An Automated GIS Tool For Property Valuation

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Abstract **- Property value is a reflection of locational, physical, legal and economic factors. Spatial factors are the most important factors among evaluation criteria. Geographic Information System (GIS) provide capable tools that can be used to record spatial information about value properties. The purpose of this study is to developing a property valuation GIS tool, which capable to estimate residential properties values. To achieve this objective, tabular data was developed that geographically represent of property information factors. Then, multi criteria decision analysis MCDA used to evaluate the property value. The tool capable to generate property values as percentage in the tabular data. In this study, Safranbolu-Turkey region has been studied. The property value influence factors are distance to main roads, distance to markets, distance to child parks, distance to schools, age of building, floor of building and distance to city center. The tool capable to help Safranbolu municipality to generate property evaluation for priced fair pricing, renting, buying or taxation and based on the data updating.**

Keywords **– Property valuation, Automated GIS Tool, MCDA.**

1. INTRODUCTION

Property valuation is a serious need for institutions and individuals worldwide for public institutions, individuals, and developing cities, which have developing and renewed properties [1]. Property valuation become a primary task for several applications such as rental, trading and tax payments [2]. Several systems were developed for property valuation based on spatial data. National land information system NLIS [3] is a great example of property valuation systems used in the UK. In NLIS system, 24 million search perform yearly regarding property values [3].

Property value is a reflection of locational, physical, legal and economic factors [4]. Spatial factors are the most important factors among evaluation criteria [5]. Property valuation parameters can be determining by using local experts, investors and institutions opinions [6]. Parameters must be relevant to the local area characteristics and frequently questioning [7].

In order to perform property valuation, spatial data of factors required to be collect for the valuation [8]. ArcGIS software contains both database manager and set of spatial functionalities. ArcGIS allow to end-users to store and analysis spatial data of valuation factors across the desired geographic landscape [9]. GIS can potentially play an important role in real estate research [10].

In order to perform property valuation for new geographic area, several GIS tools are essential. The available tools in ArcGIS are insufficient to perform property valuation. For this reason, this paper aimed to develop new tool for property valuation in Safranbolu-Turkey using ArcGIS, Python and MCDA.

2. METHODOLOGY

This study intended to develope the tool in Esri ArcGIS application using Python programing languge. ArcGIS is the most populer GIS softwere worldwide among specialists. The final outcome is ArcToolbox. The property evaluation process were divided into four steps, and the necessary scripts are written for each step. Each tool displayed as figure. These scripts are written using the python programming language. The necessary steps for the tool have been completed with four associated scripts. The general steps of the tool displayed in Figure 1.

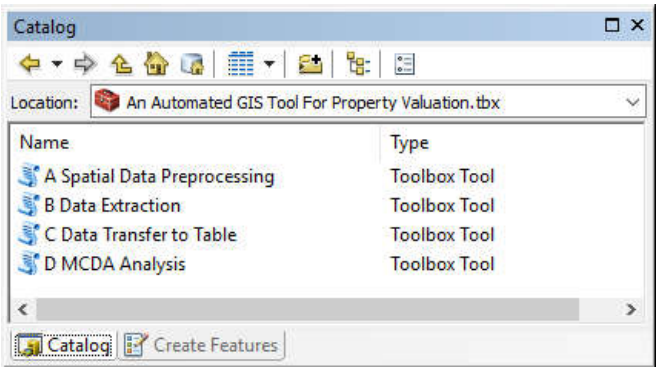

Figure 1 An Automated GIS Tool For Property Valuation

2.1. Spatial Data Preprocessing

In real world, the real value of property is difficult to define. It may vary depending on the prospects of individuals or organizations. At this instant, the furthermost mutual factors are considered. As stated in [11], 407 parameters can be subtracted according to tastes and preferences for property valuation. Based on the consultation of local experts, seven primary factors were adopted. These factors are based on the distance from property that has been evaluated to schools, streets, parks, markets and city center. In addition, the dataset is taken from the attribute table as the building age, the floor, the area information is taken as a parameter and the result is intended to affect.

In this step, spatial data layers of factors were utilized. From Vector data of factors, several parameters converted to raster data for distance calculations. The objective here to prepare the

data for next stage to obtain and automatic correct distance information from factors objects.

In addition, by converting the property data from polygon into point, next stage will be able to extract the spatial informatics from the raster data based on property points. It is aimed to get results effectively and accurately and away from technical problems. The Spatial Data Preprocessing stage showed in Figure 2. The age, floor and area factors require to be manually inter to the dataset as displayed in Figure 3.

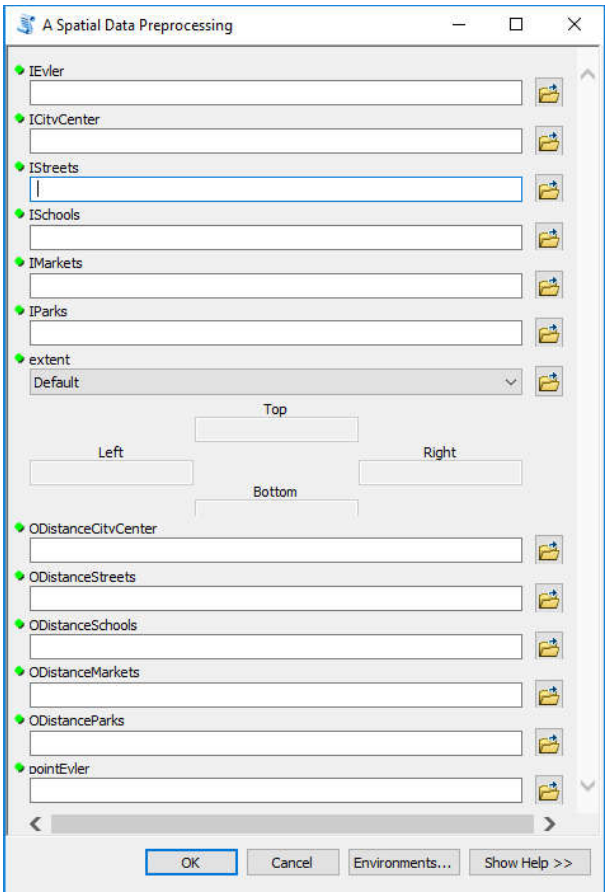

Figure 2 Spatial Data Preprocessing stage

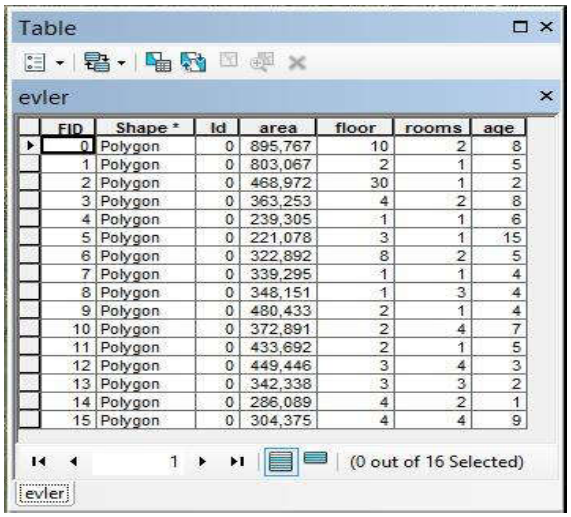

Figure 3 property dataset and manual interning factors

2.2. Data Extraction

This step is related to the previous step. The output raster data obtained in the previous step is used as input. In this step, processes were continued by creating the dataset and the attribute table for the property points automatically. Information of the distance to the city center, distance to the street, distance to the school and the distance to the park from the previous step are used as input. Factors placed in the dataset beside the age, floor and area factors for property evaluation. Thus, the dataset extraction performs. The stage tool presented in Figure 4. an example of final dataset were presented in Figure 5.

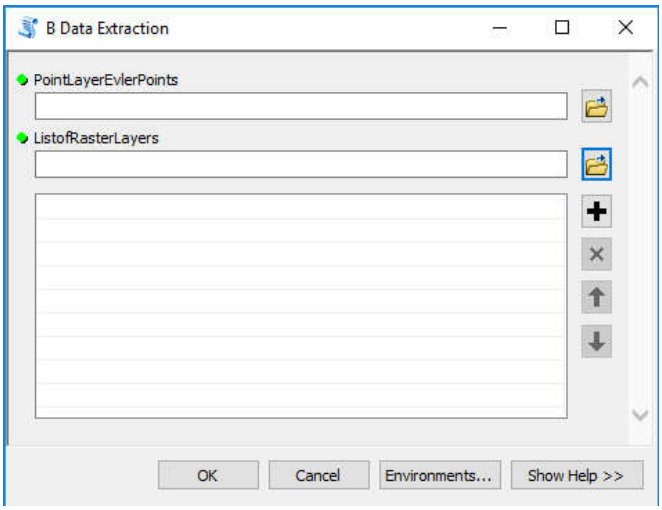

Figure 4 Data Extraction

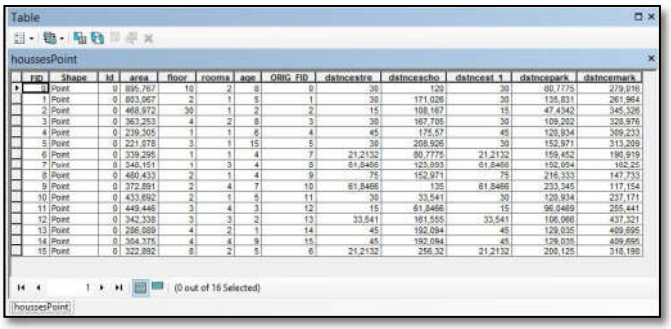

Figure 5 an example of final property valuation dataset that extracted from raster data

2.3. Data Transfer to Table

After the calculations of the property were done via point vector data, data were continued to be processed in vector polygon layer in order not to get away from real presentation. With this stage, a new layer creates and switch from point vector data to polygon vector data. The two layers are spatially matched and the tabular data joined. While joining, all raster and static table data of property are move from points layer to original polygon layer. The developed tool were illustrated in Figure 6.

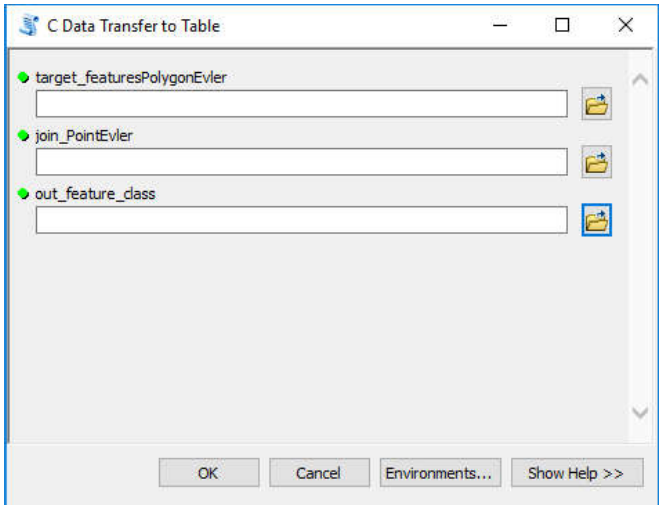

Figure 6 The third stage of the model. Joining the dataset from points layer to polygons layer.

2.4. MCDA Analysis

In this step, the vector data has been moved to the layer, and the data is presented to the user's choices. In addition, numerical result will be obtaining. As a result of this step, people or end-users can make a real property valuation.

By applying MCDA for the input factors using property valuation will be performing. The tool access to the created spatial dataset and migrate the data to a calculator. The calculator can be used to perform MCDA and produce final scores for property. The results are extracted as a percentage. The tool exhibited in Figure 7, and an example of output table demonstrated in Figure 8. Then, the user need to sort the output values and take the highest percentage.

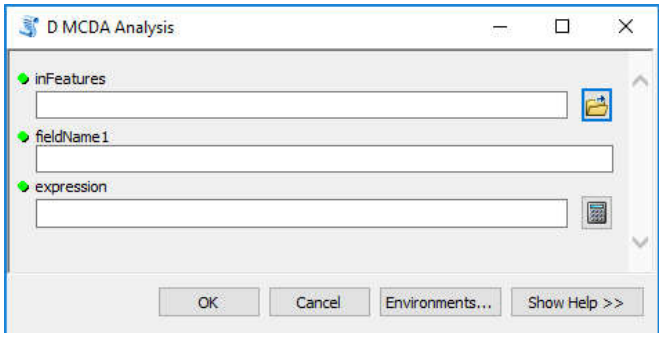

Figure 7 MCDA Analysis stage

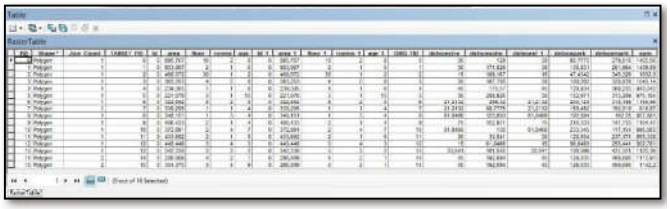

Figure 8 an example of output table based on MCDA

3. CASE *STUDY*

This study was carried out gradually and the result of each stage was used as the input of the next stage. Parameters and specified input values are left to the user. The study was conducted on Safranbolu-Karabuk as illustrated in Figure 9. However, this tool was provided to be use on the desired region by leaving the inputs to the user.

In the study, location factors are used, and access to accurate distance information is targeted as illustrated in Figure 10. The distance between the determined property and selected parameters (city center, school, park, street, market) is calculated and converted into raster data. Then the results are transferred to the database to obtain a result value. Attention was paid to produce final value to be able to the evaluate of the result value based on MCDA.

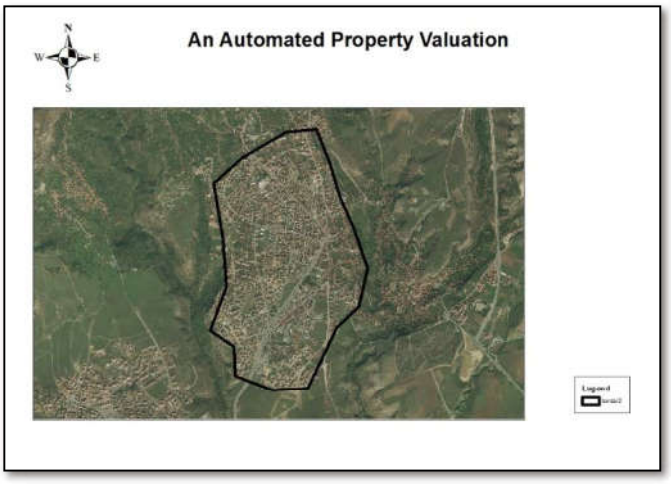

Figure 9 Study Area, Safranbolu

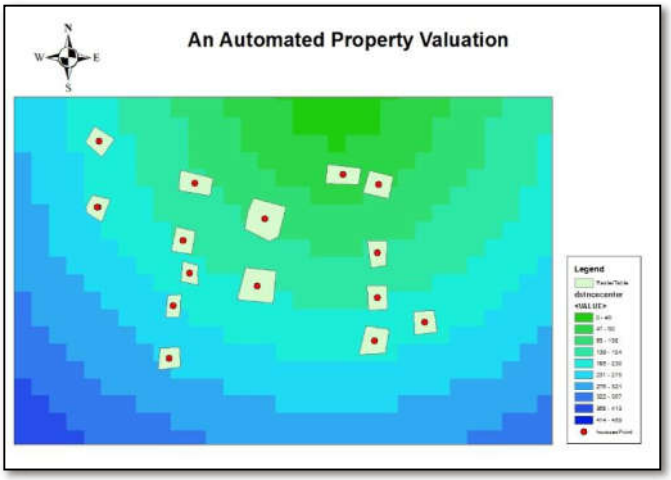

Figure 10 Property Positioning on Raster Model

4. DISCUSSION AND CONCLUSION

Location is an important factor when conducting real estate analysis. It has been determined as the public needs to obtain accurate results and improve our decision in the life such as rental, trading and tax payments. For this reason, accurate results were obtained with the same conditions in Safranbolu regions. Results were obtained with GIS technology and spatial database.

In the study, a general evaluation was made for a real estate. At the time of the study, the distinction between the distance to each point of the city center of Safranbolu Atamerkez was determined as the most important factor. Atamerkez city center was observed during the day, the distance of the restaurant, market, shopping center and cinema locations were observed at this point. In addition to this, it is reinforced that the main parameter for the people who want to live in this environment is the city center.

The Scripts were written and tool developed because the ArcGIS toolbox were inadequate at this point. Thus, the problem of spatial decision is solved. In order to help the decision making, a numerical result was produced and the decision mechanism was left to the user by knowing that the expectations of the individuals would be different.

Consequently, it has been proving that the tool was able to generate property valuation for priced fair pricing, renting, buying or taxation.

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