Scientific Papers. Series E. Land Reclamation, Earth Observation & Surveying, Environmental Engineering. Vol. III, 2014
Print ISSN 2285-6064, CD-ROM ISSN 2285-6072, ISSN-L 2285-6064

INDUSTRIAL PARK EVALUATION BASED ON GEOGRAPHICAL INFORMATION SYSTEM TEHNOLOGY AND 3D MODELLING

Andreea CALUGARU

University of Agronomic Sciences and Veterinary Medicine of Bucharest, Romania

Corresponding author email: calugaru_andreea@yahoo.com

Abstract

A Geographical Information System describes itself as a management system for databases that provides information in a user interactive mode graph organized for storage, query, update and display of information in an efficient manner. (*Imbroane A.M., 2012). This system aims to shape the information into processes and structures that reflect the real world, including past events and possible scenarios in order to analyze, understand and manage the resources and facilities. HG 834/91 concerning the application of the provisions of article 19. 20 of Law No. 15/ 1990 states that land assets of companies with state capital at the time of their establishment, necessary for activity according to their object are established by the judgment of the government organs, according to the law, or by Local State Administration. In this context the present paper proposes an inventory solution for buildings forming an industrial park in order to reorganize the unit to serve the economic urban and regional development or an eventual transformation into a site location for a possible new business, such as a commercial center. The result is the production of graphical data in both digital and analog format, offering solutions to decision-makers who allocate resources.*

Key words*: GIS technology, 3D modelling, real estate evaluation, urban development.*

INTRODUCTION

Before making any GIS analysis and obtaining data for analysing and interpreting the questions related to the objectives that follow, specialists are basically looking for the best solutions in order to have a proper perspective regarding the real situation of the ground areas. Therefore, at this stage we are looking to identify the nature of the results that are expected, the general and local characteristics of the analyzed area, the required data and the types of thematic layers that will be needed and steps to be followed for the final maps and final reports containing the requested information (Shekhar S., 2008).
This paper presents an industrial park, which has undergone several transformations in time: building were demolished, new ones were built. Because they occupy a significant urban area they are of great economic importance for the Public Administration System and raise matters regarding the heights of constructions, impact over environment and population. I considered a scenario in which the trader wishes to make an assessment of the property, buildings, basically an inventory that suggests the land use, built surface, surface movement, considering a possibility of reorganizing its activity for urban development purpose. A solution for a correct inventory is combining the advantages of a geographical information system with the possibilities of visualization into a three-dimensional model. I find this as a rational, intelligent and efficient answer for the increasingly difficult issues related to the use of land resources. The applicability of GIS is practically unlimited for the majority of human activities because of the importance of knowing the location of a certain object in space. Naturally, such a system is used for the production of plans and maps, the public management utility networks, identifying the optimal location for an investment or an objective study over the impact on the environment. (Mihai. D, 2011).

MATERIALS AND METHODS

A Geographical Information System gathers in a unique non-redundant database-graphical, cartographic, tabular and topological components (Miller H.J., 2004). To shape the

world, GIS uses the surrounding objects and spatial relationships. GIS objects are objects or geographical phenomena located on or near the Earth's surface. The objects can be natural (rivers, landforms, vegetation), built (roads, urban networks, buildings, bridges, etc.) or conventional (borders, administrative units, etc.). A GIS object is characterized by position and form in the geographical space and through a series of descriptive attributes. The spatial relationships between objects (neighbourhood, interconnection, continuity, incidence, etc.) help the better understanding of the situations and decisions. Quality information leads to quality decisions (Fisher P.F., 2004). In the first phase, the necessary data was collected, mainly the one that could be freely accessed. Thus, we used a printed location plan that was previously scanned and geo-referenced image-to-image using a high-resolution aerial image which can be found on

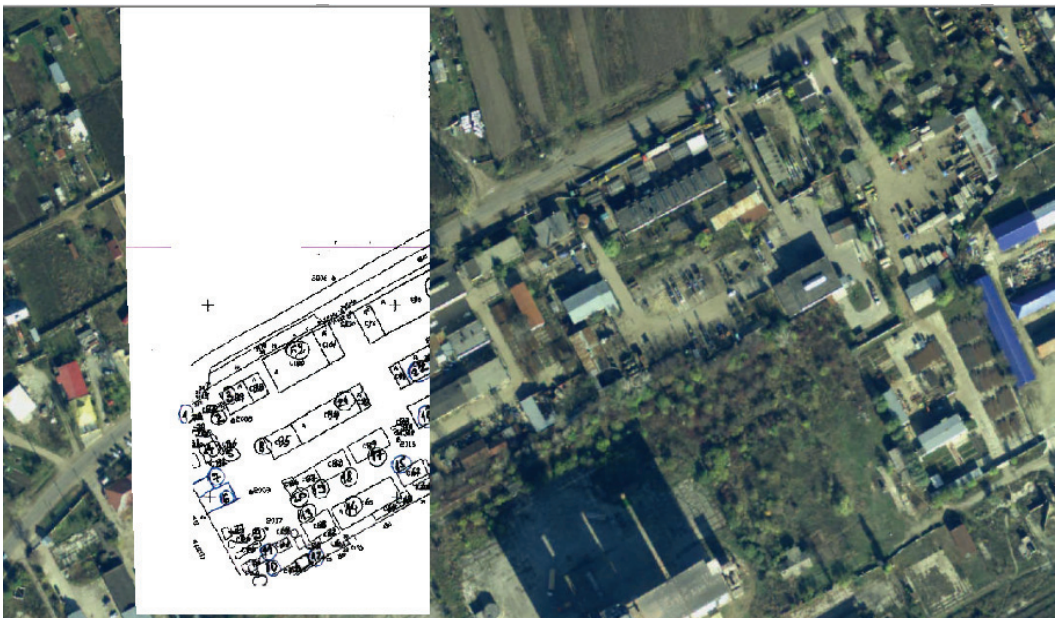

Figure 1: Location plan overlapped on orthophoto 2012 of the study area

the online portal of The National Agency for Cadastre and Land Registration in the national coordinate system Stereo 1970 (fig. 1). In order to do so, I used the software ArcGIS Desktop 1.2. In order to achieve a GIS on the area of interest, I created in ArcCatalog several layers to define the objectives of the ground areas: buildings, green areas, pathways. Then, in order to obtain a 3D model of the industrial park I used a digital terrain model, orthophoto from 2012 specified above and layers created in ArcCatalog. I imported the presented data in ArcScene. This extension allows the visualization and analysis of surfaces by using 3D models and 3D symbols in order to bring virtual objects closer to reality. Regarding the buildings, I first draw the footprints in ArcGIS which I then imported in the Arc Scene where I had the option to extrude the heights, on an estimate based on the number of floors (fig. 2). I also added operational layers: lighting poles, trees and cars. Although it is possible to create them in dedicated programs, I chose to use some of the existing ones from the software catalog. It is important to note that after digitization, the data was processed, to detect any errors by running a topology with certain rules: "most not overlap", "must not have dangles, and

"must not have gaps". Also, because the application allows it, I made a 3D flight which allows visualization of the studied surface from different points of observation, from a global or local perspective (fig 3, 4).

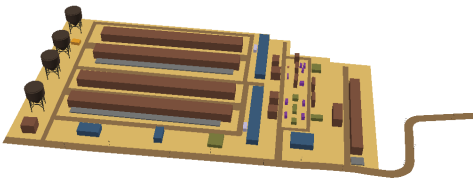

Figure 2: 3D View of a part of the Industrial Park

RESULTS AND DISCUSSIONS

This paper proposes solutions for inventory and real estate evaluation through the use of GIS technology as a set of hardware and software for collecting, manipulating and managing spatial data and their associated attributes. There were a total of 91 buildings in the industrial park on the printed location plan. Compared to the more recent orthophoto from 2012, we found that some buildings were demolished in the meantime (fig. 5). Returning to the initial objective of the project, it should be noted that the database being created along the vector data, enables query after certain criteria, for example the building material, surface.

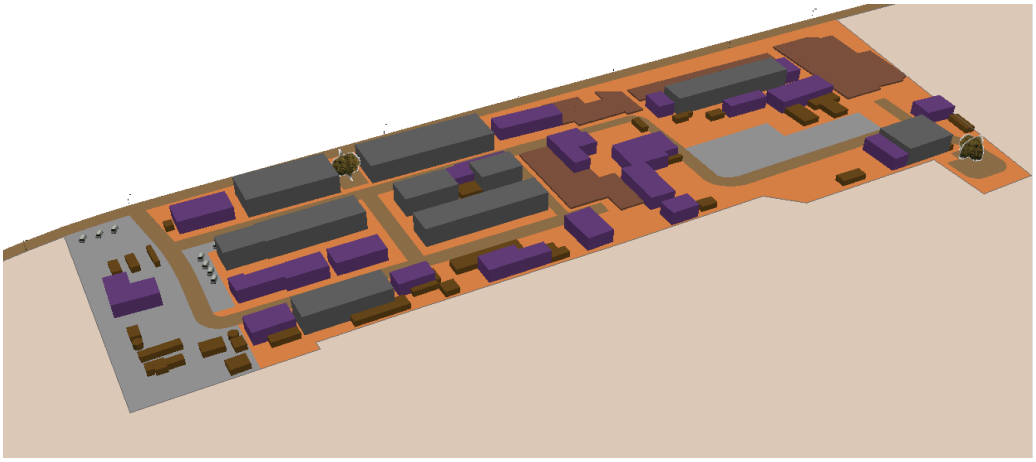

Figure 3: Global visualization of the industrial park

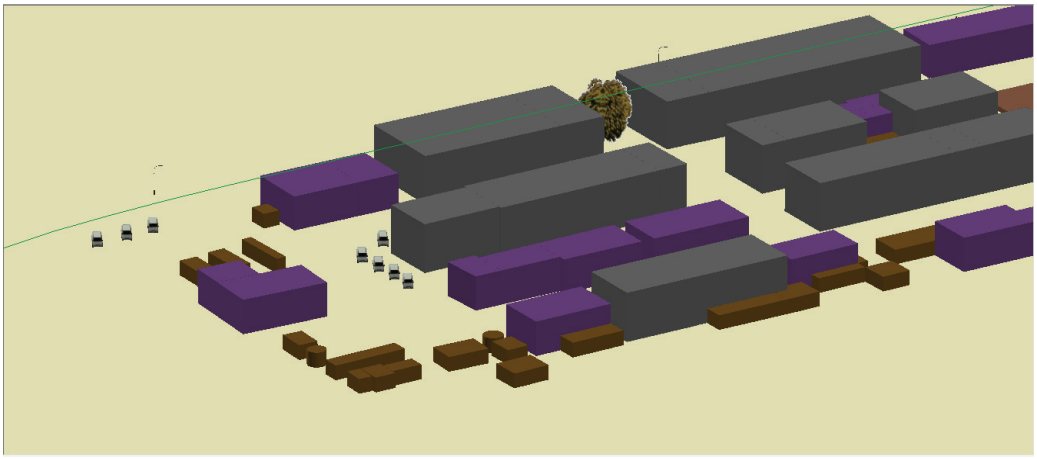

Figure 4: Local visualization of the industrial park

Figure 5: Demolished building

Tabel 1: Excel data export

FID	Shape *	Id	Building	Area
0	Polygon	0	Shed	6.45
24	Polygon	0	Shed	10.49
25	Polygon	0	Shed	12.37
26	Polygon	0	Shed	6.78
27	Polygon	0	Shed	12.09
28	Polygon	0	Shed	10.92
29	Polygon	0	Shed	12.54
30	Polygon	0	Shed	7.46
31	Polygon	0	Shed	7.64
32	Polygon	0	Shed	8.69
8	Polygon	0	Barrack	110.47
9	Polygon	0	Barrack	1691.28
10	Polygon	0	Barrack	1638.39
11	Polygon	0	Barrack	1654.31
33	Polygon	0	Barrack	1691.28
34	Polygon	0	Barrack	27.06
35	Polygon	0	Barrack	20.74

The data can be also exported to Excel (table 1) and be used as base for reports. Thus, we see that in the premises presented, from the total area of the enclosure that is located in the heritage area of the commercial company the built area represents 73% (fig. 6, 7). The level of employment of the other objectives can be seen in the attached chart.

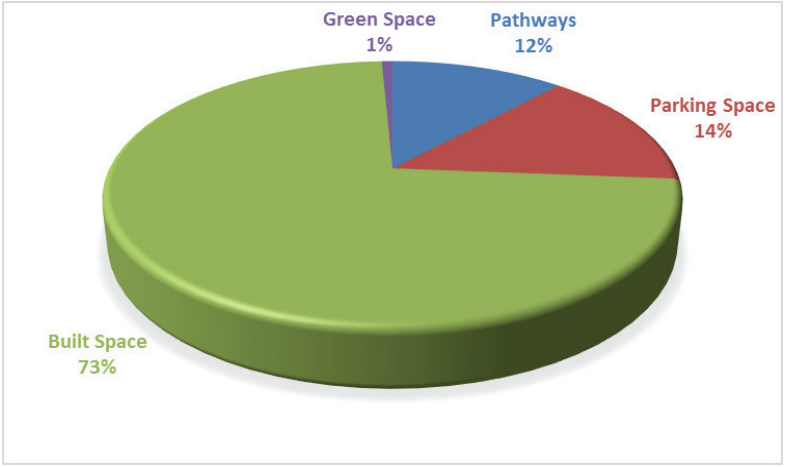

Figure 6: Land coverage

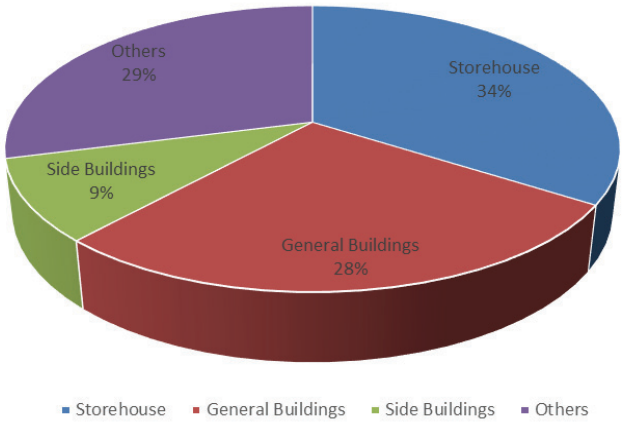

Figure 7: Build area: construction types

CONCLUSIONS

Geographical Information Systems have evolved rapidly and will soon become indispensable in the realization of projects that use spatial information (Balota O., 2009). The results that the Geographical Information Systems provide can be current data, certain categories of data and predictions of the data status at a time. The product consists of complex, spatially referenced information but does not stop at this because it integrates all necessary data to deploy efficient management of resources.

I believe that through the use of information technology and virtual realistic 3D modelling we will be able to better understand the world we live in and we will have a general perspective over the changes that are happening each day. This will bring the decision makers, accurate and relevant data that will allow future long-term development.

REFERENCES

Mihai D., 2012 Suport de curs sisteme informationale geografice an II p 1-25.
Balota O., 2009 Generarea Modelelor Virtuale pentru Localitati Utilizand Tehnici de Fotogrammetrie Digitala p 30.
Imbroane A.M., 2012 Sisteme Informatice Geografice
Petre G.L., Patrascu G.C, Visan A.N., Badea A.C., 2013 Aplicatii GIS in Zone Urbane.
Rahman A.A., Pilouk M., 2007 Spatial Data Modelling for 3D GIS p 17-25.
Fisher P.F., 2004 Developments in Spatial Data Handling p. 112.
Egenhofer M.J., Freska C., Miller H.J., 2004 Geographic Information Science p 15-20.
Xiong H., Shekhar S., 2008 Encyclopedia of GIS.