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Simulating the Structure and Localization of Activities for Decision Making and Freight Modelling: The SIMETAB Model

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Abstract

This paper aims to introduce the methodology of the SIMETAB model which attempts to simulate the economic structure of an area, and then produce inputs needed by many urban goods simulation models. The proposed model aims at understanding the economic structure of a city, in order to simulate the urban goods movements depending of the activity using an existing mode. This model's main function is to simulate the number of establishments by category of size and field of activity for a given zone, or to build evolution scenarios from a starting situation. Starting from a known structure (or simulated through SIMETAB), it is possible to make the economic structure of a city evolve. This feature allows decision makers to forecast the impacts of alterations of the urban framework in the future, from basic data such as population and employment statistics.

Keywords: Urban modeling; urban typology; urban goods movements

1. Introduction

The knowledge of the economic structure of cities is a critical point in the decision-making process related to urban goods and urban planning interactions. The structure of the activities defines the logistics behaviour of an area. This reflection finds its source in the FRETURB urban goods models (Routhier & Toilier, 2007; Gonzalez-

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Feliu, Toilier, Ambrosini & Routhier, 2013). As urban goods movement models need to be precisely calibrated on the structure of the studied area, knowledge on the activity of a given area becomes critical for decision makers. This problem is moderately relevant in France where a national establishment database is easily available. Indeed, in France, the National Institute of Statistics and Economic Studies (INSEE) produces each year censorial databases of each town's economic activities, called SIRENE files (Gonzalez-Feliu, Toilier & Routhier, 2010). In this case decision makers have a powerful tool of knowledge with high precision. However, in other countries this sort of database is sometimes not publicly available or it may not even exist.

Modeling the economic activities of a city is fundamental when it comes to describing the urban goods transport behaviour. It was proven thanks to the urban goods transport surveys carried out in France between 1994 and 1997 in three different urban areas that the type of activity of an establishments defines its urban goods movement's behaviour (Patier & Routhier, 2009). Homogeneous strata of activities showed the same ratios in terms of generated movements for one employee (for instance, a warehouse generates approximately ten goods movements per employee, whereas a tertiary office only generates 0.3 movement per employee), independent of the city size or demographic characteristics (Routhier, 2013) if the economic structure of a city is easy to identify using French databases, it is not the case in other countries, and some authors tried to overlook this issue (Muñuzuri, Cortés, Onieva & Guadix, 2012; Gentile & Vigo, 2013).

To do this, both works propose specific models when only a small amount of data is available. Those models have the advantage of needing only a small amount of data but the granularity of data outputs and the levels of detail are necessarily small. On another hand, classical models need higher amounts of data, and are in general context dependent (Gonzalez-Feliu & Routhier, 2012). Only a few groups of models need standard data: FRETURB, WIVER and VENUS (for a detail on such models, see Ambrosini, Meimbresse, Routier & Sonntag, 2008). In this context, a question arises: if a method could be developed to produce proxy input data for such models, in a standard form, they could be used even when little data is available. This is why the SIMETAB model, by describing the activities implanted inside urban areas, can be an input for urban goods movement's estimation, through activity based models or even simple ratios.

Another critical point brought up by this problem is the evolution of the structure of activities in a city. Indeed, it is hard to determine evolution scenarios with basic data such as the population and the employment. Destruction, creation and relocations of establishments are fundamental information for the transport and the urban planning process. Data can be found on this subject (ex: INSEE's various databases in France), but are not relevant in prospective approach. As the work carried out on this particular subject is not very advanced, this point will not be mentioned in the paper.

The aim of this paper is to present the SIMETAB model, which aims to reconstitute the economic structure of a city on the basis of national databases and a typology of the urban spaces. First, the general methodology of the model is introduced. Then, the calibration process is described. After that, the main calibration results are presented and discussed. Finally, a critical analysis on the limits and further developments is proposed.

2. General methodology

The aim of this paper is to present a methodology to understand the territorial dynamics and urban systems (Antoni, 2011), taking into account their characteristics in order to build a typology of different urbanized territories. This work is essentially linked to the experience of the LET in terms of knowledge of the economic and functionality behaviour of the establishments in the urban environment (noticeably the work of stratification realized for the French surveys on urban goods movements and FRETURB; Patier & Routhier, 2009). Thanks to INSEE, IGN[1], and LET[2] data we were able to detail the activities of continental France at the "commune[3]" level,

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[1] The IGN is the national geographic institute in France
[2] "Laboratoire d'Economie des Transport" in Lyon
[3] A commune is the basic geographical and administrative fragmentation in France, that can assimilated to a town. During the rest of this paper, this term will be used to describe the studied zones