

# Real Estate's Market Value and a Pollution and Health Effects Analysis Decision Support System

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**Abstract.** The authors of this paper participated in the project Framework 6 *Intelligent Cities* and the Lincoln Institute of Land Policy Fellowship. One of the above project's goals was to develop and improve a Real Estate's Market Value, and the Pollution and Health Effects Analysis Decision Support System (RE-MVPHE-DSS). RE-MVPHE-DSS consists of a market value analysis, air and noise pollution, premises microclimate, health effects, voice stress analysis, complex determination of the weights of the criteria, cooperative decision making and multiple user subsystems. RE-MVPHE-DSS is briefly analysed in this paper.

**Keywords:** cooperative decision making, multiple-user, market value, air pollution, premises microclimate, health effects, voice stress analysis.

## 1 Introduction

Certain groups of patients included in this study are those such as asthmatics, atopic patients, patients with emphysema and bronchitis, heart and stroke patients, people with diabetes, pregnant women, and the elderly and children who are especially sensitive to the health effects of outdoor air toxicants [1]. It is estimated that about 20% of the USA's population suffers from asthma, emphysema, bronchitis, diabetes or cardiovascular diseases and are thus especially susceptible to outdoor air pollution (American Lung Association, 2005). Outdoor air quality plays an important role in maintaining good human health. Air pollution causes large increases in medical expenses, morbidity and is estimated to cause about 800,000 annual premature deaths worldwide [5]. Much research [2, 3, 7, etc], digital maps and standards [6, 8, 12] on the health effects (respiratory effects, cardiovascular effects, cancer, reproductive and developmental effects, neurological effects, mortality, infection and other health effects) of outdoor air pollution, a premise's microclimate, and real estate valuation, has been published in the last decade.

The above-mentioned and other problems are related to a built environment's air pollution, the premise's microclimate, health effects, and real estate market value, etc. However, a Real Estate's Market Value, Pollution and Health Effects Analysis Decision Support System (RE-MVPHE-DSS) can analyse the above factors in an integrated way. Other positive characteristics of our System are compared with other systems and described in Section 2-5. No-one thought of the above integration function before, and

so our attempt is the first time someone has done so. The authors of this paper participated in the project Framework 6 *Intelligent Cities* (INTELCITIES) and the Lincoln Institute of Land Policy Fellowship *Development of Market-Based Land Mass Appraisal Online System for Land Taxation*. One of the above project's goals (on the Lithuanian side) was to develop and improve the RE-MVPHE-DSS.

This paper is structured as follows: after the introduction, Section 2 describes a Model of RE-MVPHE-DSS. Section 3 analyses air and noise pollution, health effects, multiple user and cooperative decision making subsystems. Section 4 describes a voice stress analyser, premises microclimate and market value analysis subsystems. Finally, some concluding remarks, testing the developed System and future research are provided in Section 5.

## 2 The Model of RE-MVPHE-DSS

Real Estate's Market Value, Pollution and Health Effects Analysis Decision Support System (RE-MVPHE-DSS) consists of the following subsystems: market value analysis, air and noise pollution, premise's microclimate, health effects, voice stress analysis, complex determination of the weights of the criteria, cooperative decision making and multiple user. The complete technical description of all the subsystems and how they are connected to serve the general purpose – cooperative decision-making – will follow. The Model of RE-MVPHE-DSS and of relations between its subsystems is shown in Figure 1.

In order to make a comprehensive analysis by RE-MVPHE-DSS of built and human environment, the built and human environment must be described in digital quantitative and qualitative forms.

All stakeholders of a real estate market can use the created system. Stakeholders are recommended to use as much of their knowledge as possible before making final decisions. For example, in order to perform the multiple criteria analysis of a real estate, buyers, sellers, brokers, financial institutions, neighbours and other stakeholders' requirements should be estimated and submitted in a quantitative form.

Several sources of quantitative information are used. The Lithuanian State Enterprise Centre of Registers is the main source of data about real estate transactions. The Environmental Protection Agency provides information about air and noise pollution. Data about indoor microclimates and allergens is obtained by measuring the related parameters in typical apartments. Data about health effects is derivative and it is obtained by transforming data on air and noise pollution by using the Air Quality Index. The obtained data is used to prepare digital maps of real estate transactions, air and noise pollution, indoor microclimates, and allergens, etc. Other data, e.g. floor area of apartments, room height, the floor in which an apartment is located, the year of construction, availability of parking, etc for quantitative descriptions of built and human environments is obtained from the Lithuanian State Enterprise Centre of Registers. This obtained data is used to develop a quantitative decision making matrix (DMM) of values of the criteria.

Qualitative (subjective) information, which provides comprehensive descriptions of built and human environments, can be classified as conditionally stable and as changing. Conditionally stable indicators describe the opinions of stakeholder groups