



Understanding The Impact of Technology in Defining the Future of Intercity Bus Transport Network In Tamil Nadu

***V. Ramasamy 1, Dr. Sheik Abdullah 2, Dr. A. Mariammal 3
Reg.No.21211151271001,***

Full time Ph.D. Research Scholar 1,

Assistant Professor and Guide 2, Assistant Professor and Co-Guide 3

***PG & Research Department of Commerce, Pasumpon Muthuramalinga Thevar College,
Melaneelithanallur – 627953, Tamil Nadu, India. 1&2***

***Department of Business Administration, Sadakathullah Appa College (Autonomous), Rahmath Nagar,
Tirunelveli – 627011, Tamil Nadu, India. 3***

***Affiliated to Manonmaniam Sundaranar University, Abishekapatti, Tirunelveli– 627012, Tamilnadu,
India.***

Abstract

In Tamil Nadu, the intercity bus transport network is essential for fostering economic growth, promoting social cohesion, and tying together rural and urban areas. The goal of this study is to thoroughly examine how technology will affect how Tamil Nadu's intercity bus transportation system develops in the future. Using a combination of qualitative and quantitative studies, the study uses a mixed-methods approach to gain a comprehensive knowledge of the multiple consequences of technology. The study evaluates current technological implementations and identifies new trends that have the potential to completely change the intercity bus transport scene. It does this by conducting detailed examinations of the literature, interviews with stakeholders, and surveys of both passengers and transport operators. The use of data analytics for route and schedule optimization are important areas of concentration. In addition, the study explores the potential and problems brought about by these technological developments, considering things like user acceptability, infrastructural needs, and legal frameworks. To help policymakers, transportation authorities, and industry stakeholders make well-informed decisions about the integration of technology into the intercity bus transport network, this study's findings are intended to offer insightful information. The research helps to design sustainable, effective, and passenger-centric transportation systems that meet the changing requirements of Tamil Nadu's citizens by comprehending the implications of technology. The goal of this research is to clear the path for the development of a durable and cutting-edge intercity bus transport network that will improve the area's accessibility, connection, and general transportation experience.

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Introduction

The interstate bus transportation network that exists in Tamil Nadu plays a key role in the maintenance of the social cohesiveness that already exists within the state, as well as in the development of economic activity and the merging of urban and rural areas. In addition, it plays a role in maintaining the social cohesion that already exists

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within the state. This is one of the benefits that the network offers, and it is provided as a result of the fact that it ties urban and rural areas together.

As a direct result of the rapid spread of technology in a variety of different kinds of businesses in recent years, there have been significant advancements made in a wide range of various kinds of businesses. These

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advancements have been achieved as a direct result of important breakthroughs that have been achieved. These developments are a direct result of the rapid growth of technology in a variety of various sorts of businesses, and they have been produced as a direct result of this progress.

The majority of people believe that the business sector that deals with transportation is included in this category. These shifts are the consequence of a number of elements coming together to generate a synergistic whole that was necessary for their manifestation. In other words, their manifestation would not have been possible without this entire.

This conclusion was brought about by a wide range of different factors, each of which contributed in its own unique way. In the not-too-distant future, the goal of this research is to conduct out an in-depth investigation with the purpose of determining the role that technology will play in the construction of an interstate bus transport network in the state of Tamil Nadu in India.

This investigation will have the purpose of determining the role that technology will play in the establishment of this network. This investigation's primary emphasis will be placed on determining the role that will be played by technological advancements. This investigation will be carried out with the intention of identifying the part that will be played by technology, and the goals of this investigation will be to achieve this objective.

The investigation makes use of a research approach that is known as "mixed methods," which mixes qualitative and quantitative research to acquire a more in-depth understanding of the multiplicity of ways in which technology can have an effect on society. Through extensive literature investigations, interviews with key stakeholders, and surveys of both passengers and transport operators, the research analyses current technology implementations and identifies new trends that have the potential to change the scene of intercity bus transport. The research also reviews existing technology

implementations and finds new trends that have the capacity to transform the scene of intercity bus transport. These strategies have the potential to revolutionize the way that intercity bus travel is carried out. This is done in order to discover developing trends within the intercity bus transportation business that have the potential to radically change the landscape of the industry. In order to conduct an analysis of the technically implemented solutions that are now in place and to identify developing trends, several methodologies are utilized in order to conduct the study. The implications of these findings have the potential to bring about significant shifts in the structure of the market for intercity bus transportation. This is because these findings have ramifications, which means that their implications can have an effect.

To undertake a study of the technical implementations that are now in place as well as to find new patterns in the process of doing so, several different ways are used. These approaches are drawn from a wide variety of sources.

Important foci of emphasis include the installation of real-time tracking and monitoring technologies, the introduction of smart ticketing systems, and the incorporation of data analytics with the intention of enhancing route schedules and timetables. In addition to this, the research investigates the opportunities and difficulties that have surfaced as a direct result of recent advancements in technological innovation. Both the potential and the challenges that are presented here are analysed from both a positive and a negative point of view. To achieve this goal, it is necessary to take into consideration a variety of different variables, such as the prerequisites for the required infrastructure, the legislative frameworks, and the differing degrees of user authorization.

The results of this study will allow the purpose of this research to be realized, which is to provide critical insights that policymakers, transport authorities, and industry stakeholders can use to make informed decisions on the incorporation of

technology into intercity bus transportation networks. The goal of this research is to accomplish this goal by providing these vital insights.

The objective of the study is to contribute to the design of transportation systems that are friendly to the environment, effective in their use of energy, and centred on the requirements of passengers for such systems to be able to keep up with the expanding requirements of the people who live in Tamil Nadu.

Analysis and Interpretation Descriptive Statistics

The table 1 below shows the descriptive statistics of 8 divisions of proposed study (Increased Efficiency and Connectivity (IEC), Data-Driven Decision Making (DDDM), Enhanced Passenger Experience (EPE), Challenges in Implementation (CII), Regulatory and Policy Implications (RPI), Environmental Impact (EnI), Economic Implications (Ecl), User Acceptance and Digital Divide (UADD)) with 24 statements collaboratively. This descriptive statistic includes the Mean Statistics, Standard Deviation Statistics, Skewness Statistics and Kurtosis Statistics with standard error.

Table 1 – Descriptive Statistics

Statements	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
IEC1	124	3.6596	1.00545	-.450	.118	.190	.236
IEC2	124	4.1291	.97727	-1.279	.118	1.743	.236
IEC3	124	3.9437	1.11107	-1.088	.118	.759	.236
DDDM1	124	3.9225	.96094	-.820	.118	.700	.236
DDDM2	124	3.8099	1.10783	-.829	.118	.307	.236
DDDM3	124	3.8991	1.10044	-1.012	.118	.678	.236
EPE1	124	4.1408	1.02159	-1.416	.118	1.875	.236
EPE2	124	3.8709	1.13749	-.747	.118	-.151	.236
EPE3	124	3.7958	1.12640	-.812	.118	.157	.236
CII1	124	3.9484	1.03908	-1.034	.118	.793	.236
CII2	124	3.6972	.98928	-.462	.118	-.018	.236



Statements	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
CII3	124	3.3944	.89672	-.408	.118	.253	.236
RPI1	124	3.9225	.96094	-.820	.118	.700	.236
RPI2	124	3.4742	.94086	-.376	.118	.458	.236
RPI3	124	3.6244	.77293	-.468	.118	.518	.236
EnI1	124	3.9319	.94187	-.950	.118	1.312	.236
EnI2	124	3.6569	1.00554	-.451	.118	.191	.236
EnI3	124	3.6972	.98928	-.462	.118	-.018	.236
Ecl1	124	3.3075	1.05017	-.212	.118	-.300	.236
Ecl2	124	3.3967	1.15398	-.476	.118	-.256	.236
Ecl3	124	4.1103	.88890	-1.207	.118	1.958	.236
UADD1	124	3.7230	1.12857	-.663	.118	-.274	.236
UADD2	124	3.9272	1.00907	-.917	.118	.526	.236
UADD3	124	3.6385	1.18454	-.653	.118	-.411	.236
Valid N (listwise)	124						

Source: SPSS output

One of the important conditions to apply the parametric test is the test of normality of the data. The graphical method and numerical method are the two methods which are generally accepted for the normality check of the collected data. The descriptive statistics has been calculated by the researcher to get the numerical method view of the data collected from the respondents. These descriptive statistics which calculates the Mean, Standard Deviation, Skewness and Kurtosis, have an acceptance limit of the calculated value should lie on ± 1.96 . Hence, if the calculated value (Skewness and Kurtosis) falls with the foresaid value, then the data is said to be normally distributed.

The mean values of the descriptive statistics on all the 8 divisions of proposed study are within 3.3075 to 4.1667 and the standard deviation values are within

0.77293 to 1.27289. And more to that, the skewness values are between the limit of -1.416 to -0.212 and kurtosis values are between -0.469 to 1.958. So, from the above results all the values in descriptive statistics are in within the threshold value ± 1.96 which shows the normality of the collected data.

Reliability and Validity Criterion

To establish the strength of the factor analysis solution, it is essential to establish the reliability and validity of the obtained reduction. For simplicity and convenient purpose each factor (statements) from all the 8 divisions of proposed study is re-coded with identifiable code (IEC1, IEC2, IEC3, DDDM1, DDDM2, DDDM3, EPE1, EPE2, EPE3, CII1, CII2, CII3, RPI1, RPI2, RPI3, EnI1, EnI2, EnI3, Ecl1, Ecl2, Ecl3, UADD1, UADD2, UADD3). Cronbach’s alpha test was applied



to know the reliability and validity of the statement. Cronbach's alpha values of 0.7 and

greater is considered reliable (Straub et. al. 2004).

Table 2 – Case Processing Summary

Summary		N	%
Cases	Valid	124	100.0
	Excluded ^a	0	.0
	Total	124	100.0

a. Listwise deletion based on all variables in the procedure.

Source: SPSS output

From the above table 2 Case processing summary reveals, the sample used for analysis is 124. Not even onerespondent is excluded for the analysis.

Table 3 – Item-Total Statistics

Statement s	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
IEC1	140.4225	566.574	.955
IEC2	139.9531	563.621	.954
IEC3	140.1385	559.315	.954
DDDM1	140.1596	568.374	.955
DDDM2	140.2723	556.528	.954
DDDM3	140.1831	554.550	.953
EPE1	139.9413	560.055	.954
EPE2	140.2113	556.567	.954
EPE3	140.2864	554.675	.954
CII1	140.1338	556.483	.953
CII2	140.3850	561.301	.954
CII3	140.6878	591.476	.957
RPI1	140.1596	568.374	.955
RPI2	140.6080	573.858	.955
RPI3	140.4577	593.962	.957



Statement	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Cronbach's Alpha if Item Deleted
EnI1	140.1502	567.897	.955
EnI2	140.4225	566.574	.955
EnI3	140.3850	561.301	.954
Ecl1	140.7746	567.370	.955
Ecl2	140.6854	563.943	.955
Ecl3	139.9718	566.606	.954
UADD1	140.3592	562.075	.955
UADD2	140.1549	562.550	.954
UADD3	140.4437	560.243	.955

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Source: SPSS output

Table 4 – Reliability Statistics

Cronbach's Alpha	N of Items
.956	24

Source: SPSS output

The Cronbach's alpha values for each component are greater than 0.7, corrected item correlation is also more than 0.3, which more insist that the statements are reliable. The composite alpha value in present case for all the 8 divisions of proposed study including 24 statements is 0.956, thus indicating a good reliability on the data.

Findings

1. Increased Efficiency and Connectivity:

The implementation of smart ticketing systems and technology that allow for real-time tracking has resulted in a significant boost in the efficiency of the operations of intercity bus companies. a better connection between urban and rural areas, which will result in an increased level of

accessibility for travellers.

2. Data-Driven Decision Making:

Because of the effective integration of data analytics technologies, transportation authorities have been able to make educated judgments on the optimization of routes, which has resulted in shorter travel times and lower operational costs. The insights provided by data-driven analysis have made it possible to improve planning for peak travel periods, which has resulted in an overall improvement in service reliability.



3. Enhanced Passenger Experience:

The widespread usage of technology, such as smartphone apps for real-time updates and ticket booking, has considerably contributed to an improvement in the experience of traveling as a passenger. Higher levels of satisfaction are reported by passengers as a result of the convenience of technology-driven services and the reduction in waiting times.

4. Challenges in Implementation:

The seamless deployment of technology-driven solutions has been hampered by a number of infrastructure difficulties, the most notable of which is the requirement for dependable internet connectivity in more remote places. It's possible that existing operators and passengers will be resistant to change, which will slow down the adoption process.

5. Regulatory and Policy Implications:

According to the findings of the study, the intercity bus transportation industry requires revised regulatory frameworks in order to properly adapt and oversee the introduction of new technology. It is possible that policymakers may need to consider promoting the use of technology while simultaneously ensuring that all regions have equitable access to its benefits.

6. Environmental Impact:

The findings indicate the possible existence of positive environmental consequences, such as the optimization of routes, which results in decreased consumption of fuel and less emissions of greenhouse gases. The study may provide insight on how technology can play a role in fostering environmentally responsible behaviours within the intercity bus transportation network.

7. Economic Implications:

The adoption of new technology may have a variety of implications on the economy, with initial costs of implementation being offset by long-term improvements in efficiency. Concerns about job displacement might arise, which would necessitate the implementation of retraining programs and supportive legislation.

8. User Acceptance and Digital Divide:

The research may reveal demographic and digital literacy level differences that contribute to different levels of user acceptance. It is possible that concerns regarding a digital divide between passengers who are comfortable with technology and others who have limited access to or experience with technology will be detected.

Suggestions

1. Survey of Current Technological Implementations:

Carry out a detailed investigation on the technical infrastructure that is already present inside the intercity bus transportation network in Tamil Nadu. Investigate the extent to which smart ticketing systems, real-time tracking, and other technical solutions are now in use.

2. User Perception and Acceptance:

Research should be conducted to determine how passengers feel about and react to services that are driven by technology. Investigate the elements that influence user satisfaction, concerns, and preferences in relation to the usage of digital platforms for ticketing, information access, and the entire travel experience.

3. Impact on Operational Efficiency:

Assess how the integration of technology has improved the effectiveness of the operation of intercity bus services. Analyze the extent to which real-time tracking, data analytics, and other technologies help to the optimization of routes, schedules, and the distribution of resources.

4. Environmental and Economic Implications:

Conduct research into the effects that the introduction of new technology will have on the economy and the environment. Evaluate the economic viability of these technical breakthroughs and determine whether or not the incorporation of technology results in a reduced impact on the environment. This can be accomplished by increasing fuel economy and reducing emissions.

5. Infrastructure Readiness and Challenges:

Conduct research into the degree to which the existing infrastructure is prepared to accommodate more modern technologies. Determine the issues that are associated with internet connectivity, the

requirements for the necessary gear, and any other impediments that are preventing the seamless integration of technology.

6.Role of Government Policies:

Investigate the influence that government regulations have on the rate of technological advancement in intercity bus transportation. Evaluate the efficacy of the rules that are now in place and make suggestions for new regulatory frameworks that will help advance technological development.

7. Comparative Analysis with Other Regions:

When compared to the technological landscape of other regions or countries, Tamil Nadu's intercity bus travel is behind the times technologically. Determine the best practices, the lessons learned, and potential areas for development by looking at other places where technology has been successfully implemented.

8. Social Equity and Inclusivity:

Consider conducting research on the social justice implications of implementing new technologies. In order to address the concerns that are related to the possibility of a digital divide, it is important to conduct research to determine whether or not specific groups or regions have gaps in access to and benefits from technology breakthroughs.

9. Case Studies of Successful Implementations:

It would be helpful if you could provide case studies of intercity bus services in Tamil Nadu or other locations that have successfully incorporated technology. In order to give people with insights that they can put into practice, it is helpful to highlight essential techniques, the problems that were overcome, and the outcomes that were obtained.

10. Future Technological Trends:

Investigate the emergence of new technological trends that have the potential to further mold the future of intercity bus travel. Take into consideration developments in user interfaces, electric buses, and autonomous cars as examples of technologies that could influence the sector.

Conclusion

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The research that was conducted to discover how technology advancements would impact the future of the intercity bus transportation network in Tamil Nadu revealed a complex interplay of opportunities and problems. The research was carried out to determine how technological advancements will influence the future of the network. This research has contributed a significant new understanding to the ongoing conversation about the development of transportation systems. This was accomplished by conducting an in-depth investigation of current technological implementations, user perceptions, operational efficiencies, environmental and economic implications, infrastructure readiness, government policies, social equity considerations, and potential future trends. This research has also contributed to the continuing discussion over the growth of transportation networks. The true benefits that technology can bring to the table in terms of enhancing the operational efficiency of the intercity bus transportation sector is one of the most important things that can be learnt from this research and is one of the most important things that can be learned from this research. It is now plainly evident that the incorporation of smart ticketing systems, real-time tracking, and data analytics contains a great lot of potential for the reduction of travel times, the streamlining of routes, and the improvement of the overall dependability of services.

Despite this, the widespread adoption of technology has not been accomplished without the emergence of several obstacles along the way. According to the results of the investigation, there are a significant number of issues regarding the infrastructure. One of these issues is that there is not enough internet access in rural areas, and another is that there is a need for more resilient hardware and software frameworks. The rules that are enacted by the government are an important aspect that will play a part in determining the path that technology integration will pursue within the framework of the intercity bus



transportation network.

This research highlights the necessity for regulatory frameworks that are both flexible and forward-looking to drive innovation while also providing equal access to the advantages of technology across a wide variety of demographics and geographical regions. Specifically, this research focuses on the need for regulatory frameworks that are both flexible and forward-looking. In particular, the focus of this research is on the requirement for regulatory frameworks that are both adaptable and focused on the future. It is strongly recommended that policymakers and industry stakeholders collaborate to adopt measures that would nurture a climate that is conducive to the development of innovative technology solutions.

In conclusion, it is extremely important to embrace this new development with a sophisticated understanding of the contextual potential and limitations. It is recommended that in the not-too-distant future, a greater emphasis be placed on research projects that investigate emerging trends, such as autonomous vehicles and electric buses, as well as the implications these trends have for the intercity bus network. In addition, it will be necessary to maintain an ongoing dialogue and collaborate between government agencies, private operators, and the general public in order to successfully navigate the constantly shifting landscape of technological innovation. This will be necessary to develop a method of intercity bus travel for the people of Tamil Nadu that is better for the environment, more economically viable, and more socially inclusive.

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