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EVALUATION OF PUBLIC TRANSPORTATION PERFORMANCE AND ACCESSIBILITY (PT-P&A) BASED ON SMART CARD DATA

Lead partner: Dr Hediye Tuydes-Yaman, Middle East Technical University (METU), Turkey

THE PEOPLE

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THE CHALLENGE

Public transit is a vital component of sustainable transportation and a decarbonised society. However, developing public transport systems that are cost-effective and offer equal access to all members of society is challenging.

Public transit systems in Turkey were traditionally planned and operated using site experience, user feedback, and insight from management. However, this approach has struggled to keep up with recent changes in the country.

In Turkey, many communities – including low-income groups, young people, the elderly and people with disabilities – are reliant on public transport to access basic services. However, the increasing size of urban areas has heightened pressure on public transit in recent years.

This IAPP project analysed smart card data from a metropolitan area in Turkey, in order to develop insights into the use of public transport and strategies for how it might be improved in the future, to support economic development and meet the needs of the country's growing urban population.

THE PROJECT

The IAPP Smart card project analysed data from cards in the Konya Metropolitan Municipality in Türkiye to detect travel patterns. To extract relevant insights from this data source (which recorded over 1 million transactions per month), the team developed systems for data management, adapted algorithms to process data on multiple machines and created a data visualisation tool. Setting up this big data infrastructure was one of the major achievements of the project and has laid the foundations for future projects.

The team also collected on-site data on the number of people around and waiting at stations in Konya and conducted short surveys with public transport users. This data was used to complement the big data analysis.

Preliminary findings showed the potential uses of the data analysis frameworks developed through the project. The research team produced a map of demand using a geographical information system (GIS), to highlight the most heavily used lines and stops. This map, and a number of other visualisations, were used to assess the performance, efficiency and accessibility of public transit in Konya and will shape future planning by the municipality.

IMPACTS

The research team's development of new research protocols, algorithms and evaluation frameworks for the analysis and visualisation of big data will help to **improve understanding of public transit accessibility and performance in Turkey and beyond**. In turn, this will help local governments and transport companies plan for the future and ensure that both the economic and social impacts of transport system development are considered.

Collaboration between partners resulted in **practical recommendations for improving the public transit system in Konya**. The team used the data analysis to develop a proposal for new public

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transit zoning structure for the municipality, which factored in the needs and preferences of local communities.

The project findings were shared with policy teams to inform **Konya's Sustainable Urban Mobility Plan**, which is a strategic plan to ensure the mobility needs of people and businesses in the city are met.

Despite challenges posed by higher-than-expected data-processing needs and restrictions linked to the COVID-19 pandemic, the team expanded its scope of work to **understand the impact of the pandemic on public transit use in Turkey**.

The project team used a variety of dissemination methods, including conference papers and journal articles, to share the findings of the project with academia and industry from across Europe. Through these activities, they have contributed to wider **knowledge of the use of big data for intelligent transport systems**. They have also built networks and strengthened links between researchers working in transport engineering and data analysis and the institutions and companies that develop public transport strategy in Turkey.

The project also created opportunities for **students and early career researchers**, who were supported to study big data and develop skills for the processing, analysis and visualisation of data.

THE FUTURE

Transport planning remains an important priority for Turkey. Although the project ended in March 2021, Middle East Technical University continued to support Parabol's research through **projects funded by the Turkish National Research Centre**.

> *"We are still in contact with municipalities and we are carrying out projects that will be the continuation of this project. We are also making developments that are more open to commercialisation. For example, we are evaluating how these outputs can be used in Europe."*
>
> Elif Karagümüş, Parabol

Parabol have continued to work on public transit improvements elsewhere in Turkey, by using the expertise and evaluation frameworks developed through the project. Currently, they are part of a consortium developing the Sustainable Urban Mobility Plan for Izmir, the third-largest city in Turkey.

Sadly, Dr Caitlin Cottrill, the lead researcher from the University of Aberdeen, passed away in May 2022. The research teams from the UK and Turkey have kept her name alive in the scientific work already conducted and in forthcoming outputs as far as possible.

SOURCES:

This impact case study was prepared using information from interviews with the project team, documents supplied by the Academy including reports and additional online resources.

- Interviews with Dr Hediye Tuydes-Yaman and Gulcin Dalkic and Elif Karagümüş from Parabol
- IAPP18-19\308 – Application
- IAPP Progress reports and other reporting documents
- Tuydes-Yaman, H., Kocak, B., Karagumus, E. and Dalkic-Melek, G. (2023) Boarding Stop Assignments for Public Bus Trips using Smart Card Data: Comparison of Two Algorithms. Transportation Research Procedia, 69, pp.471-479.
- Tuydes-Yaman, H., Kaya, B., Karagumus, E., Dalkic-Melek, G. and Doyle Cottril, C. (2023) The impact of Covid-19 pandemic on public transit use: Case study of Konya city. Transportation Research Procedia, 69, pp.480-487.

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