

## STUDY ON MERITS AND DEMERITS OF TWO TRANSPORT SYSTEMS: BATTERY OPERATED EASY BIKE WITH MOTOR OPERATED RICKSHAW AT SYLHET CITY IN BANGLADESH

Mohammad Iqbal<sup>1</sup>, Rakibul Hasan<sup>2</sup> and Tanvir Ehsan<sup>3</sup>

<sup>1-3</sup>Department of Industrial and Production Engineering, Shahjalal University of Science and Technology  
Sylhet-3114, Bangladesh

**Abstract-** This study is carried out about the comparative study of the two most common mode of transportation. Battery operated auto-rickshaws (easy bike) & motor operated rickshaw both are newly introduced vehicle in city areas and took the place of general rickshaw because of cheap cost and comfort. Easy Bikes are tiny, three-wheeled vehicles which are used extensively in many Asian countries for transport of people and goods. The numbers of battery powered auto rickshaws are increasing day by day. Sylhet City Corporation has been selected as a sample area, because there are huge motor rickshaws and easy bikes used for daily travelling. This study is based on primary data. The researchers tried to show the economic conditions which ultimately influence the income of auto-rickshaw drivers and motor rickshaw drivers. This research paper also focuses on the monthly income, profit & investment of both easy bike & rickshaw drivers. Calculation of profit-investment ratio of easy bike and motor rickshaw drivers has been highlighted.

**Keywords:** Bike, Rickshaw, Transportation and Safety.

### 1. INTRODUCTION

Economic development and transportation are closely related. Transport is important because it carries not only passengers but also enables trade among people, which is essential for the development of civilizations. Bangladesh is a developing country in South Asian where rickshaw, van and bi-cycle are most important vehicles of urban and rural areas. Battery operated auto-rickshaw (locally called 'Easy-bike') is a newly added para-transit mode in urban transportation system of Bangladesh (figure 2)[1]. The mode, being introduced in 2008 in Bangladesh attains much popularity among urban passengers since it involves lower travel cost than other locally available transport modes as well as provides reasonable safety and comfort to the users during travel [1].

This popularity, in turn results rapid growth of the mode in urban areas of Bangladesh. Now, the mode has become inseparable part of urban people's mobility network, especially in small-compact towns [2]. Therefore, it requires

careful attention in incorporating the mode in local urban traffic-mix. To serve the purpose, the study is made to explore and analyse different attributes associated with the mode both from operators and users point of view.

### 2. BACKGROUND OF THE STUDY

An electric cycle rickshaw can provide a non-polluting and a very silent transport system for urban and rural areas and busy cities. The low rolling resistance and light weight make this vehicle very energy efficient and cost effective. Work done at major research Institutions has shown that improved cycle rickshaws powered by electric motors and batteries have a potential to provide an attractive alternative to petrol and diesel powered three wheelers. Besides they can also provide large scale employment and extra income to the rickshaw operator, without affecting his or her health [2].



Fig.1: Motor Rickshaw.



Fig.2: Easy Bike.

## 2.1. Objective

Main objective of the research work is to find the differences between the two public transport namely Battery Powered Easy Bike and motor operated Rickshaw in terms of cost (operating cost, manufacturing cost, maintenance cost), user friendly, safety and environmental issue.

## 3. LITERATURE REVIEW

### 3.1 History of Auto Rickshaws

Auto rickshaws are one of the most popular modes of transport in Bangladesh mainly due to their size and speed. They are best suited to narrow, crowded streets, and are thus the principal means of covering longer distances within urban areas [3]. At the end of the 1980s, a local company Atlas designed and built a new version of the auto rickshaw, called mishuk, a name derived from a children's mascot of a local deer. Unlike baby taxis, mishuks have spokewheels and a green body, and have no meter system. Mishuks have more space than baby taxis, which makes it more popular with women.

### 3.2 Previous Work

On auto rickshaw various studies have been performed over last couple of decades. Many papers and articles have been published on Electrical and motor rickshaws. An article titled "Electronic differential with sliding mode controller for a direct wheel drive electric vehicle" by Gair, S., A. Cruden, J. McDonald, and B. Hredzak at International Conference on Mechatronics was published in 2004 [4]. The article discusses single drive systems and multi-drive systems. With multi-drive systems the motor controllers must additionally be configured to provide an electronic differential effect.

A journal paper under the title "A Study of Fuel Cell Hybrid Auto Rickshaws Using Realistic Urban Drive Cycles" was published in Jordan Journal of Mechanical and Industrial Engineering (JJMIE) By Mohammed Abu Mallouh, Bradley Denman, Brian Surgenor, Brant Peppley in January 2010. The paper tried to discuss the comparison between ICE and hybrid fuel cell rickshaw configuration was done using a realistic drive cycle [5].

A research paper based on "Development of a Micro-Hybrid System for a Three Wheeled MotorTaxi" By T. Hofman, S.G. van der Tas, W. Ooms, E.W.P. van Meijl, and B.M. Laugeman at Stavanger, Norway, was published in 2009. The goal of the research in this paper was to develop a compact, robust and affordable hybrid system in order to significantly reduce the fuel consumption and emissions of auto-rickshaws [6].

## 4. DATA COLLECTION AND ANALYSIS

### 4.1 Research Methodologies:

Methodology is generally a guideline for solving a problem, with specific components such as phases, tasks, methods, techniques and tools. In this data collection, both qualitative (Interviews) and quantitative (Questionnaires) research methods have been used. This section deals with the findings from the data collected, tabulated form and graphical representation of these data and the analysis of those data. From those data's, analysis were done to compare the two public transport namely Battery operated Easy Bike and motor operated Rickshaw. Concentration has been given on to cost, manufacturing, resource, maintenance, structure, safety and other related issue.

#### 4.2 Zone Distribution in Sylhet City

Table 1 shows zone wise distribution in Sylhet City. This is done for smooth data collection and analysis.

Table 1: Zone Distribution in Sylhet City.

| Zone | Regions  |
|------|--|
| A    | Subidbazar, Ambarkhana, Chouhatta, Zindabazar, Bondorbazar, Sylhet International Cricket Stadium |
| B    | Tuker Bazar, Varsity Gate, Noyabazar, Modina Market, MAG Osmani Medical College, Rikabi Bazar    |
| C    | Kadamtoli, Humayan-Rashid Square, Uposhohor Point, Keane Bridge                                  |
| D    | Eidgah, Tilagar, Noyasorok, Naiorpul, Shibganj, MC College                                       |

#### 4.3 Sample Size Calculation

When the target population is finite, the following formula may be used to determine the sample size

$$S = \frac{X^2 NP(1-p)}{d^2(N-1)+X^2 P(1-P)}$$

Where,

S = required sample size

X<sup>2</sup> = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841 for 95% confidence level)

N = 12000 (it is assumed that 12000 motor rickshaw and easy bike existing in Sylhet)

P = 0.37 (estimated proportion of easy bike)

d = 0.05 (the degree of accuracy expressed as a proportion).

We get S value as 348So, S=348

The minimum sample requirement is 348. Considering the equal number of sample from each of the four zones it is considered that the sample size equals 360, so 90 samples are needed to take from each zone.

### 5. RESULTS ANALYSIS

#### 5.1 Ownership of the Vehicles

Table2 portrays the number of owned & rented motor rickshaw and easy bike. In the case of motor rickshaw 39% drivers have their own motor rickshaw and 61% are used on rented basis (figure 3). On the contrary 30% easy bike was personal and 70% was rented (figure4). Due to low cost of motor rickshaw, percentage of ownership is more for motor rickshaw drivers compared to easy bike.

Table 2: Motor Rickshaw and Easy Bike in Sylhet City

| Zone  | Motor Rickshaw |       | Easy Bike |       | Out of |
|-------|----------------|-------|-----------|-------|--------|
|       | Rented         | Owned | Rented    | Owned |        |
| A     | 38             | 22    | 22        | 8     | 90     |
| B     | 25             | 17    | 33        | 15    | 90     |
| C     | 42             | 28    | 13        | 7     | 90     |
| D     | 33             | 23    | 24        | 10    | 90     |
| Total | 138            | 90    | 92        | 40    | 360    |

Fig.3: Proportion of rented and owned motor rickshaw.

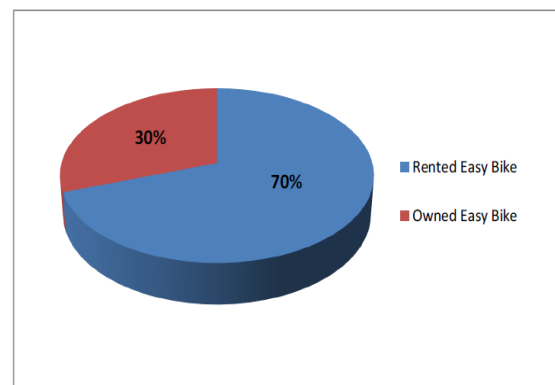


Fig.4: Proportion of rented and owned easy bike.

Figure: Proportion of Number of rented and owned motor rickshaw in Sylhet City.

#### 5.2 Percentage of Motor Rickshaw and Easy Bike

Table3 portrays the proportion of motor rickshaw and easy bike at different zones of Sylhet City. In the comparison of total number of both vehicles there are 63% motor rickshaw and 37% are easy bike (figure 5). Because of increasing demand and high income, the number of auto-rickshaw also goes up both in the case of personal and rented.

Table 3: Zone wise Proportion of easy bike and motor rickshaw.

| Region Of Sample | Proportion of  |           |
|------------------|----------------|-----------|
|                  | Motor Rickshaw | Easy Bike |
| A                | 0.67           | 0.33      |
| B                | 0.47           | 0.53      |

|         |      |      |
|---------|------|------|
| C       | 0.78 | 0.22 |
| D       | 0.62 | 0.38 |
| Average | 0.63 | 0.37 |
|         |      |      |

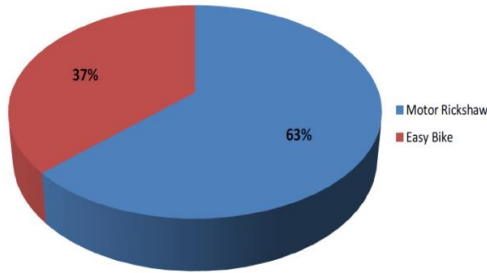


Fig.5: Percentage of Motor Rickshaw and Easy Bike.

### 5.3 Average profit investment ratio for rented vehicles

The table 4 shows the calculation of the profit investment ratio for rented vehicles of drivers. Here it is seen that the profit investment ratio is always higher for the Easy bike (figure 6). This is because of same rent & cost of battery charge but at the same time carrying capacity is higher in easy bike (maximum 6).

Table 4: Average Profit-investment ratio (zone wise) of rented vehicles (motor rickshaw and easy bike)

| Zone | Motor Rickshaw | Easy Bike |
|------|----------------|-----------|
| A    | 1.44           | 2.08      |
| B    | 1.60           | 2.24      |
| C    | 1.68           | 1.84      |
| D    | 1.72           | 1.84      |

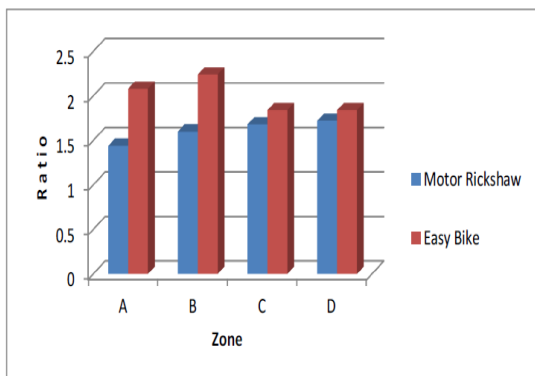


Fig.6: Average Profit-investment ratio (zone wise) of rented vehicles.

### 5.4 Average Profit Investment Ratio of Owned Vehicles

Calculation has been made for the monthly profit-investment ratio of drivers who are the owner of their own vehicles at different zone for both motor rickshaw & easy bike. It is cleared from table 5 & figure 7 that the profit investment ratio is generally higher in case of motor rickshaw. But at zone B which covers (Tuker Bazar, Varsity Gate, Noyabazar, Modina Market, MAG Osmani Medical College, Rikabi Bazar) the profit investment ratio of motor rickshaw is less than the easy bike. This is due to the high initial investment on easy bike than motor rickshaw & having the same working life (3 years).

Table 5: Average Profit-investment ratio (Zone wise) of owned vehicles

| Zone | Motor Rickshaw | Easy Bike |
|------|----------------|-----------|
| A    | 2.76           | 2.70      |
| B    | 2.57           | 2.74      |
| C    | 2.76           | 2.67      |
| D    | 2.85           | 2.67      |

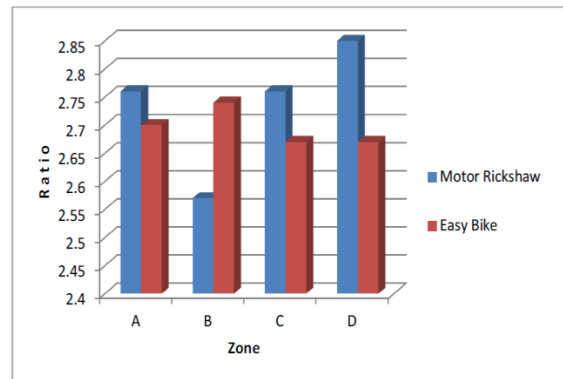


Fig.7: Average Profit-investment ratio (zone wise) of owned vehicles

## 6. ENVIRONMENTAL IMPACT

Both easy bikes & motor rickshaws are comparatively environmentally friendly than any other transportation in Bangladesh. But the battery operated easy bike may threaten the environment in future. This is due to dumping of used batteries on lands. The chemicals (acid) & plastics (battery box) may cause serious damage to soil, water and air. Thus affecting people, birds, plants and animals and other living beings.

## 7. SAFETY ASPECTS

Easy bike is generally safer than motor rickshaw because of its structural design. Moreover, easy bike is comparatively slower than motor rickshaw. This mitigates the risk of accidents. During moving with high speed, hard break may cause serious accidents for the passengers of motor operated rickshaw. Rickshaw may slip or just go upside down for such hard brake. This is due to the lack of proper braking system in motor operated rickshaw and the wheel alignment. Rickshaw's thin wheels make it unsafe when braking at high speed. But easy bike is balanced with three wheels because of its body structure. Thus making it safer when braking at high speed. Moreover easy bike is safer for the passengers while raining because it contains shade over its structure. It has been observed that motor operated rickshaw does not have front and back light which makes the rickshaw risk full at night. On the other hand, Easy bike has both front and rear lights.

## 8. Findings

The number of motor rickshaw is higher than the easy bike. The number in percentage is 37% for easy bike and 63% for motor rickshaw. Profit-investment ratio is higher for easy bike compared to motor rickshaw when these vehicles are rented. On the other hand profit-investment ratio is higher for motor rickshaw compared to easy bike when the vehicles are owned by their drivers. In safety aspect easy bike is safer than motor rickshaw due to body structure and braking system. Easy bike is more comfortable than motor rickshaw during rainy season. But in long term easy bike and motor rickshaw both are equally harmful for environment.

## 9. CONCLUSION

From the study of Battery operated Easy Bike and Motor Operated Rickshaw in terms of cost, it is seen that the investment cost are little bit higher for easy bike than motor operated rickshaw. Easy bike is more comfortable than the motor operated rickshaw for its better sitting arrangement due to body structure. Easy bike consists better braking system, controlling power and steering mechanism than the motor operated rickshaw. Easy bike is safer than motor operated rickshaw for the safety purpose. Motor operated rickshaw drivers' needs to have proper training for

operating motor-rickshaw, especially for proper using of brakes. Further research is required for the improvement of braking systems of motor rickshaw. Similar researches are required in other cities of Bangladesh where those two transports are used popular.

## 10. REFERENCES

- [1] The Daily Star, "Electric Rickshaws Run out of Steam", Published on May 30, 2011.
- [2] The New Age, "Unregistered Easy-bikes Still Plying City Streets", Published on January 06, 2011.
- [3] Auto Rickshaw (Wikipedia, the free encyclopaedia) <[http://en.wikipedia.org/wiki/Auto\\_rickshaw](http://en.wikipedia.org/wiki/Auto_rickshaw).
- [4] Gair, S., A. Cruden, J. McDonald, and B. Hredzak, An articles titled "Electronic differential with sliding mode controller for adirect wheel drive electric vehicle" at International Conference on Mechatronics (Journal of Asian Electric Vehicles) was published in 2004.
- [5] Mohammed Abu Mallouh, Bradley Denman, Brian Surgenor, Brant Peppley , A journal paper under the title "A Study of Fuel Cell Hybrid Auto Rickshaws Using Realistic Urban Drive Cycles" was published in Jordan Journal of Mechanical and Industrial Engineering (JJMIE) in January 2010.
- [6] T. Hofman, S.G. van der Tas, W. Ooms, E.W.P. van Meijl, and B.M. Laugeman, a research paper based on "Development of a Micro-Hybrid System for a Three Wheeled Motor Taxi" at Stavanger, Norway, was published in 2009.

