

## ASSESSMENT FOR DETERMINATION POSSIBILITIES OF LAND USE ECONOMIC EFFICIENCY

Vivita Baumane, Armands Celms, Aivars Ratkevics

Latvia University of Agriculture

vivita.baumane@llu.lv; armands.celms@llu.lv; aivars.ratkevics@apollo.lv

**Abstract.** Basis of agricultural production is land use efficiency. Correct and effective land use could solve several problems - food production, improving the welfare and provision of social stability. Efficient land use has impact on the different types of factors, which are mutually contradictory. For the analysis of land use of certain crop production, the main indicator is productivity, land use for livestock production is the main indicator on 100 ha. When assessing the land use in all sectors of the farm as a whole, it is necessary to apply the comparable cost indicators. For comparison of land use efficiency other types of land use equalization for notional arable land were used. In turn, the main indicators of mutual farms for comparison are weighting of arable land. The main finding is that uniting characteristic indicators of land use efficiency one of the most important factors affecting the performance of agriculture – land quality must be considered.

**Keywords:** land use efficiency, indicators of efficient land use, land quality.

### Introduction

Correct and rational use of land and obtaining the largest possible production from each hectare – it is a difficult task because land in agriculture is a complex of natural conditions, being different in each site, and can be used for different purposes and needs. Moreover, for individual pieces of land depending on their location, relief and soils, there is different responsiveness to investment of labor and the means of production. Differences in land quality and location determine the direction of specialization and location of crops, as well as industrial relations of crops and livestock. Land quality affects crop yields, costs of production, and efficiency of agricultural production [1; 2]. Differences in land quality make unequal conditions of economic production in agriculture. It has also resulted in unequal indicators of production. The economic efficiency of land use is to be understood as the management level of land. This level is characterized by the production of one unit area and its costs.

Economic efficiency of land use in different time periods in Latvia is researched by Boruks A., Locmers M., Zusevics J., Vitola I., Dobele A., in the world Volkov V., Polakov P., Masikamae S., Aleknavicius P., Aleknavicius A., Kostianen J., and other specialists and scientists. The authors' research has proven that economic efficiency of land use is influenced by different factors. The research results of these authors were compared and seen as a significant difference of opinion. Thus, at present the questions of economic efficiency of land use are open to discussion.

The land resources affect complex and efficient operation of agriculture, as well as economic, social and political stability. Rational use of land resources is the basis for the stability of agricultural production [3]. There is a need for such a mechanism in the state, which determines the requirements of effective land use for the owners of real property.

The aims of the paper are to explore these contradictions and to present proposals for determination of economic efficiency of land use. Therefore, the paper tasks are determination of the indicators of efficient land use which should be systematically related and characterize land use in different sectors and in agriculture overall.

### Materials and methods

The study used the State Land Service data from the Statement of Land about municipalities and the whole of the state in the period from 2004 to 2013 have been used in the study.

The data analyzed are based on the Cabinet of Ministers Regulations No.562 "Regulations on classification procedures of land and criteria for determining of types of land use", where the categories of land use and types of land use have been defined.

For data analysis the method of statistical data analysis and method of dynamic rows analysis were used. The EXCEL statistical functions were used in analysis of the statistical data.

Dynamic rows in statistics are called successive meanings row of statistical indicators, which numerically characterize any phenomena on processes in time [4]. The essential importance of

dynamic rows is the sequence of row members – its members cannot change with the site or other wise change their ranking, because it can change the characterizing indicators of the dynamic rows and lose all sense of dynamic rows. Each next member of dynamic rows is associated with the previous member. Change indicators of dynamic rows are obtained by comparing two levels of dynamic rows. If every dynamic row level is compared with the previous level, changes in the chain indicators are obtained. If all dynamic series levels are compared with the level of the first row, changes of the base indicators are obtained. It follows that for each dynamic row the change of the base indicators can be calculated, the number of which is about one less than the number of levels. The dynamic levels can be compared by deducting the first level from the second level or by dividing the first level with the second level. Chains absolute increase is determined by subtracting the previous row level from the current level of the row (1):

$$\Delta_{m(c)} = y_m - y_{m-1} \quad (1)$$

The base absolute increase is determined by subtracting from the current level of row the first row level or base level (2):

$$\Delta_{m(b)} = y_m - y_1 \quad (2)$$

Absolute increases are distinctly level units of row. This study unit is ha.

The chain growth rate (3) must be obtained by dividing the current row level with the previous level, but the base growth rate (4), is divided by the current level of the row with the first level. Growth rates are expressed as parts of number one. By multiplying it by 100, we obtain the growth rates in percentage.

$$T_{m(c)} = \frac{100y_m}{y_{m-1}} \quad (3)$$

$$T_{m(b)} = \frac{100y_m}{y_1} \quad (4)$$

The increase rate of the chain and base obtained from the growth rate of the chain and base subtracting 1 (100 %) (5; 6):

$$t_{m(c)} = T_{m(c)} - 100 \quad (5)$$

$$t_{m(b)} = T_{m(b)} - 100 \quad (6)$$

The increase rates well as the growth rate can be expressed as a number one in parts or percentage. In the study they are expressed as percentage. The model of economic efficiency and the model for assessment of land use efficiency are designed as theoretical models, based on the empirical research method, which is used to develop the general statement from separate facts or to determine regulatoryies.

## Results and discussion

Land classification of types of land use exists in all countries, but it varies depending on the user's system. Dedicated units depend primarily on the general state level of culture and development of the farm, on the nominated requirements of the national economy and the possibility to obtain information for each land classification unit [6]. In Latvia there is united classification of types of land use, which is binding for all public institutions and local governments, as well as the owners of land and other persons. The classification procedure and criteria of types of land use are regulated by 21 August 2007 Cabinet of Ministers regulations No.562 "Regulations on classification procedures of land and criteria for determining of types of land use" [5]. These regulations determine that the type of land use is land characteristics in accordance with the natural characteristics the current economic land use that meets the classification of the types of land use. The types of land use in the area are determined by assessing the territory in compliance with the laws and regulations specified by the criteria for determining. Land is classified in land use categories and in types of land use [7].

The analysis area of the land use categories in about 10 – year period is showing significant changes (Fig. 1). The area increase is observed in land use categories – land under buildings and courtyards and forest, which is largely related to the situation of economics in the country (from 2005 to 2007), when significant areas of land of agricultural use were transformed in to other land use categories and types of land use.

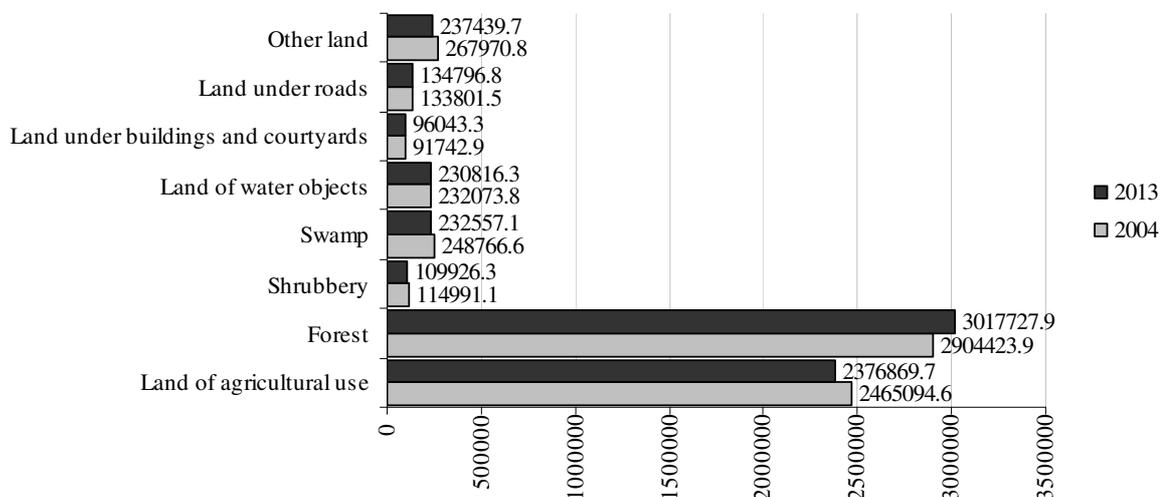


Fig. 1. Area of categories of land use (2004, 2013), ha

Agriculture land use is the land use category which consists of the following types of land useable, orchards, meadows and pastures. The analysis of agriculture land use showed that municipality areas of agriculture land use in 2004 are 2456284.90 ha, however in 2007 the area is decreased to 2433719.90, which is less than 0.92%. In 2013 in relation to 2007 the area of agriculture use increased gradually by 0.58%. Comparing the years 2004 and 2013 the area of agriculture land use decreased by 0.34%. The area of agriculture land use in 2013 is 2447824.20 ha, it is 38.2% from the total area of municipalities. However, the analysis of the total area of Latvia with the method of dynamic rows has shown a decrease in the indicators of chain and base (Table 1).

Table 1

Indicator changes in the rows of land of agriculture use

Indicators/ thousand ha	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Chain absolute increase,	-	-5.6	-11.0	5.3	-9.2	-4.1	-6.6	-20.5	-11.8	-14.0
Base absolute increase	-	-5.6	16.6	-21.9	-31.1	-35.2	-41.8	-62.3	-74.1	-88.1
Chain growth rate	100	99.8	99.6	99.8	99.6	99.8	99.7	99.2	99.5	99.4
Base growth rate	100	99.8	99.3	99.1	98.7	98.6	98.3	97.5	97.0	96.4
Chain increase rate, %	-	-0.2	-0.4	-0.2	-0.4	-0.2	-0.3	-0.8	-0.5	-0.6
Base increase rate, %	-	-0.2	-0.7	-0.9	-1.3	-1.4	-1.7	-2.5	-3.0	-3.6

In chain absolute increase and base absolute increase reduction in the area is observed, base absolute increase analysis shows, that in relation to 2004 base year the area of agriculture land use in Latvia decreased by 88.1 thousand ha. After chain absolute increase between the chain indicators the greatest decrease is observed between 2010 to 2011. Decrease of agriculture land use is a major problem in Latvia, as well as according to the collected information by the Ministry 13.1% of the land of agricultural use is not farmed, but 2.1% is overgrown. Therefore, a more and more topical question in Latvia is the efficiency of land use.

Currently, in Latvia no regulations determine how effectively land should be used and what criteria are used to determine how to assess whether and how much land is used efficiently; also, what should be the economic efficiency of land use. Having summarized the opinions of foreign authors, the authors of the paper have developed a theoretical model of economic efficiency (Fig. 2.).

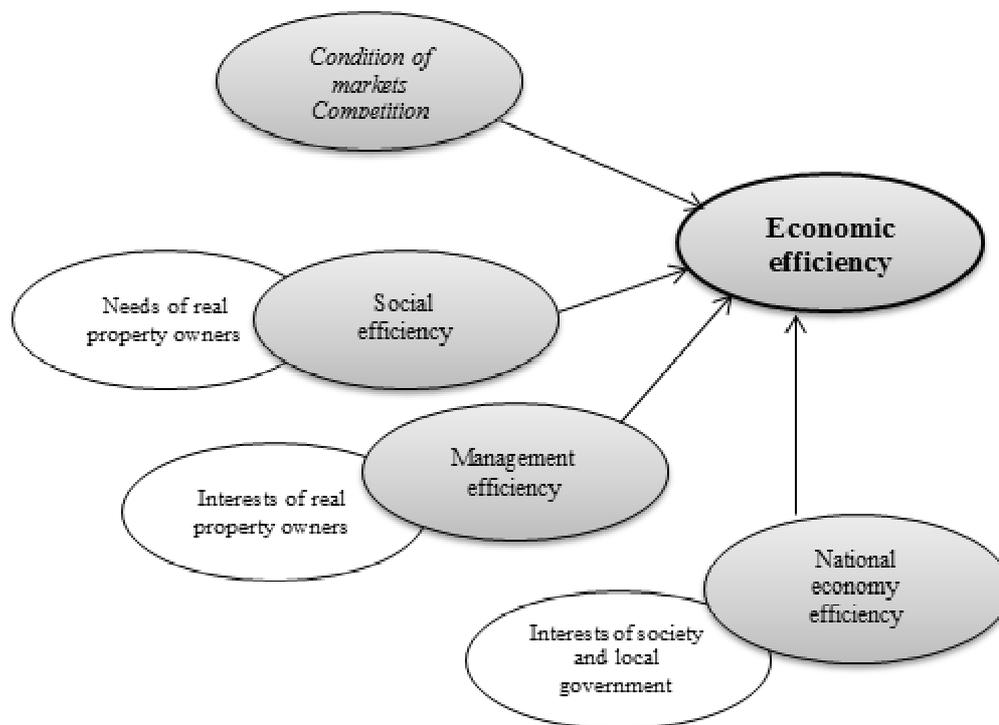


Fig. 2. Theoretical model of economic efficiency

The model is based on the needs and interests of the property owners, as well as public and local interests. Economic efficiency is formed from the social efficiency, management efficiency and the national economy efficiency, which, in turn, is influenced by the needs and interests. National and the EU regulations determined the market conditions and options of competition, which also have become the constituent elements of economic efficiency.

The economic efficiency of land use in agriculture is the management level, which is characterized by the production quantity and the costs per unit area. The main indicators of economic efficiency of land use are [8]:

- recoupment of expenses;
- share of gross products per unit area;
- share of gross income per unit area.

Currently it is difficult to perform such analysis because there are no publicly available data of economic efficiency, which characterize the general situation. Currently assessing the available indicators, which can be used to describe the efficiency of land use by farming types, it was found that they do not completely reveal the situation, because they do not provide full information about all conditions of agricultural production. In this situation, it is necessary to classify the indicators for assessment of land use efficiency of agricultural use land. Therefore, the authors offered a model for the assessment of land use efficiency (Fig. 3.). This model with clarifications can be adopted as the basis of a complex for assessment of land use efficiency. One of the major indicators of efficiency of agriculture production is labour productivity; therefore, this aspect was not included when the model for assessment of land use efficiency was created. The major indicators of efficiency of agriculture production are based on the land quality, which was taken into account when the model was developed. Also because of the increasing level of scientific and technical progress, increasing degree of automation in production processes, the necessity of manual labor is significantly reduced; therefore, there are differences in the structure of costs.

The main indicator for assessing the efficiency of land use is the indicator of the relation of the produced gross agricultural production per unit area of farmland on dedicated types of land use to the corresponding indicator of products, which can be obtained in these types of land use at an accessible level of development of productive forces in the regions.

Analytical study of regional differences in the efficiency of land use is an important prerequisite in the justification of the ways to improve the distribution of branches of agriculture in different types of land use. The efficiency of territorial concentration of agricultural production assumes a finding that the optimal ratio of crops and livestock based on their form of organization in accordance with natural and economic potential territory, therefore depends on the land quality. Therefore, the model of assessment of land use efficiency includes two models – the model for crop production and the model for livestock production.

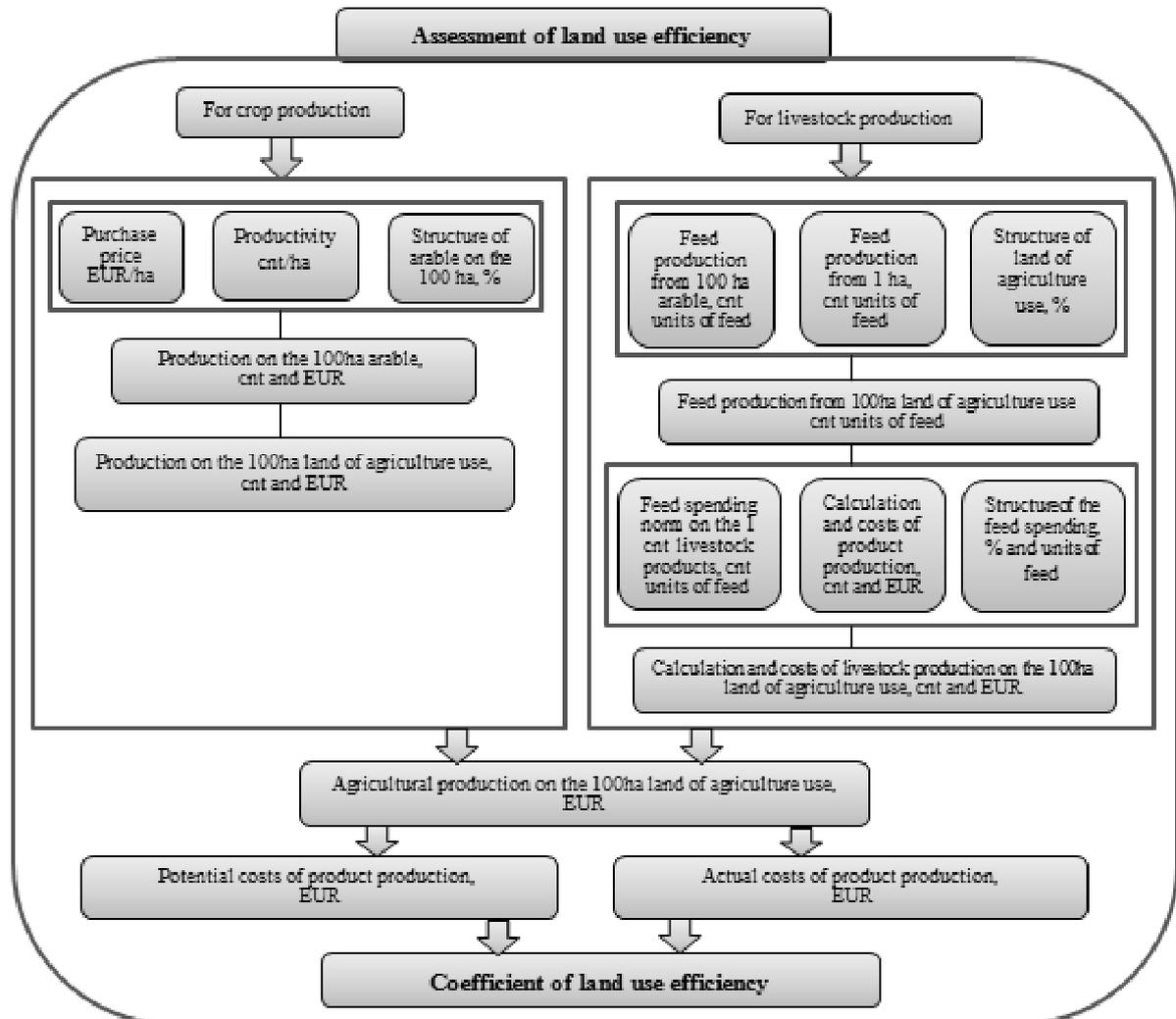


Fig. 3. Model for assessment of land use efficiency

Finding the most appropriate areas of localization of individual livestock industries should be based on an analysis of regional differences in the ratio of productivity and production costs that determine the efficiency of production of certain types of feed, as well as their combinations in certain proportions required for different groups of farm animals. Depending on the results of this analysis formation of the basis for the production of types of agricultural enterprises should be based on the sectors of agricultural products, where you can get them with the lowest cost on the basis of national economic management of land and other natural and material resources. The territorial units, within which differences are investigated in the efficiency of production of major agricultural products are generalized types of land use; it is the parts of the territory, characterized by the relative homogeneity of agro-climatic zones and soil conditions.

The main commodity crop in Latvia is grain farming. The unequal efficacy of the sectors caused by the quantity of the production costs per unit of area and yield of crops. The characteristic features of the soil and land use and land quality have the most significant differentiating influence on the yield of these crops in the territory in question. For the efficiency of different branches of livestock indicators characterizing the level of intensity livestock systems, methods of organization fodder base, productivity of dairy herd, production costs and the cost of production of meat, milk and wool were analyzed.

Potential livestock are calculated taking into account the overall yields of feed per 100 hectares of land of agriculture use. Sectorial livestock production per unit area of land of agriculture use is calculated based on production of feed on 100 hectares of agricultural land in feed units, share feeds spent on products production of the species in general consumption of feed and the amount of feed consumption per unit volume of these products.

The efficiency of agriculture land use is the basis for the improvement of agricultural holdings areas in Latvia. Such an analysis is necessary to answer the question: what is the most effective land use territorial concentration of production of various crops and livestock products, when the agricultural products can be obtained at the lowest cost based on the rational use of land resources.

### Conclusions

1. Over the last ten years the area of land use category – land of agriculture use – decreased by 3.6 %, the main reason being the lack of policy for land use efficiency in the country.
2. The model of economic efficiency is formed from social efficiency, management efficiency and the national economy efficiency, which in turn, is influenced by the real property owners and government needs and interests, as well as the condition of the market and competition.
3. The developed model for assessment of land use efficiency can be a basis for determining efficient land use in Latvia.
4. The uniting characteristic indicators of land use efficiency must be considered as one of the most important factors affecting the performance of agriculture – land quality.

### References

1. Boruks A. Zemes izmantošanas efektivitāte. Rīga: Zinātne, 1982, 224 lpp.
2. Zušēvics J. Ievads agrārpolitikā. Rīga: Ražība, 1994, 288 lpp.
3. Побегайлов О.А., Погорелов В.А. Оценка наиболее эффективного варианта землепользования (Assessment the most effective options of land use). Электронный научный журнал «Инженерный вестник Дона», 2012. (In Russian)[online][15.12.2013.]. Available at: <http://www.ivdon.ru/magazine/archive/n2y2013/1686>
4. Krastiņš Ģ. Statistika un ekonometrija. Rīga. 1998, 268 lpp.
5. Noteikumi par zemes lietošanas veidu klasifikācijas kārtību un to noteikšanas kritērijiem. 21.08.2007. [online] [15.12.2013.]. Available at: <http://likumi.lv/doc.php?id=162207>
6. Zemes izmantošana un kadastrs Latvijā. A. Boruka redakcijā. LLU Skrīveru zinātnes centrs un LR VZD. Rīga, 2001, 409 lpp.
7. Parsova V., Jankava I. Zemes lietošanas veidu izmaiņas atkārtotā zemes kadastrālajā uzmērīšanā. Geomatics, Scientific Journal of Riga Technical University. Rīga. 2010, 57-62 lpp.
8. Мишина, З. А. Экономическая эффективность использования земель сельскохозяйственного назначения в Нижегородской области (Economic efficiency of agricultural land in the Nizhny Novgorod region), (In Russian). Вестник НГИЭИ. Выпуск 5(6). – Княгинино: НГИЭИ, 2011. - с.39-50.