A GIS - Based Model for Market Analysis, Valuation and Management of Residential Properties into the Greek Real Estate Market

Stefanos GIANNOULAKIS, Nikolaos KARANIKOLAS, Agapi XIFILIDOU, Greece

SUMMARY

This paper is part of an ongoing research concerning the build of a GIS - based model for the integration of sales and rental prices of comparable properties and market values of valuation reports regarding the prices in residential market in terms of market analysis, valuation, monitoring and management with application to the residential sector of Thessaloniki's Real Estate Market.

The Greek Economy continues in the dawn of 2014 the 7th year of recession. The main key characteristics of this recession are the further decrease in households' disposable income, the contraction of investment activity, and the uncertainty regarding the tax environment as well as the rising unemployment. The Greek Real Estate Market (GREM) has long been a pillar of the Greek economy and as a result has been severely affected too. The GREM continues to be characterized by excess supply and falling purchase and rental values as well as by a limited number of transactions.. As a result the uncertainty and the difficulty in valuing properties prices kees thriving. Morever, this problem become more intense by taking into account that in the GREM there is not any database of comparable data regarding Real Estate transactions. In this research, a sample of over 600 comparable sales and rental values of residential properties in the Metropolitan area of Thessaloniki have been gathered and integrated into a geodatabase with in a GIS enviroment for a time period from 2009 till now. The geodatabase includes not only the comparable data, but aslo a great variety of the charactericists for each individual property. At the same time, by using the comparative method, valuations have been conducted for individual properties with similar characteristics based on the comparable data and have also been intergrated to the GIS model. This model offers not only home pricing trends and valuation data but also the techniques and tools for spatial analysis, both of which are prerequisite in order to to construct a sturdy comparative market analysis in the Real Estate Residential sector in terms of valuation, monitoring and management.

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015   1/9

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1. INTRODUCTION

The financial crisis that hit Greece was not caused by any subprime mortgage loan market crisis as in the USA. On the contrary, it was the financial crisis that hit Greece and its real estate market in a drastic way. The real estate market was one of the pillars of economic growth in Greece for many years before the recession. It is indicative that the construction industry contributed 6% - 8% to the country's GDP from 2000 until the financial crisis and occupied almost 7% of the country's labour for the same period (Benos et al., 2011). Nowadays, the main characteristics of the real estate market are weak –almost zero- demand and excess supply, which can be attributed to high unemployment rates and a further contraction in households' disposable income, real estate tax hikes, as well as liquidity shortage against the backdrop of banks' tightened credit standards. Residential property values throughout Greece decreased dramatically during 2013 (-10,3%) following a decrease during 2012, which reached 11,7%. On a cumulative basis residential property values fell up to 34.4% between 2008-2014. The drop in prices was even stronger for urban areas, such as Thessaloniki, the second urban area in Greece and the largest in northern Greece, which reached 37,8% for the same period of time (Bank of Greece, 2014).

Real estate valuations were also hit by the economic crisis reducing their frequency and in some cases their value. More importantly, though, is the increasing difficulty that appraisers appear to have when valuing any king of property. It is common knowledge that the comparative method is the "mother" of all methods and is basically taken into account in different extent in each valuation. The absence of comparative values is a well-known issue for many years in Greece. Unfortunately, Greece does not have any king of database on which the majority and, if possible, all transactions are documented and provided to appraisers, analysts or any scientist, causing an increasing uncertainty on valuations results (Ganos, 2011). Consequently, no clustered spatial data of the transactions exist.

This paper focuses on the assessment of this problem and the proposal of a GIS-based method of documenting, managing and analysing residential property transactions, which can be a useful tool for property valuations as well. It is not the purpose of the paper to define how appraisers will conduct their business, as factors such as experience play a major role, but to make an initial step towards the creation of the first database of transactions with spatial reference for each case.

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015

2/9

2. PROBLEM, METHODOLOGY AND MATERIALS

2.1 Problem

The finding of comparable data for residential valuations has been an issue for Greek appraisers for many years. The unwillingness of real estate brokers, bank and independent appraisers to provide information and feedback on the transactions they managed were the basic causes of the lack of a uniform database. The absence of transactions during the economic crisis added to this problem, increasing the difficulty, especially for new appraisers, in finding enough comparable data.

Countries such as the UK provide free documented data for residential values back from the end of World War I, which initiated the documentation of values so as to assess the damage and destruction caused by the war (GOV.UK, 2015). In the USA, there are many free databases from which different kind of data can be retrieved. The Federal Housing Finance Agency provides house price indexes for metropolitan cities and their subareas (FHFA, 2015), the local building permit information provides information on building permits for any kind of building, for similar buildings with the characteristics entered in the database and for any changes within each property, and lastly, FNC collects data about the changes made to each property and blends those data with current sales to produce indices of home value for metropolitan areas (FNC, 2015). In Greece, the only database of values is the one provided by the Ministry of Economy for the Taxed assessed values (Ministry of Economy, 2015). These values were constructed only for the determination of property taxation during 2007-2008. Therefore, it is clear that Taxed assessed values do not reflect the real estate reality, as they were determined before the economic crisis and in the scope of collecting as many taxed money as possible. The Bank of Greece published indices referring only to the percentage change annually and quarterly for Greece in total and the largest metropolitan areas (Bank of Greece, 2012; Bank of Greece, 2013).

Moreover, due to lack of an information system with real time data regarding market and rental values, the application of the comparative method for valuation tasks, in Greece becomes quite difficult, if not unfeasible. A significant factor affecting the use of comparable evidence in property valuation, in Greece, is that GREM lacks transparency. Details of transactions are rarely publicly available and even when they are published they may be out of date and lack detail. As a result, in Greece, a common practice, that has prevailed among the appraisers in order to be able to apply the comparative method, is to adjust the comparable evidence used in the valuation of property despite not only by the complex nature of most property assets, but also by the fact that property transactions frequently do not fully meet the criteria required to provide good evidence. In order to achieve that, appraisers use special adjustment indices in terms, of technical characteristics of the property such as date, age, floor, accommodations and facilities, view, size, asking price etc. for the comparable evidence to be a 'perfect match' for the property subject to valuation. It should be noted that these adjustment indices are more an acceptance of common experience along these years among the members of the valuation sector in Greece rather than a result of a calculation process (Table 1).

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015   3/9

Adjustment indices used in comparative approach for residential properties	
floor/level	+ - 3%
age of property	+ - 2%
accommodations and facilities: parking space, storage space	+ - 7%, + -3%
view/facade: one sided, two sided	+ - 5%
size	+ - 10%
condition/renovation	+ - 10%
asking price	+ - 10-15%

Table 1. Adjustment indices used in comparative approach for residential properties.

From all the above, it is obvious that the creation of a database of residential property values constitutes a necessity for Greece. This paper aims at presenting a GIS - based model for market analysis, valuation and management of residential properties into the Greek real estate market, a database which provides technical - structural data for each residential property in combination with its spatial reference. This way external factors, such as neighbourhood characteristics, location, distance from infrastructures etc., can be taken into account during valuations or any kind of property analysis. The documentation of socioeconomic characteristics and special environmental factors can be additional information which are not included in the present study, but are analysed and considered on the ongoing research for future incorporation.

2.2 Methodology and Materials

In this section, a detailed description takes place of the methodology that is applied in this research. The methodology consists of three different phases: a design phase, a field service data collection phase and an analysis phase.

2.2.1 Design phase

The nature of the information to be recorded may varies to some extent with the type of residential property being valued. During the design phase, a geodatabase is built within GIS environment regarding the residential property characteristics in terms of location, technical and economic aspects. It is adapted to take account of particular types of residential property and individual circumstances. The list below provides a summary as to the generic headings that should occur in most records. The geodatabase consists of four different thematic sections which are described in Table 2.

A GIS – Based Model for Valuation and Management of Residential Properties Into the Greek Real Estate Market (7767)
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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015

4/9

Unique identifier of residential property in ArcGIS	Spatial characteristics	Technical characteristics	Economic characteristics
a/a	Region	Land Use	Land zone of tax assessed value
FID	Metropolitan Section	Property type	Rate of tax assessed value (€ per sqm)
	City	Property area (square meters)	Tax assessed value (€)
	Municipality	Property's Percentage of co-ownership of the land	Valuation/Property transaction/Leasing property/Property Advertisement
	Address	Year of construction	Valuation method/Information source
	Post Code	Age (years)	Month of data
		Newly Built property	Year of data
		Renovated property	Value type
		Condition	Property Value (€ per sqm)
		Level	Property Value (€)
		Number of bedrooms	Capitalization Rate (%)
		Kitchen type	Rental value (€ per sqm)
		Bathroom/WC type	Rental value (€)
		Orientation	Type of record
		View	
		Facade	
		Elevator	
		Parking space	
		Type of parking space	
		Number of storage rooms	
		Level of storage room	
		Heating type	
		Window frame material	
		Floor-space material	
		Entrance Door type	
		Energy Performance Certificate	
		Arbitrary constructions-Semi-outdoor space/Adjustment-penalty	

Table 2. Overview of the geodatabase.

2.2.2 Field service data collection phase

The value of a property may be influenced by many different factors, each of which can have a significant influence on the outcome. Therefore in order to build a sufficiently robust basis of evidence which can then be applied with confidence to the property being valued, information were collected from a range of sources creating an initial sample of over 1000 data regarding mainly residential selling and leasing transactions, valuation reports and less asking prices, for the period 2009-2014 (December and June of every year), at the Metropolitan area of Thessaloniki, Greece.

2.2.3 Analysis phase

At the analysis phase, because of the diverse nature of the property market and the relatively small number of transactions available to provide evidence and due to poor and failing GREM's conditions, the initial sample of comparable information need to be carefully scrutinized, assessed and analyzed in detail before it can be used as evidence in a valuation.

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015   5/9

The available data were entered to the GIS environment and by using spatial analysis tools and techniques the false market values were identified and excluded from the geodatabase. The synthesis and the spatial allocation of the sample after the quality control is being represented in Figure 1. Moreover Table 3 represents the time frame of the selected data for the period of 2009 to 2014.
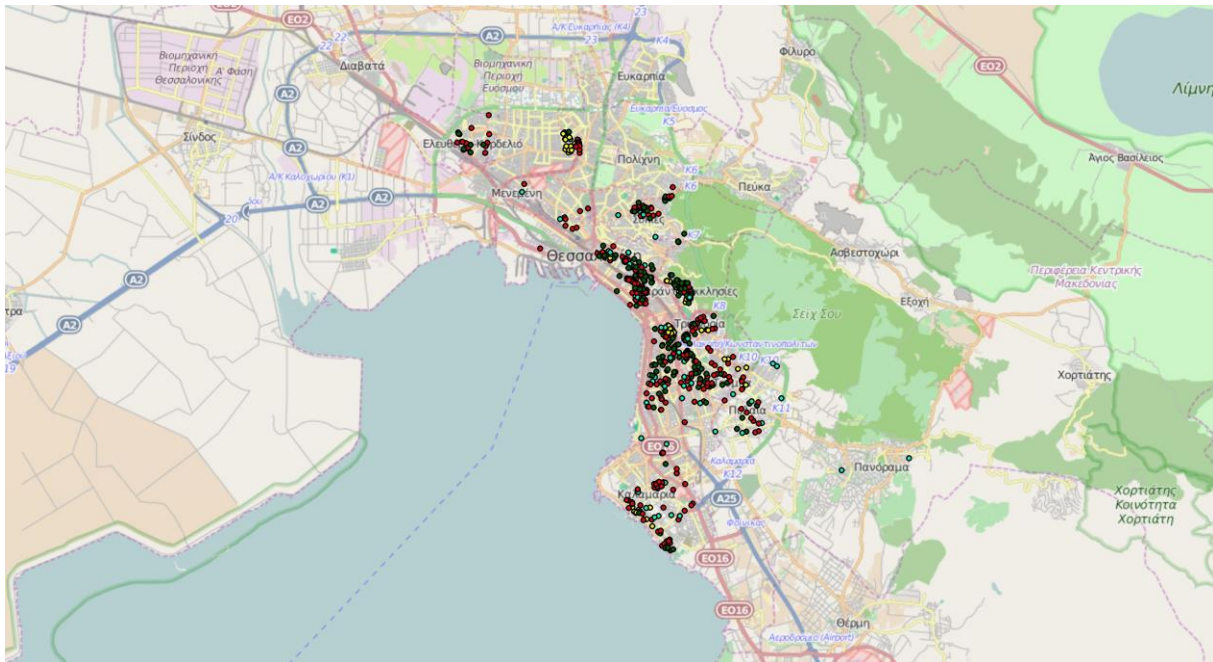
Type of values -Thessaloniki Metropolitan Area	690
● Comparable Sales Prices	309
● Valuation Reports	87
● Asking Prices	85
● Capitalized Values based on Rental Values	209

Figure 1. The synthesis and the spatial allocation of the available data after the quality control at the Metropolitan Area of Thessaloniki.

Type of values -Thessaloniki Metropolitan Area	2009	2010	2011	2012	2013	2014
Comparable Sales Prices	23	-	66	17	81	122
Valuation Reports	9	5	6	5	40	22
Rental Values	-	34	-	17	-	34
Asking Prices	-	-	1	5	79	124

Table 3. Data along with time reference.

Information for each record is summarized in a form that is easily comprehensible and aids analysis within GIS environment. Comparable evidence can be entered and ranked in terms of relevance and importance along with the spatial reference allowing efficient analysis of what is often a large and complex body of data. An example of this is process is provided as Figure 2, below.
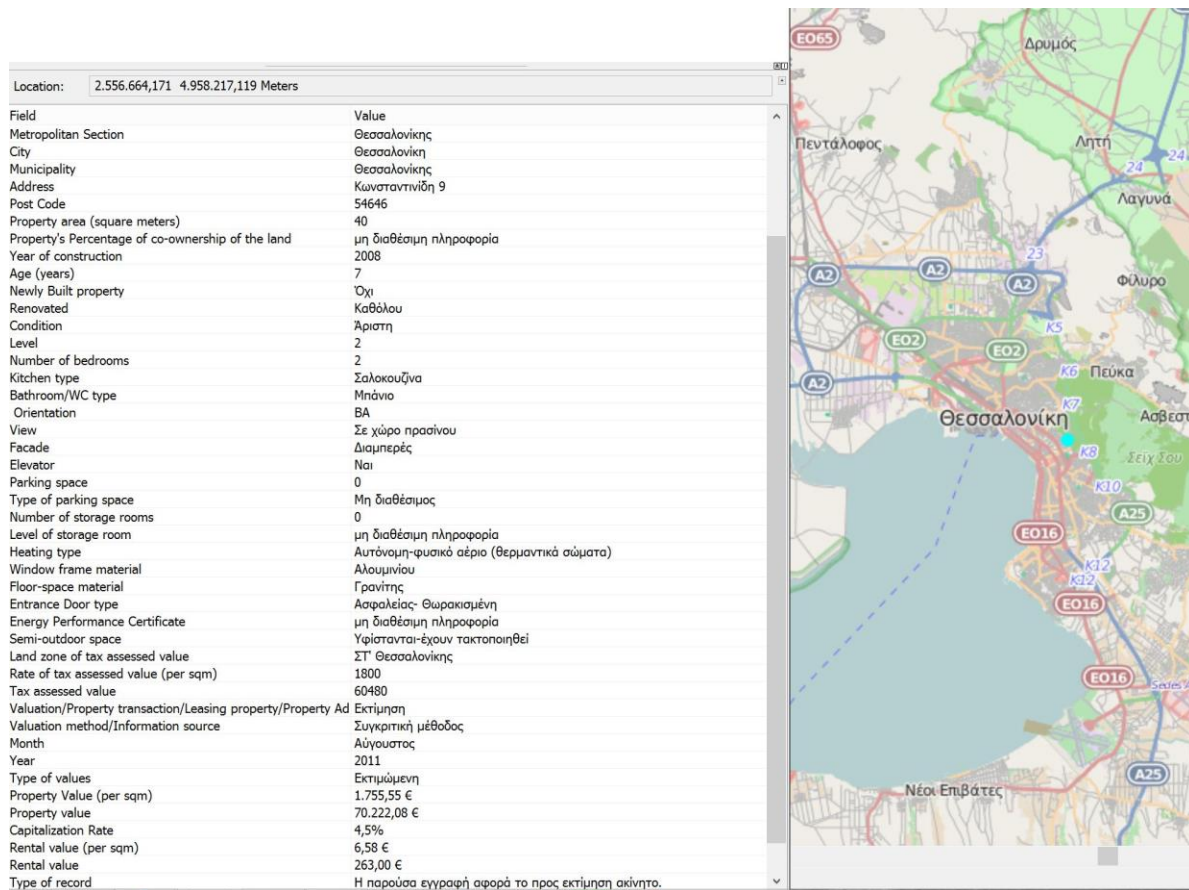
Location:	2.556.664,171 4.958.217,119 Meters
Field	Value
Metropolitan Section	Θεσσαλονίκης
City	Θεσσαλονίκη
Municipality	Θεσσαλονίκης
Address	Κωνσταντινίδη 9
Post Code	54646
Property area (square meters)	40
Property's Percentage of co-ownership of the land	μη διαθέσιμη πληροφορία
Year of construction	2008
Age (years)	7
Newly Built property	Όχι
Renovated	Καθόλου
Condition	Άριστη
Level	2
Number of bedrooms	2
Kitchen type	Σαλοκουζίνα
Bathroom/WC type	Μπάνιο
Orientation	ΒΑ
View	Σε χώρο πρασίνου
Facade	Διαμπερές
Elevator	Ναι
Parking space	0
Type of parking space	Μη διαθέσιμος
Number of storage rooms	0
Level of storage room	μη διαθέσιμη πληροφορία
Heating type	Αυτόνομη-φυσικό αέριο (θερμαντικά σώματα)
Window frame material	Αλουμινίου
Floor-space material	Γρανίτης
Entrance Door type	Ασφαλείας- Θωρακισμένη
Energy Performance Certificate	μη διαθέσιμη πληροφορία
Semi-outdoor space	Υφίστανται-έχουν τακτοποιηθεί
Land zone of tax assessed value	ΣΤ' Θεσσαλονίκης
Rate of tax assessed value (per sqm)	1800
Tax assessed value	60480
Valuation/Property transaction/Leasing property/Property Ad	Εκτίμηση
Valuation method/Information source	Συγκριτική μέθοδος
Month	Αύγουστος
Year	2011
Type of values	Εκτιμώμενη
Property Value (per sqm)	1.755,55 €
Property value	70.222,08 €
Capitalization Rate	4,5%
Rental value (per sqm)	6,58 €
Rental value	263,00 €
Type of record	Η παρούσα εγγραφή αφορά το προς εκτίμηση ακίνητο.

Figure 2. Information provided for the selected record through GIS environment.

3. CONCLUSION AND DISCUSSION

In conclusion the first results of this research approach to build and apply an expert system for market analysis, valuation and management of residential properties into GREM, appear to be quite encouraging and promising. For the first time, in GREM, an expert system integrates a great variety of data of Real Estate transactions, valuation reports and asking prices to a GIS environment and gives the necessary tools to view, understand, interpret, and share data in many ways by examining and displaying data in a spatial context.

Although the research is at an earlier stage, two prospects are being seriously considered for the near future. The first is to transform this system to a web Real Estate Appraisal Map Server, in order to be able to produce and publish the most current and accurate information possible for the purpose of developing property valuations at residential sector. In addition, it is also being considered, to evolve the system into an automated valuation model (AVM) that will real time monitor and calculate a property's value at a specific point in time, by taking into account market value, rental value along with capitalization rates, tax assessed value, asking prices, previous surveyor valuations, all pertinent information on the property in question (e.g. number of bedrooms, property improvements, etc.), historical house price movements and an analysis of the sales of like-kind properties along with the spatial reference.

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015

7/9

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BIOGRAPHICAL NOTES

Stefanos Giannoulakis is a PhD Candidate (awarded a PhD scholarship after written exams by the Greek State Scholarships Foundation (I.K.Y.)) on Real Estate analysis (appraisal, valuation, planning, development & management) in the School of Rural and Surveying Engineering (R&SE), Faculty of Engineering (FE) of the Aristotle University of Thessaloniki (AUTh), Greece. He graduated from School of Rural and Surveying Engineering, AUTh, (2008) and received an MSc on Cadaster & Spatial Analysis, AUTh (2009). Meanwhile, he is finishing his second MSc on Real Estate Investment and Finance of Herriot Watt University in Edinburgh, Scotland (UK). He has attended numerous conferences and has published multiple articles in proceedings and journals. He is a member of the Laboratory of Photogrammetry and Remote Sensing in the School of Rural and Surveying Engineering, AUTh, and he has participated in various research programs in Geoinformatics and Real estate management. Moreover he is a trainee member (chartered valuation surveyor via assessment of professional competence) of Royal Institution of Chartered Surveyors (RICS), and also a permanent member of the Hellenic Valuation Institute (ELIE), of the Association of Greek Valuers (AVAG), and of the Technical Chamber of Greece (TEE).

Dr. Nicolas Karanikolas is an Assistant Professor in the School of Spatial Planning and Development Engineering, Faculty of Engineering, Aristotle University of Thessaloniki. His research interest focuses mainly on issues Cartography & Geography, GIS, and Real Estate Valuation. He has published 3 books, more than 80 papers in international and national journals and conferences, has participated in more than 15 research projects funded by EU

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015

8/9

and national sources, 2 as supervisor of the project and participated in more than 60 national and international conferences.

Agapi Xifilidou is a PhD Candidate on Real estate analysis in the School of Rural and Surveying Engineering in Aristotle University of Thessaloniki, Greece. She graduated from School of Spatial Planning and Development (Eng.), AUTh (2010) and received an MSc on Environmental Protection and Sustainable Development, AUTh (2011). Meanwhile, she is finishing her second MSc on Real Estate Investment and Finance of Herriot-Watt University in Edinburgh, Scotland. She has attended numerous conferences and has published over 20 articles in proceedings and journals. She has participated in two research programs on Geoinformatics and Real estate management, and on Deposition and Documentation of Geographic and Socioeconomic Data.

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FIG Working Week 2015
From the Wisdom of the Ages to the Challenges of the Modern World
Sofia, Bulgaria, 17-21 May 2015   9/9