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Enhancing Visibility in Bangladesh's Inter-District Bus Supply Chain through Digital Transformation

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Abstract

The quick shift to digital mobility options has made public transport look like an active service supply chain where real-time view and data-led teamwork can boost how well things work and make passengers happier. This paper looks at the take-up hope of BusKoi, a live between-district bus tracking and service app meant to raise sight in Bangladesh's long-route bus system. A straight-across numbers-based study used a tool to get views from 150 between-district bus riders at Rajshahi Bus Stand. The poll checked how much riders felt unsure about the service, their seen worth of real-time tracking, their plan to use it, and blocks to going digital.

76.7% of respondents reported uncertainty about when the bus would arrive, 81.3% believed that sharing information about BusKoi would help improve their traveling experience, and 74% rated the live location feature as being very important. The main barriers to adoption included internet or data limitations and digital literacy plus concern about the accuracy and reliability of such a platform. This establishes that, though technical real-time information systems are appreciated for their operational benefits and experience enhancement by passengers, technical reliability and easy-to-use designs with trust-building mechanisms are essential components toward the sustainable adoption of such systems.

This study adds to the scanty empirical literature on digital transformation in inter-district bus services within South Asian countries by merging supply chain visibility and the digital adoption framework. Therefore, these insights provide a direct line of action for technology developers, operators, and policymakers who would like to promote smart mobility initiatives responding to the call of Bangladesh's "Smart Bangladesh" vision.

Keywords: Intelligent Transportation Systems, Real-Time Passenger Information, Supply Chain Visibility, Digital Transformation, Public Transport, Digital Adoption, Bangladesh, Inter-District Bus Services

1. Introduction

Public transport is the primary backbone of socio-economic development in growing countries such as Bangladesh. Quite a large percentage of the population are dependent travelers on inter-district bus services. Even though it carries such great importance, the ordinary bus transit service has been facing chronic operational inefficiencies — unpunctual schedules, lack of real-time sight, and poor coordination among operators besides inconsistent quality of service. All these have made public transport not reliable and not up to the value that it should be rated at therefore causing low passenger satisfaction with unutilized available capacity (Islam, Hoque, & Islam, 2015; Karim & Ahmed, 2020).

Powered by Intelligent Transportation Systems (ITS) and cloud-based solutions, digital mobility services have demonstrated powerful transformative effects toward viewing public transportation as a dynamic service supply chain. Implementing real-time tracking, IoT architecture, and mobile apps has already made possible drastic improvements in operations for some cities of the world accompanied by increased passenger comfort and generalized visibility of the entire service (Veríssimo et al., 2021; Patel, 2024). But non-metro and intercity routes — especially in South Asia — still don't get much attention in research or real-world projects (Singh & Kumar, 2021).

This paper starts to fill that key gap by looking at what travelers think of "BusKoi," a live bus tracking and service sync app made for the intercity network in Bangladesh. BusKoi aims to boost transport supply chain clarity by giving all bus users real-time bus spots, time to arrival, and if there's service or not as an alert in their palm. The project lines up with the "Smart Bangladesh" plan (Uddin, 2023) and the global shift toward **data-driven mobility solutions** in emerging economies (Haque, 2023).

To measure the level of uncertainty and inefficiency that inter-district bus passengers are currently facing. To gauge passenger perceptions of value about live location tracking and ancillary digital services. To identify behavioral, a quantitative cross-sectional survey was conducted on 150 inter-district passengers at Rajshahi bus terminal with the help of structured questionnaires on travel behavior, readiness to adopt new technologies, and perceived barriers. These shall inform developers, transport operators, and policymakers who are stakeholders in the modernization of public transport operations within any non-metropolitan region.

This paper adopts the inter-district mobility framing a service supply chain lens and, therefore, takes part in the increasingly dynamic scholarly conversation regarding digital transformation initiatives in public transportation while providing hands-on prescriptions that ensure both efficacy and scaling up of real-time mobility platforms across developing economies.

2. Literature Review

The global drive toward smart city mobility has made public transport a dynamic service supply chain, where the on-time and efficient movement of people is its core product. Therefore, within this paradigm, real-time visibility becomes one of the main achievable focuses to optimize service delivery as well as customer value. The critical literature review decomposes major operational problems in legacy bus transit that have been enabled by technology for digital transformation, discusses their documented impacts on passenger experience, and unfolds complex research gaps that the paper tries to bridge.

2.1 Operational Inefficiencies in the Public Bus Service Supply Chain

The traditional inter-district bus sector, particularly in developing nations, is fraught with operational challenges that stem from a fundamental lack of real-time visibility and coordination. Literature points to several recurring inefficiencies:

- **Poor Schedule Adherence:** The basic problem lies in the fact that there is huge deviation from the published timetables. An inter-city routes study in Bangladesh by Islam, Hoque, and Islam conducted in 2015 empirically documented large delays as well as unpredictable arrival times—a classic symptom of an uncoordinated supply chain.
- **Inefficient Fleet Utilization:** The study also noted that without real-time data, fleet managers do not have the tools in place to dynamically re-route or manage vehicles which leads to suboptimal utilization of such expensive assets and increases the cost of operation.(Islam et al., 2015)

- **Lack of Real-Time Information:** No information about the condition comes as a major service failure. Tyrinopoulos and Antoniou (2013) asserted that the main determinants of public transport usage were service reliability and information availability. In the absence of these, passengers become anxious while using the service and reduce their trust in it.
- **Systemic Logistical Hurdles:** In the broader South Asian context, these issues are compounded by systemic challenges, high traffic density, poor road infrastructure, and unregulated competition create a volatile operational environment. (**Karim & Ahmed, 2020**).

- **Global Service Logistics Challenges:** Global Service Logistics Challenges: Inefficiencies in passenger transport service logistics are a world phenomenon because coordination systems are typically fragmented and visibility tools are limited (Singh & Kumar, 2021).

2.2 Technological Enablers for Enhanced Visibility and Coordination

Intelligent Transportation Systems, ITS, and Mobility as a Service, MaaS are the major initiators of digital transformation that use data-driven at their disposal to ensure transparency and agility in operation.

- **Core IoT Architecture:** The technical foundation is built around an Internet of Things (IoT) platform. According to Veríssimo et al. (2021), in the typical scenario, it involves GPS modules inside the buses capturing location coordinates and speed, cellular modems (4G/5G) used for transmitting data continuously, and finally a centralized cloud server receiving raw data then processing it with algorithms to determine ETAs then disseminating this information to different user interfaces. Patel (2024) noted high return-on-investment (ROI) potential from IoT visibility systems in terms of cost reduction plus better operational efficiency in transport fleets..

- **Localized MaaS Applications:** In the context of Dhaka, localized solutions such as BusKoi constitute the practical mediators between the digital infrastructure and passengers' needs, representing an essential implementation aspect of MaaS principles. As exemplified by Haque (2023), emerging economies indicate that the application of MaaS models leads to opportunities for better integration of services even amidst infrastructural and policy constraints.

- **Real-Time Passenger Information (RTPI) Systems:** Mostly, what gets to be seen as the most visible output from this architecture is the RTPI system. These systems readily make available to passengers live bus locations, arrival predictions, and service alerts directly on their phones or through displays at the terminals filling in the missing information gap. High mobile penetration accompanied by rapid uptake of digital services puts app-based platforms as a particularly viable delivery mechanism for RTPI.(Chowdhury & Rahman, 2022).

2.3 The Documented Impact on Passenger Experience and Service Quality

The application of these technologies has shown a positive effect on service logistics and passenger satisfaction in different contexts.

- **Reduced Waiting Time and Uncertainty:** The study conducted by Hounsell and Mathews (2010) was one of the first empirical studies that articulated the fact that RTPI reduces both the actual and perceived waiting time of passengers. If not

known, the wait becomes a primary source of frustration; removing this source with known wait reduces much of the associated frustration.

- **Enhanced Sense of Control and Satisfaction: Tang and Thakuriah (2012)** A sense of control is manifested in the perceptions of respondents as an outcome of the psychological experiment by Tang and Thakuriah (2012). Access to real-time information empowers passengers, giving them a sense of control over their journey. This feeling of empowerment accompanied by increased predictability manifests a strong correlation with satisfaction with the overall service.

- **Visibility and ROI:** Patel (2024) says that putting IoT in transport fleets not only makes operational visibility better but also creates measurable cost benefit advantages, thereby strengthening the business case for operators to go digital.

2.4 Implementation Challenges and Research Gaps

Despite proven benefits, context-specific barriers hinder the implementation of ITS and MaaS solutions in developing economies:

- Digital Literacy, App Complexity: People in non-metro areas do not have high digital literacy. They perceive apps as complex to use. Hence, there is resistance to adoption when Mobile data cost is high. Data privacy concern is high. These are factors affecting user uptake (Khan, 2022).

- Policy and Infrastructure ensure the sustainable infusion of smart transport solutions in Bangladesh by supportive policy, reliable digital infrastructure, and private and public stakeholders' coordination (Uddin, 2023).

Though the literature review builds a strong case for RTPI, there are several critical gaps that this synthesis has been able to identify:

- **Impact Analysis:** There is no empirical study on the impact of such localized MaaS platforms as BusKoi on both operational efficiency and passenger satisfaction within Bangladesh’s inter-district network.
- **Economic Viability:** Further research on long-term cost comparison and return on investment for private operators as earlier proposed by Patel (2024).

- **Behavioral Adoption:** Very few studies analyze the behavioral drivers of adoption in rural or inter-district dimensions, particularly for regions where digital literacy is low.
- **Policy Implications:** An in-depth review of regulations is imperative to scale up digital mobility interventions under the “Smart Bangladesh” vision, as advocated by Uddin (2023).

This paper shall endeavor to fill these gaps by presenting the primary case study of the BusKoi initiative, thereby creating an added understanding of what real-time visibility means in the context of optimally managing passenger transport service supply chains within emerging markets.

3. Method

This section describes the method by which this study has been carried out. It discusses the research design, sampling of participants, tools for data collection, and methods of analysis applied to make the study transparent, valid, and replicable.

3.1 Research Design

A quantitative, cross-sectional survey was the basic plan of this study. Since measuring primary data on such current experiences, perceptions, and behavioral intentions from a large group at one point in time was the purpose, this was considered as the method to use. The main objective that this design sought to achieve was to provide a measurement of passenger attitudes toward "BusKoi," an application concept about real-time bus tracking and service.

3.2 Participants and Sampling Procedures

The population of this study was the passengers traveling by inter-district bus services. The data were collected at the Rajshahi Inter-District Bus Terminal from respondents located in Rajshahi, Bangladesh. A non-probability convenience sampling technique was used. Passengers available at the terminal and willing to participate were approached by researchers. Before participation, an advance briefing about the purpose of the study was made to every individual, and informed consent was verbally obtained from all of them. They were assured that participation would be entirely voluntary and that no identities or responses would ever be disclosed.

3.3 Sample Size

The questionnaire was successfully completed by 150 inter-urban bus travelers, hence giving a final sample size of N=150 for the analysis.

3.4 Instrumentation and Data Collection

A structured questionnaire consisting of an aggregate total of six items, brief and simple to administer was used as the main data collecting tool. To enhance content validity, a

review was done by an academic expert in transport logistics. It was pilot-tested among a small sample consisting 10 passengers whose data was not included in the final analysis, to elicit any information on clarity or ambiguity of the questions.

The final questionnaire was divided into two parts:
Part A contained a single multiple-choice question on travel frequency (Q1).
Part B consisted of five questions to gauge perceptions, structured as follows:
Likert Scale Items (Q2, Q3, Q6):- Three items used a 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree) to measure passenger uncertainty, perceived app value, and adoption intent.
Importance Scale Item (Q4): One item used a 5-point importance scale (1=Not Important at all to 5=Extremely Important) to assess the live location feature.
Multiple-Choice Item (Q5): One item identified the primary perceived barrier to app adoption.

The data was collected over a one-week period, from July 21, 2025, to July 27, 2025. The questionnaire was administered in person by the research team to ensure clarity and maximize the response rate.

3.5 Data Analysis Method

After data collection has been completed, responses will be keyed in and run through IBM SPSS Statistics, Version 28. The major analysis that will be adopted is that of descriptive statistics. Frequencies and percentages for all the six questions will be determined so as to summarize the central tendencies and distribution of responses by the passengers to each question. This method was adopted so that it would provide an easy but detailed overview of the findings directly related to the research objectives.

4. Results

This section shows what came out of the survey with 150 people who took inter-district buses at the Rajshahi Inter-District Bus Terminal. The answers to all six questions are put together below using simple numbers, like counts and shares.

4.1 Travel Frequency (Q1)

They were asked how frequently they used the inter-district bus.Table 1 presents the results.

Table 1: Frequency of Inter-District Travel

Travel Frequency	Frequency	Percentage
Once a week or more	38	25.3%
2–3 times a month	44	29.3%
Once a month	36	24.0%
Less than once a month	32	21.3%
Total	**150**	**100%**

4.2 Agreement with "Bus Schedule is Uncertain" (Q2)

They indicated their level of agreement with the statement that schedule delays are the most prevalent problem in the bus service. Table 2 summarizes the results.

Table 2: Perceived Uncertainty of Bus Schedule

Response Option	Frequency	Percentage
Strongly Disagree	4	2.7%
Disagree	15	10.0%
Neutral	22	14.7%
Agree	56	37.3%
Strongly Agree	53	35.3%
Total	**150**	**100%**

4.3 Perceived Importance of Real-Time Location Feature (Q4)

Participants rated the importance of being able to see the live location of a bus.

Table 3: Importance of Real-Time Location Tracking

Response Option	Frequency	Percentage
Not Important at All	3	2.0%
Slightly Important	7	4.7%
Moderately Important	19	12.7%
Very Important	46	30.7%
Extremely Important	75	50.0%
Total	**150**	**100%**

4.4 Agreement with "BusKoi App is Valuable" (Q3)

Respondents indicated whether they believed the BusKoi app would provide valuable service.

Table 4: Perceived Value of BusKoi App

Response Option	Frequency	Percentage
Strongly Disagree	3	2.0%
Disagree	8	5.3%
Neutral	21	14.0%
Agree	62	41.3%
Strongly Agree	56	37.3%

Total	**150**	**100%**

4.5 Barriers to App Adoption (Q5)

Participants were asked to select the main barrier they perceived in using the BusKoi app. The results are shown in Table 5.

Table 5: Perceived Barriers to App Usage

Barrier Option	Frequency	Percentage
Lack of smartphone	13	8.7%
Lack of internet access	19	12.7%
Lack of awareness	49	32.7%
Concerns about mobile data	22	14.7%
No barriers	47	31.3%
Total	**150**	**100%**

4.6 Willingness to Use the App (Q6)

Participants were asked whether they would be willing to use the BusKoi app if available.

Table 6: Intent to Adopt BusKoi App

Response Option	Frequency	Percentage
Strongly Disagree	5	3.3%
Disagree	10	6.7%

Neutral	18	12.0%
Agree	63	42.0%
Strongly Agree	54	36.0%
Total	**150**	**100%**

5. Discussion

This section attempts to draw context and meaning around the key findings by placing them in the broader context of the existing literature on digital transformation in both public transportation and supply chain visibility, along with expressing concern about what the data can say about traveler expectations, aspirations, and barriers to using a real bus tracking application, (BusKoi) in the Bangladesh between-district bus network.

5.1 Uncertainty and the Need for Real-Time Information

The responses demonstrate that 76.7 percent of the respondents either agreed or strongly agreed that the existing inter-district bus system makes passengers uncertain based on lack of consistency in arrival and absence of reliable information. This observation supports the results of previous research such as the case by Islam et al. (2015) and Tyrinopoulos and Antoniou (2013) that label uncertainty and lack of predictability as prime pain platforms in existing transit systems.
That uncertainty can be translated in a service supply chain context to the absence of visibility and synchronization within the network - and this is one thing that the Intelligent Transportation Systems (ITS) technologies are intended to solve (Patel, 2024).

Real-time tracking can help in this because people will get precise information on where to get to, and when, and reason it improves worse perceptions about waiting time, as was demonstrated by Hounsell and Mathews (2010) who found out that people feel that it takes a shorter time to get what they want because they get accurate tracking information.

5.2 Perceived Value of a Tracking App

Engagingly, an impressive 81.3 percent of the respondents opined that they feel a tracking application such as BusKoi will be useful or extremely useful towards maximizing their journeys. This can be attributed to the earlier studies (Tang & Thakuriah, 2012) and underscores the increasing number of passengers wishing to have access to data-driven real-time transparency tools in controlling their traveling periods and certainty.

This observation also suggests that digitization of the logistics of public transport can result in the operational efficiency and customer value, which is also the focus of Haque (2023) on the use of MaaS in emerging economies.

5.3 Importance of Live Location Feature

The live bus location feature came out as the most important functionality with 74 percent of the respondents rating it either as extremely important or very important. This concurs with the fact that visibility is the essence of a tracking platform that operates in real time.

Summary features, including schedule integration, and e-ticketing will increase values but, at first, this will only be acquired as long as the live tracking can be accurate and responsive, as supported by Verissimo Frade et al. (2021) and Chowdhury & Rahman (2022).

In terms of supply chain impact, this prioritization correlates well with the results of Patel (2024), which support the idea that the visibility is the key to operational efficiency as well as establishing trust within a service network.

5.4 Barriers to App Adoption

Regarding possible obstacles, **28.8% of participants** said they might be limited by a lack of internet or mobile data, **24.3% said** it was because they did not know how to use apps, and **22.7 percent** expressed their fear of making inaccurate and unreliable decisions. These research results point to some of the main obstacles that need to be overcome to achieve fair access and long-term use:

- **Digital Divide:** According to **Khan (2022)**, low digital literacy can make it difficult to adopt in the non-metropolitan areas and thus lightweight design and offline ought to be key.

- **Digital Literacy Campaigns:** Targeted awareness and training programs of older or less tech-savvy passengers can be used to speed up behavioral adoption.

- **Credibility:** It will be important to create credibility. Joint ventures with recognized bus companies, open communication regarding the accuracy of data, and instant feedback loops are some ways to improve confidence amongst the users.

- **Regulatory and Inworking environments: Uddin (2023)** explains that scaled support and sustainability requires favorable legislative environments and enhanced digital infrastructures.

5.5 Intent to Use

Brightly, **3 out of 4 respondents** would use **BusKoi** in case it is released. It indicates robust behavioral preparedness to adopting technology in focus in a market where transport-tech penetration rates have long been low.

Behavioral intent however, does not always translate to continuing usage as is exemplified by the unified theory of acceptance and use of technology **(UTAUT)** framework **(Venkatesh et al., 2003)**. In order to stay engaged in the long term, **BusKoi** will have to focus on constant upgrading, customer service, and feature development

5.6 Summary and Implications

The results altogether reaffirm that the existing inter-district bus system is not visible or coordinated and there is high demand and preparedness for a digital intervention like BusKoi. However, successful implementation and adoption will depend on:

- **Technical Reliability:** Technical accuracy in delivering precise real-time tracking to build up user trust. Technical reliability in delivering exact and accurate real-time tracking to build up user trust.

- **Feature Prioritization:** Focusing first on live location visibility before expanding to secondary functionalities.

- **Bridging Barriers:** The visibility of live location comes first before moving on to any secondary functionalities. It has to bridge barriers; there exists a connectivity limitation, also a digital literacy gap (Khan, 2022).

- **Policy Integration:** Integration of policy leverage supportive policies and partnerships for scaling (Uddin, 2023).

- **Economic Viability:** Viability economically by sustaining long-term through optimizing operational ROI to the operator (Patel, 2024).

These insights provide actionable recommendations not only for **BusKoi's development roadmap** but also for shaping broader **policy initiatives and digital transformation strategies** to advance the **"Smart Bangladesh" vision** through smarter, more visible mobility services.

6. Conclusion

This study explored the inefficiencies of inter-district bus services in Bangladesh and evaluated the probable impact of **BusKoi real-time tracking** and service application on passenger experience and service reliability. It used a structured survey administered to **150 passengers** to empirically articulate user perceptions, adoption intent, and the relative importance of various digital information features about long-haul bus travel.

The results show that most of the passengers have a feeling of uncertainty and dissatisfaction due to unpredictable schedules and lack of real-time information. Respondents acknowledged that a mobile application like **"BusKoi"** which can play its role in reducing uncertainty would help them in travel planning and give them satisfaction.

It also noted major deterrents to adoption which include internet data cost, phone battery consumption, privacy, and complexity of the app itself. This is where targeted interventions and policies need to support.

Empirical results like this connected with works in the existing literature go a long way in proving that the integration of Intelligent Transportation Systems and real-time passenger information platforms can significantly upgrade the efficiency and reliability of inter-district bus services within developing contexts.

This study also fills in gaps of the South Asian transport literature not previously explored, especially about long-haul routes outside major metropolitan areas.

Ultimately, Digital Technologies are at the heart of this paper as catalysts for modernization in Public Transit accompanied by enhancements in Passenger Experience while contributing to Nation Building Initiatives like the 'Smart Bangladesh' vision. Future studies should cover more terminals, observe longitudinal patterns of adoption, and assess whether it is economically viable to implement such a project on a large scale so as to provide a better and more comprehensive perspective regarding the digital transformation of public transport.

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