International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Impact of Information and Communication Technology (ICT) adoption on Public Transport Workforce Continuity

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Abstract**—***This study evaluates the role of ICT on workforce survival in south-western Nigeria's public transport system. While global digital transformation is taking place, this study looks at a region, where more than 30 million commuters rely on public transportation that faces challenges including the ones on operational and workforce. The purpose is to examine the impact of ICT integration on the sustainability of the transport workforce. The hypothesis is that adoption of ICT does not influence the workforce continuity. A population of 5220 employees from seven public transport companies in South-western Nigeria's six states was the basis of this study. The Taro Yamane formula was used to determine a sample size of 371, which was then proportionally allocated across the companies. Participants were chosen via a simple random sampling technique ensuring a wide scope of respondents. The descriptive statistic was used on the ICT adoption and its effect on workforce sustainability. The Mann-Whitney U test was used as a form of inferential statistics to test the study's objective, ensuring the robust examination of the effect of ICT on the public transport workforce. VPS was the least used of the studied ICT in the surveyed public transport companies. However, there are some concerns about the efficiencies and efficiency and the productivity of the workforce. With 65.7% respondents are uncertain, while positive outlook on workforce transition and professional development post-ICT. Therefore, it is vital to integrate ICT in public transport in order to promote workforce continuity. Public transport agencies were advised to have customized training programs to ease the transition to ICT tools. Evaluation of ICT systems is necessary to maintain congruence with user's needs and organizational goals.*

Keywords**—** *ICT, ICT device, Workforce, Workforce continue, Transportation, Public Transport.*

I. Introduction

The integration of Information and Communication Technology (ICT) in various sectors has been transformative globally, with significant advancements in mobile devices, the Internet of Things (IoT), social media, big data, artificial intelligence, and cloud computing (Bothos et al., 2019; Fortino et al., 2020; LeCun et al., 2015; Armbrust et al., 2010). In the transportation industry, ICT has been instrumental in developing advanced transportation management systems (ATMS), intelligent transportation systems (ITS), and connected and autonomous vehicles (CAVs), all of which contribute to improved efficiency, accessibility, and sustainability (Banister & Stead, 2004; Gupta et al., 2021; Kamal et al., 2020). Specifically, in the public transport sector, ICT adoption has led to the implementation of smart card systems and real-time information systems, enhancing passenger convenience and operational efficiency (Chau & Poon, 2003; Bothos et al., 2019).

Despite the global trend of ICT integration in transportation, there is a lack of comprehensive understanding of its implications within the context of South-western Nigeria's transportation sector, which is crucial for the movement of over 30 million people (Moshood et al., 2020). The region's transport industry faces challenges such as operational inefficiency, workforce continuity issues, and inconsistent customer satisfaction, which are barriers to realizing the sector's full potential. The existing literature primarily focuses on the developed world or provides a broad overview without addressing the unique socio-economic and infrastructural realities of South-western Nigeria. This study, therefore, seeks to empirically investigate the impact of ICT adoption on public transport workforce continuity in South-western Nigeria, aiming to provide insights that could guide policy and decision-making in leveraging ICT for the improvement of the transportation industry in the region. Therefore, the objective of the study is to assess the impact of ICT adoption on workforce continuity of public transport companies in the South-western Nigeria.

1.1 Hypothesis of the study

In order to analysed the objective of the study, the following hypothesis was set:

H_{01}: ICT adoption has no impact on public transport workforce continuity in South-western Nigeria

II. Literature Review

2.1 Information and Communication Technologies (ICT)

ICT has become ubiquitous in modern society, reshaping communication, economic development, and public transport. The ITU reports a dramatic increase in internet users from 738 million in 2000 to 4.9 billion in 2020, highlighting the expansive growth of ICT (ITU, 2020). This growth has revolutionized communication and business practices, making information access and interpersonal connections more immediate and widespread (Sukenick, 2012).

2.2 ICT and Transport

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The fusion of ICT with transport has given rise to advanced navigation systems, such as GPS and GIS, enhancing route planning and traffic management (Zhang et al., 2018). Connected vehicles have emerged, utilizing wireless communication to exchange information, thus improving traffic flow and safety (Wang et al., 2018). Big data analytics in transport leverages the vast data from transportation systems to optimize efficiency and reduce congestion (Liu et al., 2019). Smart mobility, which integrates ICT to manage transportation systems, offers a unified platform for various mobility services, aiming for sustainable and integrated solutions (Hess & Banister, 2017). However, this integration presents challenges, including data security and increased energy consumption (Wen et al., 2017).

2.3 ICT and Public Transport

ICT's impact on public transport is evident through real-time passenger information systems and smart ticketing, which have enhanced commuter convenience and operational efficiency (Cao & Wang, 2016). Mobile technologies like GPS have enabled services such as real-time bus tracking and route planning (Xu et al., 2017). These systems have increased commuter satisfaction and public transport usage (Hensher et al., 2016). However, concerns about data privacy, security, and potential job displacement have arisen alongside these advancements (Cao & Wang, 2016).

2.4 Public Transport Workforce Continuity

Workforce continuity in public transport is essential for reliable and efficient service. Factors influencing this include employee recruitment and retention, influenced by wages, benefits, and working conditions (Cronin, 2013). Training and development are crucial for service quality but often face funding limitations. Labor-management relations can impact service continuity and employee turnover (European Transport Workers' Federation, 2015). An aging workforce presents challenges in maintaining a skilled and knowledgeable employee base (Jones et al., 2020).

2.5 Conceptual Framework

The conceptual framework of the study identifies the independent variables (ICT adoptions) and the dependent variable (workforce continuity). The ICT adoptions include Email, Company Website, Bulk SMS, Online ticketing, Vehicle trackers, POS, Radio/TV Advertisement, and VPS. The study examines the correlation between these ICT tools and workforce continuity as shown in figure 1.

III. Methodology

This study was carried out in South-western, Nigeria. This region consist of six states which are: Oyo, Ogun, Lagos, Ondo, Ekiti and Osun States. The population of the study consisted of 5220 staff of the seven public transport company selected from the study area. These companies include: ABC Transport Company Limited, EFEX Transport Limited, Chisco Transport Limited, Cross-Country Transport Limited, Good is Good Motors, peace mass transit and E-Ekesons Transport Limited. The companies are located across the six states of the south-west states and they operate both passenger and cargo transport. The sample size was determined to be 371 using Taro Yamane formula. However, the sample size was shared equally with 7.10% among the population of the selected public transport. Thereafter, simple random sample technique was used to select 142 respondents from ABC Transport Company Limited; 37 respondents from EFEX Transport Limited; 36 respondents from Chisco Transport Limited; 46 respondents from Cross-Country Transport Limited; 57 respondents from Good is Good Motors; 37 respondents from E-Ekesons Transport Limited and 16 respondents from Peace mass transit.

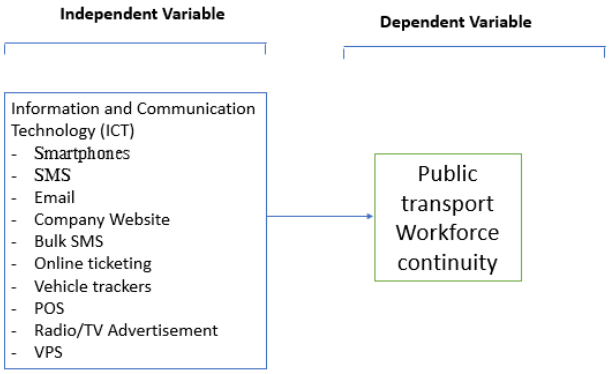

Figure 1: Theoretical framework
Source: Author's Construct (2023)

The study employed both descriptive and inferential statistics. Descriptive statistics was used to analyse the type of ICT devices adopted by the company as well as it influences on the workforce continue. The inferential statistics i.e. Mann-Whitney U test was used to examined the study objective.

IV. Results

Table 1 offer insights into the various ICT tools employed by transport organizations. All companies frequently uses multiple technologies like Smartphones, SMS, Email, website, bulk SMS, vehicle trackers, POS, and radio/TV advertising, emphasizing their importance in daily operations. It appears that these tools have become vital for communication, tracking, payment processing, and advertising in the industry. Furthermore, although digital ticketing is commonly used (62%), 38% of businesses use it less often. The uncommon use by numerous companies can be attributed to factors like customer preference, inadequate infrastructure, or insufficient resources for maintaining a reliable online ticketing platform. It pinpoints a section where greater efficiency could be realized through heightened implementation. The discrepancy between the two groups is evident, as only 24.0% of companies frequently utilize VPS, whereas 76.0% use it less often. Despite the perceived benefits of VPS, its frequent implementation in the transport industry could be stymied by factors such as expense or complexity. Aligned with broader studies on the topic, these findings highlight the transport industry's interaction with Information and Communication Technology (ICT). According to research by Alluhaidan, Chatterjee, Drew, and Stibe (2018), digital technologies have

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gained traction across various transportation sectors, with notable growth in areas like logistics and customer service. Resources and the nature of operations frequently influence the level of engagement.

TABLE 1: ICT Devices Engagement by the Transport Companies

S/N	ICT Device	Majorly in Use (%)	Slightly in Use (%)	Not in Use (%)
1	Smartphones	350(100)	0(0)	0(0)
2	SMS	350(100)	0(0)	0(0)
3	Email	350(100)	0(0)	0(0)
4	Company Website	350(100)	0(0)	0(0)
5	Bulk SMS	350(100)	0(0)	0(0)
6	Online ticketing	217(62.0)	133(38.0)	0(0)
7	Vehicle trackers	350(100)	0(0)	0(0)
8	POS	350(100)	0(0)	0(0)
9	Radio/TV Advertisement	350(100)	0(0)	0(0)
10	VPS	84(24.0)	266(76.0)	0(0)

Source: Field Survey (2023)

4.1 Workforce Experience

In this study the workforce continuity was measured with the experience of the employees at their job. Table 2 present the finding and it was revealed that majority of the employee experience continuity in their job. An approximately 9% of the respondents have an experience between 1-5 years, 17% has between 6-10 years' experience, 18% has between 11-15 years' experience while 57% has over 15 years' experience. This implies that the respondents have been working for long at their company.

4.2 Assessment of ICT Adoption and Public Transport Workforce Continuity

Table 3 presents the finding on the workforce's perception of the impact of ICT adoption in the public transport company. For the statement about ICT hindering efficiency and productivity, 11.4% of the respondents strongly agree and 20% of the respondents agree, while a significant 65.7% of the respondents disagree to varying extents.

TABLE 2: Workforce Experience

S/N	Experience	Frequency	Percentage
1	1-5 years	30	8.57
2	6-10 years	58	16.57
3	11-15 years	62	17.71
4	Over 15 years	200	57.14
	Total	350	100.00

Regarding the transition support for the workforce, 41.4% express agreement, whereas 52.9% of the respondents do not feel adequately supported. On the provision of professional development opportunities, 37.1% of the respondents are in agreement against 58.5% of the respondents who disagree. As for the improvement in communication and coordination, 36.3% of the respondents agree, in contrast to 58.6% of the respondents who disagree. Concerning the impact on job satisfaction and morale, 37.2% of the respondents agree that it has been negative, while 57.1% of the respondents disagree with this sentiment. In terms of improving the accessibility of real-time information, there is an even split among those who agree (57.2%) and those who disagree (37.1%). When asked if ICT has reduced workload and manual tasks, 36% agree, and 59.7% of the respondents disagree. For the integration of diverse skill sets and job roles, 33.7% of the respondents agree, while 61.5% of the respondents disagree. Lastly, regarding the enhancement of safety and security measures, 37.8% agree, and 57.2% disagree.

TABLE 3: Assessment of ICT usage by the Company

S/N	Impact	Strongly Agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly Disagree (%)
1	Hindered efficiency and productivity of the company	40 (11.4%)	70 (20%)	10 (2.9%)	110 (31.4%)	120 (34.3%)
2	Not adequately supported the transition of the workforce.	60 (17.1%)	85 (24.3%)	20 (5.7%)	92 (26.3%)	93 (26.6%)
3	Not provided significant professional development opportunities for the workforce.	55 (15.7%)	75 (21.4%)	15 (4.3%)	102 (29.1%)	103 (29.4%)
4	Not improved communication and coordination within the workforce.	45 (12.9%)	82 (23.4%)	18 (5.1%)	105 (30%)	100 (28.6%)
5	Negatively impacted the job satisfaction and morale of the workforce.	58 (16.6%)	72 (20.6%)	20 (5.7%)	98 (28%)	102 (29.1%)
6	Not improved the accessibility of real-time information for the workforce.	100 (28.6%)	100 (28.6%)	20 (5.7%)	88 (25.1%)	42 (12%)
7	Not reduced the workload and manual tasks for the public transport workforce.	50 (14.3%)	76 (21.7%)	15 (4.3%)	104 (29.7%)	105 (30%)
9	Not effectively integrated diverse skill sets and job roles within the workforce.	40 (11.4%)	78 (22.3%)	17 (4.9%)	107 (30.6%)	108 (30.9%)
10	Not enhanced the safety and security measures for the public transport workforce.	52 (14.9%)	80 (22.9%)	18 (5.1%)	100 (28.6%)	100 (28.6%)

Source: Field Survey (2023)

4.3 Test of Hypothesis

H_{01}: ICT adoption has no impact on public transport workforce continuity in South-western Nigeria

This test was carried out using Independent-Samples Mann-Whitney U Test. From Table 4, it was observed that there is a significance value (p-value) of .005. Since this value is less than the commonly accepted significance level of .05, it was concluded to reject the null hypothesis. This decision suggests that there is a statistically significant difference in the distribution of ICT adoption across different categories of public transport workforce continuity. Therefore, ICT

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adoption does have an impact on public transport workforce continuity in South-western Nigeria.

The analysis in Table 5 provides additional insights: the Mann-Whitney U value (5909.000) represents the test statistic used to evaluate the null hypothesis. The Wilcoxon W value (6689.000) is an additional statistic used for the same purpose. The standardized test statistic or the z-score (2.824) indicates how many standard deviations the result deviates from the mean. The Asymptotic Significance value (.005), associated with the two-sided test, is the p-value corresponding to the standardized test statistic. This value is again used in deciding whether to reject the null hypothesis.

TABLE 4: Hypothesis Test Summary

Null Hypothesis	Test	Sig.	Decision
The distribution of ICT adoption is the same across categories of public transport workforce continuity.	Independent-Samples Mann-Whitney U Test	.005	Reject the null hypothesis.

*Asymptotic significance values are displayed. The significance level is .050.
Source: Author's Field Survey (2023)

TABLE 5: Independent-Samples Mann-Whitney U Test Summary

Total N	350
Mann-Whitney U	5909.000
Wilcoxon W	6689.000
Test Statistic	5909.000
Standard Error	55.066
Standardized Test Statistic	2.824
Asymptotic Sig.(2-sided test)	.005

Source: Author's Field Survey (2023)

4.4 Discussion of Findings

The study discovered that all the selected company have adopted ICT in their operations and only VPS was slightly in use. Furthermore, the finding revealed that while highlighting areas for improvement, also shed light on the potential for significant advancements in the public transport sector through ICT adoption. Despite a notable percentage of respondents (65.7%) expressing reservations about the current impact on efficiency and productivity, this feedback provides valuable insights into how ICT can be better aligned with workforce expectations and operational goals. The finding also indicates that 47.1% and 41.5% of respondents are at least neutral or positive about the support for workforce transition and professional development opportunities post-ICT implementation, respectively. This suggests that there is a foundation upon which to build more robust training and development programs that could facilitate smoother technological transitions.

Furthermore, the responses reflect an opportunity to enhance communication, coordination, job satisfaction, and the integration of diverse skill sets within the workforce, with a significant number of respondents not fully realizing the potential improvements. This feedback is crucial for informing a more effective change management strategy that can address the human aspects of ICT integration. The divided opinions on the accessibility of real-time information, with 62.9% of respondents acknowledging some level of agreement, indicate that while there are challenges, there are also successes in the implementation of ICT systems. This highlights the importance of continuous improvement and adaptation of these systems to meet the evolving needs of the workforce. In light of these findings, it is evident that there is a valuable opportunity to refine ICT strategies in public transport. By addressing the concerns raised and building on the areas of agreement, public transport authorities can work towards a more effective and harmonious integration of ICT, ultimately leading to enhanced operational efficiency and a more satisfied and well-supported workforce. Moreover, the hypothesis was tested and the null hypothesis was rejected which implies that ICT adoption has a significant effect on the workforce continuity.

V. CONCLUSION

The study shows that ICT is widely used in the companies we looked at, although not all of them use it to the same extent, with VPS using it the least. The opinions of the people who work there show that there are some concerns about how ICT is affecting their work, especially when it comes to being efficient and productive. However, these opinions also give us valuable information on how we can make ICT work better for the employees and the goals of the company. A good number of people are either okay with or happy about the changes and opportunities for learning new skills that come with ICT. There's also a chance to use ICT to make communication better, make jobs more satisfying, and bring different skills together, but we haven't fully taken advantage of this yet. The different views on how easy it is to get information when it's needed show that while there are some problems, there are also good things happening with the ICT systems we have now. The study also proved that using ICT really does change how well the workforce can keep doing its job, which highlights how important it is to think carefully about how we bring ICT into public transport.

5.1 Recommendations

To improve the adoption of ICT in public transport, companies should focus on creating training programs that are straightforward and directly address the use of ICT tools and systems. It's important to have clear plans in place to help employees adapt to new technologies, ensuring they are comfortable with change and committed to ongoing learning. Similarly, regular evaluations of ICT systems are crucial to ensure they meet employee needs and company goals. However, open lines of communication should be maintained, encouraging employees to share their experiences with ICT, which can then be used to make meaningful improvements. Lastly, Employees should be supported in learning a range of skills to make the most of ICT systems, enhancing their flexibility and preparedness for various tasks.

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