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The Possibilities of Real Estates Market Development in Poland in Connection with INSPIRE Directive***

1. Inspire Directive and Its Implementation in Poland Concerning Cadastral Parcels

1.1. Inspire Directive and Data Specification on Cadastral Parcels

As we know in the year 2007 the directive establishing an Infrastructure for Spatial Information in the European Community, commonly cold INSPIRE directive [2] came into power. The directive has several targets. Inter alia, it should enable to combine spatial data from different sources across the Community in a consistent way and share them between several users and applications. According to the INSPIRE directive, it should be possible for spatial data collected at one level of public authority to be shared between other public authorities and spatial data should be made available under conditions which do not restrict their extensive use. It also should be easy to discover available spatial data and to evaluate their suitability for the purpose and to know the conditions applicable to their use.

The INSPIRE directive should apply to spatial data held by or on behalf of public authorities, where spatial data means any data with direct or indirect reference to a specific location or geographical area. According to the INSPIRE directive these data should be in electronic format.

One of spatial data themes named in annex 1 to the INSPIRE directive is “cadastral parcels”. They are described as areas defined by cadastral registers or equivalent. The second important for researches made in this paper spatial data theme is “buildings” (defined in annex 3).

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*** This work is financed from funds for science realized at the Department of Geomatics, AGH University of Science and Technology, allocated for the year 2011

One of the purposes for applying the cadastral parcels data in accordance with the INSPIRE Data Specification on Cadastral Parcels [3] are the socio-economic analyses. Hence the authors argue that attributes like property values may be useful in the implementation and use of the INSPIRE directive.

1.2. The Act on Spatial Information Infrastructure

On March the 4th 2010, the lower house of polish parliament (Sejm) accepted the act on spatial information infrastructure [5] that transponds the INSPIRE directive into the polish law system.

According to this act, the cadastral data are defined in the same way as in the Order on Cadastre for Grounds and Buildings [8]. That means that they are continuous areas of land contained in one cadastral precinct, are legally homogenous and are separated by boundary lines. The theme "buildings" is defined as geographical location of buildings.

To explain problems concerning real estates data in Poland, the two systems where such data are collected are presented below.

2. Systems Containing Information on Cadastral Parcels and Real Estates in Poland

There are two systems containing information on cadastral parcels and real estates in Poland. The first is the Land Register, whereas the other is the Cadastre for Grounds and Buildings.

2.1. The Land Register

The Land Register in Poland [4] captures, keeps and reveals information concerning legal objects (real estates). This information generally concerns description and designation, rights, rights established for somebody else thing and receivables (including mortgage). Data concerning description (parcel number, area and boundaries) are taken from the Cadastre for Grounds and Buildings. The Land Register is managed by the courts of law. The Land Register objects in Poland are mainly real estates. The real estate may consist of land parcels, buildings or flats. The most typical real estate consists of land parcel (parcels) and building (buildings). The main aims of Land Register are revealing the legal state of every estate and assuring the proper real estates turnover.

2.2. The Cadastre for Grounds and Buildings

The Cadastre for Grounds and Buildings [6] data are mainly objects spatial description, cadastral objects attributes, values and corresponding official docu-

ments. The Ground and Building Cadastre is managed by the local authorities at the county (powiat) level. The Ground and Building Cadastre objects are cadastral parcels and buildings or flats being separately owned estates. The most common cadastral objects are land parcels. The integral part of Ground and Building Cadastre is the Register of Prices and Values for Real Estates.

3. The Possibilities of Estates Data Practical Application for Real Estates Market Development

3.1. State of the Art

The free market economy has been restored after many years in Poland in 1989. Then there was the beginning of real estate market development. This makes the major obstacle for possible use of valuation methods that have been successfully used for many years in well developed markets. Thus the idea to grow the valuation methods for the low- and medium-developed markets was born. It enables the valuation of not only single- or multi-element properties, but the property sets as well.

In the conducted studies of world literature no such methods have been found. This is caused by several hundred years long progress in valuation methods adapted to ever-growing real estates markets, for which there is the possibility of finding similar real estate transactions. The problem of adequate amount of information concerning transactions lack occurred in countries where the political and economical transformation were carried out. The presented proposal of valuation methods is destined for this type of narrow markets. The value of property is derived from both legal and spatial data. It is linked to the specific spatial real estate.

3.2. Valuation Models

The Register of Prices and Values for Real Estates [8] is the data set containing information on real estates transactions and results of estates valuation. The public notaries and real estates valuers are obliged by law to send this information to the local authorities managing cadastre [6]. The information on price in the authenticated deed usually concerns the whole estate as it has been bought.

The transactions concerning estates having composite structure make the substantial or even major part of all real estates transactions in Poland. Composite structure means that the estate being subject of trade consists of elements having

different prices. The real estate may consist of land and building (or buildings). The land itself may include parts that have different soil classes or destination in local spatial plan, so its unit prices are different.

There is no information on estate elements (like parcels or buildings) prices in the authenticated deed, so we do not know land or building elements separate prices. Such information is very difficult for interpretation and conclusion reaching. Without knowing prices of elements that make the estate it is not possible to use them for spatial data themes “cadastral parcels” or “buildings” defined by inspire directive.

The problem of defining the separate real estate elements unit prices has not been yet solved by either polish law or other regulations, but it is possible to find that values using statistical methods. In such cases two different statistical estimation models can be used – parametrical or conditional [1].

The parametrical estimation model may be used for well developed estates markets with numerous transactions (broad market), whereas for poorly developed markets with small transaction numbers (narrow market) the conditional estimation model is possible for application.

The real estate market in Poland is relatively young, for the free market economy has been functioning here for only twenty years. The real estates transactions number is not very high yet, so the polish real estate market should be rather treated as a narrow market. In this case the conditional estimation model ought to be used for real estates separate elements prices computation.

For such calculations, real estates should be separated into groups. The criteria are their destination in local spatial plan and type of buildings, erected on the ground. To divide transaction price into separate estates parts prices, it is necessary to set equations for each estates group.

Generally, the equation has the following formula

$$C_{Tj} = S_1 \cdot c_1 + S_2 \cdot c_2 + \dots + S_i c_i \quad (1)$$

where:

C_{Tj} – transaction price for whole j -estate,

S_i – the area of every i -element (parcel, parcel parts having defined soil classes, flat or building usable areas or whole building),

c_i – i -element unit price.

The number of transactions is often smaller than the number of deliberated estates elements, so the estates prices conditional model should be used for estimation process.

To separate complete transaction price into estates parts prices we may write conditional equations as follows

$$S_1 \cdot (\tilde{c}_1 + \delta_1) + S_2 (\tilde{c}_2 + \delta_2) + \dots + S_i (\tilde{c}_i + \delta_i) = C_T \quad (2)$$

where:

- C_T – transaction prices for the whole estate,
- S_i – parcel area or arable land area with qualified soil class or complete building area as estate i -element,
- \tilde{c}_i – i -element approximated unit price,
- δ_i – i -element approximated unit price random remainder.

If we multiply and group the similar objects in formula (2), we will receive the conditional model for estate unit prices as follows

$$S_1 \cdot \delta_1 + S_2 \cdot \delta_2 + \dots + S_i \cdot \delta_i = C_T - S_1 \cdot \tilde{c}_1 - S_2 \cdot \tilde{c}_2 + \dots - S_i \cdot \tilde{c}_i \quad (3)$$

This equation constant term is the difference between transaction price C_T and model price C_M of deliberated real estate. The model estate price is calculated from areas multiplication products of area and approximated unit prices particular estate values. So the formula has the following form

$$C_M = S_1 \cdot \tilde{c}_1 + S_2 \cdot \tilde{c}_2 + \dots + S_i \cdot \tilde{c}_i \quad (4)$$

The estates prices conditional model application is going to give proper results only if the appropriate estate components prices approximations \tilde{c}_i have been calculated earlier. The estate components prices depend on real estates market localization. The proposed method can be used for agricultural, forest or real estates of any kind. The ratio of land value to building or other objects value does not matter.

3.3. Practical Example

The conditional model of unit prices is going to give correct market solutions only when estates element unit prices approximations \tilde{c}_i , appropriate for analyzed market have been presumed. Various estates markets may be characterized by different values of estates elements unit prices. The real estates markets reference levels may be estates elements unit prices proportion coefficients.

The valuation coefficients may be used for agricultural or forest estate value estimation. They are provided in the order in case of real estates valuation and preparing appraisal report [7] in tabular format. The valuation coefficients for arable land are presented in the table 1.

The valuation coefficients for permanent grassland and permanent pastures are presented in the table 2.

Table 1. The valuation coefficients for arable land

Tax district	The valuation coefficients given in quintals of rye grain obtained from 1 ha of arable land								
	Land soil classes:								
	I	II	IIIa	IIIb	IVa	IVb	V	VI	VIz
I	145	132	118	100	80	60	35	15	8
II	126	115	103	86	70	52	30	12	5
III	110	100	90	75	60	45	25	10	1
IV	94	85	76	64	50	38	20	6	1

Table 2. The valuation coefficients for permanent grassland and permanent pastures

Tax district	The valuation coefficients given in quintals of rye grain obtained from 1 ha of permanent grassland or permanent pastures						
	Land soil classes:						
	I	II	III	IV	V	VI	VIz
I	145	118	93	67	35	13	5
II	126	103	80	58	30	10	3
III	110	90	70	50	25	8	1
IV	94	76	60	43	20	5	1

The three transactions from the year 2005, concerning agricultural estates, have been selected for market analysis. These estates consist of arable land, permanent grassland and permanent pastures having different land soil classes.

We have following information obtained from authenticated deeds:

Estate number 1:

Arable land – class II, area: 1.2500 ha.

Arable land – class IIIb, area: 2.7200 ha.

Grassland – class II, area: 3.3400 ha.

Grassland – class III, area: 1.8400 ha.

Pasture – class IV, area: 2.2300 ha.

Transaction price: 160 000 PLN.

Estate number 2:

Arable land – class IIIb, area: 3.3800 ha.

Grassland – class III, area: 2.9400 ha.

Pasture – class IV, area: 3.8600 ha.

Transaction price: 120 000 PLN.

Estate number 3:

Arable land – class II, area: 4.7400 ha.

Grassland – class II, area: 3.8900 ha.

Pasture – class IV, area: 2.4200 ha.

Transaction price: 176 000 PLN.

The valuation coefficients u_i for tax district III (tabs 1, 2) have been used for determining shares of elements value in the value of the whole estate. Calculations necessary for establishing approximate values \tilde{c}_i estates elements unit prices and constant terms ΔC are presented in the table 3.

Table 3. The list of approximate values and constant terms for conditional model

	Arable land class II	Arable land class IIb	Grassland class II	Grassland class III	Pasture class IV	$\sum_i S_{ji} \cdot u_i$	C_{Tj}	U_j	ΔC_j
u_i	100	75	90	70	50	Tax district III			
S_{1i}	1.25	2.72	3.34	1.84	2.23	869.9	160000	183.9	25
S_{2i}	0	3.38	0	2.94	3.86	652.3	120000	184.0	42
S_{3i}	4.74	0	3.89	0	2.42	945.1	176000	186.2	2196
\tilde{c}_i	18390	13793	16551	12873	9195	–	–	$U_M = 183.9$	

The matrixes for transaction prices for these three similar estates have the following formula:

$$\{S_w\} = \begin{Bmatrix} 125 & 2.72 & 3.34 & 1.84 & 2.23 \\ 0 & 3.38 & 0 & 2.94 & 3.86 \\ 4.74 & 0 & 3.89 & 0 & 2.42 \end{Bmatrix}, \quad \{\Delta C\} = \begin{Bmatrix} 25 \\ 42 \\ 2196 \end{Bmatrix},$$

where $\{S_w\}$ – the prices matrix for parametrical model.

The vector $\{\hat{\delta}\}$ estimators and vector $\{\hat{c}_i\}$ estates elements unit prices and estimators of residual variance ($\hat{\sigma}_0^2$) have the following formula:

$$\{\hat{\delta}\}^T = \{ 415 \quad -212 \quad -103 \quad -83 \quad 260 \},$$

$$\{\hat{c}_i\} = \{18805 \quad 13581 \quad 16448 \quad 12790 \quad 9455\},$$

$$(\hat{\sigma}_0^2) = \frac{\{\hat{\delta}\}^T \{\hat{\delta}\}}{j} = 100749.$$

The standard deviation vector for estimated estates elements unit prices gets the subsequent values

$$\{\sigma[\hat{c}]\}^T = \{177 \ 225 \ 106 \ 271 \ 188\}.$$

The estimated estates elements unit prices fill all model conditions for deliberated estates transaction prices. It enables finding values for estates of similar structure i.e. consisting of arable land, grassland and pastures.

4. Recapitulation

Continuous market changes in countries that at the end of the last century began transforming a socialist economy to a market economy cause significant instability of real estates markets. This often leads to lack of possibility to use information on sold property prior to subsequent amendments to the law. Hence the proposal for the method of valuation for markets with a limited number of information that can be used in statistical analysis has been prepared.

The majority of real estates in Poland are complex estates. They usually consist of land and building or buildings. The land itself consists of elements having different unit prices. The estate can also include one or more various buildings. When purchasing real estate, the price for the whole estate is registered. The estates elements prices are not known.

The idea presented in this paper enable us to obtain real estates elements unit prices applying statistical methods, in the case of polish estates market it is conditional estimation model. This procedure is not defined by polish law. However, authors think that its application may be helpful in INSPIRE directive implementation in Poland if we consider themes cadastral parcels and buildings in the aspect of its value evaluation.

The paper is the complete version of work presented at the INSPIRE conference "Inspire as a framework for cooperation" taking place in Cracow on 22–25 June 2010.

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