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Full Length Research Paper

The unexploited potential of BodaBoda cyclists in transporting agricultural produce in developing countries- A case of Busembatia Eastern Uganda

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Abstract

Postharvest losses in Uganda are unacceptably high which negates food security efforts. One of the major causes of such losses is failure to transport agricultural produce to markets. The state of roads in rural areas creates a transportation gap that can be covered by motorcycles commonly known as *bodabodas*. The aim of this paper was to assess the unexploited potential of bodaboda cyclists in transporting agricultural produce; a case study of Busembatia town council in Eastern Uganda. The study revealed that maize (20.2%) is the most transported product. A chi-square test showed that the volume of agricultural products transported is highly dependent on the frequency of bodabodas. Trucks are preferred for transportation of animals because of their greater carrying capacity. The low volume of fruits transported (1.6%) is attributed to the damages caused by bodabodas when transporting ripe fruits. Most riders were 26-35 years old and bodabodas cover a total distance of 1,848 km per week transporting agricultural products. The greatest challenge outlined was the poor road network. A conclusion is drawn that bodaboda cyclists play a pivotal role in agricultural transportation but their overall potential isn't effectively exploited because of the constraints in their working environment.

Keywords: Bodaboda, transport, roads, agricultural, Uganda.

INTRODUCTION

Agriculture is still the backbone on which different classes of people survive both for food and economic stability in many developing countries (Mueller et al., 2016; Mo et al., 2014). Several African governments have lately intentionally prioritized agriculture back to the top of the development agenda by increasing the proportion of their national budgets going to this vital sector (AGRA, 2016). [1]Private companies have invested heavily in Africa's agriculture value chains in recent years from the farm to the market (Webber and Labaste, 2010) paving the way for a recovery in the food systems. This has multiplied the options for farmers in terms of inputs and the market. Research in Africa's agricultural sector has been carried out globally. The interest is mainly attributed to the realization that Africa has the potential to feed itself (Xie et al., 2018) and the world (Ittersum et al., 2016). Agriculture is also looked at as a potential engine for Africa's economic growth with factors such as trends in demand and markets, production potential and comparative advantages signifying an important role for African growth (Bruntrup and Zimmermann, 2009). According to Menya et al. (2020), 60%-70% of small-scale farmers in Sub-Saharan Africa are women. Reliable transport that can navigate through different terrains is key to reducing postharvest losses, market access and relieving women of the burden of weight of agricultural produce. This means that transport is the only means by

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which food produced at the farm is delivered to different homes and market centers (Vandercasteelen et al., 2018). Also, transport enhances interaction among different geographical and economic regions while creating market for agricultural produce beyond local boundaries. This movement opens up new areas to economic focus and exposes producers to a wider range of market options and input varieties hence boosting the entire sector. A break down in transportation may result in losses. This noted significance of transportation in agriculture implies that a high cost of transportation would translate to high selling price and if the price is too high compared to producers from other areas, customers will not buy which may result to selling at a loss (Gollin and Rogerson, 2014). Different mobility systems are first-hand strategies that are employed to reduce hardship during transportation and maximize farming time utility (Kassali et al., 2012). It can be seen that in a constant effort to reduce the distance effect and the associated drop in productivity, food farmers have widely devised strategies to tackle the negative effect of long distances. These stretch from relocating market transactions to the farm, to adoption of alternative transportation modes for example bodabodas suited for local transport problems with low and medium loads (Starkey, 2001).The sheer volume of agricultural produce transported by bodaboda is a little studied. There is still a gap in literature to evaluate the potential of bodaboda cyclists in the transportation of agricultural produce in Uganda. This paper seeks to study the role bodaboda cyclists play in the agricultural transportation sector of Uganda.

MATERIALS AND METHODS

Study Location

The study was conducted to cover Bugweri district of Busembatia town council located in Eastern Uganda as indicated on Figure 1. Eastern Uganda was chosen particularly because of the high influx of motorcycles in the region which can be attributed to the fact that it is closest to the Kenyan border where the idea of "bodabodas" emanates. Being a highly agricultural and mostly rural area, it was befitting to work as a case study on the importance of motorcycles in agricultural transportation. Busembatia town council is the busiest trading centre in Bugweri district over Idudi and Busesa. It is located on the main highway from Iganga towards Mbale along the Tirinyi road. The closest neighboring municipal area is the town of Namutumba in Namutumba district located at a distance of approximately 10 km Northeast of Busembatya. The location is approximately 65 km, Northeast of Jinja which is the largest city in the Busoga sub-region of Eastern Uganda. The National census and household survey by Uganda Bureau of Statistics (2015) puts the population of Busembatia at 14,431 people. The region sits on a plateau and is surrounded by swamps that supply farmers with water for irrigation throughout the year. It is known for growing rice which served most of Busoga before other areas in the sub-region were connected to the national power grid to run their own mills. The town's inhabitants and the surrounding villages are mostly farmers keeping domestic livestock and practicing subsistence farming of almost all crops. The market for agricultural products in this region is not focused on specific products due to the variety of crops that can be supported by the arable land in the region and the demand of several products both locally and across the national border into Kenya. A variety of products is thus available but mainly rice, maize, cassava, beans and some fruits like jack fruit. Most farmers produce crops on small scale with a main target market in Iganga and Busembatia, while large scale specialized producers sell their crops to private companies like *Tilda* Rice Company.

Research design

This section describes how the study was conducted and how the interviewed respondents were selected from region to individual level. The research design comprised of a survey done for a case study of Busembatia town council in Bugweri district found in the Eastern part of Uganda from 20th to 21st November 2019. The research involved a detailed analysis of the involvement of bodabodas in transportation of agricultural products both into and out of the study area. The research also involved an across the board review of the latest literature regarding the study location and bodaboda operations in Uganda. Both quantitative and qualitative approaches were employed during data collection but only quantitative methods were used in analyzing the data received.

Sampling

The study involved motorcyclists in Busembatia town council in Eastern Uganda whose representative sample was arrived at by using simple random sampling on the bodaboda parking stages in the region. Busembatia town council was arrived at using the multistage sampling from country-region-district to town council. Eastern Uganda was selected due to the high influx of bodabodas and being majorly an agricultural and rural area. Bugweri district was selected being one of the largest producers of a variety of crops in Eastern Uganda, down to Busembatia which is the busiest town council in Bugweri district. The sampling unit at Busembatia town council has several villages from which products are collected but with 8 motorcycle stages where all transporting bodabodas are parked during work hours. The sampling unit was stratified into 8 strata onto which simple random sampling were applied to select the respondent motorcyclists from each stratum.

Fig. 1. Location of Bugweri district on the Ugandan Map.

The overall sample size of the study area was determined using the statistical formula by Kish and Leslie in Equation 1 (Staff et al., 2010).

$$n_0 = \frac{Z^2 P\,(1-P)}{E^2} \quad (1)$$

Where, Z is the standard normal deviation at, P is the proportion of target population and E is the acceptable degree of error. With a total population of respondents in the study less than 10,000, the finite population correction approach in Equation 2 was used to adjust the sample size where n is the desired sample size and N the estimated overall population size of the study area.

$$n = \frac{n_0}{1+\left(\frac{n_0-1}{N}\right)} \quad (2)$$

The sample size of each Parking stage stratum was as well determined the same statistical formula by Kish and Leslieand tabulated.

Data collection procedures

The interviews were conducted at the different parking stages of motorcyclists and involved a series of direct and indirect questions to operators. The data collection tool employed was a questionnaire that sought to find out the involvement of bodabodas in agricultural transportation. The accuracy and quality of information that was collected rested largely on choosing the right informants and interviewer. Bodaboda parking stages were well structured and different stage leaders were consulted to formulate the right mode of interviews, appropriate communication language and population details. Consent was first sought from the respondents to ensure that none of them had been forced into giving information and that the expectations were clearly understood. The communication language was constantly altered from English to Luganda since some respondents were not highly literate. The information collected by the questionnaire included the respondents' bio data, parking stage, motorcycle brand, age group, agricultural products commonly transported and the target market.

Data analysis

A data coding technique was done where several categories of responses were grouped, classified, recorded and assigned different meanings as per the questionnaire design. These responses were then decoded using the assigned codes and recorded in a more descriptive database format. Both inferential and descriptive analyses were performed using MS EXCEL to generate mean scores, frequencies, percentages,

Chi-square values and correlations. The analyzed field data was then presented in form of tables, bar graphs and pie-charts to further visually elaborate the findings and then accompanied by appropriate explanation for the figures. A study hypothesis H_0 was proposed and tested using the Chi-Square test. The test was based on a test statistic that measures the deviation of the observed amount of products transported weekly (tonnes) from the values that would be expected under the null hypothesis of no association. The mean quantity of products was calculated from Equation 3 to deduce the expected amount of products transported per motorcycle per week.

$$\text{Mean} = \frac{Total\ products\ transported\ weekly\ (Tonnes)}{Total\ No.\ of\ motorcycles\ interviewed} \quad (3)$$

Results were tabulated and deductions made from the calculated Chi square (χ^2) and tabulated critical (χ^2) to deduce the dependence of volume of agricultural products transported on the frequency of bodabodas in Busembatia town council Bugweri district**.**

RESULTS AND DISCUSSION

Sample size determination

From Equation 1, with a standard normal deviation Z at 95% confidence level (i.e. 1.96), proportion of target population P of 50% or 0.5 and acceptable degree of error E of 5% in this case or 0.05. The overall sample size of the study area was determined as shown below.

$$n_0 = \frac{1.96^2 X\ 0.5\ (1-0.5)}{0.05^2} = \frac{3.8416\ X\ 0.5\ X\ 0.5}{0.0025}$$

= 384.16 ≈ **384**

Since the total population of respondents in the study was less than 10,000 (141), the following sample size adjustment formula was applied where n is the desired sample size when population is less than 10,000 and N the estimated overall population size (141) of the study area.

$$n = \frac{384}{1 + \left(\frac{384 - 1}{141}\right)}$$

n=103.3 ≈ **103**

Therefore the sample size of motorcyclists interviewed was103 which was increased to 113 to allow for a predicted nonresponse or inaccessibility of motorcyclists. The sample size of each stratum was as well determined the same statistical formula and tabulated as shown in Table 1.

Bodaboda's socio-economic characteristics

The distribution of respondents' age categories depicted in Figure 2 shows the total number of bodabodas interviewed in the Study area. The largest number of motorcycles interviewed fell within the age category of 26-35 years of age whose percentage was 42%. This indicates that it is mainly the youth that engage in transportation of agricultural products using bodabodas. This finding can be attributed to the mental and physical energy required to operate bodabodas, since they ride for very long distance under all-weather conditions which would have severe health implications for older men.

The second largest age category was 36-45 years old with 35%, this is also considered a youth age group in the region hence the youths dominate over 77% of the total population of bodaboda riders in the region. Results also indicate that the smallest age category among the respondents was 65 and above occupying only 1% of the total. The relatively small number of respondents above the age of 56years can be attributed to the fact that the bodaboda operation is physically tiring hence the older citizens chose to directly engage in the less tiring farming activities than motorcycle transportation. The age distribution in the operation also further underlines the importance of bodabodas in provision of employment to various age categories specifically youths. The total number of bodaboda riders within Busembatia was established to be about 141 including both bicycles and motorcycles. All the respondents interviewed at the parking stages for the study were males.

According to Table 2, most of the bodabodas interviewed for the study in Busembatia were motorcycles covering over 90% of the total. This indicates that the use of bicycles for agricultural transportation has reduced over the years and it can be attributed to the fact that motorcycles have more space available and power to carry relatively heavier loads of products. The traction power delivered by motorcycles also makes them more favorable for transportation in rural areas mostly during rainy seasons when the roads become slippery. Bicycles also require more energy to operate mostly in hilly areas and they take longer to deliver products from the farmland to the market. This can lead to loss of perishable products like tomatoes in transit causing financial losses to farmers. From the field data collected, it is seen that bicycles cover a relatively smaller distance to transport produce meaning that some regions may not be accessible hence the preference of motorcycles.

Table 1. Distribution of sample sizes according to stages in Busembatia Town council.

No.	Parking Stage	Sample size
1	Butandwe	7
2	Buyinima	6
3	Kampere	34
4	Nakasero	31
5	Naminumya	10
6	Petrol	12
7	Police	5
8	Posta	8
	Total	**113**

Source: Field data (2019).

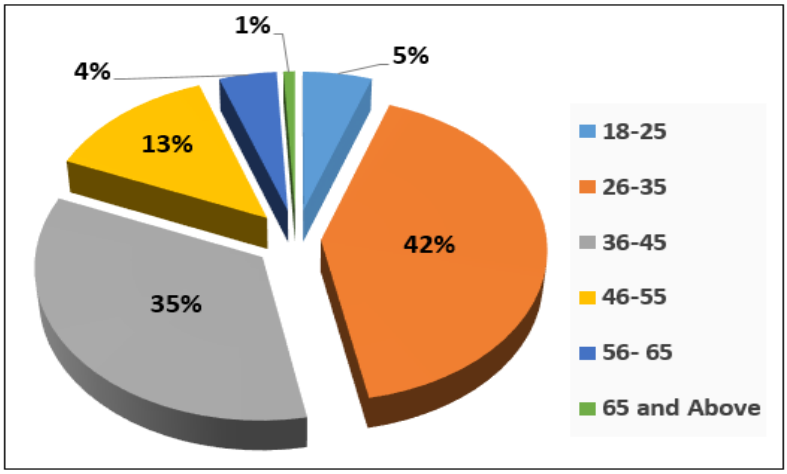

Fig.2. Distribution of respondents' age categories
Source: Field Data (2019).

Table 2. Bodaboda types in Busembatia town council.

Bodaboda	Frequency	Percentage %
Motorcycles	102.00	90.27
Bicycles	11.00	9.73
Total	**113**	

Source: Field Data (2019).

Relationship between volume of products transported and number of bodabodas

The Chi-Square test was used to test the study hypothesis H_o that suggests that there is no association between the volume of agricultural products transported and the frequency of bodabodas in Busembatia town council. From Equation 3, the mean quantity of products was found to be 0.42 tonnes. Results in Table 3 were then generated that tested the deviation of the observed amount of products transported weekly (tonnes) from the values that would be expected under the null hypothesis of no association H_o. From Table 3, deductions were made from the tested hypothesis where the calculated Chi square (χ^2) was found to be 23.38 and the tabulated critical (χ^2) was 14.07 at 0.05 level of significance and 7 degrees of freedom. Since the calculated value of (χ^2) is greater than the critical (χ^2), the null hypothesis is rejected and therefore a conclusion is made that: the volume of agricultural products transported is highly dependent on the frequency of bodabodas in Busembatia town council Bugweri district.

Table 3. Calculation of the Chi-square (χ2) for the proposed hypothesis.

Parking stages	Motorcycles interviewed	Observed products (O)	Expected products (e)	$(O - e)^2$	$X^2=\sum\frac{(O-e)2}{e}$
Butandwe	7	1.35	2.94	2.53	0.86
Buyinima	6	1.60	2.52	0.85	0.34
Kampere	34	7.40	14.28	47.33	3.31
Nakasero	31	10.08	13.02	8.64	0.66
Naminumya	10	6.00	4.20	3.24	0.77
Petrol	12	7.50	5.04	6.05	1.20
Police	5	2.75	2.10	0.42	0.20
Posta	8	10.70	3.36	53.88	16.03
Total	**113**	**47.38**			**23.38**

Source: Field data (2019).

The role of bodabodas in transportation of agricultural products

In Busembatia town council, a wide variety of products are transported from the farm site to the different market centres by several means of transport. Accessibility of these farm sites is largely dependent on the distance from the farm to the main road as well as the weather season. Table 4 illustrates the different products transported around Busembatia and the amount of each per week. According to the table, maize is the most transported product by bodaboda covering over 20.2% of the total products transported. Throughout the seasons of the past 2years, the production of maize in the region has been affected by several factors such as varying market prices, escalating cost of inputs and more recently the "*Army worm"* pest (Kebede, 2019) which led to closure of several farms. Regardless of these obstacles, the demand for maize is still high both locally for food, animal feed and for export into countries like South Sudan which explains why maize is still the most transported product in Busembatia. The biggest sources of maize in the region are villages such as *Budatu, Namalemba* and *Budwampa*, and the commonest destination of the product in Busembatia market store and Iganga where it is milled into flour, packed and stored or transported further. The second most transported product in the region was rice which covered over 18% of the total amount of product moved per week. Being surrounded by swamps, Busembatia has been known as one of the highest rice growing regions in the country which explains the high volumes of rice (Gariyo, 2001). A large number of farmers in the region act as out growers of rice, supplying to private rice producing factories like *Tilda* and *Kingdom Rice* hence the high volumes. Most rice is transported by bodabodas to Busembatia town stores where it is weighed, sorted, packed and sold on the road side to people that use the *Mbale-Tirinyi* highway. Potatoes and cassava as well account for a significant proportion of the total quantity transported which is about 31%. The high volume of potatoes and cassava can be attributed to the eating habits of the inhabitants of the place. Potato is a staple food in the Busoga region which ensures its constant supply throughout the year. This finding is also further supplemented by the fact that the productivity of these two crops isn't that much affected by soil fertility and the ever changing seasons in the year compared to crops like matooke which cover only about 6%. Findings show that 1800 kg of coffee are transported by bodabodas per week compared to the 100 kg of cotton. The low amount of cotton transported can be attributed to the timing of the survey which was done out of season for cotton as compared to coffee. The huge difference in weight recorded for cotton and coffee is also due to the fact that for the same volume of product, coffee bags would weigh heavier than cotton bags hence a bodaboda would transport more kilograms of coffee per trip. The low percentage of groundnuts recorded at 0.8% of the total is attributed to the recent weather in the country where, the region has been receiving heavy rains throughout the year which don't favors growing of groundnuts. Results also show that some bodabodas transport animals like goats from farms to market centres and slaughter houses. Goats cover only 0.2% of the total agricultural products transported and this is due to the fact that bodaboda carrying capacity is small for animals compared to cars and trucks.

Table 4. Agricultural products transported by bodabodas in Busembatia town council.

Agriculturalproduct transported	Quantity (kg)	Percentage %
Beans	6,900	14.6
Coffee	1,800	3.8
Charcoal	300	0.6
Cassava	6,500	13.7
Cotton	100	0.2
Ground Nuts	400	0.8
Goats	100	0.2
Jack Fruit	300	0.6
Matooke	2,800	5.9
Maize	9,550	20.2
Oranges	100	0.2
Mangoes	400	0.8
Potatoes	8,100	17.1
Rice	8,680	18.3
Soya	1,300	2.7
Vegetables	50	0.1
Total	**47,380**	100%

Source: Field Data (2019).

Respondents also reported that a license from authorities is required for them to transport animals like goats along the road which prevents them from transporting as much animals compared to crops. Due to the long distances traveled to the slaughter houses, it would require a second person to sit with the animal on the bike carrier and in many cases the animals get injured in transit which makes bodabodas a less preferred option for transporting live animals. Fruits like oranges, mangoes and jackfruit are also transported in proportions of 0.2%, 0.8 and 0.6% respectively. The low volume of fruits transported by motorcycles from the farm to markets can be attributed to the rough bumpy ride delivered by bodabodas that often damages the ripe fruits causing loss of products. Respondent reported that most buyers of fruits in the markets like Iganga and Namutumba prefer using trucks to transport the products due to the damage and low volume transported by motorcycles per order. The least likely agricultural products to be transported by bodabodas was vegetables covering only 0.1% of the total. This is because vegetables don't yield as much pay per trip compared to other products like rice hence transportation of this is left to bicycles. Some bodaboda respondents also reported that they do not carry any products on their motorcycles because agricultural products damage bikes with time hence they only stick to carrying passengers from one stage to another. The illustration in Figure 3 describes the relationship between the quantity moved per agricultural product and the distances moved to transport each product. In contrast to the fact that maize is the agricultural product transported mostly at 20.2% of the total weight, the illustration shows that rice is the agricultural product that is moved for longest distances per week (3800 km). This finding can be explained by the fact that maize is produced by most farmers and yet sold in nearer markets of Busembatia stores. Rice on the other hand is grown by fewer farmers compared to maize but the preferred markets for the product are at longer distances from the farms such as *Namutumba* and *Iganga*. Results also show that beans are transported further than maize and this can as well be due to the fact that the market for beans is less amongst the residents of Busembatia compared to further markets like Iganga. Results show that cotton is one of the crops that are transported for short distances at 100 km and this can be attributed to the presence of cotton handling facilities in Busembatia trading centre. The figure also shows that vegetables are at the bottom of the list for distance transported by bodabodas and this finding can be attributed to the high perishability rate of fresh vegetables compared to any other agricultural product.

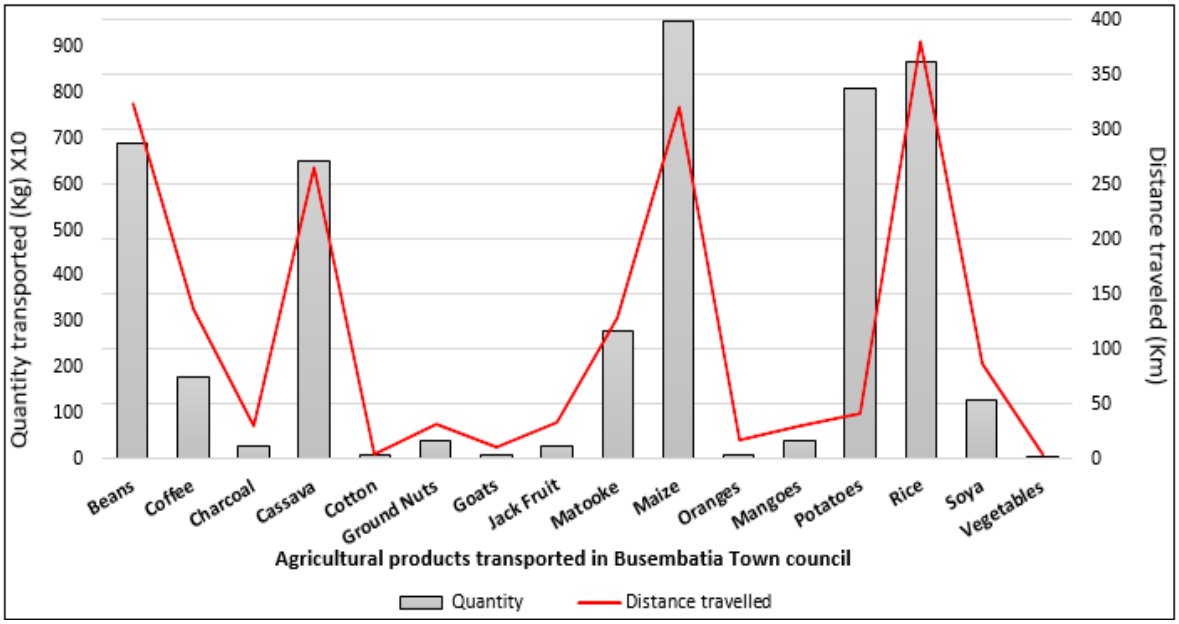

Figure 3. Relationship between agricultural products transported and the distances moved for each product.
Source: Field data (2019).

Limitations against use of bodabodas

The bodaboda business being an open business, riders are faced by several limitations that inhibit their optimal performance to transport agricultural products. (Nyaga, 2017) carried out a study that sought to understand the various challenges that were faced by bodaboda operators in their day to day business. The study revealed that only 25% of the riders possessed valid motorcycle licenses endorsed class F and G respectively as shown in Table 5. This agrees with other numerous studies on bodaboda operations where Kumar (2011) observed that of all motorcycle riders in Lagos, only estimated 50% of the riders owned driving licenses while only 18% of the riders in *Douala* had valid driver's licenses. Similarly, the same study estimated that 24% of the riders had driving licenses but were not valid since they did not match the respective motorcycle class. In most case however that pertain particularly to transportation of agricultural products in rural areas, administrative centres for registering and licensing bodabodas can be very far from areas where some rural bodaboda riders operate. This makes access to these services by riders a significant challenge and limits them from transporting produce to certain market centres to cities where licenses are a must-have. The other major limitation to bodabodas is police harassment during operation as revealed in a study by Nyaga (2017) where the law enforcers demand bribe ranging from Kshs.50 to 5000. This mostly happens whenever operators pass through police check-points which limits them from operating through specific routes and opens possibilities of bribery to sustain operations (Mutiso and Behrens, 2011, and Bishop and Amos, 2015). Poor road network is another challenge faced by bodaboda cyclists especially in these rural areas. Many roads are dusty which exposes riders to dust related illnesses like flu and cough. This agrees with Oladipo (2012) who reported that some of the major challenges that face bodaboda services were due to their operation under harsh weather condition and inhalation of various respiratory substances. Apart from health complications there is also the issue of social stigmatization from members of the public and fellow peers where bodaboda riders are generally looked down on as illiterate people (Nakanyike, 2019) who cannot get better jobs in the society. Another challenge encountered by the bodaboda riders is the high initial cost of establishing the business (Oladipo, 2012). A prospective investor willing to go into the business would need a substantial pool of money to inject into the venture. This includes the initial cost of purchasing the bike depending on the brand, the cost of legal registration and licensing it and the final registration with the riders associations to get an operation stage. Turyahikayo and Ayesigye (2017) carried out a survey in Ntungamo district in Uganda which revealed that majority of the respondents (63.3%) hired the motorcycles while the rest either individually or jointly owned them. The conclusion was that the motorcycles are expensive to buy and sometimes one needs to sell their assets including land to get one.

It is clear therefore that even when individuals try to seek

Table 5. Riders possession of valid driving licenses.

Possession of driving License	Frequency (n)	Percentage (%)
Valid Driving License	24	24
Other Endorsements	25	25
No License at all	51	51
Total	**100**	100

Source: Nyaga (2017).

non-agricultural income sources, the means for generating such incomes are not readily available. Another study carried out in Uganda showed that some passengers adamantly refused to pay the bodaboda operators after reaching their destinations (Mutiso and Behrens, 2011). The study revealed that several passengers, upon reaching their destination either jumped off the bodaboda or fled without paying the transport fare or become very violent when asked to pay. Worse still, criminals masquerading as passengers have continued to steal bodabodas from riders and this has often times led to loss of owners' lives (Nyaga, 2017). Also, minibus taxis harassed the bodaboda riders on the roadways by pushing them off the road into trenches, accusing them of stealing their customers. This report thus provided a comprehensive account of the limitations against bodaboda transportation but failed to suggest how these problems could be addressed.

CONCLUSIONS

It has been concluded that bodaboda cyclists play an essential role in promoting agricultural transportation in developing countries due to their flexibility and easy access into rural areas. It is also evident that commercial motorcycles are employed to transport farm products to market centres which is of paramount value to agricultural productivity in these regions. The potential for bodaboda cyclists in transporting agricultural products isn't effectively utilized due to the many hindrances experienced by operators in this franchise. In order for the bodaboda riders to effectively assist in agricultural transportation, there's need for government intervention to aggressively manage rampant theft cases in the business that threatens riders' lives. An improvement in the state of roads by the authorities will facilitate operation even during rainy seasons. Also important is the need to enforce traffic regulations with emphasis on wearing mandatory helmets to reduce accident fatalities on roads while training riders regularly on road usage. Further studies should focus on the adaptation of smart phone technology by bodaboda riders and a solution towards market identification for agricultural products.

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