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Factors Influencing usage of Rail Transport by Private Motorists at Park and Ride Station: a Case of Syokimau Railway Project in Nairobi County, Kenya

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Abstract:- Park and ride concept is one of the transport demand strategies adopted by engineers and transport planners to address the problem of traffic congestion experienced in urban areas. The purpose of this study was to establish the factors that influence usage of rail transport by private motorists at Syokimau Railway Station which is located in Nairobi County in Kenya. The research objectives were as follows :- to determine how parking cost differential between Nairobi Central Business District and Syokimau park and ride facility influence usage of rail transport by private motorists at Syokimau park and ride station, to assess the extent to which train schedule at Syokimau railway station influences usage of rail transport by private motorists at Syokimau park and ride station, to establish how passenger comfort influences usage of rail transport by private motorists at Syokimau park and ride station and to establish how the catchment area influences usage of rail transport by private motorists at Syokimau park and ride station. The target population was 255 subjects comprising of 250 private motorists and 5 Syokimau station managers/supervisors. This was arrived at by taking the highest number of private cars that have ever parked at Syokimau station in any single day. Krejcie and Morgan table (1970) was used to arrive at a sample size of 155. The study used descriptive survey research design. Structured questionnaire were administered to the private motorists whereas interview schedules were administered to the five managers/supervisors at Syokimau park and ride station. The findings show that 65.4 percent of respondents stated less parking charges at Syokimau station encourages them to use Syokimau Commuter train, 80.3 percent of the respondents observes that the train schedule at Syokimau station is reliable. However, 62.7 percent of the respondents claimed that Kenya Railways did not give feedback to complaints raised. The study concludes that the major obstacles influencing usage of rail transport by private motorists at Syokimau railway station negatively are dilapidated railway infrastructure, poor customer care services and inadequate train frequency. The study recommends similar studies to be extended to other park and ride facilities within Nairobi Commuter Network as well as study on influence of fuel cost on usage of rail transport by private motorists in Kenya.

Keywords:- *Usage of Rail Transport by Private Motorist at Syokimau Park and Ride station- habitual practice of taking rail transport at Syokimau railway station by private motorists, success of which is measured by number of private cars parked and the number of tickets sold. Parking Cost differential between Syokimau Park and Ride Facility and Central Business District- this refers to the amount by which parking charges at Syokimau Park and ride facility differs with parking charges at Nairobi Central Business District. Train schedule- refers to the programmed departure and arrival time for Syokimau commuter train both at Syokimau railway station and Nairobi central station. This is measured by assessing punctuality of the train and the frequency of the train service.*

I. INTRODUCTION

Park and ride concept is one of the transport demand strategies adopted by engineers and transport planners to address the problem of traffic congestion experienced in urban areas. Noel, (1988) in his study describes Park and ride (P &R) as an operation in which commuters, travel by private vehicles , either as drivers or passengers, gather at a common site that enables them to transfer to higher-occupancy vehicles (HOV) which are public vehicles. In United Kingdom (UK) the concept of park and ride originated in 1960's with pilot projects in Leicester, Nottingham and Oxford cities with a view of reducing traffic congestion, providing additional parking spaces and promoting economic development (RPS GROUP, 2009).In United States the first form of P & R was established in mid- 1970s although the concept started in mid-1920s informally (SMG, 2013). In Kenya rail based park and ride concept started in earnest in year 2012with commissioning of three park and ride railway stations namely: - Syokimau, Imara Daima and Makadara on the Nairobi Commuter Rail network.

II. OBJECTIVES

The study was guided by the following objectives: (i) to determine how parking cost differential between the Central Business District and Syokimau Park and ride facility influences usage of rail transport by private motorists at Syokimau Park and Ride station (ii) to assess the extent to which the train schedule influences usage of rail transport by private motorists at Syokimau Park and Ride station.

III. RESEARCH QUESTIONS

The following research questions were formulated in line with the stated objectives: -(i) how does parking cost differential between Central Business District and Syokimau Park and ride facility influence usage of rail transport by private motorists at Syokimau Park and Ride station? (ii) to what extent does the train schedule influence usage of rail

ISSN No:-2456-2165

transport by private motorists at Syokimau Park and Ride station?

IV. LITERATURE REVIEW

The literature review was conducted for each independent variable, to clearly elaborate how the independent variables affect usage of rail transport by private motorists at park and ride facility.

A. Parking cost differential on usage of rail transport by private motorists at park and ride facility

Stieffenhofer, Barton and Gayah (2016) conducted a study in Washington, USA under the theme "assessing park and ride efficiency and user reactions to parking management strategies" to determine the efficiency level of P & R in Central Puget Sound Region of Seattle, Washington. An onsite audit survey was conducted on a sample of nine P & R facilities using observation method whereas questionnaires were used to conduct user survey to validate the results of onsite audit survey. The study aim was to obtain the average number of persons served by each parking slot which is defined as the person-efficiency. The observers were stationed at the entry point to give them vantage view of vehicles entering the P & R. The number of people in each vehicle was counted. The study was conducted during the AM hours of the weekdays, which are the peak time. Another second team was stationed at drop-off locations to count the number of kiss – and –ride (K & R) drop offs. The following formula was utilised to estimate the person efficiency of parking vehicles.

$$person - Efficiency = \frac{Pin - 2K}{Cin - K}$$

Where P_{in} = Number of people entering the P & R, C_{in}= Number of vehicles entering the P & R, K= the number of kiss –and – ride drop offs. The denominator represents the number of vehicles parked at the P & R during the observation period, while the numerator represents the number of people using the parking space. The study assumed that each K & R vehicle had two occupants the driver and one passenger. After analysis the study revealed that the person-efficiency value are near 1, for the nine P & R facilities selected, with the highest having 1.080 passengers per parked car. This was expected as the sample was taken from on busy P & R facilities. This led to the conclusion that most of people parking at the P & R arrived at the facility using Single Occupancy Vehicle (Stieffenhofer *et al*, 2016).

A user intercept Survey was conducted in a total of seventeen facilities (including the nine where onsite audit was conducted) to assess what would be the impact of varying parking fees. The research was conducted by use of paper survey filled on site and an electronic survey by use of a card with a website linked mobile phone electronic copy. The aim being to increase the response rate. A total of 3,300 surveys were collected with paper survey accounting for 2000 responses. The penetration rate for the survey was 25% despite the effort made to reach each and every user of the facility. The survey required the users to identify all the reasons why they use the P & R facilities from a given list, and the results were as follows: inadequate parking at destination (34.9%), long travel time (44.9%), environmental impacts (36.1%), financial (77.1%), relaxation during transit (59.6%). From the analysed results it was evident that biggest motivator for use of P & R was cost related and ability to relax on transit. About half of respondents said they would not consider carpooling to avoid parking fees or to obtain guaranteed parking space. A quarter of the respondents affirmed that they would use carpools if they were exempted from payment of parking fee. The intercept survey revealed that the P & R users are not willing to pay for parking in those facilities that parking is already free. However, a substantial number of people are willing to pay to get a reserved parking (Stieffenhofer *et al*, 2016). Gayah, Stieffenhofer and Shankar (2014) in their study titled "how can we maximize efficiency and increase person occupancy at overcrowded park and ride" aver that private motorists are willing to carpool to P & R facilities to share the parking cost.

In the study conducted by Arup, Accent and the Institute for Transport studies at University of Leeds (2012) under the theme "The effects of park and ride supply and pricing on public transport demand" commissioned by Transport Scotland it emerged that most P & R users preferred driving to the park and ride facilities as the parking charges are either free or lower in comparison to the central business district. The research was conducted in seven P & R facilities in Scotland, United Kingdom. The study revealed that on average there would be a reduction of 4.9% on park and ride usage if the parking fee was raised by one British pound. The researchers utilised both primary and secondary data collected from the targeted park and ride facilities. This involved both rail based and bus based park and ride facilities. The study concluded that an increase of one British pound in parking fee in the Rail based Park and ride facility would result in loss of revenue as rail customers would switch to other mode of transport, therefore. The targeted rail based park and ride centres were: - Bridge of Allan, East Kilbride, Perth and Kirkcaldy and two control sites at Stirling and Falkirk High. A steering committee ensured that the selected sample was representative. Two control stations which had not experienced additional parking in the recent past were selected. The committee ensured that the selected park and ride stations had both rural and urban characteristic. Face to face interviews were conducted throughout the day on both weekdays and weekends.

In order to refine the survey questions a pilot survey was conducted. The survey focussed on the topics of gender, age, journey purpose and parking costs. Short interviews of 15 minutes per interview were conducted, on an equal number of male and female respondents. Vincent and Hamilton (2007) in their study states that success of park and ride facilities is pegged on shortage of reasonably priced parking lots in the central business districts. Turnbull *et.al* (2004) in their report titled park and ride/pool argue that park and ride facilities should charge discounted parking fees for those stations with strong demand. Martin and Davidson (2008) avers that municipalities should have a parking restraint policy, to favour short and medium stay users vis- a-vis long stay parking users. That way

ISSN No:-2456-2165

commuters will be enticed to use park and ride scheme located on the periphery of cities.

Shen, Chen, Su, Chen and Yao (2017) in their study under the theme of optimization of park and ride system argue that location and rules governing charges at park and ride facility have a significant impact on commuters and governments. Kalasova, Cernicky and Kubikova (2014) avers that although parking charges are used by local authorities as a source of revenue generations , moderation is necessary to ensure there is less incentive for private motorists to access the urban centres. Fontaine (2003) as quoted by Morrow (2005) states that the parking cost at the destination is a determinant in the choice of mode of transport to be taken by passenger. The author argues that parking provided by employers is major fringe benefit to the employees, which encourages private motorists to use private cars instead of public transport. Wilson and Shoup (1990) in their study conducted in America, observed that there would be a reduction of 19 to 18 percent on usage of private cars to the work places, if the employees were to pay for the cost of parking at the work place themselves. According to a study by Mc Cahill, Garrick, Atkinson-Palombo and Polinski (2015), provision of parking in urban areas has a direct influence in increase in usage of private motorists in urban areas, which in turn contribute to traffic congestion on the urban roads. In a study conducted at the University of Trieste, Italy by Rotaris and Danielis (2014), observed that an increase in parking charges would lead to 19 % increase in bus ridership.

B. Train schedule on usage of rail transport by private motorists at park and ride facility

In a study conducted in 2011 by The Gallup Organization on behalf of Directorate – General for Mobility and Transport of European Commission, punctuality and reliability was highlighted as one of key parameter that determines the level of passenger satisfaction by rail services. The study was conducted in 25 EU member states out of the 27 member states as there is no railway network in Malta and Cyprus. Interview was conducted via telephone on passengers aged 15 and above. The selected sample size was 400 in each country apart from Estonia, Latvia, Luxembourg and Slovenia where the sample size was 300. Sixty six percent of the respondents indicated they were generally satisfied by the level of service offered by the rail service in their countries. However, 56% of the respondents observed that there is inadequate communication by the railway operators in the countries whenever there is a delay or disruption of the train schedule. This indicates that passenger are concerned with reliability of train schedule and can have a direct effect on passenger patronage. (Gallup , 2011).

In the year 2016, European Union commissioned Steer Davies Gleave Company to conduct a study on prices and quality of rail passenger services in the EU members states. The researcher collected both secondary data and primary data. Reliability and punctuality data was obtained from the Rail Market Monitoring Scheme (RMMS) which holds data for rail usage in EU countries. According to EU standards a train is deemed to be on time if it is within plus or minus 5 minutes for regionals services and 15 minutes for long distance services. The study found out that time table related attributes, like service frequency ranked alongside passenger fares as key determinants of rail traffic demand. The researcher observed that the reliability of train schedule ranged from 99% to 78 % in Europe, with Estonia having the highest reliability and Hungary the lowest reliability. This explains the high ridership for trains in EU countries.

The study revealed that those EU member states with the best performing rail services had the smallest rail network for local passenger services due to sparse passenger time tables (Steer Davies Gleave, 2016). The study also found that punctuality of long- distance services was poorer than that of urban rail services. Agunloye and Oduwaye (2010) observes that train punctuality has direct correlation with the number of trips of a rail user. 5I.5% of the rail customers opined that the reliability of train services in Lagos metropolitan was not predictable. Litman (2009) as quoted by Barata, Cruz and Ferreira (2010) argue that reliability of means of transport is a key factor in persuading a passenger to use a particular transport mode, but of more importance is the certainty of the arrival time. Monchambert and de Palma (2015) in their paper states that punctuality of public transport is key in encouraging modal shift, as commuters are averse to incurring extra-cost due to waiting time or late arrival. Wardman (2004) in his paper notes that one of the undesirable aspect of public transport is that the extent to which a person can make a journey at the desired time is dependent on the frequency of the public vehicle. In his journal, Fan (2012) under the theme "reliability analysis of stochastic park and ride network" argues that attractiveness of park and ride facility is dependent on its accessibility, quality of its infrastructure and reliability of the public connection to the facility. He argues that in the modern word people are more conscious of value of time.

V. RESEARCH METHODOLOGY

The study adopted descriptive survey design and utilised both qualitative and quantitative approaches to collect data. The target population was 255 subjects, comprising of 250 private motorists and 5 station managers of Syokimau railway station from which a sample of 155 was drawn using Krejcie and Morgan table of (1970).

VI. STUDY RESULTS

The study results have been analysed under the following sub themes (i) questionnaire return rate (ii) demographic information of respondents (iii) parking cost differential and usage of rail transport (iv) train schedule and usage of rail transport

A. Questionnaire Return Rate

The study issued 155 questionnaires to respondents to fill and return for analysis. Out of this 155 questionnaires, 132 of them were completed, filled and returned. This constituted 85.2 % return rate which is over and above what is recommended according to Fincham (2008) who avers that a return rate of 60% is adequate for social sciences research. Based on this the study proceeded. Mugenda and

ISSN No:-2456-2165

Mugenda (2003) states that a return rate of 50% is adequate, 60% is good and above 70% is excellent.

B. Demographic information about respondents

The study was interested in the demographic characteristic of the respondents in terms of gender, age and education level. These characteristics determine how people make a choice, and therefore respondents were requested to give their information in these demographic.

Variable	Category	Frequency	Percent	Cumulative Percent
Gender	Male	78	59.1	59.1
	Female	53	40.9	100.0
	Total	132	100.0	
Age	18-30 yrs	30	22.7	22.7
	31-40 yrs	79	59.8	82.6
	41-50 yrs	18	13.6	96.2
	51-60 yrs	4	3.0	99.2
	above 61 yrs	1	0.8	100.0
	Total	132	100.0	
Education Level	primary	1	0.8	0.8
	secondary	5	3.8	4.5
	college (Bachelor's Degree)	53	40.2	44.7
	University (post graduate)	71	53.8	98.5
	other (specify)	2	1.5	100.0
	Total	132	100.0	

Table 1. Demographic information about respondents

On gender out of 132 respondents who participated in the study 78 (59.1%) were male and 53 (40.9%) were female. This can be attributed to the fact that Kenya has been a male dominated society with more employed males than the female. The 2010 constitution has attempted to address this by way of affirmative action like requiring public appointments to observe a third gender rule.

Age of 132 respondents who participated in the study were as follows: 30 (22.7%) fell within age bracket of 18-30 years, 79 (59.8%) age bracket 31-40 years, 18 (13.6%) age bracket of 40-50 years, 4(3%) age bracket of 51-60 years and 1 (0.8%) above 61 years. It can be deduced that 109 (82.6%) of the respondents fell within the age bracket of 18-40 years, this can be attributed to the fact that within this age bracket most people have less disposable income, therefore there could prefer to park at the railway stations where the parking cost is much less in comparison with parking cost in Central Business District. On education level out of 132 respondents who participated 1(0.8%) has highest education level as primary, 5 (3.8%) highest education level as Secondary, 53 (40.2%) highest education level as Bachelors and (71 (53.8%) highest education level as post graduate. 2 (1.5%) of the respondents did not indicate their education level. It's evident that most users of Syokimau railway station are degree holders. This can be attributed to the fact that by virtual of their education background they are able to make informed decisions on financial matters. Therefore they may prefer to reduce the transportation cost, so that they can have more disposable income.

C. Parking Cost differential between Syokimau Park and ride facility on usage of rail transport at Syokimau Park and Ride facility

This research objective was investigated by formulating research questions on the adequacy of parking lots, parking cost differential between the station and Nairobi central business district and impact of changing the current parking fee of 100 Kenya shillings at Syokimau railway station.

D. Parking cost differential between Nairobi Central Business District and Syokimau Park and ride station

This theme is in line with objective which focusses on influence of parking charges on usage of Syokimau park and ride station. A comparison was made on the parking fee at Syokimau railway station and Nairobi Central Business District which the study assumed to be the final destination for the private motorists. The study also sought to know whether increase in parking charges at Syokimau railway station would discourage the private motorists from using the Syokimau commuter train.

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Statement	Frequency					Mean Score	Standard Deviation
	Scores (where 1=strongly Disagree 2=Disagree 3=weakly Agree 4=Agree 5= Strongly Agree)						
	1	2	3	4	5		
Less parking fee at Syokimau railway station in comparison with Nairobi Central Business District encourage usage of Syokimau commuter train	12 (9.4%)	15 (11.8%)	17 (13.4%)	33 (26%)	50 (39.4%)	3.78	1.33
The parking charges of ksh. 100 at Syokimau Station is still high	42 (33.1%)	33 (25.9%)	23 (18.1%)	18 (14.2%)	11 (8.7%)	2.43	1.343
Increase in parking charges at Syokimau railway station discourage you from using rail transport	14 (11%)	16 (12.6%)	10 (7.9%)	20 (15.7%)	67 (52.8%)	3.87	1.45
The amount of parking charges at Nairobi Central Business District influences your decision to use rail transport	19 (15%)	18 (14.2%)	12 (9.4%)	26 (20.5%)	52 (40.9%)	3.58	1.504

Table 2. Parking cost differential at Syokimau Park and ride station and Nairobi Central Business District

From analysis on table 4.2, 83 (65.4 %) of the respondents states that less parking fee at Syokimau Park and ride facility influences their decision to use Syokimau commuter train whereas 44 (34.6%) are not influenced by lower parking charges at Syokimau station. The analysis returned a high mean score of 3.78 indicating agreement with the stated proposition. The standard deviation was 1.33 indicating large variation from the mean. This can be attributed to the fact that some of the employers provide free parking lots for the employees, therefore, such employees maybe motivated by reduction in fuel consumption rather than parking cost. A total of 97(76.4%) of respondents affirmed that increase of parking fee at Syokimau station from the current one hundred Kenya shilling would discourage them from using the Syokimau commuter train. Out of 127 private motorists respondents 75 (59%) observe that the parking fee of KES 100 at Syokimau is affordable whereas 52 (41%) are of contrary view. The analysis returned a low mean score of 2.43 indicating majority of the respondents disagree with the stated proposition that the parking fee of KES 100 is still high.

E. Train schedule on usage of rail transport at Syokimau Park and ride facility

In this section the study sought to assess reliability of the train schedule at Syokimau station, awareness of KRC feedback mechanism to private motorists and adequacy of train frequency at the Syokimau station to meet customers demand.

Statement	Frequency					Mean Score	Standard Deviation
	Scores (where 1=strongly Disagree 2=Disagree 3=weakly Agree 4=Agree 5= Strongly Agree)						
	1	2	3	4	5		
Train usually arrives/departs on time at Syokimau railway station	11 (8.7%)	14 (11%)	27 (21.3%)	47 (37%)	28 (22%)	3.53	1.20
Train usually arrives/departs on time at Nairobi Central Station	11 (8.7%)	12 (9.4%)	32 (25.2%)	48 (37.8%)	24 (18.9%)	3.49	1.16
Kenya Railways Corporation usually responds to customers complaint regarding Syokimau commuter train promptly	20 (15.7%)	28 (22%)	40 (31.5%)	32 (25.2%)	7 (3.9%)	3.02	1.237
Syokimau commuter train rarely stalls mid-journey	16 (12.6%)	20 (15.7%)	35 (27.6%)	43 (33.9%)	13 (10.2%)	3.17	1.196

Table 3. Train schedule on usage of rail transport at Syokimau Park and ride station

ISSN No:-2456-2165

Based on analysis of table 4.3, out of 127 private motorists who gave their response 25 (19.7%) stated that the train does not depart/arrive on time at Syokimau railway station whereas 102 (80.3%) stated that train schedule at Syokimau station is adhered to. Equally 23 (18.1%) of the respondents observed that the departure/arrival time at Nairobi central station which is the terminal station for Syokimau train is not as per schedule, whereas 104 (81.9%) of the respondents affirmed that Syokimau train departs and arrives Nairobi Central station on time. This is illustrated by the high mean scores of 3.53 and 3.49 in regard to propositions of timely departure/arrival at Syokimau station and Nairobi Central station respectively. This shows passengers have confidence on the reliability of train schedule at both Syokimau and Nairobi central station, thus; if KR was to address the other underlying issues more private motorists would be attracted to Syokimau train.

On KR customer feedback mechanism 48 (37.7%) stated KR does not respond to queries raised by customers whereas 39 (29.1%) are of contrary opinion, 32 (25.2%) of the respondents adopted a middle ground position whereby they stated they weakly agree that KR responds to customer complaints. The analysis returned a mean score of 3.02 meaning they weakly agree with the proposition that KR usually responds to passenger complains. A high standard deviation of 1.237 indicates large variation from the mean score. This is an indication of scores that lies on the two extreme ends of strongly disagree and strongly agree. This a clear indication of perceived poor customer services.

On the issue of disruption of train services midway 36 (28.3%) of respondents stated that the issues is rampant whereas 56 (44.1%) of respondents observed that this is a rare occurrence. 35 (27.6%) adopted the middle ground position of weakly agreeing with the proposition. This is reflected by the low mean score of 3.17 and a high standard deviation of 1.196. This observation is contrary to what the same respondents had observed that Syokimau train arrives and departs the terminal station on time. This disparity can be attributed to the fact that customers are more likely to remember a bad experience where a train stalled midway exposing them to long delays than slight delays of few minutes at the terminal stations.

VII. CONCLUSION

The parking cost differential between parking charges at Syokimau and Nairobi Central Business District has big impact on usage of Syokimau Commuter train. Reliability of train schedule at Syokimau station is key determinant in decision making by private motorists on whether to use Syokimau Park and ride facility. The major bottlenecks affecting the services of Syokimau commuter train are poor customer care services, inadequate train frequency during the peak hours and dilapidated railway infrastructure. These can be addressed by undertaking major rehabilitation works on both the railway track and the passenger locomotives to ensure the passenger train do not stall midway.

VIII. RECOMMENDATIONS

The study recommends the following: (i) Kenya Railways employees to be sensitized on the need to improve their customer cares services, to ensure commuters complaints are handled adequately and in a timely manner (ii) Kenya Railways should install adequate sign boards to guide private motorists to Syokimau Park and ride railway station (iii) Adequate lighting should be provided within the parking lots, to enhance security of the patrons at the station. (iv) Kenya Railways should increase the number of trains from two to three during the peak hours in the morning and evening, in order to increase usage of Syokimau commuter train. (v) Parking charges at Syokimau Park and ride facility should remain competitive in comparison with charges at Nairobi Central Business District (vi) KR should ensure that the published Syokimau train schedules are adhered to.

IX. LIMITATIONS

The study was conducted with anticipation that passengers will have limited time to fill the questionnaire at the station due to fear of being left by the train. To overcome this the researcher used a brief questionnaire which required a short duration of about five minutes to fill, and the questionnaires were administered to the private motorists at the parking lot as they arrived. To increase success rate the exercise was started one hour before the train departure time for three consecutive days. This was to ensure the respondents had ample time to fill the questionnaire.

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