STUDY ON REGULATION OF MOTORCYCLE TAXI SERVICE IN BANGKOK

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Abstract: Motorcycle taxi plays an important role as one of public transportation modes in Bangkok. However, in the past, the motorcycle taxi service has been operated under unregulated condition that causes various problems to motorcycle taxi drivers and users. In 2005, the Thai government has imposed the regulations upon motorcycle taxi service that included motorcycle taxi drivers’ registration and fare rate. This makes Thailand becoming the first country in the world that regulates motorcycle taxi service. This study examines the motorcycle taxi drivers and service conditions before and after having imposed the regulations. The results reveal that the motorcycle taxi drivers’ behavior and its service system have been changed obviously after the imposition. Also, this study proposes the equation that could represent the system of motorcycle taxi service which could be applied for future planning condition perspective.

Key Words: Motorcycle Taxi, Regulation of Motorcycle Taxi, Bangkok

1. INTRODUCTION

There are various kinds of paratransit that were originally developed in many different cities in Southeast Asia. The paratransit plays an important role as intermediary transport mode to feed mass transit, e.g. bus or train in urban transport network system. In the case of paratransit system in Bangkok, there are mainly three types of paratransit, including Songtaew, Silor Lek, and motorcycle taxi. Songtaew (a ride-sharing pick-up truck) is supplemented the lack of the bus service along local streets. Silor Lek (4-wheeled compact car) and motorcycle taxi are opened for business satisfying the user's demand as a feeder in the narrow dead-end side-street branching off a major street, connecting to local communities, that route is so called “Soi” in Thai.

As continual increase of paratransit, the government has restricted number of service vehicles and imposed the regulations upon motorcycle taxi registration system and arrangement of service routes. However, the current regulation for paratransit service has not covered the
motorcycle taxi service since it has not been considered as legal paratransit service up to recent.

In the past, the Department of Land Transport (DLT) has once revised the Vehicle Law Year 1979 in order to classify the type of motorcycles into private use motorcycle and public use motorcycle. This legitimized the motorcycle taxi drivers to legally hold public motorcycle driving license and other required regulations. The revised law has finished and proposed to the cabinets since year 1998. However, the government in that period (1998-2000) did not agree to have motorcycle taxis become legally public transport mode. This is because the government had considered that the motorcycle taxi is less safe than other public transport modes. This revised law had been on hold for the enforcement.

In year 2005, the regulation of motorcycle taxi service has been considered again to enforce since the government at that period (i.e. Taksin government, 2000-2006) has a policy to solve the problem of illegal administration and unregulated service charge of motorcycle taxi service. Therefore, the DLT has revised the Vehicle Law to control the motorcycle taxi being appropriate formal system and safer to passengers. Finally, the Vehicle Law Year 2004 (including revised regulation of motorcycle taxi service) has been established and enforced from 11 May 2005.

1.1 History and Role of Motorcycle Taxi Service in Bangkok

It believes that the first service group of motorcycle taxi in Bangkok started approximately in year 1979 at Soi Ngam-doo-plee (DLT, 2006). At that time, there were several high density communities locating inside Soi Ngam-doo-plee, far away from the main street, Rama 4 Rd. The people living in these communities were necessary to travel routinely between their houses to the main street, however, almost of them were low income people and had no enough income to pay for taxi or tuk tuk service. They tried to help each other as the families that had own motorcycles helped their neighbor families to send/pick up their family members along that Soi through sharing gasoline cost. Finally, the people inside the community gathered to establish the service group and started to operate the motorcycle taxi service, and became widely used public mode in Bangkok from that time.

However, the important event that made the motorcycle taxi service became growing rapidly was the event that the National Police Agency considered that the operation of motorcycle taxi service did not against the Vehicle Law and allowed to establish the group of motorcycle taxi service, or called ‘Win’ as a term used in Thailand, since year 1982 (Poapongsakorn, 1994). The motorcycle taxi drivers almost came from the adult males (a little portion of females). Their average income is relative low.

As considering the role of motorcycle taxi upon the network system of Bangkok, it could be mentioned that the motorcycle taxi service plays an important role in transportation network system as it plays as a minor transport mode servicing demands along narrow and deep Sois connecting their local communities and main street where other major public modes (e.g. ordinary bus, sky train, and subway) are operating.

1.2 Overview of Current Regulation of Motorcycle Taxi Service

The current regulation of motorcycle taxi service is written under the Act of Legislation of Vehicle (vol. 13) Year 2004 (control of motorcycle taxi service). This regulation has been enforced from 11 May 2005 (DLT, 2006). The regulation consists of the issues concern on formalizing motorcycle taxi service, providing safety service, and controlling driver behavior.
As regulations for formalizing motorcycle taxi service, it includes regulations for setting fare rate (2 first kilometer charging not exceed 25 Baht and next kilometer charging not exceed 5 Baht/km, if distance longer than 5 km the fare rate could be set according to the negotiation between driver and passenger), regulating specific license plate for motorcycle taxi (yellow plate with black font), and regulating drivers wearing the Win specified jackets.

As regulations for providing safety service, it includes regulations for applying safety equipment (e.g. installing handle for passenger, providing helmet for passenger, and etc.)

As regulations for controlling motorcycle taxi driver, it includes regulations for registration (paying annual tax: 100 Baht per year and fare for driving license: 150 Baht per 3 years), banning/canceling driving license, and penalty for traffic role violation and inappropriate services.

It could be noticed that this current regulation has legalized the fare rate by control the upper level rate or maximum rate.

1.3 State of Problem
As considering on the current regulation of motorcycle taxi service, it has been found that it has emphasized in detail on the safety issue. In contrast, it has a lack of emphasizing on issues of service and registration system. The impact of regulation on the passenger and driver of motorcycle taxi has not been pointed out. Especially, the impact on income of motorcycle taxi drivers. Various researches have been performed for the studies on service pattern and service level of motorcycle taxi service before regulation enforcement (Fujimaki, 2001 and Yamazaki, 2003). But there is no research on the change of motorcycle taxi service system after the regulation has been enforced. However, as actually, a service pattern and service level of motorcycle taxi is different upon each Soi which provides various service patterns and levels.

Therefore it is necessary to study the influence of recently enforcing regulation to motorcycle taxi service through impact to drivers and users. And also, the feasibility and effectiveness of current regulation whether could deal with the several conditions that are expected to encounter in near future.

2. OBJECTIVES AND METHODOLOGY

2.1 Objectives
The main objectives of the study are as follow,
1. To examine the impact of current regulation of motorcycle taxi service to driver and user through questionnaire survey examining the situations before and after regulation enforcement.
2. To propose the equation for describing service system of motorcycle taxi upon drivers.
3. To analyze the viability of current motorcycle taxi service by applying proposed equation.
4. To analyze the possibility of motorcycle taxi service continuing in the future

2.2 Methodology
The process of methodology could be explained in detail as follows.
1. Selecting the study area: In this study, the various characterics of Sois branching off Lad
Phrao Rd. were selected because it is widely known that there are many large Wins of motorcycle taxi service along Sois connecting between high density communities and Lad Phrao Rd. The location over Bangkok Metropolitan Region and boundary of study area are illustrated in Figure 1 and Figure 2.

2. Data collection:
   - Situations prior regulation enforcement (Questioning to drivers)
   - Situations under regulation enforcement (Questioning to drivers)

3. Analysis: To analyze influence and the present operation situation that regulation brought from a viewpoint of a driver. And, to analyze the influence of fare rate of existing regulation of motorcycle taxi service, finally to analyze the possibility of motorcycle taxi service in the future.

4. Proposal and Conclusion: The problem that a present motorcycle taxi regulation holds from the analysis result is brought together, and it will propose it in the future.

![Figure 1 The location of study area over bangkok metropolitan region](image)
3. INFLUENCE OF REGULATION ENFORCEMENT OVER DRIVERS AND SERVICE CONDITION

3.1 Payment of Motorcycle Taxi Driver Prior and After Regulation Enforcement
In practical service of motorcycle taxi system, the Wins, e.g. the operation groups of motorcycle taxi service, occupy their own service area, i.e. own Soi to prevent the competitive service conflict among Wins. To clarify the service area of each Win, the Win owner (usually, 2 groups of owners: 1(local governmental officer, police or soldier or 2) local powerful person) designed the specific-Win jacket and provided to the drivers who belong to his Win.

Before regulation enforcement (i.e. before May 2005), there were two kinds of informal expenses that drivers have to pay for service operation. The first expense is the administration fee that the new drivers who want to enter the business of motorcycle taxi service had to pay initially to Win’s owner, or known among drivers as buying the operation jacket. The second expense is the payment for daily making business, i.e. service operation. The drivers had to pay daily to Win’s owner for income of owner and also had to pay the police for smoothly making an informal business that even not is illegal but unregulated business.

However, after the motorcycle taxi service has accepted as one of the public transport mode through releasing the regulation since May 2005, the government has performed the administration and management of service. Therefore, the drivers have not to pay to the informal system. Instead they have to pay an annual tax and driving license fee for the government.
To examine change of driver’s payment after regulation enforcement, this study has conducted the comparison of driver’s payment conditions before (surveyed in year 2004) and after (surveyed in year 2006) regulation enforcement. For calculation, it sets the average period of making motorcycle taxi service business of drivers is 3 years that is recorded average working period of motorcycle taxi drivers in Bangkok (Fujimaki, 2001).

As unregulated condition, the drivers have to pay the same amount in annual for 3 years. However, after regulation has been introduced, it was not necessary to pay to informal system, rather pay formally only a registration fee and an annual tax to the government as shown in Table 1. The additional income of driver results from regulation enforcement (have not to pay for informal system) has been returned to drivers for three years. The ratio comparing additional income to net income of 3 years is calculated (the net income of three years could be found from results of questionnaire survey). As a result of calculation, the ratio of additional income over net income is very high; especially the ratio of Soi 63 is more than 50%. It could be believed that it impacted to decrease in welfare and profit of drivers. The summarization of payments of drivers before/after regulation is shown in Table 1.

Table 1 Comparison of payments of motorcycle taxi driver before/after regulation

<table>
<thead>
<tr>
<th>Soi Number</th>
<th>Regulation</th>
<th>Item of payment</th>
<th>Total expense / 3 years (Baht/person)</th>
<th>Additional income / 3 years (Baht)</th>
<th>% of additional income over net income for 3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>Before</td>
<td>Jacket (2,500B), Pay for win owner (50B/day), Pay for police (2,000B/month)</td>
<td>112,050 800</td>
<td>111,250</td>
<td>67.7%</td>
</tr>
<tr>
<td>71</td>
<td>After</td>
<td>Jacket (30,000B), Pay for police (150B/month)</td>
<td>35,400 800</td>
<td>34,600</td>
<td>12.6%</td>
</tr>
<tr>
<td>83</td>
<td>Before</td>
<td>Jacket (55,000B), Pay for win owner (30B/day), Pay for police (500B/month)</td>
<td>101,530 29,330</td>
<td>72,200</td>
<td>32.9%</td>
</tr>
<tr>
<td>87</td>
<td>After</td>
<td>Parking space (30B/day), Tax (1 year/100B), Registration cost (3 years/500B)</td>
<td>71,400 800</td>
<td>70,600</td>
<td>32.3%</td>
</tr>
<tr>
<td>91</td>
<td>Before</td>
<td>Jacket (6,000B), Pay for win owner (300B/month)</td>
<td>16,800 800</td>
<td>16,000</td>
<td>8.1%</td>
</tr>
<tr>
<td>93</td>
<td>After</td>
<td>Tax (1 year/100B), Registration cost (3 years/500B)</td>
<td>72,600 800</td>
<td>71,800</td>
<td>19.2%</td>
</tr>
<tr>
<td>101</td>
<td>Before</td>
<td>Jacket (2,000B/month)</td>
<td>72,000 48,350</td>
<td>23,650</td>
<td>6.2%</td>
</tr>
<tr>
<td>109</td>
<td>After</td>
<td>Parking space (50B/day), Tax (1 year/100B), Registration cost (3 years/500B)</td>
<td>12,600 800</td>
<td>11,800</td>
<td>3.6%</td>
</tr>
<tr>
<td>Happy Land</td>
<td>Before</td>
<td>Jacket (1,000B/month)</td>
<td>36,000 800</td>
<td>35,200</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>Tax (1 year/100B), Registration cost (3 years/500B)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As results of this comparison, it is clear that before enforcement of regulation, the drivers had to pay informally a large amount of money to their Win’s owners and local polices, and the regulation has functioned successfully in increase of driver’s income.

3.2 Impact of Regulation over Service System of Motorcycle Taxi

After regulation enforcement, not only the payment of drivers has been improved but also the service system of motorcycle taxi has been changed. Table 2 shows the comparison of service system of motorcycle taxi before and after regulation. The data has been obtained from conducting questionnaire survey.
Table 2 Impact of regulation over service system of motorcycle taxi and income of driver

<table>
<thead>
<tr>
<th>Soi Number</th>
<th>Regulation</th>
<th>Average service times/day</th>
<th>Average fare/service (Baht)</th>
<th>Number of registration</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>Before</td>
<td>80</td>
<td>6.3</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>43.4</td>
<td>7.4</td>
<td>70</td>
</tr>
<tr>
<td>71</td>
<td>Before</td>
<td>100</td>
<td>5.0</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>40</td>
<td>10.0</td>
<td>30</td>
</tr>
<tr>
<td>83</td>
<td>Before</td>
<td>100</td>
<td>7.0</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>90</td>
<td>5.0</td>
<td>63</td>
</tr>
<tr>
<td>87</td>
<td>Before</td>
<td>40</td>
<td>10.0</td>
<td>77</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>45</td>
<td>12.5</td>
<td>70</td>
</tr>
<tr>
<td>91</td>
<td>Before</td>
<td>80</td>
<td>4.4</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>32.5</td>
<td>9.5</td>
<td>45</td>
</tr>
<tr>
<td>93</td>
<td>Before</td>
<td>100</td>
<td>5.0</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>50</td>
<td>10.5</td>
<td>20</td>
</tr>
<tr>
<td>101</td>
<td>Before</td>
<td>50</td>
<td>6.0</td>
<td>550</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>47.5</td>
<td>12.5</td>
<td>514</td>
</tr>
<tr>
<td>109</td>
<td>Before</td>
<td>55</td>
<td>5.5</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>30</td>
<td>18.8</td>
<td>21</td>
</tr>
<tr>
<td>Happy</td>
<td>Before</td>
<td>85</td>
<td>5.9</td>
<td>40</td>
</tr>
<tr>
<td>Land</td>
<td>After</td>
<td>50</td>
<td>9.0</td>
<td>40</td>
</tr>
</tbody>
</table>

Thus, the service system of motorcycle taxi after regulation enforcement is considerably different from before regulation enforcement. It could be understood that the regulation enforcement has noticeably influenced to service level. However, the service system has been changed not only the influence from introduction of regulation but other factors as well.

- The almost all Soi’s average fare rate have been raised, because in unregulated period, the fare rate was decided by Win’s owner who had to decided the lower price that the driver’s expect. But it had become easier to change the fare by introducing the regulation system. Drivers setting of an amount of money to expect in the fare upper limit more was enabled. And it’s contemplated that the effect of the continued increase in the cost of gasoline.
- The average service time of driver per day have been decreased in almost Sois. But number of registered vehicles has been kept the same number, except Soi 63. It implies that the demand of using motorcycle taxi service decreases because fare rate has been increased due to impact of regulation and increase of gasoline price. Some of users have switched to use other alternative modes.

It could be concluded that for 2 years, there are several factors changing the service system of motorcycle taxi, not only impact of regulation enforcement but also impact of gasoline price. But the reason of decrease the average service time that it here like drivers possible to set the more suitable fare rate except Win’s influence, but at the same time the number of user and use times had been decreased.

In addition, to observe the situation in detail, the relation between the average service fare and average service time before and after introduction of regulation, and also the maximum fare rate set under the regulation is shown in Figure 3
As Figure 3, it implies that after enforcing the regulation, the fare rates have been adjusted to increase by groups of drivers (i.e. Win), it results that number of users decreases as notifying from decreasing in average service times per day of drivers.

However, it is noticed that the increasing fare rates are still much lower than the maximum rates set by regulation. For example, at Soi 114, its average service distance is 0.9 km, the drivers could set the fare rate from current rate (5 Baht) up to 25 Baht under regulation. However, in fact, Win could not set the fare rates close to such these maximum rates since the users will stop to use their services. As proving by example of fare rate at Soi 109, after regulation enforcement, the Win has raised their service fare rate to high value (Even still a bit much lower that maximum rate), it results that a lot users stop to use their service.

It is clear that the current fare rate has been influenced under decision of drivers and users. And, the maximum fare rate set by regulation is too high and has not influenced on current fare rate at all.

As conclusion of influence of Regulation enforcement over current fare rate and service condition, the results from Table 2 imply that the service systems and fare rates of each Soi are quite different, however, the results from Figure 3 imply that even service system and fare rate are quite different but it could notify that there is a general trend of pattern of fare rate and service system of a whole systems of motorcycle taxi service.

The next chapter attempts to propose the equation that could describe the general service system of motorcycle taxi upon drivers.
4. PROPOSAL OF EQUATION FOR DESCRIBING SERVICE SYSTEM OF MOTORCYCLE TAXI UPON DRIVERS

To develop the equation to describing the service system, it is necessary at least for balance of the income and expense of drivers. If motorcycle taxi driver’s income and expenditure satisfied Equation 1, it means that they could achieve the balance income and expense of the motorcycle taxi service.

\[
\frac{\text{Total Expense}}{\text{Total Income}} \leq 1
\]  

(1)

Where

\[
\begin{align*}
\text{Total Income} &= \text{Income from service charge} \\
\text{Total Expense} &= \text{Driver’s average net income} + \text{Fixed Cost} + \text{Variable cost}
\end{align*}
\]

To apply this proposed equation through the groups of drivers, it assumes that every driver always returns to their terminal, i.e. waiting point, after they serve the service to wait for next service. In addition, the gasoline consumption rate of motorcycle taxi is 50km/l (HONDA wave model, mostly used model for motorcycle taxi service in Bangkok). The calculation of the income and expenditure balance does one year to the standard. All parameters and their definitions including in Equation 1 show as the below.

- Driver’s Average Net Income: DI
  The average net income of motorcycle taxi driver per month excludes the fixed and variable costs. The value is represented by average value from the questionnaire survey.

- Fixed Cost: FC
  The fixed cost includes tax, license fee, insurance cost, and maintenance cost, but excludes the cost of motorcycle purchase, because a lot of drivers have their own motorcycles. The values are represented by the average values from the results of questionnaire survey.

- Variable Cost: VC
  The variable cost is the gasoline cost that is directly related to the service distance. average Service Length of motorcycle taxi (SL), Average service Times per day (AT) and total Service Days per year (SD) are used to calculate the total service distance per year. Hence, the gasoline cost could be calculated by Equation 2.

\[
VC = \frac{2 \cdot SL \cdot AT \cdot SD}{50} \cdot GP(\text{Gasoline Price})
\]  

(2)

- Total Income: TI
  The total income is related to the service charge rate. Average service fare rate per service (AS), Average service time per day (AT) and total service day per year (SD) are applied to calculate the total income per year. Hence, it could calculate as the Equation 3.

\[
TI = AS \cdot AT \cdot SD
\]  

(3)

Therefore, when the total expenses and total income in Equation 1 are substituted by given
variables, it becomes Equation 4.

\[
DI + FC + \left( \frac{2SL \cdot AT \cdot SD}{50} \right) \cdot GP \leq \frac{AS \cdot AT \cdot SD}{1}
\]  

(4)

4.1 Validation of Proposed Equation from Current Service System

To validate the proposed equation, the data of each driver obtained from the questionnaire is inputted into equation (e.g. Win data of Soi 63, 71, 81, 83, 87, 91, 93, 101, 109, and Happy applied because these Sois have all data before and after regulation).

According to results of questionnaire survey, the average net income of drivers is 81,057 Baht/year (DI), the all fixed costs of drivers is 4,450 Baht/year (FC), and the average service length is 2.3 km (SL). As setting the total service days per year of drivers, according to the questionnaire survey, almost drivers work 6 days per week (i.e. a day for rest per week). Then, it sets that a driver works 313 days a year (SD). In addition, the gasoline price is set at 27 Baht per liter (GP) as price recorded on December, 2006 (EPPO, 2006). To analyze the relation between Average Service fare rate (AS) and Average service time per day (AT), then, substituting all above values into Equation 4, it hence becomes Equation 5.

\[
\frac{DI + FC + \left( \frac{2SL \cdot AT \cdot SD}{50} \right) \cdot GP}{AS \cdot AT \cdot SD} = \frac{81,057 + 4,450 + \left[ \frac{2 \cdot 2.3 \cdot AT \cdot 313}{50} \right] \cdot 27}{AS \cdot AT \cdot 313} \leq 1
\]

(5)

\[
\frac{273.2}{AT} + 2.45 \leq AS
\]

Figure 4 shows the values of AT and AS resulted of Equation 5 and the observed values from questionnaire.
To validate the accuracy of equation, the coefficient of determination, $R^2$, has been applied to check the goodness of fit of values from propos equation with observed value. The result of $R^2$ is 0.67. It implies that the proposed equation could be well representing the current condition. For example, it can be seen from the graph plotted by equation that if fare rate set at 25 Baht, thereby a few average service times. Therefore, it could set the maximum fare rate according to average service times of drivers in each Soi as proposed equation. This equation would be further applied to analyze the viability of motorcycle taxi service on current condition and future condition.

4.2 Viability of current motorcycle taxi service

The proposed equation would be applied to analyze impact of profit of drivers when the influencing variable would change from current service level. The average service day per year, average service times per day, and average service fare per service have been set to be vary in order to check which conditions that the drivers could not continue their service any more. The graphs of relation between ratio of expenditure and above service variables are shown in Figure 5, 6, and 7, respectively.

As the results of analysis, the ratio of expense and income would be less than 1.0 if they have to work for service at least 244 days per year. And if considering on number of service per day, they have to give the service at least 39 times per day. Lastly, if considering on service charge, they have to charge at least 7 baht per service. A rise of a sudden fare may cause a decrease in number of users, but it is effective way because a rise of fare rate 1 Baht from the existing rate, it results in impact better than increasing number of service per day.
4.3 Possibility of motorcycle taxi service continuing in the future

The proposed equation would be applied to analyze whether the motorcycle taxi service is able to continue their business in the future. It assumes the situation that it is expected that the motorcycle taxi drivers would face in the future that increase in expense due to sudden rise of gasoline price that is progressing now. Whether it is necessary to assume the situation what correspondence to do by the motorcycle driver are examined.

The sudden rise of a rapid gasoline price in recent years is a very critical situation for the motorcycle taxi driver whose major expense is fuel expense. As two years ago, the gasoline price was 19 Baht per liter; however, it increases to 27 Baht per liter on December, 2006. The drivers had been severely impacted through 70% increase in gasoline price for two years. According to result from questionnaire survey, 80% of drivers answered that the they were impacted by rise of gasoline price, therefore, it assumes if the gasoline price rises in the future, it would be impacted to the driver’s fuel expense with same rate. Then, this level service is supplied, and the proper fare level that can be continued will be examined in the future where the fuel expense will rise. The equation presenting relation of gasoline price (GP) and service fare rate (AS) could be solved by substituting all variables, except the gasoline price and service fare rate in Equation 4, hence, it becomes Equation 6.

$$\frac{DI + FC + \left( \frac{2SL \cdot AT \cdot SD}{50} \right) \cdot GP}{AS \cdot AT \cdot SD} = 5.19 + 0.084GP \leq AS \quad (6)$$

The boundary where service can continue when gas price increase in future is shown in Figure 8.
When condition is satisfied to the boundary from proposing equation, the motorcycle taxi drivers can provide their service. As current rate of gasoline price (27 baht/liter), the service fare rate could be set at minimum 7.5 baht (value on the boundary line), but the current average fare rate is 10 baht according to the questionnaire survey. And, the planner can know from this graph that if the gasoline price increases to 50 baht in the future, the fare rate should be changed to set at least 9.4 baht, otherwise the motorcycle taxi drivers could not continue their business.

In addition, when it plots the graphs of relation between ratio of expenditure and income of drivers for the future condition when gasoline price increasing as shown in Figure 9.

According to Figure 9, it reveals that the drivers would not be able to continue their business when gasoline price raise more than 44 Baht in the future. However, if the income of drivers increases according to adapting in increase of fare rate, the drivers are possible to continue their service even if the gasoline price rises.
5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion of the Regulation System Based on the Result of Analysis
The main purpose of enforcement of regulation for motorcycle taxi service in Bangkok is to solve the informal administration and unregulated service charge of motorcycle taxi service. The results of the analysis prove that the main purpose has been achieved as the drivers have not to pay a huge amount of money to informal system, rather pay formally relative cheaper amount of money to government, and the current service charge has been done under the regulation.

This study proposes the equation of financial condition of drivers that could describe the service system of motorcycle taxi. The proposed equation could be applied properly the viability of current motorcycle taxi service as its boundary of possible financial condition of drivers could explain clearly that current conditions of motorcycle taxi services.

The proposed equation could be applied properly to analyze the future conditions of motorcycle taxi service as the drivers could continue their business under current fare rate until the gasoline price increases up to 44 baht in the future under assumption of constant average service time. If the drivers want to continue their business under condition of gasoline price over 44 baht, they have to change the service condition.

As an issue for future study, we should consider to include the depreciation cost of the motorcycle as a total expense when drivers purchase a new motorcycle and start the service. However, it is uniformly difficult to define by the equation since the driver used a various year-types of motorcycles. It is necessary to investigate the price of the every company motorcycle cost using by service and a ratio of the depreciation separately.

5.2 Recommendations for Motorcycle Taxi Service in the Future
The current regulation on fare rate is still not appropriate because it should control the maximum fare rate, it is not flexible and adapts based on the service situation. The more suitable regulation of fare rate should be decided by applying the equation proposed by this study.

Relating to the service of the fare system comes to still leave the driver though a main purpose of the regulation introduction was achieved. Therefore, the motorcycle taxi regulation system should proceed to the next step. Especially, to prepare the regulation system that can correspond to it because it is thought that the situation in which the change in the service system such as increases in the fuel expense and decreases of the user will be done through necessity in the future. Moreover, the opinion on the user side should also take it enough in that case.

In the future, it is possible to introduce the motorcycle taxi service as effective transportation though the motorcycle taxi is special service being chiefly provided in Bangkok. As other Asia cities, it is necessary to use an experience of the regulation system begun in Bangkok. According the questioner answer showed that almost users stop the use of the motorcycle taxi after a fare is raised more than 5 Baht. However, the motorcycle taxi is one essential transport modes that still be demanded for travelers who do not have other choice even if the fare rises. Therefore a better regulation system would be based on opinion of users and drivers.
The maintenance of the infrastructure facilities related to the motorcycle taxi service is painfully slow, and not improved the circumference environment of the motorcycle taxi service now. The regulation system that manages the motorcycle taxi service system and keeps the quality is necessary. It can be said that the regulation system introduced by doing the facilities maintenance corresponding to service there at the same time, and treating the motorcycle taxi at the same level as other public traffic will function more. The Figure 10 shows that one of the example that motorcycle taxi service with public transportation.

Figure 10 The image of the terminal system of motorcycle taxi service
REFERENCES


