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Planning local public transport: a visual support to decision-making

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Abstract

This paper describes a visual tool for data analysis applied to a case in public transport. Our tool is based on geo-referenced dynamic maps, created with free Web GIS applications, and allows users to visualize data and interact readily with a large database of public transport service information. This tool will support decision-makers in detecting issues of inefficiency and ineffectiveness related to the public transport services of a given area. The paper focuses on the visualization system, its features, and its use, detailing the indicators utilized and the analyses it may be employed for.

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Keywords: Visualization; public transport; dynamic maps; reorganization; decision support systems.

1. Introduction

Public administrations face increasingly tight budgets and, more than ever, must make the most of available money to provide public services. When tackling budget limitations in public transport provision, informed decision makers may do better than resolving to undifferentiated service cuts. However, good data sources and analysis tools are crucial in making smart choices.

In Italy, Provinces and Regions are responsible for planning and contracting the interurban public transport. Regions are also in charge of financing the services -using government funds and, if necessary, topping them up- and coordinating the planning activity of the different Provinces. In 2012 the research institute SiTI carried out a study analysing the whole regional interurban public transport of the Piedmont region. Such work was conducted for the regional administration to find the main inefficiencies and optimize service provision to comply with reduced public budget. Within this work SiTI elaborated an assessment methodology (Isabello, Arnone, & Rosa,

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2013) and a web-based interactive visualization tool, discussed here. The content of this paper is based on the final report of the study by SiTI (2012), which the authors contributed to.

This visualization tool has been realized to give to the contracting bodies a decision support system useful to visualize the main issues, both locally and looking at the whole regional public transport network, characterized with the aforementioned assessment methodology and also develop different scenarios, e.g. given different budget constraints.

The choice of a web-based interactive visual tool was also due to the size of the task: the analysts had to work on a database of some 70 indicators each detailed for about 4000 bus routes. While working with a large dataset we aimed at ensuring the user-friendliness of the tool -to allow a quick deployment in planning and contracting bodies-, limiting development costs, and obtaining something that could be applied to other areas and, eventually, able to include real-time data feeds.

The paper focuses on the decision tool to be provided to the regional planning and contracting body in order to support the assessment process of the Piedmont public transport system. In the next section, an overview on current available tools is discussed, while section 3 describes the working framework of the Visual TPL tool. The conclusion proposes some possible implementation of the research in the field under investigation.

2. Low-cost technologies for supporting decision-making processes

In the context of Piedmont region, in which data are gathered following different procedures by a significant number of operators independently managing their own transport lines, the evaluation of the current status of public transport system was a difficult challenge. First of all, the differences in data collection generated a large number of reports with no common terms of comparison. Secondly, many available data were referred to territory only by the name of the path or line, which was not sufficient to understand their actual geometry, their catchment areas or possible overlapping with other lines. Thirdly, possible inefficiencies and inconsistencies of the transport system were not readily recognizable.

Due to these reasons, there was a strong need to make the data homogeneous, even though the dataset available was fragmentary and incomplete. In order to analyse, manage and evaluate such data, a new framework with two key requirements, related to each other, was required. The data structure should allow clear reading and easy understanding of the data, avoiding possible misunderstandings in readings.

Several commercial tools have been designed to manage data related to transport issues. In particular, there is a large number of simulation models which aim to provide useful information on efficiency of transport systems. Nevertheless, to use these tools, input data have to respond to specific requirements of homogeneity in graph representation, a condition that is sometimes impossible to obtain with real data. The data available for the application discussed did not have those desirable features and new opportunities were to be found in other fields.

Therefore, a research started to understand the state of the art in managing large geographical databases coming from different sources and structured with different typologies of attributes. The obvious choice would have been to use GIS applications, which are conceived to manage geographical information from different sources, merge tables and represent data visually. However, GIS were not suitable for achieving the main task of the research, which was not just identifying solutions for reducing transport system costs, but providing a decision tool to the planning and contracting bodies. This tool should support decision-makers in analysing and evaluating data related to the current status of the public transport system in order to investigate the whole network, with particular care to its dynamics and efficiencies. To that end, the new tool should be able to show the key elements of the system, independently of the fragmentation of the system among about one hundred companies. Elements such as overlapping lines, low value of average ridership on lines needed to be clearly visible.

GIS require specific users' skills, which are not necessarily those of the decision makers involved, thus resulting complex for end-users. Moreover, GIS tools have often significant license costs, a fact that may reduce