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Ai-Driven Smart Mobility Frameworks for Sustainable Urban Business Ecosystems

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Abstract

The emergence of urbanisation has created a necessity for the development and enhancement of intelligent mobility systems that may serve the purpose of sustainable economic growth as well as efficient urban transport systems. The current research is looking at how Artificial Intelligence and Machine Learning can help businesses and cities. It wants to see if Artificial Intelligence and Machine Learning can make business economic systems better and stronger. In addition to the research objectives mentioned above, this research aims to find out whether artificial intelligence and machine learning can help to enhance and sustain urban mobility in the future. It should be noted that regions and cities are considered a focus of this research to examine the role of AI and machine learning in this respect. The objective of this research is to discover how the acceptance level of an AI-based transportation system can be increased. The way people accepted and supported something was looked at by using things that describe how useful it seems, how easy it is to use the good it does to the environment, and the cost people think it has. The risk people think it has. A survey with questions was given to 250 people, including people who travel to work and people who have jobs. Numerous statistical techniques were applied, including discriminant validity analysis, regression analysis, and reliability analysis. The findings indicate that stakeholders' adoption intention is positively impacted by operational convenience and environmental sustainability, and that perceived usefulness is the best predictor of adoption intention. On the other hand, adoption behaviour is adversely affected by technology hazards and economic worries. By providing useful implications for policymakers, transportation planners, and urban business stakeholders, the study adds to the expanding conversation on smart mobility.

Keywords: *Artificial Intelligence (AI), Machine Learning (ML), Smart Mobility, Business Environment Enhancement, Sustainable Urban Development, Transit-Oriented Development (TOD)*

I. INTRODUCTION

The transportation system has changed a lot. This change in the transportation system is because of things like more people, new technology and worries about the earth. Big cities like New York and London need to change their transportation systems. The transportation system needs to change so that cities can do an important thing. They need to reduce the number of cars on the road. The bad air we breathe. The transportation system also needs to help people get jobs and make it easy for them to get around the city. This will make the transportation system better for the people who live in the city and for the earth. The change in the transportation system is very important, for the cities. The ability of AI and ML to be used as strategic tools has been recognized as essential for the attainment of these objectives. With AI and ML, predictive analysis, responsive traffic management, intelligent route optimization and data-driven decision-making are available at one's finger-tip, helping urban systems operate more efficiently and businesses achieve enhanced productivity.

Governments and urban planners have been inspired to incorporate intelligent transportation technologies into metropolitan infrastructure by the development of sustainable mobility frameworks. By using less fuel and emitting fewer greenhouse gases, smart transit systems encourage environmental sustainability while increasing operational efficiency. Additionally, by promoting workforce mobility, customer accessibility, and commercial connectedness, effective mobility networks strengthen urban business ecosystems.

The paper analyzes the stakeholders' perception about AI-based transit systems and the impact of these perceptions on sustainable urban business operations. This study also broadens the TAM framework by adding environmental sustainability, risk perception, and cost perception aspects to it.

II. LITERATURE REVIEW

Past work demonstrates the importance and priority that AI and ML technologies are getting for building smart transportation for smart cities. It is pointed out by the scholars that intelligent transport systems bring an improvement in operations, pollution and traveller experience. The study of smart cities is concentrating towards mobility in cities and sustainable business ecosystems, as with the rapid urban population increase, the traffic congestion and urbanisation will continue to increase, and the environment requires intelligent transport systems resulting in efficiency, lower emissions, and improvement in the lifestyle of the urban.Technology such as artificial intelligence (AI) and machine learning (ML) has been a disruptive force in addressing issues around urban mobility, since they allow for real-time decision making, adaptive transport systems and predictive analytics.

The Technology Acceptance Model proposed by Davis (1989) remains a foundational framework for understanding technology adoption behaviour. Perceived usefulness and perceived ease of use significantly influence stakeholder willingness to adopt advanced transit technologies. Recent studies further suggest that environmental sustainability and perceived technological risks play an important role in shaping public acceptance of smart mobility solutions. The Technology Acceptance Model was developed in 1989 by Davis to address how people deal with new technologies. The Technology Acceptance Model identifies two important constructs that may differentially impact the behavioural intention to adopt and use technology. PU may be described as the perceived operational advantages provided by AI/ML-enabled transportation systems in urban transportation, such as decreased travel times, improved predictability, and better route optimisation. PEOU describes the relative ease of use and intuitive experience from modern transit systems that include a digital ticketing system, AI-enabled trip recommendations, and smartphones, also extending TAM to reflect social impact and facilitative conditions within urban transportation, where adoption typically includes public and private actors like travellers, business operators, and transit authorities.

AI-enabled transport systems support predictive maintenance, traffic flow optimisation, intelligent routing, and multimodal integration. These technologies improve transportation reliability and reduce congestion-related economic losses. However, concerns related to cybersecurity, implementation cost, and technological complexity continue to challenge large-scale adoption. Recent research indicates that in cases such as AI-based urban transportation, traditional TAM can be augmented with environmental perception, cost, and risk to more accurately predict behavioural intention. The relationship, for example, between PU and intention to use may be mediated by perceived negative environmental impact, while perceived risk may moderate the relationship. Scholars can use these additional constructs to represent more accurately the complexity of stakeholder decision-making involving sustainable urban mobility plans.

III. RESEARCH METHODOLOGY

For this study, we used two types of research: quantitative and descriptive. We collected data by giving people a questionnaire to fill out. The questionnaire was structured, meaning it had specific questions, and we gave it to a variety of people in the city, including professionals, students, policymakers, business owners, and people who commute often. We used a convenience sampling method, which means we

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gave the questionnaire to people who were easily accessible, and we got 250 responses that we could use.

Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Environmental Sustainability (ENV), Perceived Cost (COST), Perceived Risk (RISK), and Behavioral Intention (INT) were the six main constructs of the questionnaire. A five-point Likert scale was used to gauge responses. To assess the suggested relationships, statistical tests such as multiple regression analysis, correlation analysis, Cronbach's alpha reliability testing, and descriptive statistics were carried out.

The following are the major objectives for the current research:

1. To study and investigate the perceptions of various stakeholders belonging to metropolitan cities regarding the adoption of AI and ML technologies in the mobility system.
2. To evaluate and analyse the effect of perceived usefulness on adoption intention.
3. To examine whether perceived ease of use has a positive impact on the acceptance of AI and ML technologies in transportation mobility.
4. To examine whether environmental sustainability has a positive or negative impact on the adoption behaviour of AI and ML technologies in transport mobility.
5. To study the impact and effect of perceived cost and perceived risk on behavioural intention among metropolitan citizens.
6. To analyse the role of AI-enabled transportation systems towards the enhancement and adoption of sustainable urban business ecosystems.

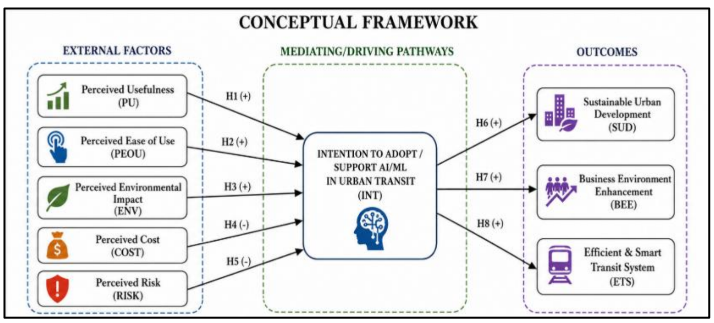

Figure 1: CONCEPTUAL FRAMEWORK

IV. DATA ANALYSIS AND FINDINGS

Table 1: Respondent Demographics (n = 250)

Variable	Category	Frequency	Percentage
Gender	Male	128	51%
Gender	Female	117	47%
Gender	Other	5	2%
Education	Bachelor	135	54%
Education	Master	72	29%
Education	Doctorate	18	7%
Education	Others	25	10%
Occupation	Professional	148	59%
Occupation	Student	42	17%
Occupation	Business Owner	40	16%
Occupation	Policy Maker	20	8%

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According to the present study's demographic analysis, professionals and individuals who regularly commute to cities made up the majority of respondents. The sample's representation of a range of educational backgrounds confirmed the validity of stakeholder opinions about AI-powered smart mobility systems.

Table 2: Descriptive Statistics

Construct	Mean	Standard Deviation
Perceived Usefulness (PU)	4.15	0.69
Perceived Ease of Use (PEOU)	3.92	0.71
Environmental Sustainability (ENV)	4.01	0.65
Perceived Cost (COST)	3.08	0.82
Perceived Risk (RISK)	2.95	0.79
Behavioural Intention (INT)	4.10	0.67

Based on this study, respondents showed a positive attitude toward the two constructs which are perceived usefulness and environmental sustainability. But the relatively small mean suggests moderate worries about technology and information security implementation.

Table 3: Reliability Analysis

Construct	Number of Items	Cronbach's Alpha
Perceived Usefulness (PU)	3	0.742
Perceived Ease of Use (PEOU)	3	0.721
Environmental Sustainability (ENV)	3	0.758
Perceived Cost (COST)	2	0.704
Perceived Risk (RISK)	2	0.716
Behavioural Intention (INT)	3	0.768

All constructs achieved Cronbach's Alpha values above the acceptable threshold of 0.70, confirming satisfactory internal consistency and scale reliability.

Table 4: Multiple Regression Analysis Predicting Behavioural Intention

Predictor	Beta (β)	Std. Error	t-value	p-value
Constant	0.768	0.421	1.825	0.069
PU	0.425	0.053	7.891	<0.001
PEOU	0.138	0.049	2.551	0.012
ENV	0.121	0.056	2.012	0.046
COST	-0.219	0.051	-4.389	<0.001
RISK	-0.205	0.052	-4.113	<0.001

Regarding the p-value, it can be stated that perceived usefulness was the most significant positive predictor of behavioural intention to adopt artificial intelligence-powered mobility solutions. Meanwhile, two factors were found to negatively affect adoption intentions, and these include cost and risks.

Table 5: Fornell-Larcker Discriminant Validity Analysis

Construct	AVE	PU	PEOU	ENV	COST	RISK	INT
PU	0.68	0.82					
PEOU	0.65	0.33	0.81				
ENV	0.63	0.11	0.10	0.79			
COST	0.60	-0.19	-0.12	-0.11	0.77		
RISK	0.61	-0.18	-0.13	-0.09	0.18	0.78	
INT	0.70	0.43	0.17	0.16	-0.22	-0.21	0.84

The square root of AVE values for all constructs exceeded the inter-construct correlations, confirming satisfactory discriminant validity.

Table 6: HTMT Ratio Analysis

Construct	PU	PEOU	ENV	COST	RISK	INT
PU	1	0.39	0.12	0.22	0.20	0.45
PEOU	0.39	1	0.11	0.13	0.12	0.19
ENV	0.12	0.11	1	0.10	0.08	0.17
COST	0.22	0.13	0.10	1	0.20	0.23
RISK	0.20	0.12	0.08	0.20	1	0.24
INT	0.45	0.19	0.17	0.23	0.24	1

The HTMT value in all constructs was below 0.85 which shows that all constructs possessed discriminant validity.

The results strongly suggest the conceptualisation of AI-driven smart mobility for sustainable urban business ecosystems. Operational usefulness, environmental impact and ease of use had a positive impact on adopters' intention to adopt, while perceived cost and perceived technological risk hurt adoption behaviour. The suggested framework is empirically sound and appropriate for further scholarly investigation, as evidenced by the entire model's good reliability and validity. The empirical results show that respondents' opinions of AI-enabled transportation systems are usually favourable. The strongest positive correlation between behavioural intention and perceived usefulness was found. Adoption intentions were also significantly impacted by environmental sustainability and usability. On the other hand, stakeholder acceptance was significantly correlated negatively with perceived risk and cost. The results of reliability analysis indicate that there is acceptable internal consistency in terms of all constructs, where values of Cronbach's alpha exceed established criteria. The discriminant validity analysis proved the uniqueness of each construct used in the study. The findings suggest that for the effective implementation of AI-powered transit systems, it is important to maintain a balance among effectiveness, cost-effectiveness, sustainability, and technology trust.

V. IMPLICATIONS

By examining the acceptance of new technology, this research will extend our current knowledge on the specific acceptance of intelligent mobility systems based on artificial intelligence. It will be based on human acceptance with reference to how important the environment sustainability, cost, risk to the individuals for their considerations on whether to use smart mobility systems. The framework being developed here might help guide any university or similar entity in their investigation into Intelligent Transportation Systems (ITS), Integrating Sustainable Mobility and Urban Business Ecosystem Development. The research demonstrates the importance of reducing perceived risk and costs associated with implementation before engaging with project stakeholders. In addition, municipalities should create enabling policies, develop standardized regulations for cybersecurity, and implement subsidization programs to facilitate the establishment of smart mobility projects through the development of intuitive public transportation mobile applications, reliability, and educating citizens about sustainability. In designing AI driven transportation systems, security, ease of use and affordability are important in order to make it simple and gain the confidence of all interested parties.AI assisted transportation system is capable of increasing customer accessibility, employee mobility, logistics efficiency and the efficiency of business operation in city.

VI. LIMITATIONS

The sample size of 250 respondents in this study does not represent the population of all urban stakeholders in different geographical areas and demographics. A larger sample size would have enabled broader coverage and increased generalizability of the findings. So, this was a study of city stakeholders in a few large

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areas. How do you think then, the findings would be fully generalizable to people in rural areas or smaller towns with different transport habits? This experiment observed phenomena at a single point in time and therefore could not determine the evolution of individual beliefs and sentiments over time. Further research is needed over an extended period to determine how people become acquainted with using an AI-driven transportation system.

VII. CONCLUSION

Based on research conducted, AI and machine learning will help change urban mobility and business ecosystems into sustainable ones. Smart transport services will improve travel efficiencies, be environmentally friendly and create more accessible cities for all citizens while providing economic opportunity to those in the neighbourhood. The biggest driver of getting stakeholders on their side will be based on their perception of how useful and environmentally friendly these new technologies are. Still, there are cost factors and technological challenges.

All these technologies make the city more live able and working, and this is good for us all. Leaders will have to reconsider how to develop smarter cities, thinking about how to improve mobility and security of the city, ensuring citizens' access of information, low cost and protection against attacks and hackers so that they could adopt and trust the new mobility systems which rely on artificial intelligence.

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