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RESEARCH ARTICLE

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PASSENGERS DEMAND ON RAILWAY TRANSPORT IN TANZANIA A Case of Dar es Salaam to Moshi – Arusha Route

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ABSTRACT

This paper presents mathematical model on the effect of parameters on passenger demand on the train transport from Dar es Salaam to Moshi - Arusha Route. **Methodology:** Numerical simulations were used to demonstrate the impact of parameters on passenger demand. **Findings:** The results shows that increase of extra effort of selling tickets and availability of transport to the train station and from the train station to the passengers' destinations S, ratio of change of passenger demand and change of train capacity r, number of coaches with service improvement C_a will increase passenger demand. Nevertheless, increasing number of coaches without service improvement C_p , the passenger demand decreased due to the poor service, that is train transport users who have a negative image of the agency will not consider train as the best means of transport. However, if passengers are not satisfied, will opt to other means of transport which will make passenger train transport run with loss in which operation cost like paying salary to staff members, fuel consumption, train services and other office expenses are fixed. The train is expected to be cheap to passengers and run with high profit. For example, during peak month November to February each year most people are moving from Dar es Salaam to Moshi- Arusha. The company can increase frequency, coaches and ticket seller to every corner of the city with cost of ticket buyer which was compromised by the company and make sure that they are taken to the stations with the cost of passenger like other western countries. **Originality:** This paper determines the best way regarding the causes of demand in train passenger transport. Passenger demand on train is associated with availability of tickets in bus stand like Magufuli Bus terminal, Kibaha stand and other stations like Gongo la Mboti, Pugu, Kigamboni, Buza, Mbagala, as well as having buses which carry passengers to the train station on time and also when the train arrive to the stations the passengers get the buses which will carry them to their destination either Arusha, Moshi, Tanga, Coast, Dar es Salaam regions or in the middle stations. **Practical value:** Implementing increase of extra effort of selling tickets and availability of transport to the train station and from the train station to the passengers' destinations S and increase number of coaches with service improvement C_a will increase passenger demand and the train will run with profit.

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INTRODUCTION

A train is a set of railway cars (also called vehicles) that are tied together with or without a locomotive. Trains are used to carry people raw material, finished goods, cargo, and waste. While railway is the system and network of tracks that trains travel on. A passenger train is a train used to transport people along a railroad line [1,2]. The first railway on the mainland (German East Africa) was opened in 1893 between the Indian Ocean port of Tanga and a point near Mombo, serving Wilhelm stal (present day Lushoto) in the Usambara Highlands, a distance of 108km. The northern line from Tanga to Mombo was built in 1905 and reached Moshi in 1911 and Arusha in 1929, then was extended to Kenyan border at Taveta, where there was formerly link to the Kenyan Railways system, it was constructed to meter gauge railways which is most ideal for moving large amount of passengers at one time [3,4].

It is actually the cheapest mode of transport in Tanzania when considering taking large number of passengers, heavy and bulky goods. Railway transport is considered to be among the key players and drivers of national economy in Tanzania. It serves in transportation of raw materials, finished goods and people from one point to another with low cost. The Northern Line from Dar to Tanga, Moshi and Arusha closed in the 1980s but reopened in 2019/2020, except for a short section leading to the Kenyan border at Taveta, where there was formerly link to the Kenyan Railways system [3,4]. Since from 2019/2020 passengers were expecting to have high quality of train transport than other means of transport like buses and private cars which will serve time and cost. The passenger train service operates on Monday, Wednesday and Friday. The journey takes approximately 18h 30m, and by bus takes 10h 25m in 630km from Dar es Salaam to Arusha. Train transport retention is a challenge for many cities and countries. To develop comprehensive strategies aimed at retaining riders, it is necessary to understand the aspects of

Train transport that influence users to become faithful to the system. This paper determines the best way regarding the causes of demand in train passenger transport. It was observed that the service factors most associated with demand are on-board sanitation, caring, relief and helpful behaviour from operators, safety, comfortability, frequency of service, punctuality, time serving, availability and affordable. Furthermore, passenger demand on train is associated with availability of tickets in bus stand like Magufuli Bus terminal, Kibaha stand and other stations like Gongo la Mboto, Pugu, Kigamboni, Buza, Mbagala, as well as having buses which carry passengers to the train station on time and also when the train arrive to the stations the passengers get the buses which will carry them to their destination either Arusha, Moshi, Tanga, Coast, Dar es Salaam regions or in the middle stations. Furthermore, the results clarify that the concept of passenger demand is based on users' intentions to continue using the service, their willingness to recommend it to others, their overall fulfillment, but also the most importantly, their image of and involvement with passenger train transport.

Train transport users who have a positive image of the agency and consider train transport an integral component are more likely to demonstrate trustworthiness and act like ambassadors for train transport agencies. However, if passengers are not satisfied, will opt to other means of transport which will make passenger train transport run with loss in which operation cost like paying salary to staff members, fuel consumption, train services, that is the cost of current and capital repair of fixed assets related to passenger transportation and transport facility, building servicing, constructions, equipment and inventory connected with passenger transportation, overall repair, roundhouse servicing of maintenance vehicles, machinery, equipment and others as in [5-8].

Passenger train transport is expected to be cheap to passengers and run with high profit as it can carry all the passengers opting to use this means of transport, as can add coaches by using the same locomotive. For example, during peak months November to February each year most people are moving from Dar es Salaam to Moshi- Arusha. The company can increase frequency, coaches and ticket seller to every corner of the city with cost of ticket buyer which was compromised by the company and make sure that they are taken to the stations with the cost of passenger like other western countries.

Purpose: The study is aimed to find best way regarding the causes of demand in train passenger transport from Dar es Salaam to Mosh-Arusha route using mathematical model.

METHODOLOGY

In this section, a deterministic model is formulated that describes the increase of passenger Demand of the train.

In formulating the model, the following assumptions are considered

- i) Model is of a Single Line
- ii) Train stops location is fixed.
- iii) The coach capacities are 30, 60 and 80 passengers for first, second and third class respectively
- iv) Train carry passenger every after one day with 8-30 coaches.
- v) Distance from Dar es Salaam to Arusha is 630 kilometers, which uses 18hour and 25 minutes from Dar es Salaam to Arusha
- vi) One trip carry 600 passengers that is one coach for first class which carry 20 Passengers, three coaches for second class which carries 180 Passengers and five coaches for third class which carries 400 Passengers

Considering the above considerations and assumptions, schematic model flow equation is as follows as in [9]

$$\Delta D = D_p r \frac{(SC_a - C_p)}{C_p}$$

$$D_a = D_p + \Delta D \quad (1)$$

$$D_a = D_p + D_p r \frac{(SC_a - C_p)}{C_p}$$

$$D_a = D_p \left(1 + r \frac{(SC_a - C_p)}{C_p} \right)$$

Where

r is the ratio of change in demand and change in capacity,

S is extra effort done by selling ticket to bus stations, stands, other areas with availability of passengers and support transport services to and from the station

D_p is current demand in passenger

D_a is increase demand in passenger after increasing the capacity (coaches)

ΔD is change in demand due to increase in coaches

C_p is number of coaches without service improvement

C_a is number of coaches with service improvement

FINDINGS

In order to find the best way to increase passenger demand of train transport, numerical simulation will be used.

Numerical Simulations: Here analytical results are illustrated by carrying out numerical simulations of the model equation 1. Parameter values are estimated to vary within realistic means as shown in (2).

$$S=10, r=0.98,$$

$$C_p = 8,$$

$$C_a = 30$$

$$\text{and } D_p = 600$$

(2)

Originality and Practical Value

The variation of passenger demand in different values S , r , C_a and C_p are shown in Figures [1-4]. It is observed that as S increasing, the Passenger demand is increasing, this is due to the extra effort done by selling tickets in bus stands and stations like Magufuli bus terminal, kibaha, Moshi, Arusha bus stands and stations like Gongo la Mboto, Pugu, Buza, Mbagala, Kigamboni and other areas where passengers are available and then the arrangement to be done to carry the passengers to the train station/their destination for the cost of passengers like western countries.

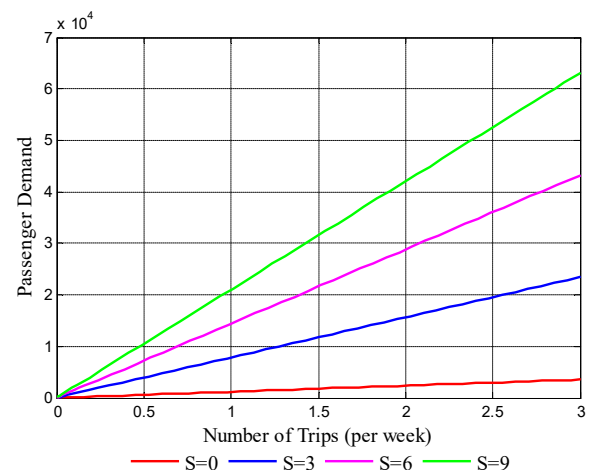


Figure 1. Passenger Demand against number of trips with increasing service improvement S

Figure 2, illustrates that increasing r that is ratio of change of passenger demand and change of train capacity led to increase passenger demand.

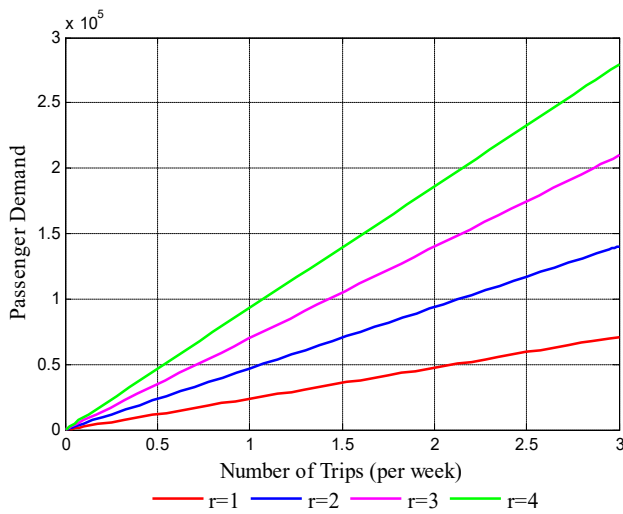


Figure 2. Passenger demand against number of trips with increasing r

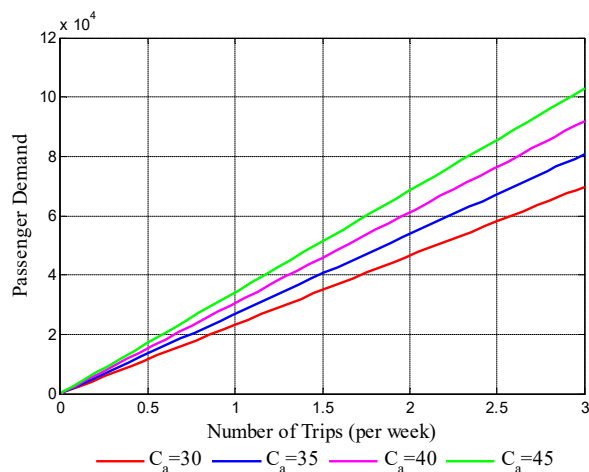


Figure 3. Passenger demand against number of trips with increasing number of coaches with service improvement C_a

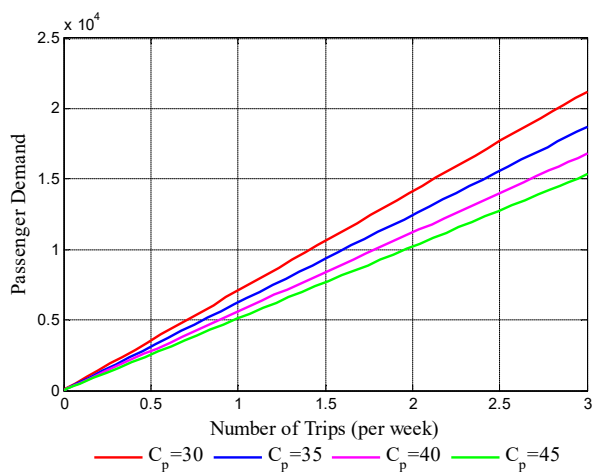


Figure 4: Passenger demand against number of trips with increasing coaches without service improvement C_p

Figure 3 presents the influence of increasing number of coaches with service improvement C_a , it is observed that the increase of number of coaches and the service improvement like cleaning the coaches and others like customer care led to the increase of passenger demand. The effect of adding number of coaches without service improvement C_p , is presented in figure 4. It was observed that when C_p is increased, then the passenger demand decreased due to the poor service and the passengers will not be willing to recommend it to others in positive way. That is train transport users who have a negative image of the agency, will not consider train as the best means of transport are doubtful to demonstrate trustworthiness and act like ambassadors for train transport agencies.

CONCLUSIONS

Mathematical explored the effect parameters on passenger demand. Numerical simulations were used to demonstrate the impact of parameters on passenger demand. The results show the increase of extra effort of selling tickets and availability of transport to the train station and from the train station to the passengers' destinations, ratio of change of passenger demand and change of train capacity r , number of coaches with service improvement C_a will increase passenger demand. Nevertheless, increasing number of coaches without service improvement C_p , the passenger demand decreased due to the pure service and the passengers will not be willing to recommend it to others in positive way, that is train transport users who have a negative image of the agency will not consider train as the best means of transport and act like ambassadors for train transport agencies.

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