

Land Fragmentation and the Need for the Land Consolidation in Estonia

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1. Introduction

The fragmentation of land is a result of different factors and reasons. It is inevitable in some extent and in some cases the result of objective reasons. But there are also subjective reasons for land fragmentation. The land fragmentation is common for rural areas of Estonia. It concerns agricultural and forest land first of all.

As of 31 March 2006 altogether 80.9 percent of the area of Estonia (4522.7 thousand hectares) has been registered in the Land Cadastre. The total number of registered parcels (cadastral units) is approximately 500 thousand (by cadastral data of Estonian Land Board).

The reasons of land fragmentation in Estonia are different but the ideology of land reform is playing notable role in it. It is stated in the Land Reform Act (State Gazette 1991, 34, 426) that:

Land is returned according to its former boundaries unless otherwise provided by this Act, planning and land readjustment requirements or by agreement between adjacent neighbors who are entitled subjects...

The restitution of land to its former boundaries was the common practice even though there were the options to follow the planning or land readjustment requirements. The chance to prepare land consolidation plans was used very seldom and on relatively small areas. We can not talk about good practice and good experiences of land consolidation projects in Estonia at present. The Estonian state authorities (Ministry of Agriculture and Land Board) are not concerned with the issues of land consolidation. The dominating ideology is that the free market (including free land market) can solve most problems of development. Therefore few people are speaking about land consolidation in Estonia at present.

The main aim of this contribution is to analyze some aspects of land fragmentation in general. The presented opinions in this paper are based on the experiences of the ongoing investigation the land fragmentation issues in rural areas of Estonia. Not all the aspects of land fragmentation are covered in this paper. The attention is been paid to the following issues:

- Average size of parcel as an indicator of land fragmentation;
- The problem of internal fragmentation of parcels;
- The shape of parcels and land use conditions.

2. The Average Size of Parcels and Landholdings as an Indicator of Land Fragmentation

The parcel or landholding area is the first and main parameter if to describe the single parcel or to characterise the land use conditions for some region. The average figures have been used in statistical reports for example. There is no doubt that the parcel area (no matter a single plot or average figure for some region) is giving useful information for planners, politicians and other decision-makers. The average size of parcels is been used also for

assessment of the land fragmentation. The average size of parcels and/or landholdings has been used if the land use conditions of different countries or other regions are compared.

But one can ask some question in this connection. Is the size (average size in particular) the main and best indicator to describe the land fragmentation? How does it describe the land fragmentation? Does the average size of the parcels describe all aspects of land fragmentation? There is not a universal answer to those questions. The land fragmentation is complicated and complex phenomenon actually. The average size of parcels or landholdings as an indicator of land fragmentation has the advantages and disadvantages.

The main advantage of average size of parcels or landholdings as an indicator of land fragmentation is the fact that it can be easily calculated. There is no need to carry out special tasks. The initial data for calculations are in different registers (e.g. land cadastre) as a rule. The people can easily understand the sense of the average size. It is quite important if working with people who are not familiar with the essence of land fragmentation.

The main disadvantage of average size of parcels and/or landholdings is the fact that it does not describe the distribution of parcels by size. The average figure will “hide” the variability and differences of parcels sizes. The same average result (e.g. 11 hectare) can be result of very different initial figures, for example:

$$\text{a) } (11 + 11 + 11 + 11)/4 = 11$$

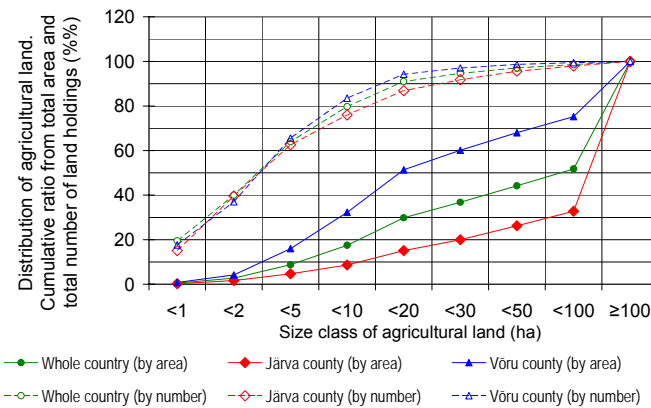
$$\text{b) } (5 + 10 + 10 + 19)/4 = 11$$

$$\text{c) } (1 + 1 + 21 + 21)/4 = 11$$

Let us suppose that optimal (reasonable from economic point of view) size of parcel is 20 ha at least and let us examine the cases of the example. The first conclusion might be that the average size of parcel is almost two times less than optimal size. It happened if we do not know the distribution of the parcels by size. All the parcels (100 percent) are less than optimal size in the first case (a). In the second case (b) 75 percent of the parcels by the number of parcels are less than limit of optimal size but about 50 percent of total area is in the optimal size of parcel. Finally, in the third case (c) a half of the parcels by the number of parcels are less than optimal size but approximately 95 percent of land is meeting the criterion of optimal size of parcels.

The average size of Estonian agricultural landholdings is 20.34 ha (calculated by data of Agricultural Census 2001). The average area of agricultural land per landholding is 10.45 ha. The differences of average sizes of landholdings are considerable between regions of Estonia even though it is not a large country. The differences between sizes of individual landholdings are common for Estonia also. The distributions of agricultural landholdings by size of agricultural land (see figure 1) are an evidence of those differences.

From figure 1 one can estimate the ratio (percentage from total area) of arable land (by the area and by number of landholdings) that is less than a particular rate. The presented data are for Estonia in average and for two extreme counties. The average size of the agricultural landholding in the Võru county is 6.42 ha (the smallest) and 18.95 ha (the largest) in the Järva county respectively.



Source data for diagram: Agricultural Census 2001, Statistics Estonia.

Fig. 1. The distribution of the agricultural land by the size of landholdings in the Järva county and in the Võru county in Estonia and for whole country.

It can be seen from the figure 1 that approximately 10 percent of the total area is been owned by the landholdings that are less than 5 ha. This number is approximately 15 percent for the Võru county and for the Järva county approximately 5 percent respectively. The number of small landholdings is relatively large at the same time, more than 60 percent from total number of landholdings. The use of diagrams like presented on the figure 1 gives good possibility to estimate the ratio of the area that is under the specified size (10, 15 or 20 ha e.g.) of parcels or landholdings.

To finalize the problem of average size a parcel (or landholding) it can be said that the study of the distribution of parcels or landholding size will give more information to estimate the land use condition from an agricultural point of view.

3. Internal Fragmentation of Land Parcels

There are few studies on the problems of internal fragmentation of parcels. The attention is been paid mostly to the possibilities and means to describe the land fragmentation on the property or farm level. Different aspects of land fragmentation have been investigated e.g. by J. W. Bentley (1987). He summarizes results of different studies on the land fragmentation issues but the main attention has been paid on the problems of external fragmentation.

Most of the land fragmentation indexes are measuring the size of parcels, the number of parcels per landholding and the scattering parcels over a wide area. At the same time we can see the parcels with a very different inside structure. Sometimes there is inside the parcel only one land type (arable land or forest land e.g.). At the other hand, one parcel may consist of several land types.

The internal fragmentation of parcels can be described from two aspects.

- The division of one parcel into different land types;
- The division of one parcel into separated land type contours.

The essence of the problem is illustrated on the figure 2. The arable land consists of five separated fields. The forest land for example is been split into seven separated parts, some of them are very small.

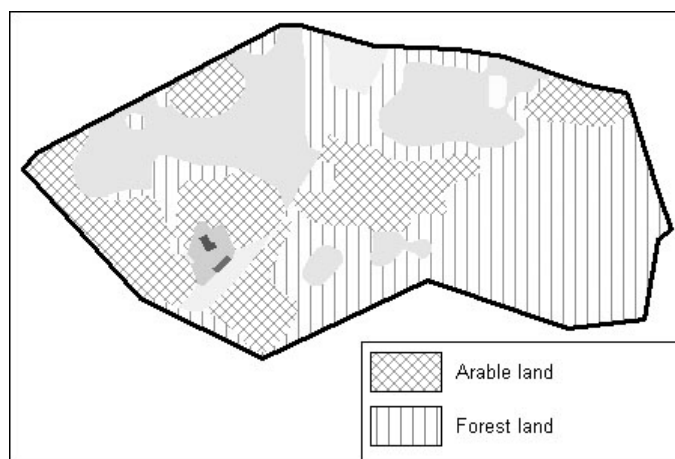


Fig. 2. The example of the internal fragmentation of the parcel.

The arable land e.g. can be considered as one whole (one figure for further calculations) in the first case of evaluation the internal fragmentation. The areas of arable land on the figure 2 are 0.48, 0.43, 1.32, 2.20 and 0.69 hectare respectively but for calculations will be used the total area of arable land (5.12 hectare).

Each separated field or separated area of particular land type will be handled as individual figure in the second case. It meant that the areas of the contours of arable land (0.48, 0.43, 1.32, 2.20 and 0.69 hectares) will be not summed up for further calculations for example.

The Januszewski's index (or Simmon's index) is meant to describe the distribution of one landholding into numerous discrete parcels. Januszewski's index is given by square root of the total landholding area divided by the sum of the square roots of the parcel sizes. The same method can be used to characterize the internal fragmentation of the single parcel. The square root of the parcel area will be divided by the sum of square roots of the areas of different land types or by the sum of square roots of the separated land type contours.

It is not very labour-consuming to calculate the Januszewski's index that will describe the division of one parcel into the different land types. The cadastral data (attribute data in the registers) about areas of different land types can be used to perform those calculations. It is quite easy to perform this task by using the spreadsheets (MS Excel e.g.).

It is not so easy to calculate the Januszewski's index that will describe the division of one parcel into separated land type contours. The cadastral map with the boundaries of different land types must be used and the areas of each separated contour of different land types must be identified. The use of modern GIS will be helpful to perform this task but anyway it needs some more efforts than in the previous case.

The Januszewski's index for the example on the figure 2 is 0.54 if areas of different land types were aggregated and 0.35 if the areas of arable land and forest land contours were not aggregated respectively.

The histogram on the figure 3 describes the distribution of parcels by the Januszewski's indexes that were calculated to characterise internal fragmentation of agricultural parcels. The cadastral data of agricultural parcels of the Haanja municipality were used for calculations.

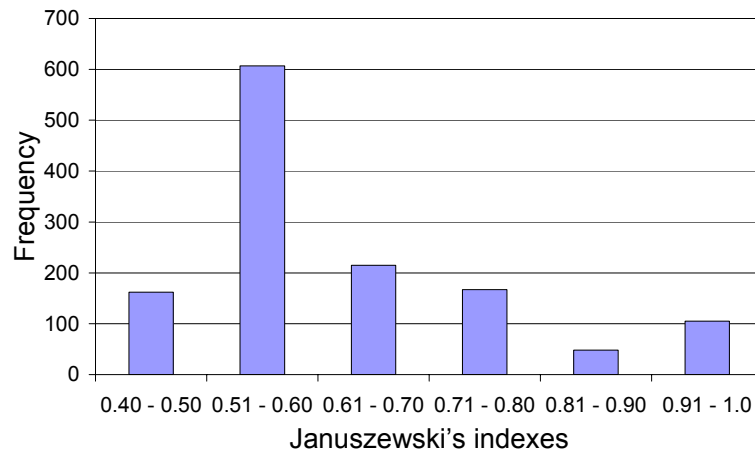


Fig. 3. Distribution of the parcels of the Haanja municipality by the internal fragmentation (Januszewski's index).

The distribution of Januszewski's indexes on the figure 3 is indicating that there is considerable internal fragmentation of parcels in Haanja municipality.

Two simple conclusions can be drawn from the presented above examples:

- The parcels can be substantially different if comparing their internal fragmentation;
- The value of the fragmentation indexes for the same parcel may be considerably different. It depends whether the areas of separated land type contours are aggregated or not.

4. The shape of parcels and land use conditions

The problem of parcel shape is complicated and has different aspects. It is worth to be investigated in details. The attention is been paid only to one aspect of the problem in this paper: is it possible (or is it sensible) to improve the land use condition without amalgamation of scattered parcels? Is the readjustment of the parcels boundaries without amalgamation at all land consolidation?

The problem of the parcels shape in Estonia will be illustrated by some simple examples. The parcel on the figure 4 has a very un-compact shape. The arable land is been split into two parts as a result of such a shape.

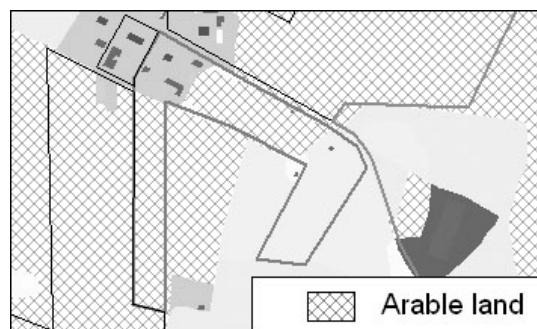


Fig. 4. Unpractical shape of the parcel. Arable land is been split into two parts.

The land use conditions of the imperfect parcel on the figure 4 can be improved if to readjust the boundaries of that particular parcel. This can be made without the loss for neighbouring parcels. Even more – the land use conditions of neighbouring parcels can be also improved.

The parcel on the centre of the figure 5 has triangular shape with sharp angles in two corners. This is the first imperfection of this parcel. This parcel (only arable land) is surrounded by other parcels of arable land beside that. There is no direct access from the road to the parcel. This is the second imperfection for this parcel.

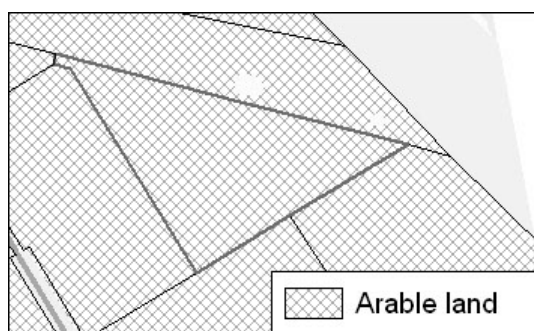


Fig. 5. Unpractical shape of the parcel. Sharp angles in the corners of parcel and no road to the field.

The readjustment of boundaries of the parcels on the figure 5 can improve land use conditions (including access). The land use conditions of neighbouring parcels will be also improve if the readjustment of boundaries of triangular shape parcel will be carried out.

It follows from the above examples that the land use conditions can be improved even if only the shape (location of boundaries) of the parcels will be changed. The following results can be achieved:

- The decrease of internal fragmentation;
- Decrease of fields with unpractical shape for land tillage;
- Better access to the parcels and less need for the easements.

5. Concluding Remark on the Need for Land Consolidation in Estonia

The land use conditions are very varying in Estonia. There are agricultural landholdings in optimal size from an economic point of view but the too small farms are also present. The shape of the parcels is not always perfect and expedient. It all refers to the need for land consolidation in Estonia.

The current situation of land fragmentation in Estonia is unclear at the same time. There is no systematic information about the land use conditions all over the country. The average size of the parcels or the land holdings does not cover all the aspects of land fragmentation. The methodical study of land fragmentation should be the first task therefore.

Not only average size of parcels or landholdings must be used if the extent of land fragmentation will be investigated. The use of more land fragmentation indexes will give additional and useful information for decision-making.

References

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