Peer-reviewed version available at *International Journal of Crowd Science* **2018**; doi:10.1108/IJCS-06-2018-0010

Article

Prediction and Analysis the Causes of Increasing an Illegal Low-Cost Taxi in Bangladesh Municipalities: A Case Study of Pabna Municipality

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Abstract: The impact of an unlicensed low-cost taxi in Bangladesh is very severe, especially in municipal cities. Day by day the numbers of unlicensed low-cost taxi are increasing by jumping up and creating pressure on traffic and transportation system. The aim of this study is to find out the causes of increasing illegal taxi and the extent of this vehicle in the municipalities of Bangladesh. Pabna municipality is used as a case study due to the more activeness of illegal taxi then the other municipalities. To achieve the objectives, the researcher used a qualitative approach to acquire more depth about the problems. Besides a direct observation of the study area, an open-ended questionnaire survey and HIS survey were conducted. The illegal low-cost taxi is very active it was analyzed through the field survey. A statistical model was developed to understand the actual causes of increasing illegal low-cost taxi, where ten predicted hypotheses (age, education level, marital status and family member support of illegal drivers, and the variable of commuter satisfaction e.g. safety, comfort, continuous service, affordability of service, reliability of service and driver behavior) were tested. The model was run through the multiple regression analyses technique in SPSS and the result proved that education level of illegal low-cost taxi drivers, and the commuter satisfaction variable (safety and comfort) had a positive and significant effect of increasing illegal low-cost taxi in the study area. However other variable had no significant effect in case of increasing illegal low-cost taxi. Besides the safety and comfort, steady job for the operators, provision of continuous, individual and door to door service system are the main reasons for increasing the illegal low-cost taxi in the study area. Finally, the researcher concludes with the requirement of some necessary action from the responsible authority on vehicular regulation for the improvement of the local public transport system in Bangladesh.

Keywords: illegal taxi; door to door service; local public transport; traffic congestion

1. Introduction

The taxi is one of the important local public transports. This traffic mode has special characteristics lacking in other public transport (like- public buses and railway) services. The special characteristics of these vehicles are the individual (chartered by single passengers) and door to door service provision for 24 hours [6]. But the unlicensed taxi may create a negative impact on the urban transport environment. In Bangladesh, most of the municipal cities were jam-packed with these unlicensed low-cost taxis. The Pabna municipality is one of them. This low-cost taxi first introduced in Bangladesh around 2004, by a private company with the name of "Maa Enterprise" [12]. Since then, the numbers of these vehicles were increasing with jump up. Numerous such vehicles are now

playing all over the country, largely in the municipalities and suburban area. Some measure the figures of a million. Exactly no one knows the actual figure of these vehicles as they are not registered or licensed with the transport department.

These vehicles are first introduced in Pabna municipality by some passionate business company. About 80% urban people including law administration officers have even been observed to use the illegal low-cost taxis to travel to certain parts of the city [5, 12]. The Pabna municipal authority officially claimed that they gave license up to 1200 low-cost taxi and 530 rickshaws, and the rest are roaming around the municipality without any license. Often these low-cost taxis are witnessed to be driving suddenly away from law enforcement agents (e.g. traffic police). In some cases, these illegal low-cost taxis have been involved in a serious road accident and traffic congestion at the major road intersection. Therefore, there was a need of an examination to know the reasons for the existent of illegal low-cost taxis in the face of opposition from the authorities and the latent threat to both drivers and their passengers. The major aim of this study is to find out the actual causes of existent of the unlicensed low-cost taxi and the extent of these vehicles in the local public transport system.

2. Literature Review

2.1. Research on an unlicensed taxi in other countries

Many types of research have been carried out on the assimilation of informal urban transport systems with formal systems and on the regularization of the informal systems. A study by Paget-Seekins et al, [17] reviewed a method of consolidation of informal urban transport suppliers in Santiago, Bogotá and Mexico City into fewer, a larger regulated corporation with a bigger role for the authorities. They established that systematization increased price involving public funding and better fares, thereby putt monetary pressure on the public sectors. They propose that due to these issues shakiness in the administrative cycle would endure, making opportunities for illegal sector service. Hidalgo and King, [8] surveyed the experience of the two Colombian urban areas of Bogotá and Cali in incorporating illegal urban transport system into a controlled far-reaching transport system. While recognizing huge advance, they reasoned that an exceptionally a slow approach may encounter challenges radiating from discontinuities in a political initiative and powerless institutional limit. Çetin & Eryigit, [4] develop a model to estimate the effect of entry restrictions in the Istanbul taxicab market over real medallion prices and inflation and they found that entry regulation in Istanbul pressures inflation rates as well. Jun-Zhong, [10] also argues that the taxi industry does not fit for general competition if the government does not fix any entry rules and regulation because if the government regulates the enterprise, and the enterprises will regulate taxis and their operations. For improving the taxi services, Baoxing [1] emphasize the importance of 1) service qualities, 2) nature and positioning, 3) stability of the taxi industry and 4) the qualifications of the taxi drivers. Yanshen, [30] said that the key factor of the taxi industry stabilizing is the process of a taxicab license because unbalance taxi supply and demand have caused higher and higher prices of the taxi license. Ming-Yi, [15] in his research, he explained that the main reason for increasing the unlicensed taxi in Beijing and Shanghai was the entry regulation, regulation effects, and fare control. Unlicensed taxi transport mode also an important issue in Masvingo and Harare in Zimbabwe [25]. To prevalence of an informal taxi transport system and the authentication for its existence, Tichagwa [25] recommend particular routes mapped out for them, with a flexible licensing rule to match. Yuan et al, [29] developed a model using real-life data to identify the unlicensed taxi, better regulate the traffic operation, reduce associated costs and helping governments.

2.2. Research on an unlicensed taxi in Bangladesh

For the push and pull factor day by day the people from the rural area are migrating in urban areas of Bangladesh. As result population density in an urban area are increasing with jumping up and these surplus people are involving with different illegal activities including illegal taxi operation [24]. Ultimately, these vehicles are creating pressure on traffic and transportation system. The

volume of the vehicle is so much that in the capital city of Dhaka, average public transport speed 5kmph, same as average walking speed [26]. To describe the traffic jam situation in the major city of Dhaka Bangladesh, Rosen [22] said that-

"Of all the dysfunctions that plague the world's megacities, none may be more pernicious than bad (really, really bad) traffic."

Not only in the capital city, now this problem spreading up into the other municipalities as well. Low-cost taxi and rickshaw are considered as the main causes for this traffic congestion and the reason is that the slow-moving and roadside parking by ignoring traffic rules and regulation [19, 20]. Although the government of Bangladesh dismissed the low-cost taxi in the Third Five-Year Plan in a single sentence: "Slow-moving vehicles such as Auto (low cost taxi), pedal rickshaws, push and pull carts etc. should be gradually eliminated through development of automotive vehicles and training of existing operators for such vehicles" [7]. Because low cost and rickshaws are considered to be slow moving vehicles that occupy much road space and create congestion [2]. But in other town and municipalities' rickshaw and low-cost taxi banning procedure has not yet implemented. And these vehicles numbers are increasing with jumping up (see in figure 1) and most of these vehicles are unlicensed [5, 12]. The poverty among the people (per capita income is US$351) is considered as the main influential factors [13]. Poverty imposes the people to choose cheap transport mode for daily transportation. On the other hand Chakma, [5] & Mamun, [12] said that cheap travel fee, safety, nonpolluting and comfort are the leading effective factors to become popular of low-cost taxi among the low and middle classes people. Provision of a steady job for the uneducated people was considered as one of the major causes of increasing low-cost taxi in Bangladesh municipalities [21, 27]. No one knows the exact figure of these vehicles by which millions of family are living. Begum & Momotaz, [3]; Horsu & Yeboah, [9] said that customer satisfaction (satisfaction variable e.g. reliability, safety, continuous service, affordability, comfort, and drive behavior) are the key influential factor to become a popular traffic mode in a city. Customer satisfaction is a conclusion that a service has provided a pleasurable level of consumption-related happiness [16].

2. Materials and Methods

The main attention of the research is to explore the influential factors regarding low-cost taxi in Pabna municipality. The study involves an overview of study area, design of questionnaire, data collection and statistical analysis of collected data.

3.1. Study area

The study area of Pabna municipality located at 24.99^0 north latitude and 89.23^0 east longitude. It is about 219 kilometers away from the capital city of Dhaka (Figure 2). The total area of the study area is about 18.64 sq. km where 142.86 km is road network and serves as a home of 181939 people [5, 12]. According to UGIIP report the population density of the study area is higher than the other municipalities (30 persons per acre). The major transport modes of the municipality are low-cost taxi, rickshaw, tempo, van, bi-cycle and Motor Cycle. The low-cost taxi first introduce in the Pabna municipality is around 2005 [12, 23]. Since then, the numbers of these vehicles were increasing with jump up. Now, many people estimated the numbers of this vehicle is around 5000, exactly no one knows the actual figure of this vehicles because this vehicles are unlicensed (Figure 1). For this reason, the municipality is fully jammed packed with these surplus vehicles.

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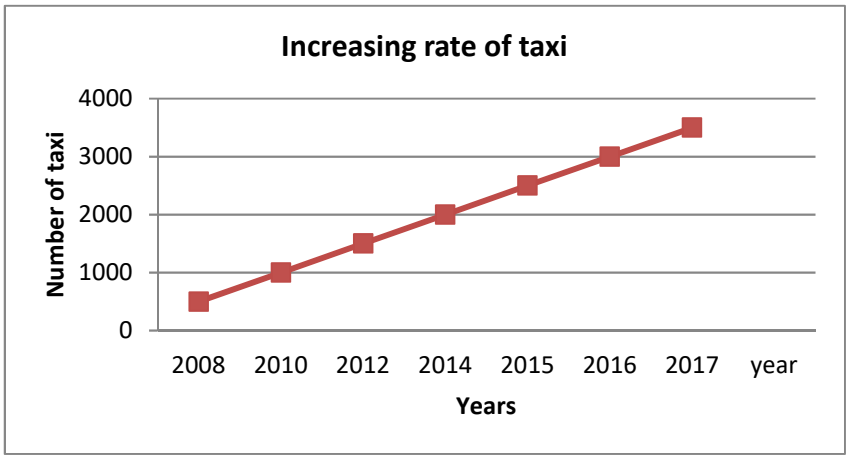

Figure-1: Increasing rate of low-cost taxi in the study area,

3.2. Questionnaire design and survey:

Six major road intersections (Terminal, maril bypass, traffic more, Nimtola more, Edward College, Judge Court) were selected for traffic volume survey in Pabna municipality (Figure-2). Two sets questionnaire were designed for both commuter and low-cost taxi drivers to acquire more depth about the situation. Randomly 50 household were surveyed to observed there socioeconomic, demographic condition and there satisfaction level in travelling with low-cost taxi; and road side interview taken with 30 drivers to analyses there socioeconomic, demographic and there satisfaction with driving a low-cost taxi. In household survey, beside the socioeconomic and demographic condition author tries to find out why, when, how and where the people are travelling. In commuter satisfaction level where include Safety, Comfort Reliability, Affordability, Continuous service and Driver behavior. The questionnaires were pre-tested before administration. After some modification, the questionnaires were administered on larger samples by hiring some research assistant.

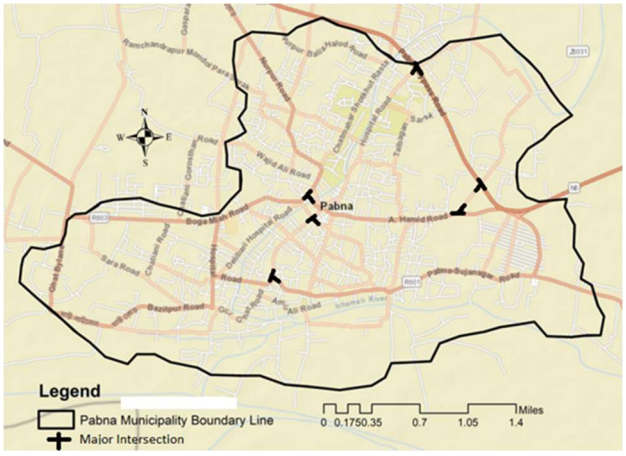

Figure-2: Survey location in the study area

Table -1: Variables considered in the Questionnaire

Section	Variables
Socio-Demographic information	Sex (Male or Female) Age range (under 20, 20-25, 25-30, 30-35, and above 40) Profession (Unemployed, self-employed, Privet sector, Govt. sector, Business, student)
Safety	Very high, High, Moderate, Low, Very low
a)Low probability of accident	Very high, High, Moderate, Low, Very low

b)Low probability of fallen	Very high, High, Moderate, Low, Very low
c)Low probability of assault	Very high, High, Moderate, Low, Very low
Comfort	Very comfortable, Comfortable, Moderate, Low comfortable
a)Comfort seat	Very comfortable, Comfortable, Moderate, Low comfortable
b)Smooth ride	Very smooth ride, Smooth ride, Moderate, poor
c)Sheltered waiting area	Yes, no
Continuous Service	Excellent, satisfactory, poor and Very poor
a)Service on weekends	Yes, No
b)Service on weekdays	Yes, No
c)Service on public holiday	Yes, No
d)Door to Door service	Yes, No
e)Service on Evening	Yes, No
Affordability	Very high, High, Moderate, Low, Very low
a)Cheap fares	Yes, No
b)Travel fee low	Yes, No
c)No tickets required	Yes, No
Driver behavior	Good, bad
Reliability	Very high, High, Moderate, Low, Very low
a)Arriving on time	Yes, No
b)Waiting away from home	Yes, No
c)Delay on route	Yes, No

3.3. Statistical Approach

A statistical model was introduced to predict and analyses the causes of increasing unlicensed low-cost taxi in the study area. Ten hypotheses were tested to predict the causes. Before run the model, reliability of the data was tested. The reliability test guarantees that each of the scales utilized is being evaluated to set up the inner consistency of the present investigation [14, 18]. Cronbach's alpha is the most common measure of internal consistency ("reliability"). The alpha values indicate a high level of reliability (Table 1).

H1 Age of the respondent has a positive and significant influence to operate an unlicensed taxi

H2 Educational level of the respondent has a positive and significant influence to operate an unlicensed taxi

H3 Marital status of the respondent has a positive and significant influence to operate an unlicensed taxi

H4 Family member support of the respondent has a positive and significant influence to operate an unlicensed taxi

H5 Safety as observed by commuters has a positive and significant influence to increase unlicensed taxi

H6 Continuous service as provided by unlicensed taxi has a positive and significant influence to increase unlicensed taxi

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H7 Comfort as observed by commuters has a positive and significant influence to increase unlicensed taxi

H8 Affordability of service as provided by unlicensed taxi has a positive and significant influence to increase unlicensed taxi.

H9 Reliability of service as observed by commuters has a positive and significant influence to increase unlicensed taxi

H10 Good driver behavior observed by commuters has a positive and significant influence to increase unlicensed taxi

Table 2: Reliability test result

Independent Variable	Cornbrash's Alpha
Age of the respondent	0.503
Educational level of respondent	0.807
Marital status of the respondent	0.626
Family member support	0.509
Safety	0.851
Comfort	0.765
Reliability	0.633
Affordability	0.714
Continuous service	0.907
Driver behavior	0.683
Commuter Satisfaction	0.708

4. Exploratory Analysis

4.1. The extent of an unlicensed taxi in the local public transport system of the study area

A comprehensive socio-economic household survey revealed that 90% of daily trips in Pabna municipality are made by low-cost taxi (Figure-3) and bicycles, while another 7% are made on foot and rest of the 3% made by cars. 90% of all retail, wholesale foodstuff, and worker are using this taxi for their daily transportation [28]. Traffic volume survey revealed that the unlicensed taxi was very active in the study area and adversely affecting on the roadway Level of service (LOS). LOS measures the operating conditions of a roadway based on travel time, speed, delay, maneuverability, and safety. LOS is designated with a letter, A to F, where "A" representing the best-operating conditions and "F" the worst [11].

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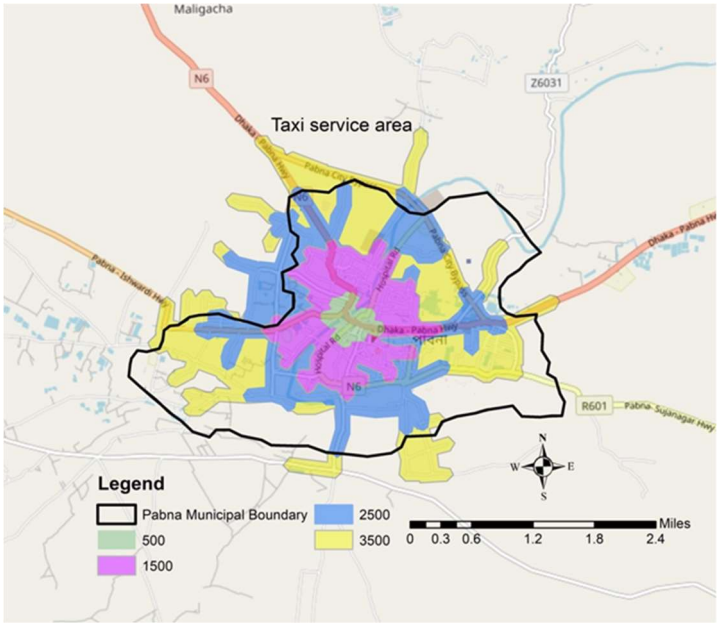

Figure 3: Taxi service map in the study area

Table 3 illustrates the worst operating condition (F) of a roadway at traffic more and nimtola more intersection. Inappropriate channelization of vehicles in the narrow roadway intersection is considering as the main influential factors of this worst traffic condition. The operating condition of other road intersection is not also satisfactory level and the main reason for this worst condition is the illegal use of footpath, lack of traffic police in the intersection, on-street parking on a narrow road, no traffic sign and signal and inappropriate channelization of vehicles.

Table 3: Impact of illegal taxi on roadway level of service

Intersection Name	Route name	Vehicle Number (PCU) (V)	Capacity (C)	Peak Hour (V/C)	Level of Service (LOS)	Width of Carriage way (meter)
Terminal	Terminal to Town	4595	5928	0.77	D	7
	Terminal to Maril Bypass	3298	5928	0.55	C	8.5
Traffic more	Town to Maril Bypas	4523	4155	1.08	F	6.5
	Town to Edward college	2040	3025	0.68	C	6.8
In front of Judge court	Town to Ananto	2720	3600	0.75	D	8
	Town to Library bazar	1728	3600	0.48	B	8
Maril Bypass	Maril to Town	2895	3989	0.72	D	7
	Gaspara to Terminal	1748	3575	0.48	B	9
Nimtola more	Town to Terminal	4176	3601	1.16	F	6.5
In front of Edward college	Town to Gaspara	3634	3878	0.93	E	7

Source: Field survey, 2018

Figure 4 shows the temporal variation of traffic flow at major road intersection (Terminal, Traffic more, Judge Court, Maril Bypass, Nimtola more and Edward College). The traffic desperate was observed from 7 am to 1 pm and 2 pm to 5 pm in afternoon. The numbers of traffic were a greeter at 12 pm to 1 pm and 4 pm to 5 pm then the other time, and 7am to 8am were also found very low numbers of traffic.

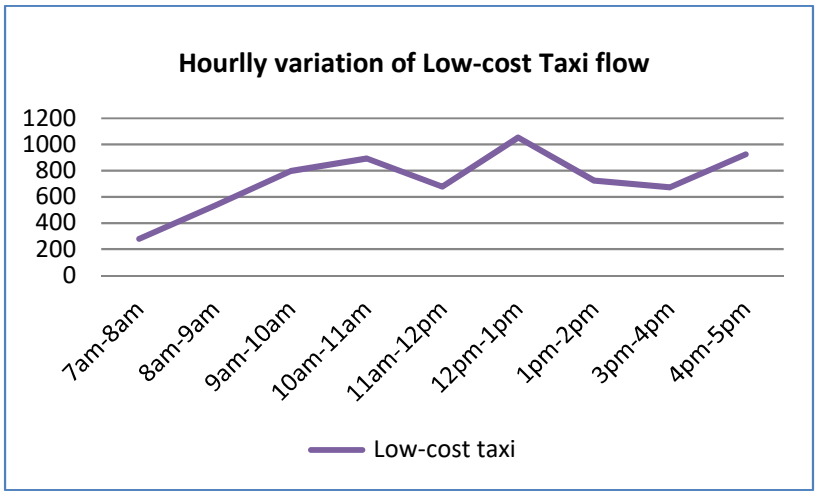

Figure 4: Average number of taxi trip per day

This could be because a lot of people go to the CBD area for shopping and recreation (especially 4 pm to 5 pm), and in case of morning time (7 am to 8 am) people start prepared themselves to go to their daily work for this reason the traffic flow number was low at that time. Sever traffic congestion was also observed during pick our period at Traffic more, Nimtola more and in front of Edward College. Lack of traffic management, lack of traffic signal, illegal use of footpath and traffic rules violate by unlicensed taxi was observed.

Figure 5 shows the average number of unlicensed taxi trips for each day of the week. It was found that the greatest number of trips on Thursday (6977) and Sunday (6279) and the smallest on Friday (4053). This could be because Friday and Saturday are weekdays, and Thursday and Sunday are the days off before and after the weekend day. It was also noted that almost all government officials, businesses and hospitals were closed on Friday. Therefore, there were fewer taxi passengers during the daytime.

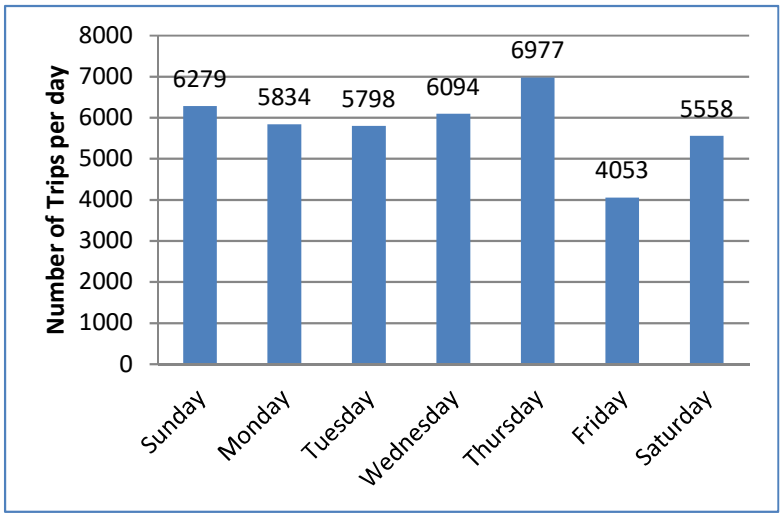

Figure 5: Average number of taxi trips for each day of the week

Figure 6 shows the taxi trips characteristics of the study area. An OD survey was applied to collect the origin and destination data (e.g. drop off and pick up location) of the commuters.

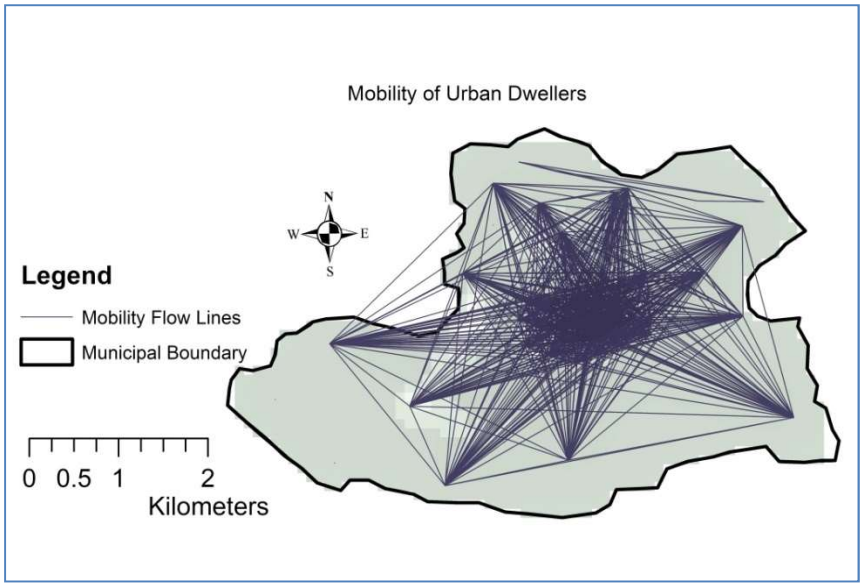

Figure 6: OD Matrix in the study area

Therefor OD survey data were processed by using google earth and ArcGIS 10.3 software. First, shapefile were created for each facility in the study area. Second, pick up and drop off location was indicated with the help of google earth and finally run the network analysis model. It was found that the most of the trips were originated from out of the CBD area and concentrate into the CBD area (Figure 7). OD survey revealed that about15% trips made for schools and college; 4% recreation; shopping 9%; others and personal work purpose trips 3%; and the rest 69% trips are related to either home or work/office (Figure-6).

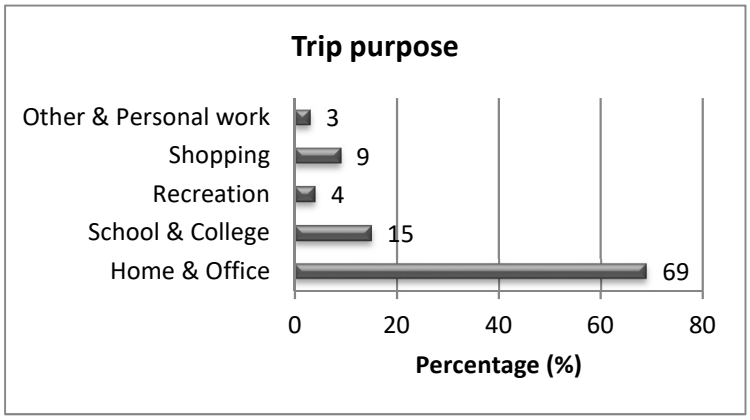

Figure 7: Purpose of trips

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

4.2. Motivational factors of commuter to use an unlicensed taxi

4.2.1. Socioeconomic and demographic conditions of the commuter

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To understand how the socio-demographic, socio-economic and the socio-cultural profiles of the commuters motivate for using an illegal low-cost taxi, authors conduct a direct interview with dwellers.

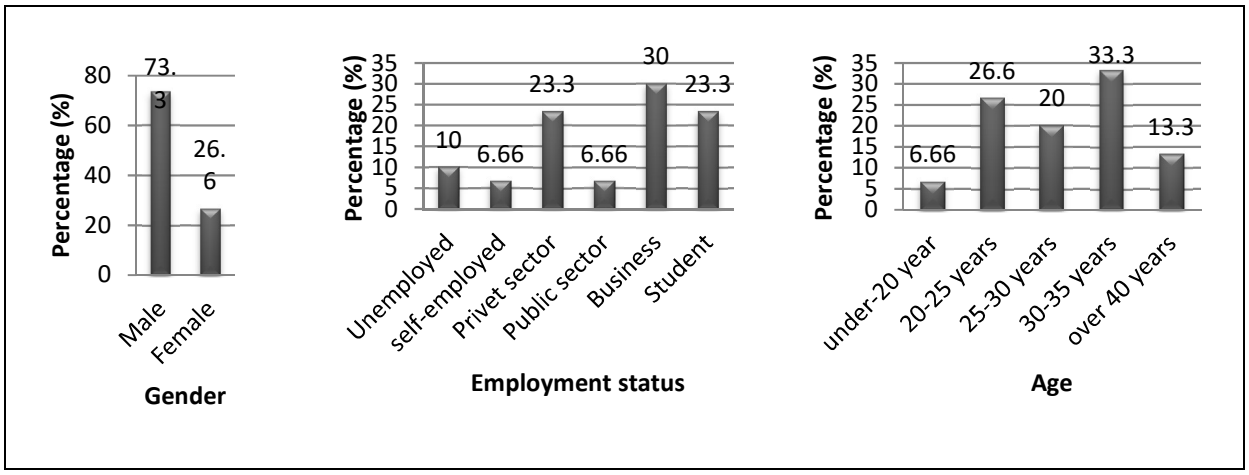

Figure 8: Demographic characteristics of commuters

From the survey it was found that the main economic source of the urban dwellers is a small business (30%, Figure 8), where include retail, hotel, and restaurant, cottage industry etc. and other important sources are privet sectors (23%). Different types of Non-Government Organization (NGO) like BRAC, Grameen Bank, ASA etc. provide employment opportunity for the unemployed. But higher educated people mostly get a job in these NGOs, on the other hand, the people who engaged in the illegal taxi operation they are uneducated and somehow completed primary education level. Very few people were engaged with government service sectors (6.6%). Students (23.3%) are another one major population parts of the municipality who use an unlicensed taxi for their daily transportation from home to the different educational institution. The main reason for this large number of student is that the location of "Pabna University of Science and Technology" and "Medical College" in the municipality. The majority of students reside off-campus and travel to and from the institutions at various times of the day by using their institutional buses and informal taxis. Some university student said that they do a part-time job (e.g. tuition) to support themselves and reduce pressure on their families. They have to use illegal taxi to go to their work place and have no alternative option.

30-35 years ranges people are more used illegal taxi (33.3%), it was observed from the analysis and the main reason is the easiness of getting in and out from the taxi (which is suitable for old age people), comfort seat and smooth riding. Other age ranges people are also using, which is shown in figure 2. From the field survey, it was experiential that the male is the money-earner in the family, he has to go out to earn daily bread and it was the main reason for increasing the male journey trips number (73%) than the numbers of female (26.6%). UGIIP [29] report said that about 80% commuter use taxi for internal transport in the municipality and their traveling patterns were attributed to traveling from residence to work/business place and academic institutions, including going to markets for shopping and offices for getting different orders, completing business deals, dealing cases in the court, medical centers and for social visits. UGIIP [29] also said that about 50.48% dwellers from total population were sufficient for meeting minimum requirements of family expenditures, and the rest 49.52% met their family need in hardship; by taking loan from their friends/relatives, moneylenders and illegal taxi driving, which gives a comprehensive picture of how the individual commuters are involving with illegal taxi business to meet their minimum family requirement.

4.2.2. Commuter satisfaction level

Table 4 shows the frequency of commuter satisfaction level on the taxi service system. Table 5 indicates the correlation matrixes of six service quality variables i.e. continuous service, comfort,

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safety, reliability, affordability and driver behavior with customer satisfaction. All the variables instead of driver behavior have a positive and significant relationship with customer satisfaction; with the adjusted R-squared value of 0.76.

Table 4: Frequency of commuter satisfaction levels

Question	Variables	Respondent	Frequency (%)
Commuters Perception on taxi service quality			
Safety	Low probability of accident	15	50
	Low probability of fallen	6	20
	Low probability of assault	9	30
Comfort	Comfort seat	16	53.3
	Smooth ride	14	46.6
	Sheltered waiting area	-	-
Continuous Service	Service on weekends	6	20
	Service on weekdays	7	23.3
	Service on public holiday	6	20
	Door to Door service	4	13.3
	Service on Evening	7	23.3
Affordability	Cheap fares	5	16.6
	Travel fee low	12	40
	No tickets required	13	43.3
Driver behavior	Good	22	73.3
	Bad	8	26.6
Reliability	Arriving on time	15	50
	Waiting away from home	9	30
	Delay on route	6	20

Source: Field survey, 2018

The correlation result said that:

1) "Safety" had a positive value and statistically significant; commuters usually felt safe in using the low cost taxi because smooth ride and drivers drove carefully.
2) "Comfort" had a positive value with highly significant level; the commuter gain satisfaction when the taxi service provides comfortable seats and enough air circulation.
3) "Continuous service" had a statistically significant positive values; commuter very satisfied with the continuous service of taxi for the door to door regular bases service.
4) "Affordability" had a positive value and statistically significant; the commuter use taxi because the travel fee of the taxi is economy (2.5 km only 20 taka).
5) "Driver behavior" had negative values and statistically significant; that's means the driver behaviors does not effect on the commuter satisfaction level.
6) "Reliability" implied that readily available of low-cost taxi at the station, timely arrival at the destination is the main reason for large volume use of taxi in the study area which is positively and significantly related to customer satisfaction.

Table 5: Correlation matrix of taxi service quality

	Safety	Comfort	Continuous service	Affordability	Driver Behavior	Reliability

Safety	Pearson Correlation	1	.858**	.918**	.820**	-.553**	.940**
	Sig. (2-tailed)		.000	.000	.000	.002	.000
Comfort	Pearson Correlation	.858**	1	.855**	.802**	-.645**	.838**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
Continuous service	Pearson Correlation	.918**	.855**	1	.894**	-.715**	.904**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
Affordability	Pearson Correlation	.820**	.802**	.894**	1	-.739**	.786**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
Driver Behavior	Pearson Correlation	-.553**	-.645**	-.715**	-.739**	1	-.540**
	Sig. (2-tailed)	.002	.000	.000	.000		.002
Reliability	Pearson Correlation	.940**	.838**	.904**	.786**	-.540**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.002	

**. Correlation is significant at the 0.01 level (2-tailed).
Adjusted $R^2 = 0.76$

Table 6 shows the results of a multiple regression analysis on the commuter satisfaction level. The result shows a positive beta coefficient score for safety, comfort, driver behavior and reliability are (b=0.613, p=0.04), (b=0.141, p=0.048), (b=0.27, p=0.091) and (b=0.109, p=0.70) respectively. Continuous service and affordability, however, score negative beta coefficient. The overall regression model was statistically significant with the $F(6, 23) = 16.62$, $p<.001$, $R^2 = 0.76$. They predict the commuter satisfaction significantly, that means the commuter satisfactions are the main influential factor for the increase of unlicensed low cost taxi in the study area.

Table 6: Result of regression analysis of taxi service quality

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.575	.323		4.878	.000
Safety	.262	.137	.613	1.908	.049
Comfort	.105	.146	.141	.718	.048
Continuous service	-.065	.087	-.253	-.746	.463
Affordability	-.540	.111	-1.054	-4.854	.000
Driver Behavior	.228	.129	.270	1.763	.091
Reliability	.052	.136	.109	.381	.707

Dependent Variable: Customer satisfaction;
Adjusted R Square: 0.76

4.3. Motivational factors of taxi drivers to operate an illegal taxi

4.3.1. Socioeconomic and demographic conditions of the taxi operator

Figure 9 shows the socioeconomic and demographic condition of the illegal taxi operators in the study area. The figure illustrated that the largest group of informal taxi operators were 30-35 years group of people who were about 33.3%. The next group 26.6%, 20% and 13.3% under the age range of 20-25, 25-30, and 40+ years, respectively. Under-20 year group (6.6%) is not yet fully involved in

this slightly risky business. From the figure, it is clear that the peak period for the informal taxi business was the 20– 35 year group (79.9%) because the 20-35 years range people were married person (83.3%) and they need a job to support their family. The married person had to support 3-4 members (43.3%) or more than 5 members (36.6%). On the other hand for the low education level (primary level 63.3%), they did not get a stable job in different NGOs and government department; eventually, to support their family they started the illegal taxi operation as the only means of living. However, the over 40 groups are the most experienced and knowledgeable operators who were actively thinking about to quitting the job or expand into different exercises like - small shop.

Pearson correlation analysis was conducted, to show how the socioeconomic and demographic conditions of the drivers' influence to operate informal taxi (Table 7). The degree of correlation, however, differ among the variables with age of respondent having the highest correlation of (1) followed by education level (0.4), marital status (0.2), family member support (-0.13) and a monthly salary (-0.15).

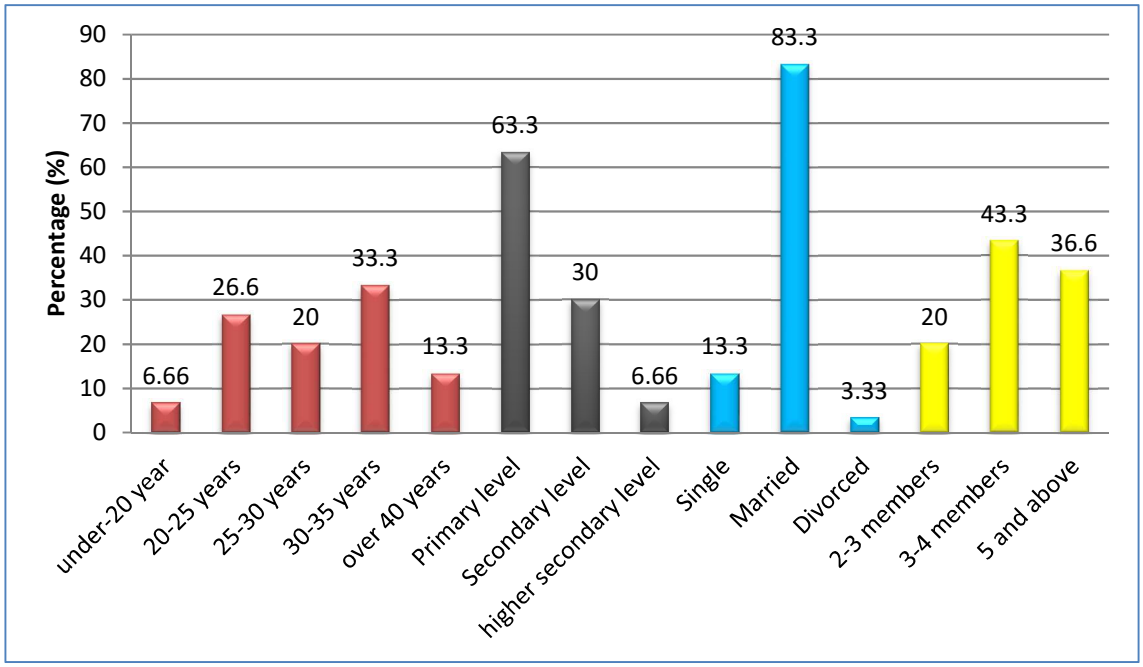

Figure 9: Socioeconomic and demographic condition of the illegal taxi operators

Table-7: Correlation matrix of the taxi drivers socioeconomic and demographic condition

		Age	Educational qualification	Marital status	Family member support	Monthly salary (in TK)
Age	Pearson Correlation	1	.404**	.236	-.136	-.155
	Sig. (2-tailed)		.004	.099	.347	.282
Educational qualification	Pearson Correlation	.404**	1	-.053	-.189	-.110
	Sig. (2-tailed)	.004		.716	.189	.445
Marital status	Pearson Correlation	.236	-.053	1	-.245	-.108
	Sig. (2-tailed)	.099	.716		.086	.457
Family member support	Pearson Correlation	-.136	-.189	-.245	1	.260
	Sig. (2-tailed)	.347	.189	.086		.068
Monthly salary(in TK)	Pearson Correlation	-.155	-.110	-.108	.260	1
	Sig. (2-tailed)	.282	.445	.457	.068	

**. Correlation is significant at the 0.01 level (2-tailed).

Adjusted $R^2 = 0.21$

The correlation result said that age of respondent and education levels have a positive correlation with the illegal taxi operation. On the other hand, family member support and monthly salary have a negative correlation with the illegal taxi operation. It's mean family member support and a monthly salary of the drivers does not affect to the illegal taxi operation where education level and age of drivers have a significant influence to operate an illegal taxi. Different age groups of people (under 20 to over 40 years) and the different education level of people (primary to higher secondary level) both are positively involved in illegal taxi operation in the study area, and the reasons are that the lack of employment opportunity. The illegal taxi operations ensure a stable job to support their family.

Table-8: Result of regression analysis for the taxi drivers socioeconomic and demographic condition

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.410	.518		4.650	.000
Age of the respondent	-.005	.071	-.009	-.064	.949
Educational qualification	.272	.098	.402	2.787	.008
Marital status	-.014	.173	-.011	-.083	.934
Family member support	-.175	.089	-.263	-1.953	.057

Dependent Variable: Causes of driving illegal taxi

Adjusted $R^2 = 0.21$

The multiple regression result shows (Table 8) the beta and p values for the four independent variables age, education level, marital status and family member support are (b= -.009, p=0.949), (b=0.402, p=0.008), (b=-.011, p=0.934), (b= -.263, p=0.057) respectively. The regression result said that the age, marital status and family member support had negative values and not statistically significant, that means the age, marital status and family member support of the illegal taxi driver does not influence to engage them into the illegal taxi operation. On the other hand, educational qualifications of the drivers were found to be statistically significant to influence them into the illegal taxi operation. It represents that the primary educated and illiterate people of the study area are largely involved in this illegal business.

The above results lead to the acceptance of three (3) hypotheses and rejection of nine (7) hypotheses. The outcome of the hypotheses test is summarized in Table 9.

Table 9: Results of hypotheses test

	Statement	B	P value	Accepted /Rejected
H1	Age of the respondent has an influence to operate unlicensed taxi	-0.009	0.949	Rejected
H2	Educational level of the respondent has a positive and significant influence to operate unlicensed taxi	0.402	0.008	Accepted
H3	Marital status of the respondent has an influence to operate unlicensed taxi	-0.011	0.934	Rejected
H4	Family member support of the respondent has an influence to operate unlicensed taxi	-0.263	0.057	Rejected
H5	Safety as observed by commuters has a positive and significant	0.613	0.049	Accepted

	influence to increase unlicensed taxi			
H6	Continuous service as provided by unlicensed taxi has a significant influence to increase unlicensed taxi	-0.253	0.46	Rejected
H7	Comfort as observed by commuters has positive and significant influence to increase unlicensed taxi	0.141	0.048	Accepted
H8	Affordability of service as provided by unlicensed taxi has a significant influence to increase unlicensed taxi	-1.054	0.001	Rejected
H9	Reliability of service as observed by commuters has positive and significant influence to increase unlicensed taxi	0.109	0.70	Rejected
H10	Good driver behavior observed by commuters has significant influence to increase unlicensed taxi	0.270	0.09	Rejected

4.3.2. Satisfaction level of drivers to driving an illegal taxi

Figure 10 shows the satisfaction level of drivers with the income they earned from illegal taxi operation. The drivers said that their monthly income range from the illegal taxi operation was (12000TK-14000TK) for the employed taxi drivers and (16000TK-18000TK) for owners. The majority of taxi drivers (71.3%) observed the level of wages they earned as satisfactory for the time and effort they put in. Around 15.5% drivers said the revenue they earned from the illegal taxi driving ranged from good to very good. Very few drivers (13.2%) said the income they earned was less than satisfactory. Most of the drivers said that the amount they earned from the illegal taxi operation allowed them a reasonably good standard of living.

Figure 10: Satisfaction level of taxi driving

4.4. Positive aspects of driving an illegal taxi

Beside every action plan must have some positive aspect, from the illegal taxi operation researcher found out three major positive aspects. Figure 11 summarized these positive aspects. Firstly, provision of a steady employment opportunity (75.5%) for the taxi drivers, secondly reduced taxi waiting time (23.44%) and finally management opportunity (5.25%) than the licensed taxi. The majority of the drivers appreciated the fact that the informal taxi business provided them a steady job, enabling them to support their families. A sizeable number of drivers said that dealing with a smaller number of passengers was easier to manage than in the licensed taxi business.

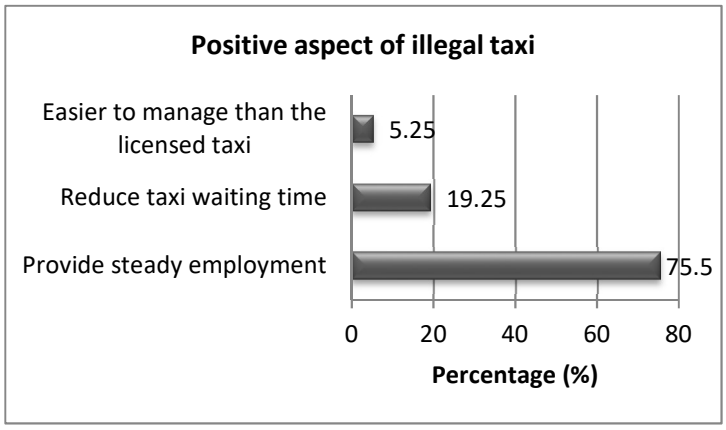

Figure 11: Positive aspect of Illegal taxi

4.5. Negative aspects of driving an illegal taxi

Figure 11 summarized the major negative aspect of the illegal taxi business that was observed from the direct conversation with the drivers and through the field survey. The most responsive negative aspect of the informal taxi operation is the traffic congestion (45.6%) in the Central Business District (CBD) area. It is quite difficult to move 5000 unlicensed taxis on only 187.50 km road from where 18.80 km streets are unpaved.

The second negative aspect of the informal taxi operation was the highly competitive (31.75%) nature of the business. Since the business is not controlled, it is common for new drivers to quickly perform on the scene and add to the number of taxis on specific routes. The impact of such an improvement is to reduce the number of travelers accessible to individual operators; consequently, reduce the trips of the drivers. This regularly causes pressure among the operators however since they are on the whole working unlawfully they can scarcely keep the inclusion of any new players. Such strains are managed following a concurred procedure. The trips are normally planned on a first come, first served premise, and by understanding, no driver is permitted to hop the line – everybody must anticipate their turn.

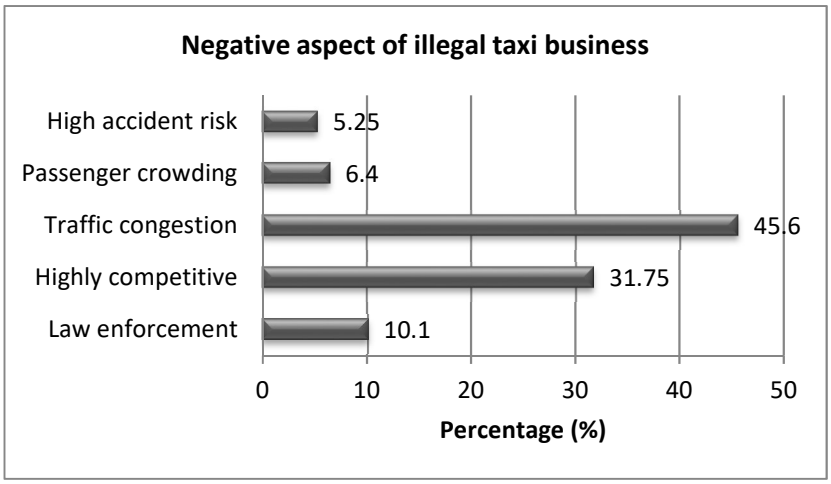

Figure 12: Negative aspect of illegal taxi driving

Law enforcement (10.1%) is another major challenge. As the illegal taxis were operated without a license, the drivers run their taxis anywhere and at whatever time they wish. Sometimes they were stopped and fined by the traffic police. The traffic police frustrated at their helplessness to manage and to force the illegal taxi to stop.

The negative parts of the illegal taxi operation specified by the drivers were the crowding of the passengers (6.4%) and the high accident risk (5.25%). The insight of a high accident risk is related to the run-ins with the law enforcement agents. Despite that the drivers realize that they need to take after the street rules expected of each driver, they regularly go for broke to abstain from having their vehicles seized. Some drivers (6.4%) said they were to some degree humiliated at squeezing four or five travelers into their small size vehicles. Be that as it may, they said they needed to do this to accomplish their objectives of every day takings.

5. Conclusions

This study aims to find out the actual causes of increasing unlicensed taxi and its extent in the Pabna municipal city. In order to do that, this study used a qualitative method to acquire more depth about the topics, where the researcher gave concern on the both (commuter and operator) socio-economic, demographic and cultural profile to understand how their socio-economic, demographic condition motivating to conduct illegal taxi business. It was found that-

- The routes of Pabna municipality were patronized by the illegal taxis very actively. All classes of urban dwellers use this mode for their daily transportation.
- The economic conditions and the lack of employment opportunity are the main causes to engage the commuters with this informal job.
- It ensures a stable job for both educated and uneducated people, which allow them to accommodate their families. But increasing the volume of taxi might be reducing the trips of the drivers.
- Most of the illegal taxi operators were uneducated, unskilled and otherwise unemployed.
- Commuters were very satisfied with the door to door service system of these informal taxis.
- The surplus illegal taxi creating pressure on traffic management system by introducing road accident, traffic congestion, and traffic rules violations.

After the analysis of socioeconomic condition of commuters and drivers, the researcher developed a statistical model, where ten predicted hypotheses (age, education level, marital status and family member support of illegal drivers, and the variable of commuter satisfaction e.g. safety, comfort, continuous service, affordability of service, reliability of service and driver behavior) were tested. The model was analyzed through the multiple regression analyses technique and the analysis result proved that education level of illegal taxi drivers, and the commuter satisfaction variable (safety and comfort) had a positive and significant effect of increasing illegal taxi in the study area. However other variable had no significant effect in case of increasing illegal taxi. This is the special mention of this paper. From this, it is possible to find the possible way of legalizing the informal taxi to ensure the development of local public transport system in the study area as well as in Bangladesh.

References

1. Baoxing, Q. I. U. (2006). Improving the Regulations, Orderliness and Services of the Taxi Market [J]. *Urban Transport of China*, *5*, 000. http://en.cnki.com.cn/Article_en/CJFDTOTAL-CSJT200605000.htm
2. Bari, M.; & Efroymson, D. (2015) Improving Dhaka's Traffic Situation: Lessons from Mirpur Road. Health Bridge and Work for a Better Bangladesh Trust, Dhaka, 2005
3. Begum, R.; & Momotaz, S. N. (2014). DETERMINANTS OF PASSENGERS' SATISFACTION WITH CNG-RUN AUTO RICKSHAW SERVICES IN BANGLADESH: AN EMPIRICAL STUDY ON DHAKA CITY. D.U. Journal of Marketing, Vol. No. 15, June 2012 (Published in November, 2014)
4. Çetin, T.; & Eryigit, K. Y. (2011). Estimating the effects of entry regulation in the Istanbul taxicab market. *Transportation Research Part A: Policy and Practice*, *45*(6), 476-484. https://doi.org/10.1016/j.tra.2011.03.002
5. Chakma, M. (2018). Analyze the Effect of Drivers Behaviors and Socioeconomic Condition on Traffic Flow: A case study of Pabna municipality, Bangladesh. Proceeding in the *4th International Conference on*

Civil Engineering for Sustainable Development (ICCESD 2018), KUET, Khulna, Bangladesh. ISBN: 978-984-34-3502-9(Printed copy), Pp., 261-262. ISBN: 978-984-34-3502-6 (online).

6. Fukumoto, M.; Matsuo, K.; and Matsumoto, Y. (2017) A Study into the Factors Affecting the Number of Taxi Trips in Toyohashi, Japan, Journal of the Eastern Asia Society for Transportation Studies. Vol. 12 (2017) p. 1434-1447. https://doi.org/10.11175/easts.12.1434
7. Government of Bangladesh. Third Five-Year Plan: 1985–1990. Dhaka, Bangladesh, 1985.
8. Hidalgo, D.; & King, R. (2014). Public transport integration in Bogotá and Cali, Colombia: Facing transition from semi-deregulated services to full regulation citywide. Research in Transportation Economics 48, 166–75. https://doi.org/10.1016/j.retrec.2014.09.039
9. Horsu, E. N.; & Yeboah, S. T. (2015). INFLUENCE OF SERVICE QUALITY ON CUSTOMER SATISFACTION: A STUDY OF MINICAB TAXI SERVICES IN CAPE COAST, GHANA. International Journal of Economics, Commerce and Management. Vol. III, Issue 5, May 2015. ISSN 2348 0386
10. Jun-zhong, W. Q. Q. T. (2011). Nature, role and management mode of the taxi industry [J]. *Urban Problems*, *11*, 016.
11. Kadiyali, L. R. (2013). Traffic Engineering and Transport Planning. Khanna publishers. New Delhi, 3013.
12. Mamun, A. H. (2015). Electric Three Wheelers and Municipal Transportation in Bangladesh. International Journal of Innovative and Applied Research, 3(2), 12-16.
13. Mannan, S. M.; & Karim, M. M. (2001). Current State of the Mobility of the Urban Dwellers in Greater Dhaka. 94th Annual Conference and Exhibition of Air and Waste Management Association, June 24-28, 2001, Orlando, Florida, USA.
14. Merriam, S.B. (2009). Qualitative research: A guide to design and implementation. Jossey-Bass, San Francisco, CA. ISBN-13: 978-0470283547.
15. Ming-yi, C. H. E. N. (2007). Entry Regulation, Fares Control and the Divagation of Unlicensed Taxis——Analysis on the Taxi Markets in Beijing and Shanghai [J]. *Journal of Shanxi Finance and Economics University*, *11*, 010.
16. Oliver, R. L. (1997). "Satisfaction: a behavioral perspective on the consumer", Irwin/McGraw Hill, New York, p.13.
17. Paget-Seekins, L.; Dewey, O.F.; & Muñoz, J.C. (2015). Examining regulatory reform for bus operations in Latin America. Urban Geography 36(3), 424–38. https://doi.org/10.1080/02723638.2014.995924
18. Peterson, R. A. (1994). A Meta-Analysis of Cronbach's Coefficient Alpha. *Journal of Consumer Research.* Oxford University Press. Vol. 21, No. 2 (Sep., 1994), pp. 381-391. http://www.jstor.org/stable/2489828
19. Rahman, M. M.; Okura, I.; & Nakamura, F. (2004) . EFFECTS OF RICKSHAWS AND AUTO-RICKSHAWS ON THE CAPACITY OF URBAN SIGNALIZED INTERSECTIONS. IATSS RESEARCH Vol.28 No.1, 2004.
20. Rahim, M. A.; Joardder, M.U.H.; Hoque, S.M.N.; Rahman, M. M.; & Sumon, N.H. (2012). Socio-economic & environmental impacts of battery driven auto rickshaw at Rajshahi city in Bangladesh. *International Conference on Mechanical, Industrial and Energy Engineering 2012 01-02 February, 2013,* Khulna, BANGLADESH.
21. Rana, S.; Hossain,F.; Roy, S.S.; & Mitra, S.K.(2013). The Role of Battery Operated Auto-Rickshaw in the Transportation System of a City. *Journal of Asian Electric Vehicles*, Volume 11, Number 1, June 2013.
22. Rosen, J. (Sept. 23, 2016). The Bangladeshi Traffic Jam That Never Ends. The New York Time Style Magazine. https://www.nytimes.com/2016/09/23/t-magazine/travel/dhaka-bangladesh-traffic.html
23. Saha, A. K.; Haque, M. R.; Nahar, T. T.; & Rahman, M. M. (2013). Application of Traffic Management Plan a Sustainable Solution of Traffic Congestion in Pabna City, Bangladesh. *International Journal of Recent Development in Engineering and Technology, 1*(3), 11-15.
24. Shamsher, R.; & Abdullah, M. N. (2013). Traffic Congestion in Bangladesh- Causes and Solutions: A study of Chittagong Metropolitan City. Asian Business Review, Volume 2, Number 1/2013 (Issue 3) ISSN 2304-2613 (Print); ISSN 2305-8730 (Online).
25. Tichagwa, C. G. (2016). Unlicensed taxis in Zimbabwe's urban areas: The case for legalising an informal urban transportation system. *Development Southern Africa*, *33*(1), 81-98. https://doi.org/10.1080/0376835X.2015.1113125
26. Tribune, D. (2018). Study: Dhaka traffic wastes 5 million work hours, costs Tk37,000 crore. Tuesday, May 22, 2018.

https://www.dhakatribune.com/bangladesh/dhaka/2018/05/20/study-dhaka-traffic-wastes-5-million-work-hours-costs-tk37-000-crore

27. Uddin, M.F.; & Sano, K. (2011). Transportation Problem Urban City of the Developing Country Bangladesh. Proceedings of the Eastern Asia Society for Transportation Studies, Vol.8, 2011
28. UGIIP. (2007). *Urban Governance and Infrastructure Improvement Project (UGIIP) for Pabna Pourashava.* Dhaka: Local Government and Engineering Department of Bangladesh.
29. Yuan, W.; Deng, P.; Taleb, T.; Wan, J.; & Bi, C. (2016). An unlicensed taxi identification model based on big data analysis. *IEEE Transactions on Intelligent Transportation Systems*, *17*(6), 1703-1713. DOI: 10.1109/TITS.2015.2498180
30. Yanshen, C. H. E. N. (2009). Analysis on Current Problems of Taxi Industry Stablizing and Developing [J]. *Urban Studies*, *2*, 022.