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Role of Battery - Operated Rickshaw in Income and Employment Generation of Urban Bangladesh: A Study of Chittagong City

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I. INTRODUCTION

Battery operated rickshaw (BOR) is a latest version of the pedal rickshaw which has been recently added as easy bike to the transportation sector in Bangladesh. BOR gets more popularity than other transport modes to the lower, lower-middle and even middle income living in urban areas because of its some preferable characteristics such lower travel cost, greater travel comfort, availability, time saving, social status, etc. Generally, the battery rickshaw operator comes from the poor sector of a country who invests their poor savings to purchase BOR. Also, those operators who have no savings hire battery operated rickshaw to operate in order to earn income. Non - motorized rickshaw reduces the actual capacities of highway facilities. Although rickshaw is one of the major sources of traffic jam in urban areas of Bangladesh, it provides low transportation cost than other vehicles, demanded by the city's people. Traditional rickshaw which came into

use in early 1940s, were a great technological improvement over the large, inefficient, wooden-wheeled hand-pulled rickshaw, though they are inefficient, uncomfortable and not very safe. A traditional rickshaw carries two passenger on an average while a single BOR can carries three passengers at the same time.

BOR facilitates comfortable and safe seating with adequate suspension, hence giving a bump-free ride. The BORs are really revolutionary in terms of safety, comfort, time savings both for the rickshaw drivers and the passengers. The weight of battery operated auto rickshaws is about 30% less than the traditional rickshaws which helps the rickshaw drivers to get less stressed and can ply more in a day without affecting his health. BORs do not pollute the environment especially air. The majority transport sectors depend on fossil fuel, diesel etc. whereas, the battery operated auto rickshaws are environment-friendly transport system.

II. RATIONALE OF THE STUDY

BOR has some advantages compared to pedal rickshaw (PR). BOR is more time effective than PR. In the city town, sufficient numbers of vehicles are not plying as per the demand of the city dwellers. Public vehicles are always rudely operated in the town. CNG (Compressed Natural Gas) driven auto-rickshaw is in general, out of reach to the middle and low-income earners due to its excessive fare. Therefore, rickshaw is one of the best alternatives for middle and low income earners in the town. It is reported from several studies conducted recent period that the BOR puller can generate income more among the different jobs in informal sector of the country's economy. The BOR puller requires physical less energy than the PR puller. However, various transportation problems, such as traffic jam, lack of sufficient public vehicles, terrific operating condition of public vehicles, high rate of fare in the private transports like CNG, Taxi cab, microbus etc. provoke the city dwellers to use to ply with rickshaw, preferably BOR. Since most of the areas in Chittagong city are hilly, so BOR can be easily operated. Recently, CCC (Chittagong City Corporation) banned BOR in the city town claiming that the BOR causes indiscriminate traffic jam and energy pressure. But the public perception is different.

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Among different common public and private hauling in the city town such as bus, tempo, rider, taxi cab, CNG taxi, pedal rickshaw etc., BOR is more advantageous to the city dwellers who are generally prone to occupied with low and middle income levels. For instance, considering traffic jam, to reach 2 no. gate to new market, a PR puller earns Tk. 100 in an hour whereas BOR puller usually is convinced with Tk. 70-80 and takes only 20 minutes to run this distance. In the same way, BOR puller can run two times more within the time taken by PR puller, which accumulates his total earnings to Tk. 210-240 in an operational hour. From this statistics we find, BOR puller can earn Tk. 110-120 more than pedal rickshaw. But it has been adjudicated by the Chittagong city corporation to run BOR in Chittagong city town since March, 2015. Showing some allegations as said earlier against of BOR, it is a common belief to all that every initiative has some merits and demerits to its stakeholders.

III. LITERATURE REVIEW

The importance of Battery Operated Rickshaw (BOR) is observed differently by different researchers. Some researchers give importance on cost-effectiveness and income generating role of BOR and some researchers give their focus on eco-friendly role of BOR. But an argument also existed regarding whether BOR is good for society or country or not. Some views are pointed out below:

Rajvanshi (2002) suggested that the improved and electric cycle rickshaws such as Improved Pedal Cycle Rickshaws (IMPRA) and Motor-assisted Pedal Cycle Rickshaws (MAPRA) are environment friendly, energy efficient, cost effective and silent transport modes which do not adversely affect rickshaw puller health. He explained that, such vehicles provide large scale employment to millions of urban and rural poor since most migrant population especially migrant laborer found the benefits of operating a cycle rickshaw relative to other jobs. Supporting this view, Rana et al. (2012) stated that battery operated rickshaw is economically beneficial for poor urban people because it increases income and generates employment opportunities. It is profitable for operators since it includes an income-cost ratio of 1.85. In addition, unemployment is reduced by this mode as occupation. It is also found that migration from small cities to big cities has been reduced and depressurized due to earning opportunities and better comfort than other jobs. In addition, they explained (2013) that along with increasing annual income of the city significantly through increasing income of low income people, battery operated rickshaw reduces transport related emission through placing fuel operated vehicles. In this regard, Rahim et al. (2012) suggested that Battery driven rickshaw plays a proactive role in the development of socio-economic condition of the auto

rickshaw drivers. They mentioned that unemployment problem is decreased about 2% and income level of rickshaw puller is increased by battery operated rickshaws. They also found that such rickshaws are eco-friendly vehicles as compare to other vehicles which causes air pollution through emission resulting from burning of the fossil fuel. Again, Singh (2014) focused on the socio-economic impact and technical characteristics regarding battery operated e-rickshaw. He tries to form policy recommendations for making such vehicles safer and more efficient as 80% of the passenger in his research sample felt unsafe while travelling by these rickshaws. He explained that this mode of transport can play a vital role in the revenue generation of the government, urban planning and improving the transport structure of the state.

Again explaining differently, Begum and Binayak (2004) stated that rickshaw pulling may be somewhat effective exit route from rural poverty. They explained that rickshaw pullers who are from a poor economic background attain a degree of modest upward mobility, especially those who operate this vehicle as their occupation for a few years. They stated that various indicators (income, health, livelihood etc.) can be used to measure the well being of rickshaw pullers. It is found from this study that rickshaw pullers face systematic health risks, unsustainable livelihood, very limited schooling and poor range of occupational choices for children throughout their life. They suggested public policy that can be undertaken to reduce such problems.

According to Rahman et al (2008) showed that the role of rickshaw is pivot as it is preferred mode of travel by vulnerable social groups such as women, children and the elderly due to their safety, security and comfort perspective. They explained that rickshaws are not a substitute for motorized public transport; rather they are complementary and partially overlapping modes of transport. For that reason motorized and non-motorized vehicle policies and initiatives should be integrated especially for the travel utility, economic role, extent work force involvement, population dependence, eco-friendly nature, equity contribution and freight usage of rickshaws. They (2009) also opine that although there some hindrances such as slow speed, congestion, inhumanity etc. towards non-motorized public transport (NMPT) development, a comprehensive planning effort will help to accept this mode as a complementary force to motorized transport in the future. In this regard, Rahman (2013) found from his research that Manual rickshaw is an inhumanity profession as two or three person seat down on it and the driver pull them like an animal. He indicated that in our country this profession is considered very low status job. They suggested that electric motorized rickshaw can be used to save the rickshaw drivers which help to increase their roles in our rural economy and keep our environment free from

carbon emission. They also suggested to develop hybrid "Green" rickshaw which can run on an electric charged battery and solar energy. Supporting this view, Saha and Goswami (2011) hybrid rickshaw i.e. motor assisted battery rickshaw provides satisfactory speed, easier motion control and good scope of manipulating of the sources of human effort and motor power. They showed that hybrid rickshaw can be formed by combining the advantages of the pedal and electric auto rickshaw in a single arrangement without changing the main feature of existing rickshaws at an effective conversion cost. They also argued that such vehicles play a crucial role in both reducing air and sound pollution and creating large scale employment as it needs less physical effort. Suggesting BOR, Rashid et al. (2010) showed that rickshaw as green vehicle is environment friendly to save our environment from air pollution by toxic emission. They found that motor assisted pedal rickshaws have extra power due to small motor attached to assist pedaling that allow rickshaw puller to ply longer distance. Furthermore, to achieve economical development and energy efficiency, green vehicle as rickshaw should be focused as it uses alternative fuel sources such as solar power.

From the above literatures, it is revealed that despite of having some hindrance, battery operated rickshaw helps to ensure increasing the living standard of urban people as an occupation which ultimately contributing in the annual income of the city as well as the country.

Objectives

1. To analyze the income & expenditure ratio of the battery rickshaw puller.
2. To determine the investment –cost ratio for the non-rented (owner) rickshaw puller.
3. To explore profit outlook for the non rented rickshaw puller.
4. To evaluate the impact of occupational migration from other job sectors to battery rickshaw operation.

IV. METHODOLOGY

a) Study Area Selection

Battery operated rickshaw have been banned. So drivers of battery operated rickshaw operate in some places where traffic surgeon is not available. They operate secretly. Study areas are selected on the basis of two major criteria as following:

- i) Number of battery operated rickshaw running different areas of Chittagong city.
- ii) Physical distances of selected scattered areas from New market in Chittagong.

Initially some urban areas of Chittagong city are considered on the basis of availability of data regarding the number of battery operated rickshaws. Among them, ten have been selected as study areas based upon the criteria mentioned above. Number of battery operated rickshaw as well as physical distances (travel distances) of selected areas from Chittagong New market are presented in Table-1.

Table 1: Number of battery operated rickshaw and physical distances of selected areas from center of Chittagong

Areas of Chittagong City	Number of Battery Operated Rickshaw Running Within the Area	Distance from Center of Chittagong, Bangladesh (Kilometer)
Sholashahar 2 No. Gate	15	4.6
Oxygen	10	7
Bayezid	18	7.8
Jamalkhan	17	6.9
Rahattar Pul	13	5.9
Battery Goli	17	2.9
Pathor ghata	11	1.1
Nalapara	18	4.1
South Kattoli	16	9.5
North Kattoli	16	9.2

Source: Authors' Own Survey, 2018

According to the stated criteria, these ten areas have been selected as study area.

b) Variable Selection and Data Collection

Variables selected to fulfill the objectives are presented in Table-2.

Table 2: List of Parameters and Variables

Parameters	Variables
Income-Expenditure Ratio	Income, Expenditure, Savings (Monthly)
Investment-Cost Ratio	Investment/ Purchasing cost, Operating and maintenance cost, Profit earned
Operational Period	Operational hour per day
Economic Issues	Net increase in individual operator's income: – Previous income – Current income Change of Occupation: – Previous occupation – Current occupation

Source: Authors' Own Survey, 2018

Operator opinion survey is conducted extensively to collect data on selected variables. Sample size is estimated 151 for the ten study areas. Sample size is divided based upon the percentage share of available data of the selected study areas. In addition, data regarding the physical and operational characteristics of battery operated rickshaw are collected from the interview with drivers (operators).

V. RESULTS AND DISCUSSION

The contribution made by battery operated rickshaw in urban income and employment generation as found from the study are discussed below.

a) Income - expenditure ratio (Both non - rented and rented rickshaw)

Economic feasibility of battery operated rickshaw is analyzed in terms of income-expenditure ratio and savings analysis. Data regarding two types of battery operated rickshaw i.e. non-rented and rented, are collected. Income and expenditure of a battery rickshaw driver of both categories are shown in Table 3.

Table 3(a): Income of a batter rickshaw driver

Income Range	No. of Rickshaw Driver (In Terms of Income)	%
5000-9999	14	9.27
10000-14999	27	17.88
15000-19999	61	40
20000-24999	38	25.17
25000-29999	11	7.28
Total	151	

Source: Operator Opinion Survey, 2018

Table 3(b): Expenditure of a battery rickshaw driver

Expenditure Range	No. of Rickshaw Driver (In Terms of Expenditure)	Percentage (%)
5000-9999	31	20.53
10000-14999	57	37.75
15000-19999	33	21.85
20000-24999	27	17.88
25000-29999	3	1.99
Total	151	100%

Source: Operator Opinion Survey, 2018

Savings of battery rickshaw puller is shown in Table 4.

Table 4: Savings of a battery rickshaw driver

Savings (Tk.)	No. of Rickshaw Driver	%
0-4999	135	89.40
5000-9999	15	9.93
10000-14999	0	0
15000-19999	1	0.66
Total	151	

Source: Operator Opinion Survey, 2018

Study shows that Tk. 15000-19999 income range rickshaw drivers are 40%, which is maximum. On the other hand, Tk. 25000-29999 income range rickshaw drivers are 7.28%, which is minimum. Percentage of Tk. 5000-9999, Tk. 10000-14999, Tk. 20000-24999 income range people is 9.27%, 17.88% and 25.17% respectively. 57 rickshaw drivers out of 151 experience expenditure of Tk. 10000-14999, whereas only 3 rickshaw drivers are in Tk. 25000-29999 expenditure range group. Percentage of Tk. 5000-5999, Tk15000-19999, Tk. 20000-24999 expenditure group is 20.53%, 21.85% and 17.88% respectively.

Each rickshaw driver has some savings as found from the interview in Chittagong city. Considering the savings range, most of the drivers save less amount of money as 89.40% drivers save Tk 0-4999 per month. Although 33 rickshaw drivers out of 151 earn 15000, experience savings range of Tk 0-4999. Their consumption is higher than savings. Only one rickshaw driver save 15000-19999, where his income is 24000. His savings is higher than consumption.

b) Investment - cost ratio (non rented battery operated rickshaw)

Non rented rickshaw drivers are owner of the rickshaw. To justify the economic profitability of the occupation, investment-cost ratio is calculated. Table-5 shows purchasing costs for a battery operated rickshaw.

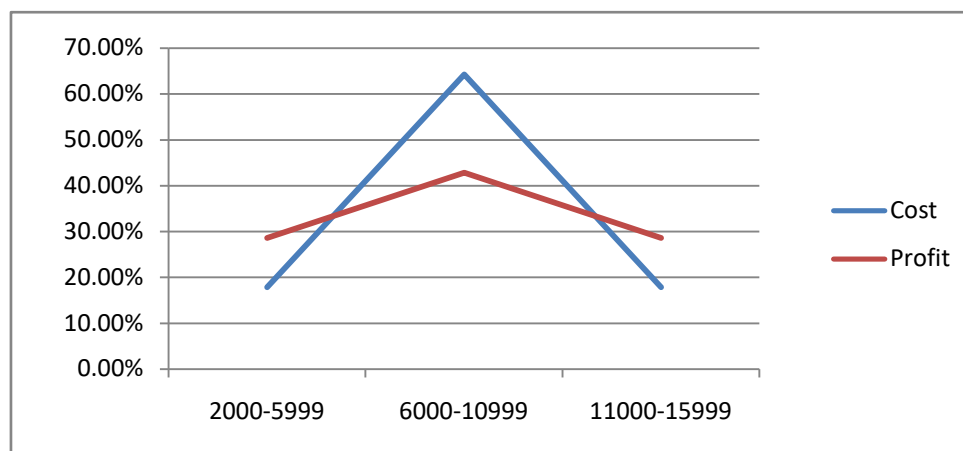
Table 5: Purchasing cost of battery operated rickshaw

Purchasing Cost (Tk.)	No. of Rickshaw Driver	%
20000-22999	5	17.86
23000-25999	15	53.57
26000-28999	8	28.57
Total	28	≈100

Source: Operator Opinion Survey, 2018

Only 28 rickshaw drivers own their rickshaw out of 151 drivers. The purchasing cost of the vehicle is Tk. 20000-29000. 15 drivers invested Tk. 23000-25999, whereas only 5 drivers invested Tk. 20000-22999. The purchasing cost varies due to the category of new, second-hand or third-hand vehicles.

The cost and profit of a battery rickshaw driver is shown in Graph-1.



Source: Operator Opinion Survey, 2018

Graph 1: The cost and profit of a battery rickshaw driver

As is observed, 18 rickshaw owners have to face cost of Tk. 6000-10999 (64.28%), 5 owners face cost of Tk. 2000-5999 (17.86%) and 5 owners have to face cost of Tk. 11000-15999 (17.86%). Using the data of profit, 12 owners can earn profit of Tk. 6000-10999 (42.86%), 8 owners earn profit of Tk. 2000-5999 (28.57%) and 8 owners gain Tk. 11000-15999 (28.57%).

Owner of battery rickshaw have to bear many other costs such as garage cost, repairing cost, battery charging cost, battery replacement cost etc except purchasing cost. Garage cost as found from the study is presented in Table-7.

Table 7: Garage cost of battery rickshaw owner

Income Range	Garage Cost		Total
	Tk. 500	Tk. 600	
9000-11999	1	1	2
1200-14999	5	2	7
15000-17999	4	3	7
18000-20999	4	2	6
21000-23999	1	5	6
Total	15	13	28

Source: Operator Opinion Survey, 2018

Study reveals that 15 rickshaw owners cum drivers had a garage cost of Tk. 500 and 13 rickshaw owners cum drivers had a garage cost of Tk. 600. Table-7 shows the ranges of income of individual owners with the garage cost as found from the study.

Table 8: Repairing cost of battery rickshaw owner

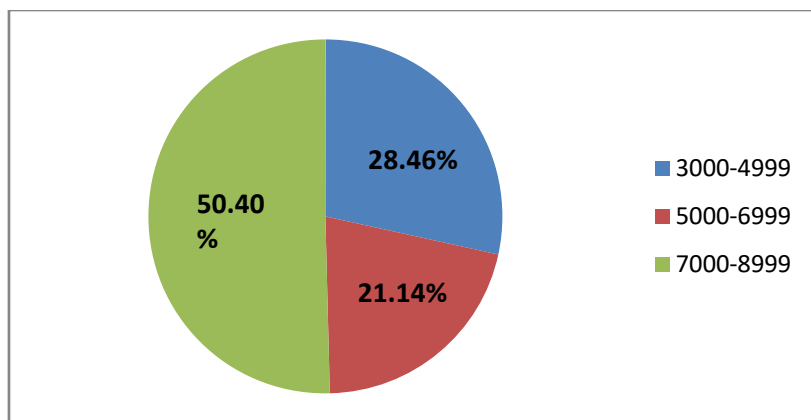
Repairing Cost (Tk.)	No. of Rickshaw Drivers	%
0-499	19	67.86
500-999	8	28.57
1000-1499	1	3.57
Total	28	100

Source: Operator Opinion Survey, 2018

More than 65% of the battery rickshaw owners bear repairing cost less than Tk. 500. Around 29% rickshaw owners have a cost of Tk. 500- Tk. 999. Only one rickshaw owner bear cost above than Tk. 1000 which is anomalous from others. Study shows that the rickshaw owner bought a third-hand rickshaw.

i Cost benefit analysis (Rented battery operated rickshaw)

Rented battery rickshaw drivers have to pay rent per day. Rent per day is converted into monthly rent to analyze monthly cost-benefit status. Our study shows that rented battery rickshaw driver pays Tk. 3000 to Tk. 9000 monthly according to their operational hour. Income level of battery rickshaw driver depends on operational hour per day. 23 rickshaw owners cum drivers operate 7 to 8 hours per day for their livelihood. Only four owners cum drivers operate 9 to 10 hours in our study. 82% owners prefer to operate 7 to 8 hours, whereas only 18% choose to operate more than 8 hours. Graph 2 shows range of monthly rent of rented battery rickshaw.

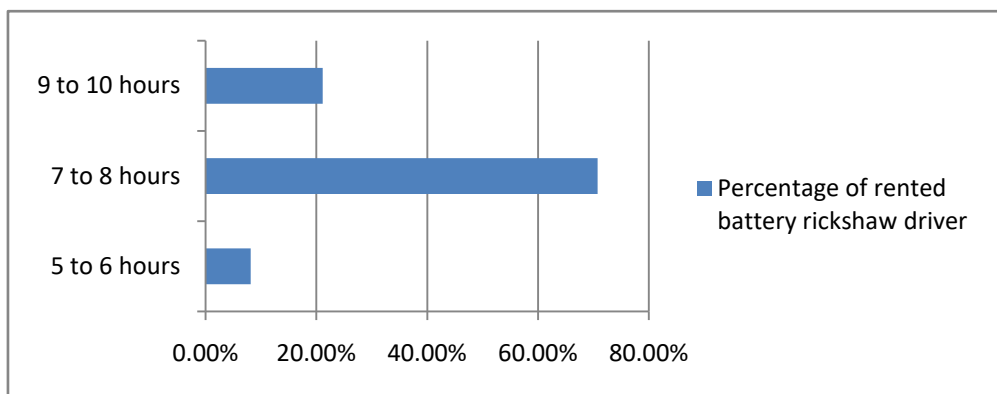


Source: Operator opinion survey, 2018

Graph 2: Range of rent of battery rickshaw

Study reveals that 50% rickshaw drivers pay rent of Tk. 7000 to Tk. 8999 as they operate maximum hours as they can. If they operate more hours, they will have to pay greater amount of rent. 26 rickshaw drivers out of 123 drivers pay rent above Tk. 5000 and below Tk. 7000.

As calculated from the data, 72 battery rickshaw drivers earn Tk. 15000 to Tk. 19000 and pay rent Tk. 6000 to Tk. 9000 monthly. In addition, 49 drivers earn the same amount of money, but pay more than Tk. 9000 monthly. It depends on the operational hour, travel distance, fare rate etc.



Source: Operator Opinion Survey, 2018

Graph 3: Operational hour of rented battery rickshaw drivers

Graph-3 shows that more than 70% battery rickshaw drivers of rented rickshaw drive the rickshaw seven to eight hours per day. About 21% drive more than eight hours and only 8% drive five to six hours.

ii Net increase in individual operator and city's income

Study reveals that maximum operators had income between Tk. 200 and Tk. 300 per day from their previous occupation. Table -9 shows the ranges of income of individual operators from their previous occupation as found from the study.

Table 9: Ranges of daily income of individual operators from their previous occupation

Daily income range (BDT)	Percentage
<200	15.23%
>=200 and <=300	72.19%
>300 and <=400	5.96%
>400	6.62%

Source: Operator Opinion Survey

On the contrary, battery operated rickshaw driving as an occupation enables operators to earn around two times to their previous income. Table-10 shows the ranges of current income of battery operated rickshaw operators.

Table 10: Ranges of current daily income of battery operated rickshaw operators

Daily income range (BDT)	Percentage
<300	9.27%
>=300 and <=500	17.88%
>500 and <=700	40.40%
>700	32.45%

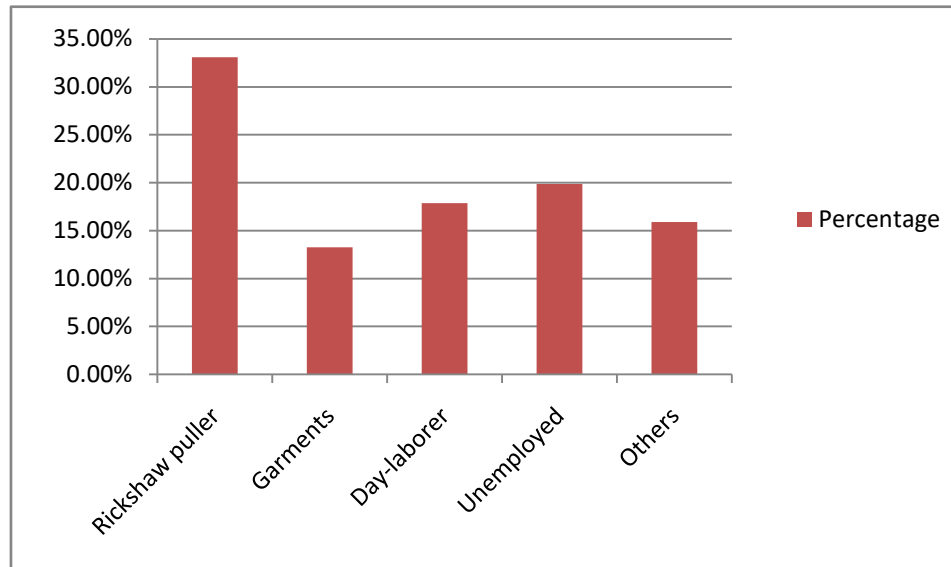
Source: Operator Opinion Survey, 2018

61 drivers earn more than Tk. 500 to below or equal Tk. 700. 32.45% drivers earn more than Tk. 700. As is observed, there is a dramatic increase in an individual operator's daily income. As the battery rickshaw is banned, Chittagong has a few battery

rickshaws. Though the city has less quantity of battery operated rickshaws, it has an additional income per day in current year. This additional income is incurred solely by the increase in battery operated rickshaw operator's daily income. Now the town's economy lost the huge amount of battery rickshaw operator's income. Battery rickshaw is essential in some areas to contribute to the city's economic structure significantly.

iii Employment Generation

Study shows that a large number of people switched from their previous occupation as they believed that battery operated rickshaw driving render some benefits over others available in local towns of Bangladesh. Previous profession of operators as found from the study is presented in Graph-4.

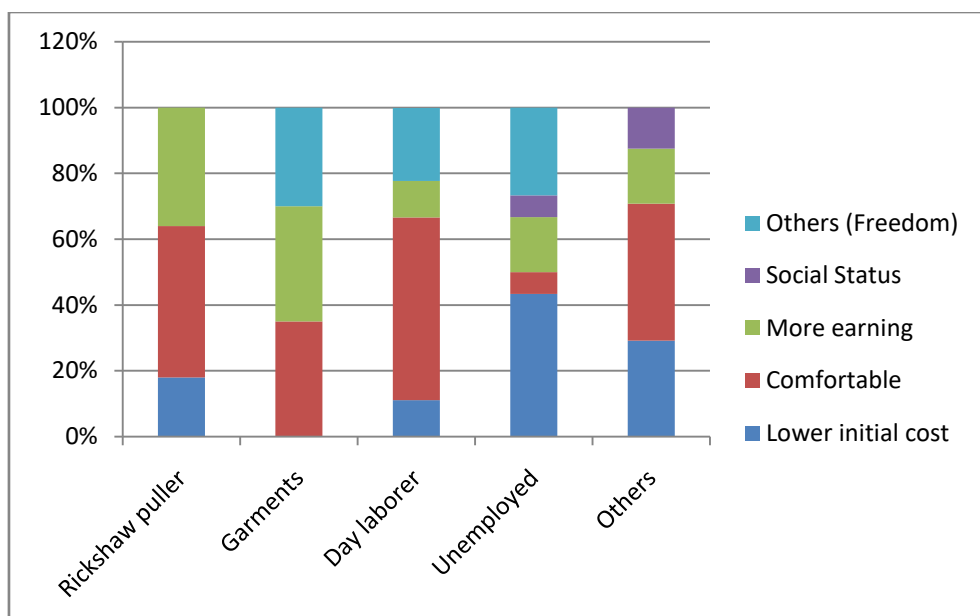


Source: Operator Opinion Survey, 2018

Graph 4: Previous occupations of operators

Study shows that around 19.87% of battery rickshaw operators were unemployed before choosing the current occupation. All the operators who were unemployed previously are aged between 16 and 30 years. Most of them are students now who avail this occupation to earn pocket money besides continuing their study along with tuitions.

Graph-5 shows reasons for choosing battery operated rickshaw as a medium of income by those who were in other professions or unemployed previously. 46% rickshaw puller chose battery rickshaw as they think that current profession is comfortable. 36% rickshaw puller chose battery rickshaw for more earning. Garments worker chose this occupation for relaxing, more earning and freedom. More than 55% day laborer chose the profession for relaxing. Around 43% unemployed chose this occupation for lower initial investment cost, 27% chose for freedom, 17% chose for more earning, 7% chose this profession as they think it as a comfortable occupation and other 7% chose this profession for social status.



Source: Operator Opinion Survey, 2018

Graph 5: Reasons for choosing battery operated rickshaw driving as occupation

Although battery operated rickshaw is banned in Chittagong city, it is generating employment as around 20% unemployed are getting work and are entering to effective labor force. It can be increased if the restrictions can relax.

iv Mean, Standard deviation, Maximum and Minimum of the variables

Characteristics	Number of Observation	Mean	Standard Deviation	Minimum	Maximum
Income	151	16993.38	5687.409	6000	30000
Expenditure	151	14278.15	5097.593	5000	28000
Savings	151	2715.232	2017.019	0	18000
Non-Rented Rickshaw					
Investment	28	24607.14	2282.612	20000	28000
Profit	28	7646.429	3548.133	2000	15000
Cost	28	8603.571	2857.152	1500	15000
Earnings	28	16250	3921.687	9000	21000
Garage cost	28	546.4286	50.78745	500	600
Repairing cost	28	532.1429	334.5019	100	1500
Operational hour	28	7.785714	.8325393	6	10
Rented Rickshaw					
Income	123	16121.95	1090.836	15000	19000
Rent	123	6699.187	1057.254	5000	9000
Operational hour	123	7.804878	1.021559	6	10
Previous income	151	9357.616	3375.094	3000	17000
Previous profession	151	2.980132	1.659197	1	6

Source: Operator Opinion Survey, 2018

The table reveals that the mean income, mean expenditure and mean savings of Battery operated rickshaw driver are Tk. 16993.38, Tk. 14278.15 and Tk. 2715.232 respectively. It is explicit from the table that the mean income (Tk. 16250) of non-rented rickshaw driver is higher than the mean income (Tk. 16121.95) of rented rickshaw driver. The table depicts that the mean current income (Tk. 16993.38) of the respondents are higher than their mean previous income (Tk. 99357.616). Since income from previous profession was not satisfactory for the respondents, they abstained from their previous

profession. Mean of their previous profession is 2.980132. It is observed from the analyses that mean operational hour of non-rented rickshaw driver is 7.785714 and means operational hour of rented rickshaw driver is 7.804878.

VI. LIMITATION

The authors could not able to conduct the study rigorously due to unavailability of battery rickshaw drivers. If the authors could cover more samples and more study areas, the study would be more responsive

and significant. Due to the banning decision of Chittagong City Corporation, scattered data were collected from the respondents which did not cover all the areas in Chittagong city.

VII. CONCLUSION

Significant findings show that maximum rickshaw drivers (40%) having the income range TK. 15000-19999. It is revealed from the analyses that 53.57% battery rickshaw owners bear purchasing cost of Tk. 23000-25999. 89.40% drivers save less amount of money. From the study it is clear that 65% battery rickshaw owners bear repairing cost less than TK. 5000. 28.57% battery operated rickshaw owner can gain profit of Tk. 11000-15999, whereas 42.86% can earn profit of Tk. 6000-10999. Study reveals that battery operated rickshaw drivers earn two times more than their previous occupation. 46% rickshaw drivers choose this profession for their comfort.

VIII. SOCIAL IMPACT AND POLICY IMPLICATION

Battery operated rickshaw increases economic feasibility of the occupation since the operator earns more income from their previous occupation which ultimately contributes to the city's economic structure significantly. So, without introducing battery operated rickshaws, the town's economy might loss a huge amount of income. It also helps to decrease unemployment as it easy to operate and it has earning opportunities, occupational freedom and lower investment cost. Based on the study analysis, Chittagong City Corporation (CCC) can reintroduce battery operated rickshaw considering some issues. The authority can separate the route for plying less speedy and more speedy vehicle so that BOR will be rendered as a nice alternative vehicle. If a speed controller device can be adopted in BOR, then unexpected accident can be avoided and the city dwellers can enjoy a comfortable and safe life. As a result, extra pressure on existing vehicles due to over- population can be reduced. Solar panel based battery operated rickshaw will reduce the extra pressure on electricity.

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