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Abid Ullah [1],* and Hamid Ullah [2],*

[1] Lyallpur Business School, Government College University Faisalabad
[2] School of Economics, Quaid-i-Azam University, Islamabad
* Correspondence: itsabiduk@gmail.com (A.U.); live.hamidullah@gmail.com (H.U.)

Abstract: This article explores the reciprocal relationship between travel behavior and urban mobility, highlighting how each influences and shapes the other. The paper is divided into two sections. The first part examines the key factors that influence travel behavior, including socio-demographic characteristics, land use, transportation options, and travel costs. Additionally, it discusses the role of lifestyle choices in shaping transportation preferences. The second part presents case studies of successful and unsuccessful urban mobility projects, analyzing how community collaboration or the lack there of affects the planning and decision-making process in urban mobility planning. Understanding user mobility patterns is recognized as a complex and context-dependent process, driven by diverse factors that vary with the specific needs and characteristics of different communities. The paper emphasizes that effective mobility planning requires a comprehensive understanding of these behavior patterns and the active engagement of communities in the planning process.

Keywords: sustainable mobility; urban mobility; transportation behavior; travel patterns; community collaboration; mobility policies; climate mitigation

Introduction

Sustainable mobility seeks to tackle the environmental, social, and economic challenges that come with transportation. As urban areas expand and populations rise, the reliance on private vehicles and other modes of transport has also increased. Currently, the transportation sector accounts for over 20% of global emissions, with road transport alone contributing up to 75% of these CO_2 emissions. In today's world, urbanization and sprawl have made mobility an essential part of daily life, creating a dependence on transportation to move between various locations—such as work, school, shopping, and leisure activities. Freedom of movement is a fundamental human right , and ensuring equitable access to diverse transport options is crucial for fostering inclusivity.

The 11th Sustainable Development Goal (SDG) focuses on building Sustainable Cities and Communities. This goal aims to make urban areas inclusive, safe, resilient, and sustainable, through targets such as providing affordable and sustainable transport systems (Target 11.2), reducing the environmental footprint of cities (Target 11.6), and fostering robust national and regional development plans (Target 11.8) [3]. Therefore, adopting an integrated approach to urban planning that addresses the needs of the population is vital for sustainable development. This strategy can help mitigate the environmental impact of urbanization and population growth, ensuring a more sustainable future.

When considering urban mobility and travel behavior, the relationship between the two can be understood as a mutually influencing dynamic, where each affect and adapts to the other. Successful urban mobility systems depend on their ability to collaborate and evolve together. The availability of well-connected, affordable, and accessible public transportation options, along with micro-mobility solutions, is reshaping travel behavior, while shifting mobility patterns are in turn influencing transportation demand.

Methodology

Materials and Models

To explore the factors influencing travel behavior, key elements were defined based on existing literature to underscore the complexity of the subject. The research hypothesis, formulated at the outset, posited that user behavior patterns are shaped by multiple factors. To test this, three examples of successful urban planning initiatives and three examples of projects with limited success or outright failure were analyzed. These case studies were selected to illustrate how travel behavior patterns are linked to urban mobility planning—specifically, how these patterns are addressed when user demand is incorporated into the planning process versus when it is overlooked. Analyzing these examples allowed for a deeper understanding of how travel behavior and urban mobility interact and influence one another. Furthermore, through the study of these projects, recurring patterns in the planning approaches were identified, offering insights into the elements that contribute to successful outcomes.

Travel Behavior and Urban Mobility

To better understand the relationship between travel behavior and urban mobility, it is crucial to first identify the factors that influence individuals' decisions when traveling to various destinations.

Factors Influencing Mobility Patterns

Travel behavior is shaped by a wide range of factors, including socio-demographic characteristics (such as age, gender, income, education, employment status, and household size), as well as land use and transportation infrastructure. The availability of public transport, the design of streets and sidewalks, and the proximity of residential areas to workplaces and other key destinations all play important roles. Additionally, travel costs—such as fuel prices, parking fees, and public transport fares—are significant influencers. As Van Acker notes, travel behavior is also heavily shaped by lifestyle choices, which extend beyond just cost, comfort, or travel time. Salmon further elaborates that "lifestyles reflect an individual's attitudes toward family, work, leisure, and consumption, which, in turn, influence behavior patterns".

Different behavioral patterns have been identified based on factors like gender, age, social status, income, and culture. Studies by Haustein and Hunecke show that gender and age group influence travel behavior, with women generally exhibiting more sustainable mobility habits than men. However, as income increases, there tends to be a shift away from sustainable travel practices. Some research indicates that young adult women, in particular, tend to make more trips with shorter durations compared to their male counterparts, while older adults especially older men are more likely to use public transportation than younger men.

Further research has also explored the relationship between commute distance and income. It has been found that individuals with lower incomes tend to live closer to their places of employment and rely more on public transport, while higher-income individuals often live further away and are more likely to own and use private cars. Additionally, there is a stark contrast in car ownership between developed and developing countries. In more developed countries with better public transport systems and greater multimodal options, car ownership tends to be lower, while in developing countries with less robust public transportation networks, higher car ownership is often associated with higher income levels, with car ownership sometimes seen as a status symbol.

In such contexts, cultural practices, access to education, and information play crucial roles in shaping behavior patterns. Understanding these influencing factors is vital for urban planners and policymakers who aim to reduce traffic congestion, improve air quality, and create more livable cities. It is also important to note that these factors interact in complex ways; for example, the availability of public transportation can affect travel costs, which, in turn, influence travel decisions.

Planning Urban Mobility

Urban mobility planning and policymaking play a critical role in shaping travel behavior. Effective planning strategies and well-crafted policies can influence mobility patterns by providing a range of transportation options for users. For instance, initiatives such as congestion charging, offering tax incentives to promote car-sharing and ride-hailing services, or investing in infrastructure and awareness campaigns to encourage walking and cycling, can all steer travel choices toward more sustainable alternatives. In this context, planning and policies become powerful tools for advancing sustainable development and climate mitigation while simultaneously addressing the mobility needs of the population.

Policymakers often use a mix of carrot-and-stick approaches to promote changes in travel behavior. While offering a variety of transport options without heavy restrictions can make urban mobility more accessible, failure to regulate car ownership—especially without incentivizing alternatives—may result in underutilized public transport systems and unsustainable urban mobility.

As demonstrated by Razmus, the most effective policies are those that complement one another to drive real changes in user behavior. For example, policies that make sustainable transportation alternatives—such as public transit, walking, or cycling—more convenient and attractive can encourage their adoption. At the same time, measures that increase the costs of car use, such as congestion charges or parking fees, can deter driving and promote the use of more sustainable modes. Policies aimed at promoting telecommuting, such as tax incentives for remote work, can also reduce the number of daily car commuters, which in turn helps to ease traffic congestion and reduce pollution.

To shift from private car usage to public transport, certain improvements are needed. Public transport must be made more competitive in terms of affordability, comfort, and efficiency. The introduction of intramodal (within one mode of transport) and multimodal (interconnected transport systems) options, along with higher service frequency, are essential to enhance the attractiveness of public transit. While offering alternatives is important, imposing penalties for unsustainable travel choices can increase awareness of the long-term impact of these decisions on the environment and encourage more sustainable mobility behaviors.

Ultimately, urban mobility policymaking has the potential to significantly influence travel behavior. By making alternative modes of transportation more convenient, accessible, and affordable—and by framing the choices people make around taxes and restrictions—policymakers can drive a shift in travel patterns. This, in turn, can reduce traffic congestion, improve air quality, and contribute to making cities more livable and sustainable in the long term.

Case Studies

This section of the paper presents an analysis of six case studies. Half of these cases showcase urban mobility projects that are regarded as best practices in planning, while the other half focuses on projects that have been unsuccessful or only partially successful, examining their outcomes and impacts.

A thorough study was conducted to gain a deeper understanding of the various dynamics that influence travel behavior within urban environments. To emphasize the complexity of the issue, key factors shaping travel behavior were identified through an extensive review of existing literature. With a hypothesis regarding the multiple factors affecting user behavior, six urban planning initiatives were selected as case studies.

The goal was to demonstrate the significant interaction between urban mobility patterns and planning outcomes, particularly in relation to how well user demands and community engagement are incorporated into the planning process. These case studies serve as practical examples, providing a clear foundation for understanding the interdependent relationship between travel behavior and urban mobility. Additionally, by closely examining these projects, we identified common themes and recurring strategies that influenced both their success and their challenges.

Good Practice Projects Planned in Collaboration with Communities

The Vauban Neighborhood in Freiburg, Germany, stands as a prime example of a successful urban mobility project developed through community collaboration. This innovative neighborhood has gained international recognition for its sustainable urban planning, particularly its eco-friendly living and transportation strategies. Vauban was even presented by Germany as a model of best practice at the 1996 United Nations Conference on Human Settlements in Istanbul, highlighting its pioneering approach to sustainable mobility.

Key features of the Vauban project include a car-free design aimed at minimizing car dependency and promoting alternative modes of transportation such as public transit, cycling, and walking. The neighborhood is well-connected by an efficient public transport system, featuring tram and bus lines that integrate it with the rest of Freiburg. Additionally, an extensive cycling network makes cycling a convenient and popular option for residents. Other elements include energy-efficient housing, green spaces, and, crucially, significant community involvement.

Community engagement played an essential role in the development of Vauban. Residents were actively involved in the planning process, with opportunities to express their opinions, raise concerns, and offer suggestions on various aspects of the design, from housing layouts to transportation systems. Workshops and consultations with urban planners, architects, and policymakers allowed for direct interactions, ensuring that the community's needs were integrated into the planning decisions.

This participatory approach allowed for experimentation and flexibility in the design process, with planners adjusting and refining the project based on real-time feedback from residents. This adaptability was key to ensuring that the neighborhood's features were well-received and suited to the community's needs. Vauban has become a model for inclusive urban development that respects the aspirations of its residents, providing a successful example of sustainable, community-driven urban mobility.

Similarly, the city of Groningen in the Netherlands is known as one of the most bicycle-friendly cities globally, with over 60% of trips made by bike [23]. Recognized by the Global Institute of Sustainability and Innovation as the "Bicycle Capital of the World", Groningen's success in promoting cycling is a direct result of sustained investment in bicycle infrastructure and policies that prioritize cycling as a primary mode of transportation.

The community played a significant role in the development of Groningen's cycling infrastructure. The city engaged residents through collaborative workshops and consultations, involving cycling advocacy groups and NGOs in the planning process. Educational campaigns raised awareness about the benefits of cycling, encouraging residents to embrace biking as a convenient and eco-friendly alternative to driving.

The strong community involvement fostered a sense of ownership and pride, which contributed to the success of the cycling network. As a result, Groningen has transformed into a model city for sustainable urban mobility, where cycling is seamlessly integrated into everyday life.

In the small town of Totnes in the United Kingdom, the Transition Town movement has inspired a community-led approach to sustainability, emphasizing local solutions, renewable energy, and resilience. Totnes has implemented a range of sustainable mobility measures, including car-sharing programs, electric vehicle charging stations, and improvements to public transportation. Additionally, pedestrian-friendly infrastructure and walkable neighborhoods have been prioritized.

Totnes' Transition Town initiative highlights the power of grassroots efforts in addressing environmental challenges. By focusing on local, practical solutions, the project has not only helped reduce dependence on fossil fuels but also strengthened the local economy and enhanced community cohesion. The Totnes project serves as an inspiring example of how local communities can take action to foster sustainability and resilience in the face of global environmental challenges.

These case studies demonstrate the positive impact of community involvement in urban planning. When communities actively collaborate in the design and implementation of urban mobility projects, tailored to their specific needs, the outcomes are more likely to be successful, creating more sustainable, livable environments for all residents.

Unsuccessful/Partially Successful Projects That Failed Due to Lack of Community Collaboration

One example of an unsuccessful urban mobility initiative is the Pronto bike-sharing system in Seattle, which was launched with the goal of providing a sustainable transportation alternative for both residents and visitors. However, the project struggled from the outset, particularly due to financial issues. The system's implementation costs exceeded initial expectations, and the number of users was insufficient to cover operational expenses, ultimately leading to its discontinuation after just three years. Several factors contributed to the failure, including limited coverage, competition from electric scooters, and the lack of flexibility that scooter services offered, which made them more attractive to potential users [28]. Additionally, Seattle's climate and hilly terrain posed challenges, as the rainy weather and steep streets made bike-sharing less appealing, especially for casual riders.

The combination of these factors, coupled with low ridership and financial deficits, led the City of Seattle to halt the Pronto Cycle Share system in 2017. However, the lessons learned from this failure helped inform the development of a new, more successful bike-sharing system based on dockless bikes, which offered greater affordability and convenience. This case highlights the importance of addressing user needs, environmental context, and financial sustainability when designing urban mobility projects.

Another example is the Dublin Metrolink project, which aimed to provide a rapid transit link between Dublin city center, the northern suburbs, and the airport. Despite its planning starting in the early 2000s, the project has faced continuous delays and setbacks. The lack of strong community involvement and poor communication with residents and businesses in the affected areas contributed to opposition, as many were concerned about the project's impact on local businesses and the environment [30]. Financial challenges, as well as changes in economic conditions, further hindered progress. After several postponements, the project's completion date is now set for 2027, though it remains uncertain whether it will proceed due to these ongoing issues.

The implementation of shared electric scooters in Europe is another example of a micro-mobility initiative that initially appeared successful but later encountered significant issues due to a lack of proper planning and regulation. While e-scooters gained popularity as a last-mile, eco-friendly transport option, their use led to safety concerns and confusion, particularly because of the absence of clear guidelines for usage and parking. In many cities, riders used sidewalks or mixed with traffic, posing risks to pedestrians and other road users. In some cases, the lack of dedicated infrastructure further exacerbated these safety issues, leading to a negative public perception of e-scooters as a mode of transport.

In response to these challenges, cities like Paris have held referendums to ban electric scooters, citing concerns over public safety and the negative impact on the urban landscape [35,36]. However, some cities have been able to overcome these challenges by introducing better-regulated e-scooter programs, learning from the failures of other cities and adopting more refined policies. This highlights the importance of planning, regulation, and clear communication when implementing new forms of urban mobility.

These examples demonstrate that urban mobility projects can fail or only partially succeed when there is a disconnect between the system being implemented and the needs, preferences, and safety concerns of the local population. They underscore the importance of thorough feasibility studies, community engagement, and clear communication to ensure that a mobility system aligns with user needs and local conditions. Without these elements, even well-intentioned initiatives can falter.

In conclusion, the success of urban mobility projects often hinges on the balance between top-down policy-making and bottom-up community involvement. The cases reviewed here emphasize the need for early-stage community engagement in planning and decision-making. By involving users in the design process and considering their feedback throughout, urban mobility projects are more likely to meet the needs of the people they are meant to serve and achieve lasting success.

Results and Discussion

The findings of this study confirm that urban mobility behavior and urban planning are interdependent and must work together to achieve optimal outcomes. Travel behavior is a multifaceted process shaped by a variety of factors, including gender, age, lifestyle, and urban mobility planning. A key takeaway is the necessity for strong collaboration between communities and decision-makers, both during the design and planning stages and throughout the implementation process. Additionally, a balance between top-down and bottom-up approaches in policymaking is essential for creating more inclusive and effective mobility solutions.

The case studies further demonstrate the substantial impact that community involvement has on the success of urban mobility projects. When local populations are actively engaged in the planning process and their specific needs are considered, cities are better equipped to enhance the sustainability and efficacy of their mobility initiatives. These examples highlight the importance of integrating both bottom-up and top-down approaches, emphasizing that early and ongoing collaboration with residents is vital for the acceptance and success of mobility projects.

A "carrot and stick" approach in policymaking, which combines incentives for sustainable transportation with restrictions on more polluting alternatives, is critical in ensuring that the transition towards sustainable mobility is both practical and effective. Offering a range of transportation options while also placing reasonable limitations on car usage can help shape more environmentally friendly urban mobility patterns.

However, the research does have certain limitations. Due to constraints in data collection and the scope of field observations, further studies should aim to explore these dynamics in more detail, particularly to identify trends between different demographic groups (e.g., age, gender, employment status, etc.). In addition, conducting surveys would be valuable to test and refine the theoretical hypotheses developed in this paper, providing more empirical evidence to support the findings.

Conclusions

This study highlights the necessity of a paradigm shift toward sustainable mobility in order to meet global climate mitigation targets for the future. Urban mobility is a dynamic and complex system shaped by a combination of infrastructure, policies, and the daily choices made by individuals. The decisions people make about how to commute, what mode of transport to use, and their broader lifestyle preferences collectively influence the mobility landscape of a city.

There is no single, universal solution for changing travel behavior. Instead, a combination of factors—ranging from urban planning and policy interventions to shifts in personal habits and societal norms—must work together to reshape mobility patterns. As urban populations continue to rise, it becomes even more critical to foster mobility behaviors that emphasize sustainability, efficiency, and inclusivity.

By embracing shared transportation, exploring alternative modes of transit, and adopting environmentally-conscious practices, individuals can contribute to a positive transformation in urban mobility. This shift has the potential to spark a ripple effect, influencing broader societal change and helping to create cities that are more sustainable, livable, and adaptable to future challenges.

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