Peripheral Rural Areas around Poznań and Their Value Measured with Economic Indicators

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Abstract

In the era of consumption — appropriation of rural areas located in the metropolitan region of Poznań it seems reasonable to estimate their material value. According to authors of publications on environmental services: Mizgajski, Lowicki, and authors discussing problems of sustainable development of rural areas in Poland, such as Kistowski, Matczak, and Myga-Piątek, the economic value of the natural environment is important from the point of view of geographical environment management, both at the local and regional level. The example of peripheral areas in the metropolitan region of Poznań serves to allow the authors of this study to present the approach of preparation of an economic card for the efficiency of agricultural space. The research objective was to present an evaluation of economic opportunities achievable with different classes of soils that are subject to subsequent transformations to a non-agricultural land use. The estimation of economic values based on indicators of costs and income from 1 ha of arable land, and their comparison to the indicators included in projections of financial results made for local spatial development plans allow determination of the actual value of rural areas which, as a result of suburbanization, were consumed by residential and economic stimulation.

Keywords: suburbanization, sustainable development, rural areas

Introduction

In the era of consumption — appropriation of rural areas located in the metropolitan area of Poznań it seems reasonable to estimate their material value. According to authors of publications on environmental services: Mizgajski (2009), Łowicki (2012), and authors discussing problems of sustainable development of rural areas in Poland, such as Kistowski (2009), Matczak (2009), and Myga-Piątek (2010), the economic value of the natural environment is important from the point of view of geographical environment management, at the local and regional level. A selection of peripheral areas in the metropolitan region of Poznań is a good scientific example for presenting a research approach that enables creation of an economic card of the efficiency of agricultural space. Suburbanization is one of the phases in the process of urban development (urban sprawl). That process leads to irreversible, adverse changes in the landscape, among others fragmentation of ecological corridors of green infrastructure and cutting off the city from the natural environment. Uncontrolled development of rural areas and gradual degradation of the landscape require full inventory and registration of spatial and landscape conflicts. Therefore, there is a need of development of effective methods of protection and proper management of the landscape through defining spatial policy anticipating effects of contemporary socio-economic processes within the studied urban agglomeration. The research objective was to present valuation of economic opportunities achievable with different classes of soils which are subject to subsequent transformation of the agricultural function into a function of spatial development. Estimating economic value based on indicators of costs and income from 1 ha of agricultural land and comparing them to projections of

financial results made for local development plans allow us to determine the actual value of rural areas which, as a result of suburbanization, were consumed for residential and economic stimulation purposes.

The authors wonder whether the results obtained in the form of economic indicators can be a prerequisite for urban planners, investors and environmentalists in the transformation of appropriate rural areas for non-agricultural purposes.

1 Research issue: the degree of anthropogenization of rural areas in the light of economic indicators

According to Raszeja (2002), attempts to define the landscape were made for legal purposes in order to unify and standardize formal possibilities of spatial management. National and European legislation propose different definitions of landscape, classifying them on the basis of various characteristics such as the naturalness, cultural values or the degree of transformation or anthropogenization. The Benelux Convention of 1982 states that the landscape can be considered a reflection of the community approach to the environment, and the way in which it interacts with the environment. In the Netherlands, however, the report of 1992 drawn up by the Ministry of Fishery and Environment defines landscape as a visible part of the earth's surface, resulting from interaction of various factors: climate, terrain, water, soil, vegetation, animals and people (Raszeja 2002). Using a more traditional approach to landscape as a subject of protection, Raszeja reports that in Switzerland, where there is currently no legal definition, the purpose of the Federal Act of 1995 was the protection of rural landscapes, places associated with the past, natural resources and monuments. The process of change in the landscape takes place at the moment of the establishment of villages. Historical transformation in the landscape was initiated from the original landscape, through natural, to cultural effects. The modern landscape is a result of evolution. As a consequence of uncontrolled development of rural areas, the progressive degradation of the landscape requires full recognition and registration of spatial and landscape conflicts (Raszeja 2002); this enforces a strong need for developing effective methods of protection and proper management of the landscape. In the process of human exploitation of natural resources, the landscape is subject to constant transformation and its most important feature is its variability. The scale of risks, especially of rural areas, is reflected in part in chaotic building structures disregarding the architectural and landscape specificity.

A proper approach to landscape as a rural area requires separation of the primary agricultural function of this landscape from the approach of appropriation of agricultural land for residential use. In his research, Łowicki (2012) presents a new economic approach to the landscape, estimating its value for development and in this way he stresses the benefits of keeping the landscape elements in a good condition. Studies show that landscape has important advantages for people. According to Łowicki, it is reflected in the price which a buyer is willing to pay for a property. Also Kistowski (2009) discusses the economic dimension of the landscape. He sees risks arising from the fact that greater distance from city centers results in decline of land prices and the value of products and services. This approach was used by the authors of this study, who attempt to parameterize the value of rural and agricultural landscape. According to Kistowski, mining of construction materials (clay, boulders, sand, gravel) which is concentrated in rural areas, causes adverse effects in agrosystems resulting from construction and modernization of roads. The main factor that affects the rural areas is a type of spatial development. This applies to the process of suburbanization, including residential buildings, shopping centers with car parks, industrial facilities, and development of networks of heavily used roads. Kistowski concludes that these actions cause irreversible destruction of environmental resources and fragmentation of corridors that cut off cities from natural facilities. Transformation of rural areas is a threat resulting from changes in the agrarian structure. On the one hand, it concerns fragmentation of plots, e.g., for the purposes of development, and their integration into large properties on the other. Also introduction of new plant species, e.g. energetic, has negative impact on ecosystems. Maintaining the features of rural landscape requires actions, such as preservation of alleys, the order of exposition in manor

parks, introduction and protection of midfield shelterbelts/vegetation in agricultural areas, restoring natural areas (e.g., ponds) (Kistowski, Lipińska, and Korwel-Lejkowska 2006). So, is the rural landscape a cultural environment? According to Myga-Piątek (2010), almost every European landscape is the work of man, a proof of the intellectual maturity of society, degree of environmental awareness, and the ability of landscape management. Continuing this thought, the landscape is the image of a region through which we can read its history and try to predict the future. That is why attention should be paid to the creation of buffer zones around areas of high natural value (e.g., increasing the density of forest borders and areas located near the forests). As an example, Żarska's (2005) research confirmed the importance of forest islands in the agricultural landscape for different species of mammals (e.g., rodents). So, are we able to manage the landscape? The answer is yes. Myga-Piątek (2010) states that an „aesthetically correct" landscape becomes a subject of trade. Participation of society in the benefits and costs requires thinking about the landscape, among other issues, by introduction of learning content concerning aesthetics and care for its beauty. On the basis of a review of literature concerning rural areas, the authors of the present study conclude that rural areas should be understood as arable lands, managed agriculturally in a form of farm and animal production.

2 Methodology, research methods applied and sources of information about rural areas

The aim of the research was to determine the spatial and statistical data concerning rural areas under agricultural management in context of suburbanization processes that take place in Polish cities of metropolitan regions. As a case study, the selected research area — the peripheral zone of the city of Poznań, allowed us to build a conceptual algorithm estimating the agricultural land value (ALV). Such a research objective presented an attempt to actual valuation of the rural space intended for suburbanization purposes in terms of economic profitability of a building plot. Property price is one of the criteria of valuation of rural areas. Valuation of rural areas is based on quantitative data, such as acreage, soil class, price of a building plot, infrastructure costs, costs of crop production, etc. These parameters/characteristics allow valuation of a selected land property. The valuation procedure is based on data obtained during the field study, statistical or geographical (spatial) databases. The authors of this paper using their own data and generally available data propose to carry out valuation of the rural area in the peripheral zone of the city of Poznań, based on generally available agricultural-environmental data in order to build the algorithm estimating the agricultural land value (ALV).

When estimating the impact of landscape on the property price the following elements are taken into account: terrain, the presence of forests and lakes, type of buildings. They all allow estimating the measurable benefits, which result from maintaining landscape elements in a good condition and thus reducing losses, which may result from, for example, location of industrial plants. High variability of terrain is associated with the degree of difficulties in mechanical land cultivation. The authors have knowledge of the complexity of components, which are taken into account in the agricultural land valuation. Specific elements that influence the valuation of such areas, quoted in the publication by Bajerowski, increase the importance in the algorithm built by the authors, as for example, the slope – the degree, which is an expense in the crop cultivation, is also a construction expense (Bajerowski, Biłozor, and Cieślak 2007).

Less economical transport is also a problem related to agricultural production: longer driveways, consumption of more fuel contribute to the emission of additional substances that cause environmental degradation and reduce the quality of produced goods.

Spatial and statistical data accessible to the general public were acquired from the following databases:

- Database: Agricultural Property Agency, which performs tasks arising from the policy of the state concerning the creation and improvement of the area structure, restructuring and privatization of the State Treasury property used for agricultural purposes, administration of property resources of the State Treasury intended for farming purposes. This range of spatial and

statistical data provides information about the areas used for agriculture, which in case of transformation into other purposes, require use of certain administrative and legal procedures.

- Database: Agency for Restructuring and Modernisation of Agriculture which implements co-financing instruments of the EU budget in agriculture and rural areas; and provides financial assistance from national funds for purposes of economic support of agricultural production and the purchase of machines and equipment, increasing the level of technology in agriculture. The acquired data on the level of additional investments of rural areas has the actual rural dimension of the economic value of agricultural space. This database allows us to obtain information in the form of economic indicators constructed by the authors of the ALV algorithm. Beneficiaries of funds in this database are farmers, rural residents, entrepreneurs working for agriculture, and local governments.
- Database: Local Data Bank is engaged in providing information at the level of a village, commune, district or province.
- Database: Central Statistical Office (CSO), particularly the National Agricultural Census, includes generalized results of a representative land use survey, crop area in individual farms, statistical reports on the land use, structure and area of sowings in spatial administrative systems, both in the private and public sector. Information acquired from this database are an important source in form of indicators such as „sown area in the community."
- Databases of institutions such as the Ministry of Agriculture and Rural Development, Agricultural Market Agency, Institute of Soil Science and Plant Cultivation, District Centre for Geodetic and Cartographic Documentation or Agricultural Advisory Centre in Poznań include details of the strategy of sustainable rural development, agriculture, development of the agricultural area in terms of crop and animal production. This data is part of the algorithm estimating economic value of the rural area.

3 Individual research

The authors of the study used the data presented above and prepared an analysis of selected levels of information from the published material *Study on the spatial development of the Poznań Agglomeration of 2012* (Kaczmarek, Kaczmarek, and Mikuła 2012) concerning the agricultural space and its qualifications. For the implementation of the research objective involving the identification of economic indicators estimating the value of agricultural lands, there were chosen sample data from the level of Murowana Goślina municipality and the level of a farm. For both subjects there were proposed economic indicators.
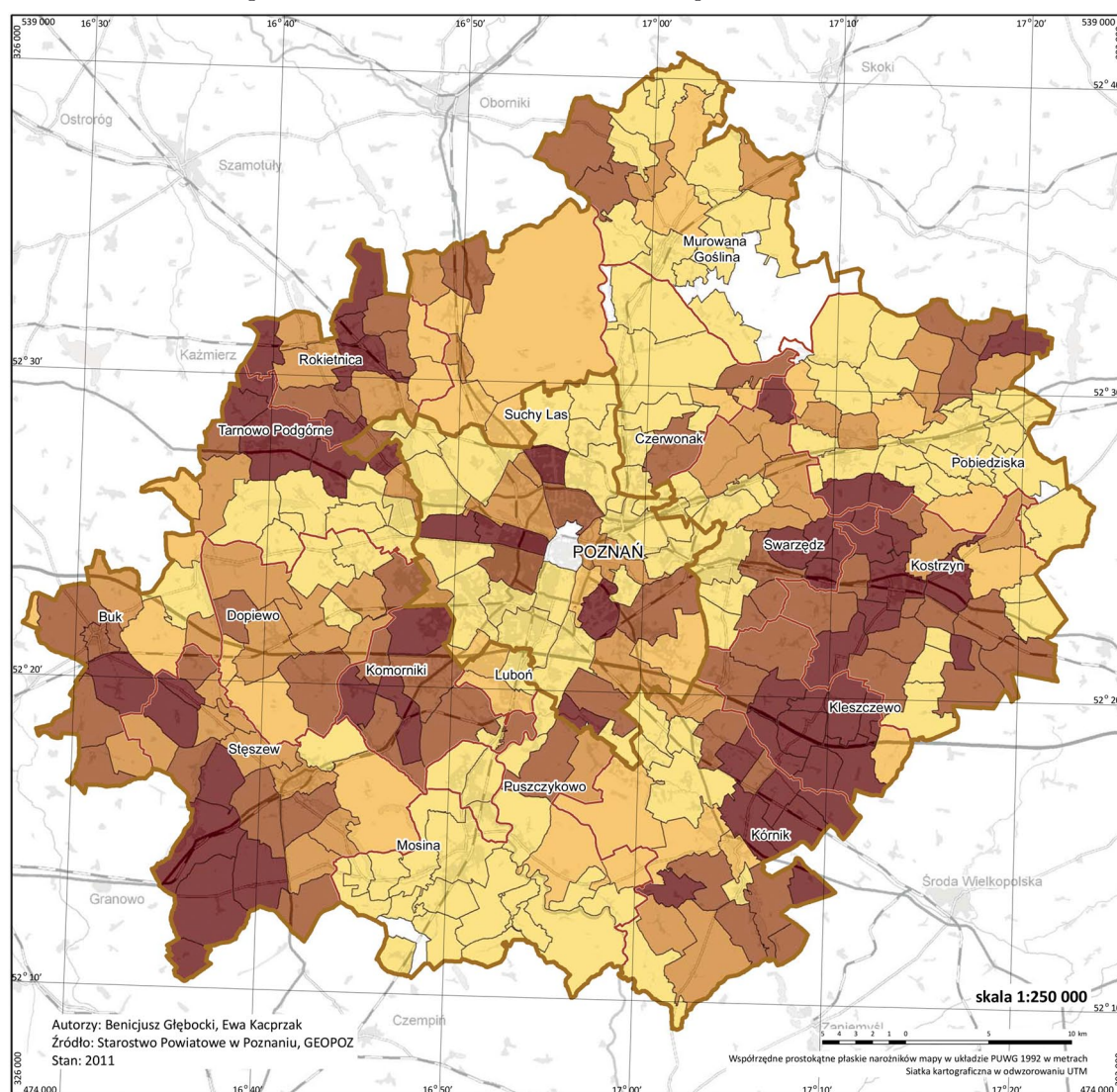
For the analysis at municipality level there were chosen the following data allowing indexation in a form of economic indicator:

- share of the area of a given soil and agricultural complex
- soil valuation classes
- soil use structure
- share of arable land in villages
- exclusion of agricultural land from agricultural production
- real estate trading, including sale of plots and increase in residential development in municipalities. The attached map of soil valuation classes within metropolitan area of Poznań shows that "the greatest share in the structure of arable land quality have soils of IV class (48,9%). Soils of classes IIIa and IIIb comprise 28% of the area of the agglomeration." (Głębocki, Kacprzyk, and Maćkiewicz 2012)

Data obtained from the databases and the cited study for the Poznań agglomeration served as a basis for selection of statistical indicators in the form of: percentage share of soil classes in the municipality, percentage of area at risk of use change, and volume of land property trading expressed by supply and demand.

In order to make the approach of indexation of arable land with economic indicators more detailed, statistical analyses were performed at the level of a farm in which arable land is used for agriculture, and production allows economic valuation of components of crops, such as winter wheat,

Map 1. Location of the research area—metropolitan area of Poznań

The structure of arable land capability classes by communes

The area of arable lands (in hectares)

10 000
1 000
100

Land capability classes

RII
RIIIA
RIIIB
RIVA
RIVB
RV
RVI
RVIZ

scale 1:1 000 000

**The share of good quality arable lands
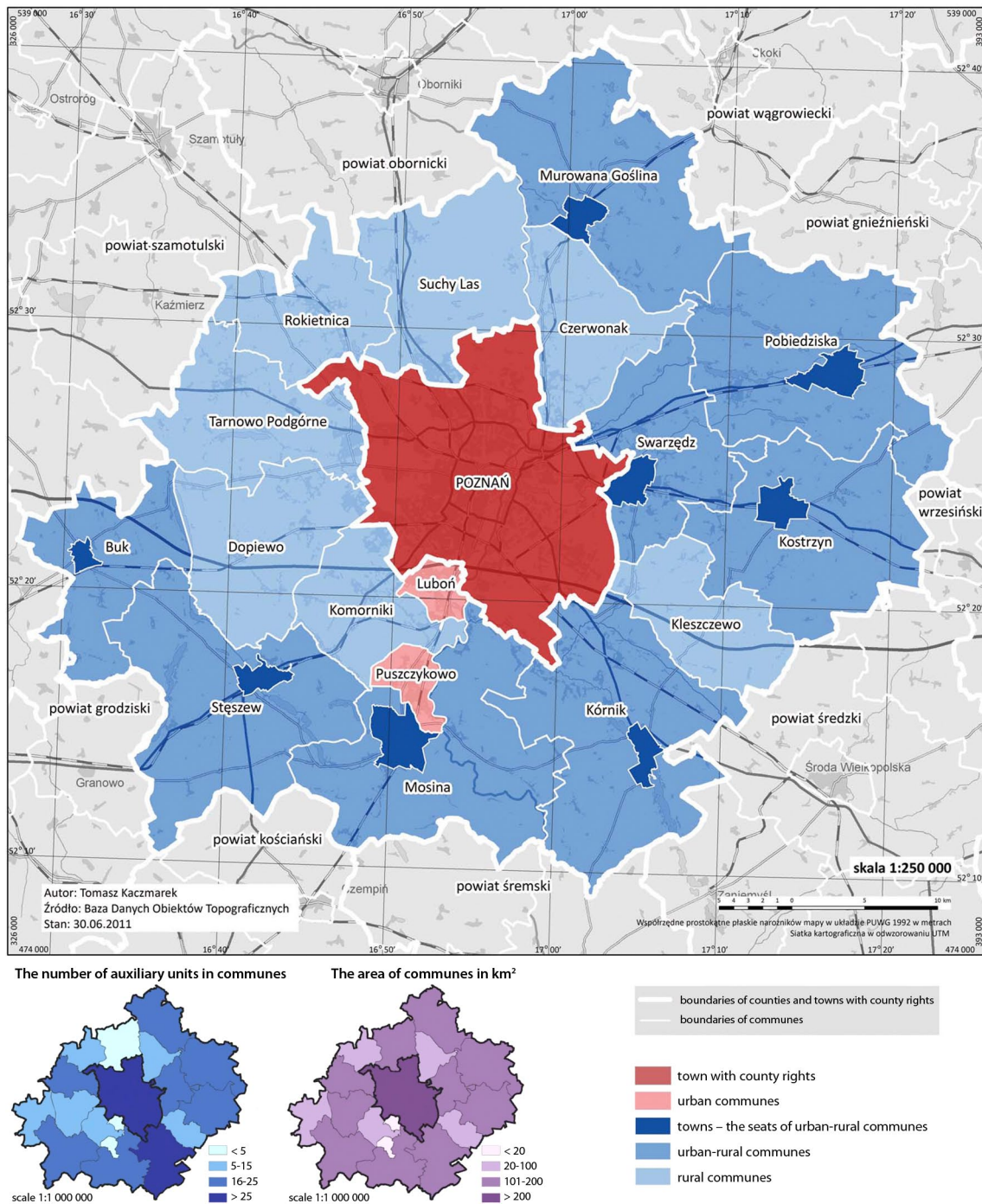(land capability classes: II, IIIa, IIIb, IVa, IVb)
in the total area of arable lands (%)**

none   < 60   60-70   70-80   80-90   > 90
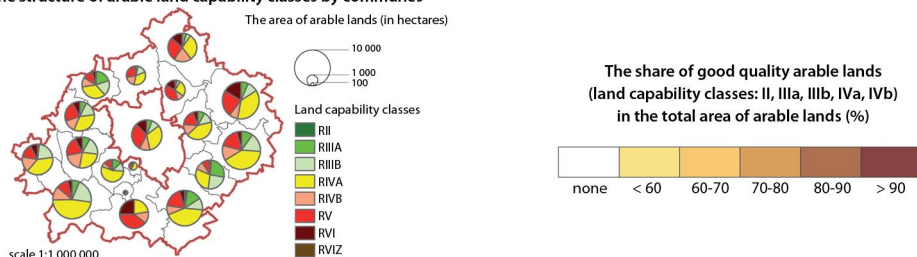
Source: Map previously published in *Studium uwarunowań rozwoju przestrzennego aglomeracji poznańskiej*, edited by T. Kacz-marek, L. Kaczmarek and Ł. Mikuła, p. 66. Courtesy of Tomasz Kaczmarek, Benicjusz Głębocki and Ewa Kacprzak.

oilseed rape, maize, etc. Such examples of crops were used for analysis of costs associated with the type of agro-technological procedures, fertilizers, plant protection products and the costs resulting from these activities. After adding combined cost of taxes, crop insurance, subsidies and financial result from the value of production/yield, there was obtained a profit made from 1 ha. This value, in the form of the inancial result, becomes an actual measure of annual economic value of one hectare of arable land per year. Statement of profit from 1 ha/year in the period of time—e.g., taking 20 years of agricultural use, we get the amount of PLN 3 589 × 20 years = PLN 71 720, as specified in table 1.

Map 2. The structure of valuation classes of arable land by municipalities

The number of auxiliary units in communes

< 5
5-15
16-25
> 25

scale 1:1 000 000

The area of communes in km²

< 20
20-100
101-200
> 200

scale 1:1 000 000

boundaries of counties and towns with county rights
boundaries of communes

town with county rights
urban communes
towns – the seats of urban-rural communes
urban-rural communes
rural communes

As a result of analysis, in terms of the types of crops on a specific area of arable land taken from the agricultural census for the studied municipalities characterized as rural in the metropolitan region of Poznań, we obtain measurable economic value of rural areas. Comparing this data with projected trading of the land for development in spatial policies of municipalities, we obtained the basis for the ALV algorithm of economic value of rural areas.

Annexation of rural areas by non-agricultural use is illustrated by included aerial photographs that picture typical agricultural landscape in the study area (fig. 1), a strip of agricultural land occupied by local communication investments (fig. 2) and universal transformation of rural areas intended for development (fig. 3).

Tab. 1. Winter wheat, light soil, valuation class IVA-IVB

| Crop in the main field | Winter wheat | | | Component kg/ha | | | | | cost/ha |
Type of activity	name of pesticide/fertilizer	dose of pesticide/fertilizer	observations	N	P	K	Mg	Ca	(PLN)
Disking									36
Tillage		936+G-B	Cost of pesticide + labour + amortization						115
Placement of fertilizer	K orn K ali-40K-6MG-12S P olidap 18N-46P-5S	250 kg 100 kg/ha		27	69	6	0,9		600
Wheat sowing	Kuban	250 kg/ha							450
Spraying	Leader 750 E C-0,3 l/ha, Tebu-250 E W-0,5 l, Atac 450 E C-0,5 l								80
Spraying	Mustang 306 S E, Plonvit Z, Spartak Alpha 380 E C, Antywylegacz 375 S L Tolurex 80 WP								250
Placement of fertilizer	Ammonium sulphate	400 kg/ha		136					540
Placement of fertilizer	RSM	200 l/ha		64					190
			Tax + insurance						150
			Cost in total	227	69	6	0,9	0	2 411
Value of production			90 × 60 dt						5 400
Subsidies			1 000						1 000
			Financial result						3 589

Fig. 1. Characteristic rural landscape in the metropolitan area of Poznań. Photo by A. Kijowski

Fig. 2. Construction of national expressway S11 crossing agricultural landscape regardless of the soil class and type of crop. Photo by A. Kijowski

Fig. 3. Residential development completed on the basis of provisions of local spatial plans in a rural area. Photo by A. Kijowski

Summary

The algorithm of valuation of rural areas is a conceptual approach which was to identify a methodological procedure with the use of agricultural land valuation techniques in terms of their entering the real estate market. Investors interested in agricultural land intended for agricultural purposes look for real economic indicators describing the economic value of these lands and hence their market profitability.

The presented approach concerning sources of information about agricultural space together with the hierarchical approach as to the level, availability, specificity of information up to the level of the individual farmer, allowed the authors to build a general „economic" algorithm. It is a result of the components included in the matrix of dependencies causing economic valuation of rural areas that perform agricultural function and remain under the pressure of suburbanization processes. The hypothesis put forth by the authors of this paper is: valuation of rural/agricultural areas in the metropolitan area of Poznań based on the ability/profitability derived from the agricultural lands along with a long-term financial prognosis should provide an answer to the question of the cost of converting agricultural areas into construction zones. For this purpose the authors build a valuation algorithm that takes into account various components, which are included in the valuation of a land property and the costs of its conversion. Projections of financial consequences made for local development plans make it possible to determine the actual value of rural areas consumed by residential suburbanization and economic stimulation. The economic valuation based on indicators of costs and income from 1 ha of agricultural land and their comparison with economic indicators provided by the various agencies working for agriculture provided a market estimation evaluating rural areas. The algorithm proposed by the authors is:

ALV is a function of components which take the form of quantitative data as economic indexes/indicators valuating the agricultural space.

$\text{ALV}_{\text{(agricultural land value)}}$ is a function of B > R > K > D > T > P > O > S > G. . .,

where:
B — soil valuation class
R — crop type
K — production costs
D — value of subsidiesvalue of subsidies
T — period of a financial forecast
P — indicators of plant and animal production indicators of plant and animal production
O — distance from urban areas and transport connections
S — indicators of agricultural census
G — data/spatial indicators

By substituting the proposed indices/quantitative indicators to the algorithm we obtain the collective cost of, for example, 1 ha of agricultural land in a given valuation class in a given period of financial forecast in relation to the investigated metropolitan area of the city of Poznań. To illustrate this quantitative approach, the following result can be presented:

ALV for 1 ha/IVa and IVb class, cultivation of winter rape, municipality Murowana Goślina, forecast for 20 years, profit by production price will be PLN 52 360.

It is possible to provide such data for different crops. The authors would like to emphasize this fact by attaching table 1 presenting cost of production and profit for winter wheat. Selection of peripheral areas in the metropolitan area of Poznań for the study is a good example presenting a research approach enabling creation of an economic card of efficiency of agricultural space. It is also a source of spatial information which is illustrated by the maps and photographs provided in this study.

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