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**EFFECT OF INTEGRATED INFORMATION TECHNOLOGY ON SUSTAINABLE
MOBILITY OF MATATU SACCOS IN NAIROBI COUNTY, KENYA**

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Abstract

Purpose: The purpose of this study was to establish the effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County, Kenya.

Materials and Methods: The study was guided by Positivism philosophy while descriptive research design was adopted. The target population was 177 Sacco Managers and two representatives, one from MOT and other from MVOA respectively. The whole population of 179 respondents was used in the study hence; the study employed the census approach. The questionnaire was pilot tested on 18 respondents who were selected randomly. The study applied Cronbach's alpha and the results displayed a high level of internal consistency hence infers that the research tool used in the study was reliable. The data collection instrument was a semi-structured questionnaire, which were dropped and picked later. A semi-structured interview guide was also used. Data was analysed using descriptive and SPSS Version 24.

Results: The research findings indicated that most Saccos have embraced speed-recording devices, vehicle-tracking devices, and that Sacco's were using smartphones. Correlation analysis showed that information technology had a strong positive significant relationship on sustainable mobility of Matatu Saccos in Nairobi County, Kenya ($\rho = 0.821$, p value <0.05). This was confirmed by regression analysis which showed positive and significant influence of integrated information on sustainable mobility ($\beta = 1.140$, t statistics = 16.582, p value <0.05). This suggested that there is a causal effect of IIT on sustainable mobility.

Unique contribution to theory, practice and policy: The research findings indicated that most Saccos have embraced speed-recording devices, vehicle-tracking devices, and that Sacco's were using smartphones. Correlation analysis showed that information technology had a strong positive significant relationship on sustainable mobility of Matatu Saccos in Nairobi County, Kenya ($\rho = 0.821$, p value <0.05). This was confirmed by regression analysis which showed positive and significant influence of integrated information on sustainable mobility ($\beta = 1.140$, t statistics = 16.582, p value <0.05). This suggested that there is a causal effect of IIT on sustainable mobility.

Key words: *Integrated Information Technology, Sustainable Mobility*

1.0 INTRODUCTION

Information Technology (IT) can have a significant effect on the movement of people and goods. White (2016) points out that information is an important component of any public transportation service and people using transport should have relevant information, which they should be able to read and interpret timetables since knowledge is crucial. IT has a potential of enabling change both for organizations and social environment and, it therefore affects the demand for transport. The technological processes meet the demand for comfort, safety, and speed through advances in IT in the field of telemetric. This covers areas in traffic and transport management, information about travel and reservations, guiding vehicles and mobility cards. In the last few years, firms doing business in the transport sector have made significant improvement in their adoption of new technologies, particularly those linked to the internet and e-business (Macharia et al., 2015).

Polzin, (2016) explains that informing users about public transportation allows them organize their journeys. He further says that information on public transport must be readily available, complete, and clear and presented in an utterly consistent way throughout the network. The success of any public transportation depend mainly on providing users with a seamless journey, it is important to offer an integrated public transport information, taking account of the various service providers. Additionally, Singal (2010) argues that communication should establish traveler's information centers complete with dedicated route planning, telephone services, complemented by the judicious location of web-based automated, manual or computerized information hubs. The traveler's information centers should provide service for a group of operators, to informed the travelers so that they can make informed decisions about their travel, as this postulates and influence behavioral changes by way of a modal shift in favor of public transport

According to Williams (2008), information technologies is represented to society and other fields of science, including traffic and transport are the base of intelligent systems. Traffic demand is growing steadily in the whole world, and authorities today face daily challenges, such as increased fare and the time spent traveling. (Williams, 2008) explains that there should be added global concern about environment protection from noise and air pollution. The impossibility of infinite construction of transport infrastructure and growing awareness of the concerns about endangering of the life surrounding activates the question about new intelligent solutions for transportation equipment (ITS) (Aworemi & Ilori, 2008).

Black and Van Geenhuizen, (2017) posits that it is important to provide passengers with information on the progress of their journey using both audio and visual communication media. Black and Van Geenhuizen et al. (2017) further says that information should be provided about imminent stops and possible connections and, when services are disrupted, about possible delays that could jeopardize travelers' connections (real-time information) and possible alternatives for connecting trips as this helps in reducing passenger uncertainty. This is especially important when nothing is running to schedule.

Olga (2013) argues that Integrated Information Technology (IIT) in the transport sector allows the improvement of sustainable mobility. It also improves customer service and obtains cost reduction. Information Technology in the transport sector, commonly referred to as Intelligent

Transport System (ITS) has been used to improve the performance and safety of transport not only of parcel delivery but also for passengers using different modes of transport such as road, air just to mention but a few. Macharia, Mike, Ondabv and Kepha (2015), postulates that IT increases the efficiency and effectiveness in the operation of vehicles in the transport sector. Gilaninia (2011) observes that integrated information technology has become an important part in the business world. He further says that information technology improves the effectiveness and efficiency of services offered to customers. Implementation of IIT in the transport sector can significantly create high competition using E- ticketing, ease of communication, vehicle tracking devices and parcel delivery. This will help Matatu Sacco to afford sustainable mobility.

A study by Jarasuniene (2012) on intelligent transport systems technologies and efficiency identified various systems such as inductive detectors, ultrasonic, infrared and radar sensors, video imaging detectors devised to enhance transport mobility. The study recommended the inclusion of CCTV system to support in vehicle detection. Stefan, (2017) also conducted a study on IT and transport sustainable. The findings provided ample evidence that IT has significant impact on transport and hence the overall sustainability of the transport system. Further, Samson (2014) conducted a study that focused on the adoption and implication of IT in the transport sector. The objective of the study was to provide a broad view on the strategic impact of IT usage and implication in the transport sector. The study findings concluded that IT was an enabling tool in the transport sector that provide accurate flow of information on car tracking, increasing personal safety and security, and reduction in insurance costs. The findings also revealed that there was positive and significant effect in the transport sector. The contextual gaps in these studies are that they are all based in developed countries.

1.1 Statement of the Problem

Matatu Saccos dominates the main transport in Kenya and especially the urban sector accounting for over 80% of the country's total passenger transportation. The sector is a pillar in the development of the economy in the country through direct and indirect employment as well as promoting individuals who offer other services in the transport sector. The Matatu Sacco is not only preferred choice for many commuters but the only option to those commuters who do not have the luxury of owning their own vehicle since it has an elaborate transport network of routes which transverse the whole country. The significance of the Matatu Sacco sector in economic creation cannot be gainsaid. The sector is the fifth largest contributor of formal employment and the fourth largest contributor of informal sector jobs in Kenya (Republic of Kenya, 2011). In spite of the significant role played by the Matatu Sacco in Nairobi County and the Country at large, the sector is associated with several challenges. Among the challenges are lack of sustainable mobility with the following ripple effect of traffic jams and death, dangerous driving behaviour, environment pollution, economic problems and social issues affecting the cities and the life of the city dwellers with an equal breath.

Despite the many interventions carried out by the government to streamline the Matatu Sacco to attain sustainable mobility, the situation persists. The government has established several bodies like NTSA, TLB, KeNHA, KURA, NAMATA, among others to create synergy in the sector. Other interventions such as the marking and mapping out of the red lane (lip stick lanes) on

Thika and Mombasa road, and the free-car plans for two days, the situation is still grim. The implementation of the famous Michuki laws (via legal notice No. 161 of 2003) gave a form of normalcy and orderliness for a time, but its fading with time. Finally, the registration of all Matatu into Saccos or companies is bearing fruits as they have developed terms of service and codes of conducts for their owners and Sacco managers. The duo and other stakeholders have a potential of transforming. Through its operation, the Matatu Sacco have always suffered the love- hate relationship with the players and its absence in the streets of Nairobi during strikes makes the city to come to a standstill and this provokes the following questions. “Is banning the services offered by Matatu Saccos in Nairobi County the solution?” “Or having the two car free days?” “Or is strategic transport integration and sustainable mobility the only option for the Matatu Saccos?” is it the option what will give the Nairobians an end to the Matatu nightmare? Given the above-illuminated gap, the researcher was motivated to carry out this study, entitled Strategic Transport Integration and Sustainable Mobility on Matatu Saccos in Nairobi County, Kenya.

2.0 METHODOLOGY

The study was guided by Positivism philosophy while descriptive research design was adopted. The target population was 177 Sacco Managers and two representatives, one from MOT and other from MVOA respectively. The whole population of 179 respondents was used in the study hence; the study employed the census approach. The questionnaire was pilot tested on 18 respondents who were selected randomly. The study applied Cronbach's alpha and the results displayed a high level of internal consistency hence infers that the research tool used in the study was reliable. The data collection instrument was a semi-structured questionnaire, which were dropped and picked later. A semi-structured interview guide was also used. Data was analysed using descriptive and SPSS Version 24.

3.0 RESULTS

3.1 Descriptive statistical Analysis Results

3.1.1 Descriptive Statistics of Integrated Information Technology

The study sought to establish the effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County. To measure these strategies, the respondents were rated on a five-point Likert scale based on the extent of information technology integration in Matatu Saccos in Nairobi County. Frequency, percentage, mean, and standard deviation were used to analyze the data. The means were interpreted as follows; mean value ranging from 0-1 implies that the majority of the respondents agreed with the statement to a small extent. While a mean value of 1.1 – 2.0 means that, the respondent agreed to a small extent with the statement. Additionally a mean value of 3.1 – 4.0 implies that the respondents agreed to the statement to a great extent. Otherwise a mean value of 4.1 -5.0 means that the respondent agreed with the statement to a very great extent. The results on the table reveals that the mean value obtained from the responses were all above 3.1 indicating that the respondents agreed with the statement to great extent. Table 1 shows the descriptive results of Integrated Information Technology.

Table 1: Descriptive results for Integrated Information Technology

	Percentage (n=135)					Me an	Std. Dev
	SD	D	N	A	SA		
Ease of communication between Sacco managers and employees enhances customer satisfaction	9.6	8.9	28.1	32.6	20.7	3.5	1.2
Use of tracking devices improves competitiveness	8.1	4.4	20.7	34.1	32.6	3.8	1.2
The Sacco has put in place e-ticketing channels	2.2	6.7	24.4	37.8	28.9	3.8	1.0
Information technology enhances awareness on departure time and arrival time to the passengers	5.2	15.6	27.4	34.8	17	3.4	1.1
Good communication channels increase innovativeness	7.4	10.4	23	39.3	20	3.5	1.1
Overall average						3.6	1.1

**SD- Strongly disagree, D-Disagree, N-Neutral, A-Agree, SA- Strongly Agree.*

The results in table 1 indicate that majority of respondents agreed that use of tracking devices improves competitiveness in the Matatu Sacco. This represents 66.7% of the total respondents with a mean of 3.8 and standard deviation of 1.2. (mean = 3.6, standard deviation = 1.1). These devices would aid in curbing in-securities associated with Matatu Sacco. Similarly, majority 37.8 percent agreed, and 28.9 percent strongly agreed that availability of e-ticketing enhances customer satisfaction with a mean response of 3.8 Standard deviation 1.0. This implies that there is a need for coherent communication structure within Sacco's to amplify on quality of services accorded to customers. Further, majority agreed that their Sacco has put in place good communication channels with other people in Matatu Saccos (mean = 3.8, standard deviation = 1.0). Finally, 34.8 percent agreed, and 17 percent strongly agreed that information technology enhances awareness on departure time and arrival time of passengers. Finally, 39.3 were used percent agreed, and 20 percent strongly agreed that good communication channels increase competitiveness. However, 5.2% strongly disagreed with 15.6 disagreeing that information technology enhances awareness on departure time and arrival time to the passengers. These findings agreed with Black and Van Geenhuizen (2017) who posited that the sense of insecurity is even more acute at interchanges than on a vehicle since there are various options and travelers have to make choices and take decisions. Passengers feel uncertain during a trip since they are not in control of the vehicle conveying them from A to B. This implies that passengers using transport systems should have relevant information to help them on decision-making.

The findings agreed with the EEA report (2007) that recommended the essence of incorporating tracking devices by transport sector to ease tracking, management and maintenance of their vehicles. The report also, argued that adoption of tracking devices would aid in fleet management, repair, and maintenance since it would be easier to track the vehicles whenever there is breakdown. The results further agreed with Kitheka (2014), who argued that tracking devices are tools for efficiency and efficient service provision in transport industry. This will cumulatively improve customer satisfaction and create competitive advantage. Finally, the findings concurred with Weber, Heller-Schuh, Godoe and Roeste (2014) who concluded that there was need for incorporating information technology as tools for gathering and managing

business information. This implies that use of tracking devices is positively related to enhanced communication and increasing firm mobility. Finally, the findings are in line with the resource-based theory Barney (2003) which suggests that the resources possessed by a package of an organization are the sole determinants of its performance which may contribute to mobility in the transport sector.

3.1.1.1 Type of Information Technology Saccos have Embraced

The study evaluated the type of information technology embraced by Matatu Saccos in Nairobi County. The results are presented in Figure 1.

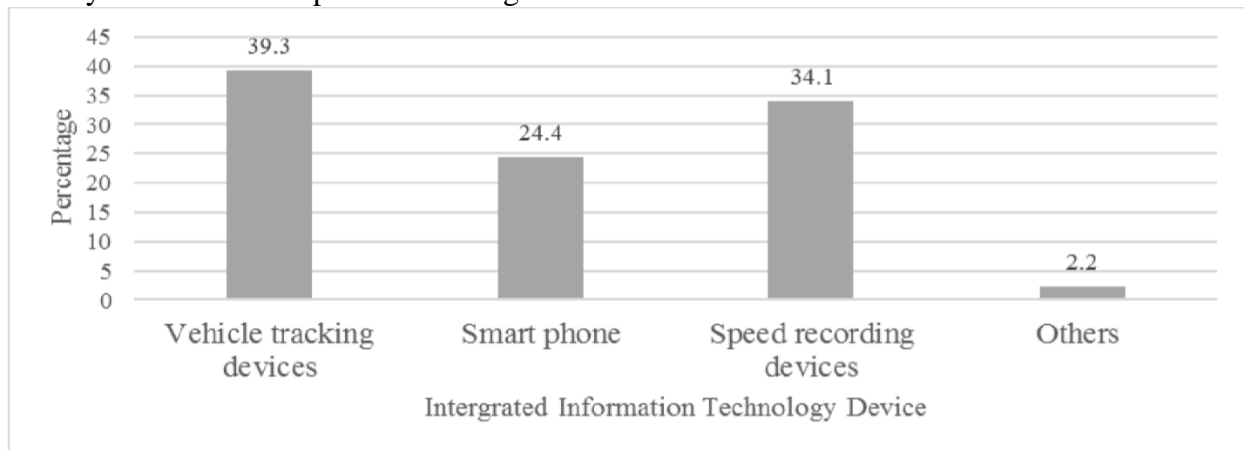


Figure 1: Integrated Information Technology Adopted Device

The findings represented in figure 1, revealed that majority of the respondents, representing (39.3 percent) of Saccos had adopted vehicles tracking devices; followed by 34.1 percent whose vehicles had speed recording devices and 24.4 percent with smartphones. These devices also included speed limiters incorporated as NTSA requirements. These findings mirrored European commission study report (2008) that there is need to incorporate information technology devices in the Matatu Sacco for security and rapid responses.

During an in-depth interview, the informant (KI1) shared similar sentiments,

“There is a need to have modern ICT gadgets fitted in Matatus, for security reasons, easing major operations, monitoring vehicle movements, and reducing carjacking.”

According to the informant (KI₂),

“Having modern ICT gadgets fitted in Matatus will help in monitoring the vehicle, have the schedule maintained, and sharing information with the Matatu Sacco’s for booking and to meet other customers’ expectations”

The view of the respondents supports Macharia, Mike, Ondabv and Kepha (2015) who suggested that adoption of IT increases the efficiency and effectiveness in the operation in the Matatu Sacco. This implies that Saccos that embrace technology in their operations have a high chance of creating enhanced communication and performance of their operations. The findings further complement Samson (2014) who stated that adoption of IT was an enabling tool in the transport sector that provide accurate flow of information on car tracking, increasing personal safety and

security, and reduction in insurance costs. This implies that adoption of technology may lead to increased communication and efficiency in the transport sector.

3.2 Factor Analysis

3.2.1 Factor Analysis for Integrated Information Technology

KMO and Bartlett's test was carried out to examine the interrelationship between attributes adopted to measure integrated information technology in Matatu Saccos in Kenya. It null was that there was no significant interrelationship between attributes of integrated information technology. Its alternative was that there was the interrelationship between said attributes.

Table 2: KMO and Bartlett's Test for Integrated Information Technology

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.729
Bartlett's Test of Sphericity	Approx. Chi-Square	177.777
	Df	10
	Sig.	.000

As shown in Table 2, KMO coefficient of 0.729, depicted that a sample of 135 was appropriate to execute exploratory factor analysis since KMO value was greater than 0.5. Further, Bartlett's coefficient of 177.777 and p-value of 0.000 was realized. Hence, there was a significant interrelationship between attributes of integrated information technology, and exploratory factor analysis was appropriate in the study.

As shown in Table 3 initial number of attributes for integrated information technology used in factor analysis were five. In subsequent analysis, only three attributes will be extracted for subsequent analysis since they had factor loadings of more 0.7. In EFA Eigenvalues are adopted to account for variation amongst factors. In the column of initial Eigenvalues, total columns have Eigenvalues.

Table 3: Total Variance Explained by Integrated Information Technology

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.561	51.211	51.211	2.561	51.211	51.211
2	0.91	18.208	69.419			
3	0.767	15.339	84.758			
4	0.403	8.059	92.816			
5	0.359	7.184	100			

As shown in Table 3, the initial factors account for the highest variation and have the highest Eigen magnitude; in this case, 2.561. Subsequent attribute accounts for leftovers and is arranged in descending order. In this case, the second attribute had an Eigenvalue of 0.91, and the third one had 0.767. Percentage variance column accounted for percentage variation associated with the respective component, in this case, the first factor accounted for 56 percent, second had 18.208 percent, and the third had 15.339 percent, and cumulatively they accounted for 84.758

percent. An extracted sum of squared loadings accounts for variance distribution upon varimax rotation. Varimax aims at maximizing individual attribute variance.

Scree plot as adopted to what number of factors which accounted has the highest eigenvalues.

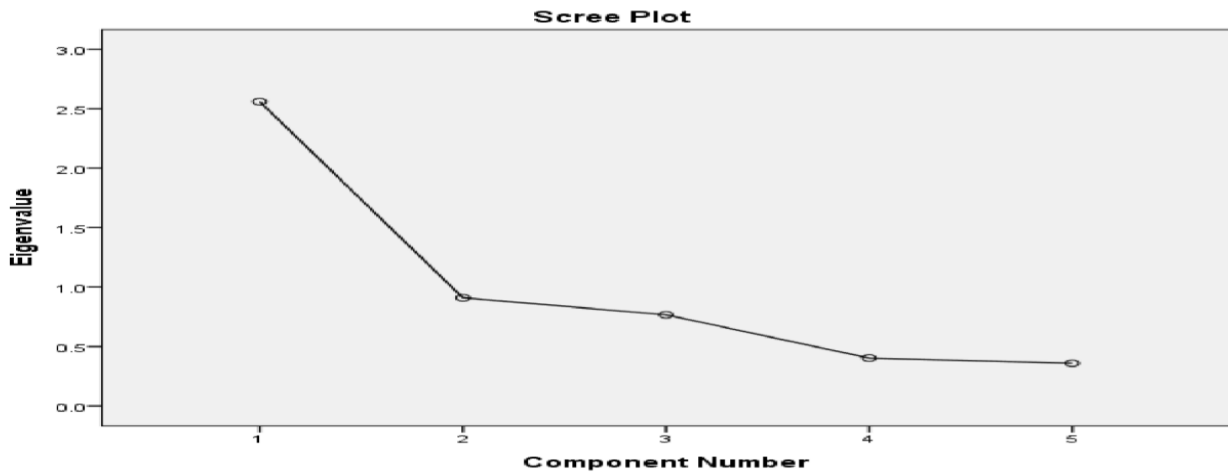


Figure 2: Eigen Values for Integrated Information Technology

Pictorial presentation in Figure 2 shows that only three factors accounted for the highest variation in integrated information technology. Since after the third factor, there was decline accompanied by smaller changes which showed that the remaining two attributes accounted for smaller variations. In Table, 3-factor loading of extracted factors is presented.

Table 3: Extracted Components for Integrated Information Technology

	Component Loading
Ease of communication between Sacco managers and employees enhances customer satisfaction	0.824
Use of tracking devices improves competitiveness	0.776
E-ticketing increase innovativeness	0.811

As shown in Table 3 three components were retained and their factor loadings were 0.824 for ease of communication between SACCO managers and employees enhances customer satisfaction, E-ticketing channels increase innovativeness (0.811), and use of tracking devices improves competitiveness (0.776). This calls for coherent and integrated bottom-up and top-down communication in SACCOs to enhance customer satisfaction. This will too enhance innovation and will create strategic postures which will enhance competitiveness amongst SACCOs.

3.3 Inferential Analysis of Integrated Ticketing on Sustainable mobility

3.3.1 Effect of Integrated Information Technology on Sustainable Mobility

The study examined the effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County. The first hypothesis stated that integrated information

technology had no significant effect on sustainable mobility of Matatu Saccos in Nairobi County. Simple linear regression was adopted to test the integrated information technology effect on sustainable mobility.

Table 4: Model Summary on the Effect of IIT on Sustainable Mobility of Matatu Saccos in Nairobi County

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.821	0.674	0.672	0.640

The results indicate on table 4 reveals that $R=0.674$ which is a positive correlation, coefficient of determination $R^2=0.672$ while adjusted $R^2=0.640$ showing regression model fits the data. This implies that Integrated Information Technology contributes 67% of the overall sustainable mobility when other factors are held constant.

Table 5: ANOVA on the Effect of IIT on Sustainable Mobility of Public Matatu Saccos in Nairobi County

	Sum of Squares	Df	Mean Square	F	Sig.
R Regression	112.573	1	112.573	274.973	0.000
Residual	54.45	133	0.409		
Total	167.022	134			

The goodness of fit statistics in Table 5 documented that the F-statistics of the regression ($F_{(1, 133)} = 274.973$) is statistically significant ($p < 0.05$). Value 0.000 implies that the coefficients of the model are not equal to zero, suggesting that there is causal effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County.

Regression coefficients summary is shown in Table 6.

Table 6: Regression Coefficient on Effect of IIT on Sustainable Mobility of Matatu Saccos in Nairobi County

	Unstandardized Coefficients	Std. Error	Standardized Coefficients	t	Sig.
	B		Beta		
(Constant)	-0.074	0.068		-1.086	0.279
Integrated Information Technology	1.140	0.069	0.821	16.582	0.000

Study results on the effect of IIT on sustainable mobility of Matatu Sacco in Table 6, there was a positive and significant effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County. From the findings it can be implied that an increase in integrated information technology increases sustainable mobility of Matatu Sacco's in Nairobi county by 1.140 units ($\beta = 1.140$, t statistics= 16.582, p value < 0.05). The effect was significant since t statistics was greater than 1.96 and p-value less than 0.05. Consequently, there was enough evidence to warrant rejection of null hypothesis that stated that integrated information technology had no significant effect on sustainable mobility of Saccos in Nairobi County. Hence, we conclude that there was statistical significant effect of integrated information technology on sustainable mobility of Matatu Saccos in Nairobi County. The study findings agreed with

Mongare and Nasidai (2014) who found significant contribution of information on management controls in ferry services in Mombasa, Kenya. Similar findings were documented by Ayantoyinbo (2015) who found ICT to impact performance positively despite huge initial outlay. Iravo et al. (2015) found a positive significant influence amongst logistics companies in Nairobi County. The regression equation was of the form; Sustainable mobility = $-0.074 + 1.140 \times \text{Integrated Information Technology}$

4.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Descriptive statistics revealed that most respondents agreed that integrated information had influence on sustainable mobility. Exploratory factor analysis extracted four indicators which had factor loadings greater than 0.7. They were, ease of communication, tracking devices, communication channels and E-ticketing. Under ease of communication, descriptive statistics indicated that the respondents agreed that ease of communication between Sacco managers and employees enhances customer satisfaction. The respondents also agreed that use of tracking devices improves competitiveness. Further majority of respondents agreed that e-ticketing increase innovativeness. The research findings indicate that most Saccos have embraced speed-recording devices, vehicle-tracking devices, and that Sacco's were using smartphones. Correlation analysis showed that information technology had a strong positive significant relationship on sustainable mobility of Matatu Saccos in Nairobi County, Kenya ($\rho = 0.821$, p value < 0.05). This was confirmed by regression analysis which showed positive and significant influence of integrated information on sustainable mobility ($\beta = 1.140$, t statistics = 16.582, p value < 0.05). This suggested that there is a causal effect of IIT on sustainable mobility.

Conclusion

The findings indicated that information technology had positive significant influence with sustainable mobility of Matatu Saccos in Nairobi County, Kenya. It was concluded that integrated information technology had a significant contribution to sustainable mobility of Matatu Saccos in Nairobi, Kenya. Secondly, it was concluded that there was ease of communication between Sacco managers and employees thus enhancing customer satisfaction. However, e-ticketing has increased innovativeness among Matatu Saccos in Nairobi County, Kenya. Additionally, it was concluded that the use of tracking devices had a significant contribution to sustainable mobility.

Recommendations

From the study findings and conclusions, it is clear that information technology had positive significant influence on sustainable mobility of Matatu Saccos in Nairobi County, Kenya. Ease of communication between Sacco managers and employees enhances customer satisfaction. The study, therefore, recommends that the management of Saccos should initiate easy communication policies between Sacco managers and employees. The adoption of information technology in communication helps reduce the anxiety on passengers as this promotes use of relevant information during decision making. Information Technology is an enabling tool in the transport sector as it provides accurate flow of information on car tracking, personal safety and reduction in insurance costs. In addition, the study recommends that E-ticketing to be established

as it could increase innovativeness in companies. Therefore, the management of the involved Saccos should adopt better promotion of e-ticketing policies towards improving innovativeness.

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