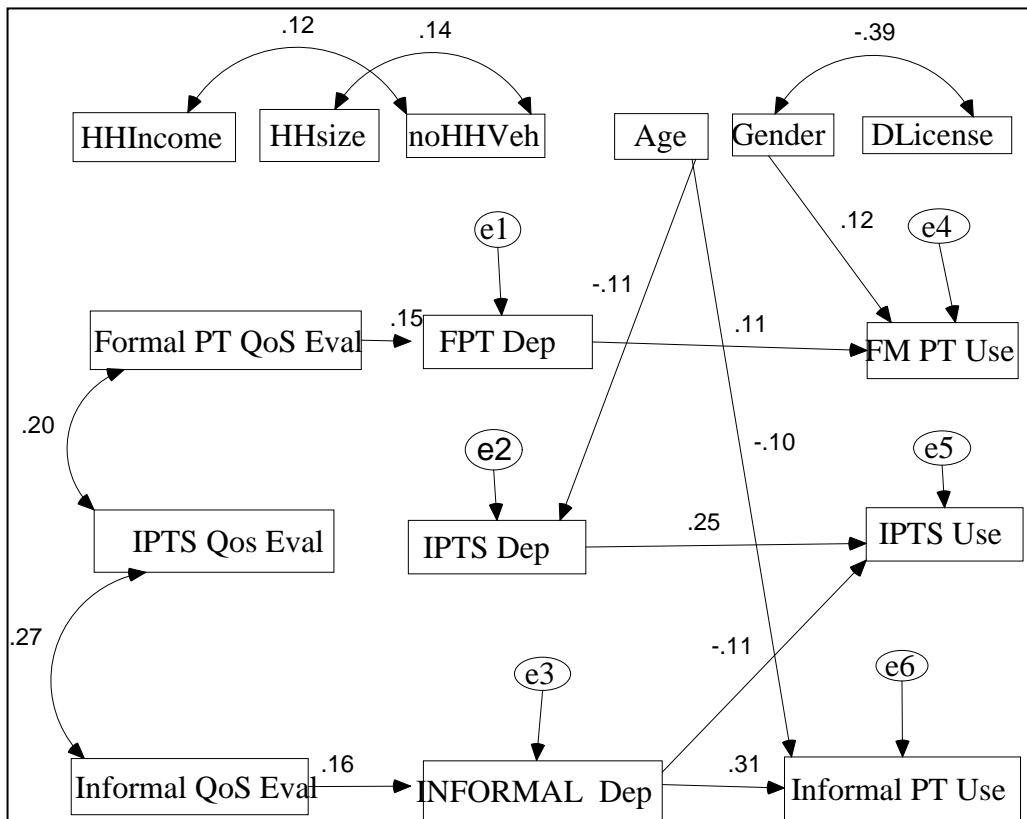
Figure 12.Analysis of Moment Structures (AMOS) Regression and Path Analysis Result

Source: Guillen, M.D., 2008

The quality of service evaluation has direct effect on how the respondent evaluate his/her formal and informal public transport habit (dependency) and has an indirect effect on the frequency of use (may be cause by some item/s positively evaluated by the respondent, hence make him/her choose the mode regularly).Informal quality of service evaluation has negative indirect effect (0-.11) on the use of IPTS modes and which indicates lower QoS evaluation to informal mode and the likelihood of using IPTS modes

The model also analysed the correlation of socio-economic factors or the strength of relationships between two variables. In this figure, estimated household monthly income has a correlation with the number of vehicles a household have (0.12) and that household size also has a correlation with the number of vehicles in a household (0.14). The relationship of household income and household size with the number of vehicles owned by the household has been verified in various studies. Vehicle ownership is a function of the capability to purchase a vehicle as well as the number of members in a household. Gender has no relationship (-0.39) on respondents having driving license. Gender is not an issue in getting a drivers' license. The quality of service evaluation on formal modes has a correlation with quality of service evaluation on indigenous modes attitude (0.20). The correlation of the overall quality of service

attitude between formal public transport mode with indigenous public transport mode and the overall quality of service attitude between indigenous mode and informal mode can indicate that respondents regard indigenous modes to have an almost similar quality of service with that of formal and informal modes. The quality of service evaluation on indigenous mode has a correlation with the attitude towards informal modes (0.20). There was no correlation indicated between the formal and informal public transport mode and this provides an insight on how the respondents regard the difference between formal and informal mode.

Given that the respondents belong to the middle-class socio-economic strata with the capability to own a house and/or vehicle and from this analysis, it can be interpreted that only the respondents' personal characteristics showed direct relationship in predicting the use of public transport modes. The path analysis shows that only gender and age among the socio-economic factors has causal relationships with the use of formal public transport modes (bus, taxis) ,indigenous public transport dependency (habit) and informal public transport modes (mc taxis), respectively. Such as women are most likely to use formal modes and that age is factor in dependency perception and actual use. Younger population (-11) would mean the likelihood to use informal modes (mc taxis).

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Public transport dependency is defined here as the objective (actual use) and the subjective (habit-forming definition) reliance to the available road-based public transport modes in emerging metropolitan cities like Davao City.

The structural equation model confirms the over-all hypothetical framework on the relationships of socio-economic factors, over-all quality of service evaluation and the role of personal dependency assessment or "habit" and its likely relationship in the actual use of public transport mode. However, contrary to the hypothetical framework which shows that household variables (income, size, no. of vehicles in the household) as possible factors, only the individual characteristics (age and gender) showed strong direct relation on the personal dependency (or habit) of using indigenous modes (PUJ, tricycles) and its direct relation on predicting the use of formal modes and informal modes. These findings made sense since women are most likely to use formal modes (bus, taxis) and can be inferred that the mode is considered to be safer. The younger the respondent is the stronger likelihood of using informal public transport mode such as tricycles. The findings suggest the role of rational behaviour concept where in the individual socio-economic factors affect the modal choice decision. Interestingly, quality of service evaluation played a direct role in the dependency to formal public transport modes and informal public transport modes and the indirect role in the use of both modes. The study shows the relationship of personal dependency assessment or

"habit" and the use of indigenous modes (PUJ, tricycles) and confirms the previous theory suggesting the role of habits and "mere exposure" effect. Moreover, in informal modes, the quality of service can have indirect relationship to the use of indigenous modes (PUJs, tricycles) from informal modes (mc taxis).

It also showed indigenous public transport mode's role in the community, in a sense that the personal assessment of dependency (habit) has direct relation to the actual use of indigenous public transport modes more than the associated issues in the quality of service evaluation. The PUJ or jeepney somehow mirrors the Filipino's identity which is said to be a result of the history. It is important to note that PUJs and tricycles have been existent for a long time and has been part of the everyday life of average Filipinos such that its use can be habitual.
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Actual trip characteristics data also show that formal modes esp. buses are use for long-distance trips competing with PUJs while informal modes like the MC taxi are use for short-distance trips competing with tricycles. Mostly the latter mode also served as access modes. This result suggests the existing gap between supply and demand that need to be addressed. On the other hand, it is important to note the result of overall quality of public transport service and the t-test with regards to actual use and dependency perception to bus suggest a positive perception given to bus system. Policy makers should take into consideration that bus system is generally regarded highly, regardless of whether the mode is use or not and even if its quality of service is not highly rated. Interestingly with formal modes, even if the personal dependency perception is low at personal level, community perception gets higher. The perception of community dependency indicates that it is needed (community perception). Interestingly, motorcycle taxis or informal modes are mostly use for very short-distance trips. This kind of output has an impact how the community could regard the possible existence of non-motorized policy eg. the importance of non-motorized infrastructure, promotion of walking and cycling for healthy lifestyle.

Moreover, given study area's sampling limitation and that half of the household population own vehicles the structural analysis reveals that the role of habit (public transport dependency) is quite strong. This indicator can actually be verified by the fact that most of the respondents use public transport modes even for short-distance trips. In a way, this result confirm what was proven in other psychological and social science based studies in developed countries that suggest that habitual actions are cued without consulting conscious intentions. The case study result has similarities with previously explained in studies in developed countries where case studies suggest that drivers repeated their prior actions regularly. In this case study, residents are dependent to indigenous public transport modes even for very short-distance trips. These findings suggest that careful review of key detailed issues such as the overall quality of service level and the associated items regarding indigenous public transport modes must be done before going into any specific policy or planning interventions. As

proven in many studies, it is important to note that habits are not easily altered. In this case, improvement on the quality of service of indigenous public transport mode should be considered.

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