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# Transition to Sustainable Urban Mobility: The Contribution of AI to Bus Fleet Selection in Portugal

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**Executive summary**
The decarbonisation of bus fleets is becoming increasingly essential to Portugal's climate commitments, but most local authorities and operators are planning this transition without sufficient evidence or the tools to take action. The 'OPTIMOB-@I.PT' project has developed analytical methods and open-source software to address this gap, using real-world usage data from Porto (STCP) and Zurich. The results show, firstly, that investing in more service attracts more passengers, in a measurable effect (around 1% more demand for every 10% increase in service) that provides decision-makers with a concrete basis for investment; secondly, that this effect varies depending on the area, which suggests investing in a differentiated manner rather than applying a one-size-fits-all approach; and, thirdly, the project has made available PID-Transit, a free tool, and the first training material in Portuguese on the European NeTEx and GTFS standards, which helps operators of any size to comply with Regulation (EU) 2024/490. Together, these results provide decision-makers with the evidence and tools to accelerate an efficient and fair fleet transition.

**Recommendations**

- (Consider expanding service provision as a means of decarbonisation: the established relationship between service provision and demand makes it possible to estimate, from the outset, how many passengers will be attracted by each investment in the network;
- Prioritise investment on a region-by-region basis, concentrating resources where they generate the most demand and the greatest social benefit, rather than applying a one-size-fits-all approach across the country;
- Adopt and support open and standardised data tools, such as PID-Transit, so that small and medium-sized operators can comply with Regulation (EU) 2024/490 and integrate into the European multimodal information system;
- Base fleet procurement decisions on multi-criteria methods that transparently weigh up the cost, emissions and social impact of diesel, electric, hybrid and hydrogen technologies.

**Target audience for the policy brief**
IMT and AMT; local authorities and metropolitan transport authorities; public transport operators; and the government departments responsible for the Environment and Climate Action, and Infrastructure and Mobility.

## Introduction and Problem Statement

The transport sector accounts for around a quarter of global greenhouse gas emissions, and most vehicles still rely on fossil fuels. For this reason, decarbonising public transport fleets is a central part of Portugal's climate commitments, notably the National Energy and Climate Plan (PNEC 2030) and the target of carbon neutrality by 2050, in line with the European framework. Urban buses, due to their presence in every city and the frequency with

which they operate, are one of the most immediate levers for this transition. Local authorities and operators are under growing pressure to renew their fleets and expand services, but most lack the evidence or tools to support these decisions. There are no answers to two practical questions. i) How many more passengers does investing in more service yield? Without this answer, investment decisions are based on fragile estimates. ii) How can the new European obligations on transport data sharing be met, when most operators store this information in proprietary, non-standardised formats? These two gaps – one in evidence and the other in data – delay decisions that have a direct impact on emissions and the service provided to the public. The 'OPTIMOB-@I.PT' project was designed to address both, gathering evidence on demand and developing practical tools for operators.

## Key Findings

To understand how service provision influences demand, the project analysed real-world usage data from nine urban bus routes (Zurich, 2020–2022), combining artificial intelligence methods with statistical models. Three findings stand out for their relevance to public policy.

Firstly, more service translates into more passengers, and this effect is measurable. Given that operators tend to increase service where demand is already rising, the analysis isolated the effect of supply itself: on average, a 10% increase in service (kilometres travelled) corresponds to an increase of around 1% in demand on the routes in question. The effect is modest, but consistent and statistically robust, and provides decision-makers with a concrete basis for estimating the return, in terms of passengers, of each service enhancement before funding it.

Secondly, this effect is not uniform across the city. The impact of increasing service depends on the characteristics of each area, such as the proportion of households without a car or the profile of the resident population. The same investment in service yields more passengers in some areas than in others, which suggests investing in a differentiated manner, rather than applying a one-size-fits-all approach across the country.

Thirdly, demand is highly responsive to past trends: today's passenger numbers are the best indicator of tomorrow's passenger numbers. Drops in demand, such as those caused by the COVID-19 pandemic, do not recover on their own and require ongoing investment in the service to be reversed. The characteristics of the area determine the long-term potential of each route, but not short-term fluctuations, so it makes sense to combine service improvements with land-use policies.

It is important to be transparent about the scope of this evidence: as it comes from a benchmark city, with high-quality data, and refers to the short- to medium-term effect on the lines analysed. The exact scale of the effect varies between regions, so its application to Portuguese cases gains robustness when calibrated with local data.

Data standardisation is a prerequisite for this type of planning. Delegated Regulation (EU) 2024/490 now requires operators to publish their data, in a standardised format, on the National Access Point, in accordance with the European NeTEx and GTFS standards. The available tools are, however, scattered, inflexible and almost always documented only in English, which leaves smaller operators without a straightforward way to comply with the law.

To address this need, the project developed PID-Transit, an open-source tool that organises, validates and exports transport data in the required formats (GTFS and NeTEx) from a single database (Figure 1). When applied to a real network comprising 71 routes, 2,550 stops and over 12,000 daily journeys, it produced zero errors compared to official validators and reduced data quality alerts by 30%, without any manual correction. It also includes the first training material in Portuguese on these standards.

Figure 1 – The PID-Transit workflow, from the collection of scattered data to its export in compliant formats (GTFS and NeTEx) to the National Access Point.


Souce: OPTIMOB-@I.PT project.

## Policy Options and Recommendations

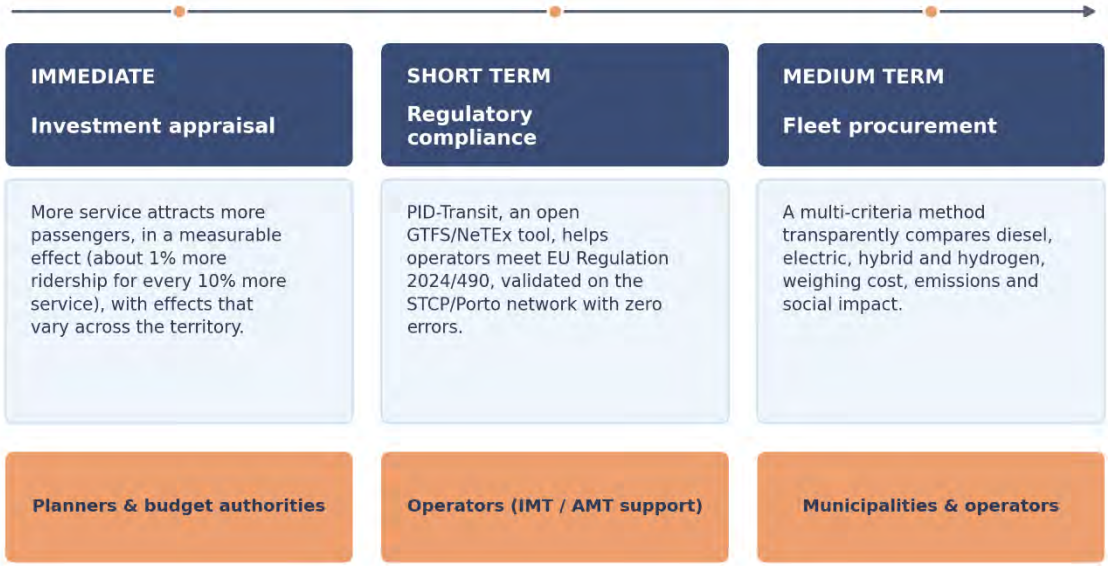
The results translate into concrete measures across three time horizons (Figure 2). In the short term, the relationship between service and demand can be used to evaluate investments. As the effect has been measured rather than assumed, planners and budgetary authorities can compare different service enhancement scenarios based on the number of passengers expected to be gained, and justify investment in the network as an efficient way of attracting users and reducing emissions. As the effect varies across zones, investment should be concentrated where it generates the most demand and the greatest social benefit.

In the short term, the deadline for Regulation (EU) 2024/490 is the most pressing obligation for many operators. Adopting a standardised tool, such as PID-Transit, enables compliance with obligations at the National Access Point at low cost and integration into the European travel information system, from which non-compliant operators are excluded. Beyond complying with the law, standardised data is a prerequisite for evidence-based planning. The IMT and AMT can accelerate this process by recommending or supporting open tools and providing training in Portuguese.

In the medium term, local authorities and operators will be making purchasing decisions that will shape the vehicle fleet for the next decade. The project provides a method that takes into account various criteria—including cost, emissions and social impact—to transparently compare diesel, electric, hybrid and hydrogen technologies, making priorities clear and identifying choices that remain sound across different scenarios.

Underlying all of this, the standardisation of operators' data is not a technical detail: it is the condition that makes it possible to plan on the basis of evidence, collaborate on research and comply with regulations. It must therefore be treated as a priority in funding and regulatory decisions.

Figure 2 – The project's three policy contributions, the stakeholders they are aimed at, and the timeframes within which they apply.




Souce: OPTIMOB-@I.PT project.

## Conclusion

The 'OPTIMOB-@I.PT' shows that decarbonising urban bus fleets can be supported by evidence and practical, free tools. The project has demonstrated that investing in more services attracts more passengers, and that this effect varies depending on the region; it has created an open-source tool to help operators comply with new European data obligations; and it has developed a structured method to support the procurement of new fleets.

These contributions serve different audiences and timeframes: the authority assessing a service expansion this year, the operator facing a legal deadline, and the municipality planning its fleet for the next decade. The approach is transferable to any Portuguese municipality where data is available, and partnerships with research teams in Brazil and South Korea pave the way for extending the work to an international comparison.

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