LAND MANAGEMENT PATERNS IN LATVIA AND ITS REGIONS

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Abstract. Efficient land use plays an important role in the context of sustainable agricultural development. Assuming that it will be viable only in cases when individuals employed in agriculture can ensure themselves an income equivalent and not less than the average wage in the national economy. Certain sizes of agricultural area, which are different for every key agricultural sector, are required to achieve it. The present research analyses the minimum land area needed in field crop, dairy and grazing livestock farming in Latvia and its regions depending on land quality and the amount of support payments received. The research sets the following **aim**: to identify the minimum areas needed in agriculture in Latvia in order to ensure sustainable farm management depending on land quality and, in the regions, the amount of support payments received. A minimum land area for sustainable farm management in Latvia per individual varies from 48.3 ha in dairy farming to 65.5 ha in field crop farming. However, there are major differences depending on land quality and in the amount of support payments received.

Key words: agricultural land, area, income.

JEL code: Q01, Q15.

Introduction

Integrating the principles of sustainable development within sector policies is one of the main strategic objectives of the European Union. As pointed by E.Majewski (2013), the concept of "Sustainable Development" is multidimensional, and sustainability can be measured on various levels, in space and time. This provides a wide field for the search of methods of measuring "sustainability", which are addressed to different sustainability aspects.

Every day, farmers and ranchers around the world develop new, innovative strategies to produce and distribute food, fuel and fibber sustainably. While these strategies vary greatly, they all embrace three broad goals or the 3 Pillars of Sustainability: 1) profit over the long term; 2) stewardship of a nation's land, air and water; 3) quality of life for farmers, ranchers

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and their communities (Sustainable Agriculture Research..., s.a.). As farmers assume more responsibility for managing natural resources, they play an increasingly important role in assessing sustainable agriculture (Belanger et al., 2012). Serageldin I. (1999) stresses that rethinking resource use is a major issue in terms of sustainability in the medium- to long term, because it is a given that population pressure is going to be there. This also refers to land as the key natural resource exploited in agricultural production.

Antonella Trisorio (2004) emphasises that the economic dimension of sustainability mainly refers to: a) efficient use of resources; b) competitiveness and viability in the agriculture sector; c) profitability of the agriculture sector; d) agriculture's contribution to the development and/or conservation of rural areas; e) the diversification of sources of income within farming families.

Agriculture income derives from the revenues received from the labour input, interest payments, rent of land payments and profit from agriculture activities. All these income flows are generated by the factors of agriculture production: land, labour, capital and entrepreneurship (Cepaitiene, Vinciuniene, 2009). But land is the key resource without which no production and income generation in agriculture is possible.

Efficient land use in the context of sustainable agriculture has been widely researched by scientists of various countries, for instance, C.Gutzler, K. Helming, D. Balla et al. (2015); H.Wiggering, U.Steinhardt (2015); V.Popescu, G.Popescu, C. Popescu (2015); M. Hartvigsen (2014); L.Latruffe and P. Laurent (2014) and others.

Since the potential of land use in agriculture in Latvia has not been fully exploited (Dobele, 2005; Baumane, 2012; Pilvere, Nipers, Upite, 2014 and others), it is important to identify the minimum land areas, the management of which is profitable in various agricultural industries, and the factors affecting it.

Therefore, the research sets the following aim: to identify the minimum areas needed in agriculture in Latvia in order to ensure sustainable farm management depending on land quality and, in the regions, the amount of support payments received (in this case term sustainable farming is understood as one where individuals can ensure themselves an income equivalent and not less than the average wage in the national economy).

In accordance with this aim, the following specific research tasks were defined:

- to analyse the effects of land quality on land management in Latvia;
- to assess the role of financial support in land management in Latvia and in its regions.

Analysis, synthesis, logical and constructive methods were employed to tackle the research tasks. The study analysed information and data from the Central Statistical Bureau (CSB) and the Farm Accountancy Data Network (FADN).

In Latvia, the minimum land areas needed to ensure sustainable farm management are different among various agricultural industries; accordingly, for a detailed analysis, the key

agricultural sectors associated with land use were selected: a) field crop farming; b) dairy farming; c) grazing livestock farming, as these sectors contributed to 66% of the total output of agricultural goods at base prices (product subsidies included) in Latvia in 2012 (MoA, 2013).

The research assumes that individuals employed on agricultural holdings can provide themselves with an income equivalent to at least the average wage in the national economy. Otherwise, one can consider that the mentioned way of earning one's living is not sustainable. It is assumed that in order an agricultural holding is viable, at least one individual has to gain an income from agricultural activity that is equivalent to the average wage in Latvia (with labour taxes paid). A widespread model of agricultural holdings in Latvia is a family farm in which two adults work, as the average number of agricultural annual work units is equal to 2.2 (CSB, 2010). Therefore, calculations are performed also for an assumption that in order an agricultural holding is viable, at least two individuals could gain an income from agricultural activity that is equivalent to the average wage in Latvia (with labour taxes paid). The average wage in the country is calculated based on the CSB data for 2013, and the calculations employ the minimum income level (MIL): EUR 10 619 per employee and EUR 21 238 per two fulltime employees (CSB, 2013).

With increase in the size of land area, farms gain greater revenue per ha. The increase may be characterised by a function, according to which, on farms with a smaller land area, every additional hectare of land increases total revenue (in the form of profit and wages) more than on large farms. This situation may be described by a logarithmic function:

$$п / ha = b \cdot \ln (ha + a) + c \quad [1]$$

where п – revenue;

ha – land area of the farm;

a, b, c – equation coefficients.

At the same time, greater revenue per ha directly affects the area needed for ensuring the minimum income level. In this case, the minimum land area for ensuring the minimum income level may be expressed by means of the following equation:

$$ha_{min} = п_{min} / (п / ha) \quad [2]$$

where $п_{min}$ – minimum revenue for sustainable farm management;

ha_{min} – minimum land area for sustainable farm management.

By combining both equations, the functional dependence of the minimum land area on the total area of a farm is as follows:

$$ha_{min} = п_{min} / (b \cdot \ln (ha + a) + c) \quad [3]$$

The present research employed the FADN data. The FADN is a survey carried out by the EU Member States. It was established in 1965 in accordance with Regulation No 79/65 of the Council of 15 June 1965 setting up a network for the collection of data on the incomes and

business operation of agricultural holdings in the European Economic Community. The target size of the sample for the FADN in Latvia is 1000 farms (Bratka, Praulins, 2007).

Based on the FADN data, the minimum income level is calculated as revenue made up of the value of products, financial support for production and investment support minus the cost of goods and services, depreciation of fixed assets, interest payments, rent and production taxes. Accordingly, the revenue used in the analysis is calculated by the following formula:

$$\pi = q + sp + si - ic - d - i - r - t \quad [4]$$

where π – revenue of the farm;

q – total output of the farm;

sp – financial support for production received by the farm;

si – investment support received by the farm;

ic – intermediate consumption by the farm;

d – depreciation of the farm's fixed assets;

i – interest payments made by the farm;

r – rent paid by the farm;

t – production taxes paid by the farm.

In this case, the farm's revenue is the remaining value that may be used for paying wages, offsetting a decrease in equity capital and for profit.

The revenue calculated are then expressed per ha of farmed land, and the minimum area is calculated by dividing the minimum income level that was set for ensuring sustainable farm management by the return on land (according to Formula 2).

The calculations of minimum land areas needed to ensure a minimum income per employee were performed based on the FADN data for groups of farms with standard outputs (SO) of, on average, EUR 4-15 thou, EUR 15-25 thou or EUR 25-50 thou for a 5 year period (2008-2012). Average land areas, which determine an approximate productivity level at a certain quantity produced, are calculated for the groups of farms of particular specialisation.

The overall economic performance of farms of particular specialisation is assessed for identifying the minimum land area in the particular industry.

The minimum land area in Latvia's regions was identified taking into account only the differences in land quality among the regions (average agricultural land qualitative estimates were calculated and employed to provide the characteristics of the differences) and the related Rural Development Programme measure "Payments to Farmers in Areas with Handicaps, Other than Mountain Areas" (LFA). LFA support rates for the regions in accordance with the LFA categories set for the level of rural territories were employed to identify the LFA support level. The minimum land areas for the regions were calculated by adjusting the average farm performance results in the country.

Sensitivity for a minimum land area needed, depending on land quality, was calculated based on the FADN data, using only the data on products associated with a particular industry and related costs. Given the fluctuations in land quality, a minimum land area was calculated as follows:

$$ha_{min}' = п_{min} / (п' / ha) \quad [5]$$

where ha_{min}' – minimum land area needed for sustainable farm management, taking into consideration the changes in land quality;

$п_{min}$ – minimum revenue needed for sustainable farm management;

$п'$– revenue of the farm, taking into consideration the changes in land quality.

In the EU, the FADN data are classified by region, using the territorial division in accordance with the Nomenclature of Territorial Units for Statistics (NUTS) classification. In Latvia, the following administrative and territorial division exists in accordance with the NUTS classification: the whole territory of the country corresponds to Level 1 and Level 2, there are five agricultural regions at Level 3: Pieriga, Vidzeme, Kurzeme, Zemgale, and Latgale (LSAEI, 2012).

Research results and discussion

1. Effects of land quality on land management

Land quality directly affects the return on land. With costs being equal, quantities of products produced on quality and low quality land are different, thus, affecting revenues and, in their turn, incomes. Yet, it has to be stressed that these calculations were performed for equal support payments (the payments were equal to the average national support payment level in the period 2008-2012) for various land quality groups.

In case of high quality land, the minimum land area has to be smaller than the average. However, in case of low quality land, the minimum land area has to be greater than the average. To understand the scale of this effect, calculations were performed for field crops (grains and rapeseed) and the results are presented in Table 1.

Table 1

Average minimum land areas required in field crop farming depending on land quality in Latvia in the period 2008-2012

Indicators	Land quality					
	25 points	32 points	Average field crop land quality in the country – 40 points	45 points	50 points	60 points
Minimum area, ha (MIL 1)	444.5	120.1	65.5	51	41.7	30.6
% of the average value	679	183	100	78	64	47
Minimum area, ha (MIL 2)	889.1	205.3	108.9	84.1	68.6	50.1
% of the average value	816	189	100	77	63	46

Source: authors' calculations based on LSIAE 2009, 2010, 2011, 2012a, 2013

As shown in Table 1, given the different land quality in Latvia's regions and, accordingly, different rates of return on land, the minimum land area for a farm was adjusted based on agricultural land qualitative estimates measured in points. The result obtained reflect the situation for farms with a SO within a range from EUR 15 000 to EUR 25 000 at a MIL 1 and a SO from EUR 25 000 to EUR 50 000 at a MIL 2. For farms with a higher agricultural land qualitative estimate, the minimum land area is smaller. For instance, if the land qualitative estimate is 60 points, on average, 30.6 ha had to be exploited to provide a MIL 1 in the period 2008-2012, while for a MIL 2 this required 50.1 ha. With decrease in land quality, the minimum area to be exploited for ensuring a minimum income level increases. For example, at a land qualitative estimate of 25 points, an agricultural area of more than 400 ha was needed to provide a MIL 1 in the period 2008-2012. Yet, it should be emphasised that these calculations were performed for equal financial support payments (the payments were equal to the average national support payment level in the period 2008-2012) for various land quality groups.

The calculation methodology provides that livestock farming – dairy and grazing livestock farming – is associated with the areas of permanent grasses sown in arable land (PGSAL) and permanent meadows and pastures (PMP), as these areas are the basis for milk and meat production. The cost of milk production as well as the revenue from sales of milk was calculated to determine the cost of producing permanent grasses sown in arable land. The production cost of PGSAL and that of milk are interrelated to each other by a coefficient that reflects the area needed per animal, taking into account the yield of sown grasses. In a similar way, the area of PMP needed for raising grazing cattle was also determined.

The average quality of land under PMP and PGSAL in the country is equal to 36.9 points, while changes in the minimum land area were assessed at agricultural land qualitative estimates within a range from 25 to 60 points. As land quality varies, the minimum land area for a farm was adjusted to examine the effect of the change. One has to conclude that the effect of land quality change in dairy farming is smaller than for field crops. For example, if the land quality declines from 36.9 to 32 points, the minimum land area needed increases by only 18%. If the land quality, in points, increases from 36.9 to 45, the minimum land area needed decreases by 17% (Table 2).

Table 2

Average minimum land areas required in livestock farming depending on land quality in Latvia in the period 2008-2012

Indicators	Land quality				
	25 points	32 points	Average PMP and PGSAL land quality in the country – 36.9 points	45 points	60 points
Dairy farming					
Minimum area, ha (MIL 1)	79.4	56.8	48.3	39.9	32.8
Minimum area, ha (MIL 2)	138.8	99.2	84.4	69.8	57.2
% of the average value (MIL 1 and MIL 2)	164	118	100	83	68
Grazing livestock farming					
Minimum area, ha (MIL 1)	82.9	62	53.7	45.2	37.7
Minimum area, ha (MIL 2)	155.6	116.4	100.8	84.8	70.7
% of the average value (MIL 1 and MIL 2)	154	115	100	84	70

Source: authors' calculations based on LSIAE 2009, 2010, 2011, 2012a, 2013

The range of change in the minimum land area, depending on land qualitative estimates, in the sector of grazing livestock is smaller than for field crop farms and slightly smaller than in the sector of dairy livestock. So, one can conclude that in the sector of grazing livestock, the effect of land quality is not as important as for field crops. For instance, if the land quality is as high as 60 points, in the period 2008-2012, 37.3 ha had to be exploited to provide a MIL 1 and 70.7 ha for a MIL 2. In contrast, at a land qualitative estimate of 25 points, 82.9 ha and 155.6 ha were needed to provide a MIL 1 and a MIL 2, respectively, in the period 2008-2012.

2. Effects of financial support on land management in Latvia and its regions

To take into account the differences in support payments, the minimum land area was calculated not only for the entire country but also for its regions (Table 3).

Table 3

Average minimum land areas required to achieve a MIL 1 in Latvia and its regions in the period 2008-2012

Indicators	National average	Average in Pieriga	Average in Vidzeme	Average in Kurzeme	Average in Zemgale	Average in Latgale
Field crop farming						
Total support per ha, EUR	177.1	163.9	188.4	178.2	172.1	202.4
Revenue per ha, EUR	162.2	161.5	158.3	167.5	185.2	158.4
Minimum area, ha (MIL 1)	65.5	65.8	67.1	63.4	57.3	67.0
Dairy farming						
Total support per ha, EUR	236.6	205.2	239.3	227.9	249.3	243.9
Revenue per ha, EUR	219.8	198.4	214.9	216.0	248.9	213.4
Minimum area, ha (MIL 1)	48.3	53.5	49.4	49.2	42.7	49.8
Grazing livestock farming						
Total support per ha, EUR	287.4	232.5	283.3	263.6	286.1	291.7
Revenue per ha, EUR	197.9	165.3	191.1	184.6	208	193.4
Minimum area, ha (MIL 1)	53.7	64.2	55.6	57.5	51.1	54.9

Source: authors' calculations based on LSIAE 2009, 2010, 2011, 2012a, 2013

Receiving a total support of EUR 177.1 per ha, the production of field crops in Latvia provides an income of EUR 162.2 per ha, and, in order to achieve a MIL 1 within a year, a farm has to exploit at least 65.5 ha. Regionally, a substantially lower minimum area was identified for farms in Zemgale region – 57.3 ha or 13% less than on average in the country (even though support payments per ha were smaller there than on average in the country). This is associated with higher returns on land for the farms located in this region. An income, too, per ha on the farms of this region is much greater – by 14% more than in comparison with the average situation in the country. In the regions of Latgale and Vidzeme, farms need a greater minimum land area to provide a MIL 1, 67 ha and 67.1 ha, respectively, which may be explained by the smallest quantity of products produced per ha.

In the five-year period, the situation in Latvia's regions on dairy farms differs both in terms of value of products produced and in terms of income and, accordingly, minimum land area. In Latvia, dairy farms with a SO of EUR 15-25 thou, which employ one AWU, need to exploit, on average, 48.3 ha. Such a performance result can be achieved producing products worth EUR 563.8 per ha, while the total cost is equal to EUR 580.6 and the investment and production financial assistance amounts to EUR 236.6. The total income per ha on farms is equal to EUR 219.8. In Latvia's regions, the minimum land area to provide a minimum income level varies from 42.7 ha in Zemgale to 53.5 ha in Pieriga. Zemgale region is characterised by the highest value of products produced per ha (EUR 641.3), which is 14% more than on average in Latvia. An income per ha, too, is the highest, which results from the smallest difference between the value of sold products and the total cost as well as the large amount of support.

In Pieriga region, however, farms need the largest area – 11% more than on average in Latvia. A significantly lower total value of products per ha (94% of the average in Latvia) as well as the smallest amount of support for this region's farms generate the lowest income per ha (EUR 198.4 or 90% of the average in Latvia). In Vidzeme, Kurzeme and Latgale, the minimum area is relatively similar in size despite the differences in production efficiency, which determines the value of products per ha.

Receiving a total support of EUR 287.4 per ha, the production of products of grazing livestock generates, on average, an income of EUR 197.9 per ha in Latvia, and, in order to achieve a MIL 1 within a year, a farm has to exploit at last 53.7 ha. Regionally, a slightly smaller (5%) minimum area was identified for farms in Zemgale, 51.1 ha. The quantity of products produced and an income per ha are greater on farms of this region in comparison with the average situation in the country. One has to note that the amount of support received by Zemgale region's farms is among the highest (second position behind Latgale region). The poorest performance results were presented by farms in Kurzeme and especially in Pieriga where the largest minimum land area is required to provide a MIL 1, 57.5 ha and 64.2 ha, respectively. The key reason relates to the facts that the smallest quantity of products and the lowest amount of support per ha are observed for these regions.

Table 4

Average minimum land areas required to achieve a MIL 2 in Latvia and its regions in the period 2008-2012

Indicators	National average	Average in Pieriga	Average in Vidzeme	Average in Kurzeme	Average in Zemgale	Average in Latgale
Field crop farming						
Total support per ha, EUR	215.3	198.3	225.1	214.7	209.8	240.7
Revenue per ha, EUR	195.0	193.7	188.3	200.5	223.2	187.7
Minimum area, ha (MIL 2)	108.9	109.7	112.8	105.9	95.2	113.2
Dairy farming						
Total support per ha, EUR	265	219.5	256.3	244.5	269.4	260.9
Revenue per ha, EUR	251.6	218	236.2	238	275.7	234.4
Minimum area, ha (MIL 2)	84.4	97.4	89.9	89.2	77.0	90.6
Grazing livestock farming						
Total support per ha, EUR	297.1	247.5	300.5	280.2	304.7	309.1
Revenue per ha, EUR	210.7	181.1	208.6	201.8	226.9	211
Minimum area, ha (MIL 2)	100.8	117.3	101.8	105.3	93.6	100.6

Source: authors' calculations based on LSIAE 2009, 2010, 2011, 2012a, 2013

To provide a MIL 2, a minimum land area for field crops, on average in Latvia, is equal to 108.9 ha. The calculations showed that to provide a MIL 2, the situation across the regions was similar to that for a MIL 1. The smallest minimum land area is needed in Zemgale region, 95.2 ha, whereas the largest one is required on Latgale region's farms, 113.2 ha. Like in Latgale, about 113 ha for field crops are needed to provide a MIL 2 in Vidzeme, too, where farms generate the largest income without financial support, while the financial support is EUR 15.6 per ha smaller there.

The situation in dairy farming in Latvia's regions on farms employing 2 AWU and generating a SO of EUR 25-50 thou is characterised by similar trends. On average, in the country, the total quantity of products and the cost per ha make up a gap of EUR 13.1; an income per ha is EUR 251.6, which is substantially affected by the total assistance of EUR 265 per ha. Accordingly, on average, an area of 84.4 ha has to be annually exploited in Latvia to achieve the required income level.

The smallest minimum area is needed on dairy farms in Zemgale, 77 ha or by 9% less than on average in the country, whereas the largest one is required on farms located in Pieriga region, 97.4 ha or by 15% more than on average in the country. The difference in the minimum area is mainly determined by the differences in the total value of products produced as well as the size of total cost per ha.

To provide a MIL 2 in the sector of grazing livestock, on average, a minimum area of 100.8 ha is needed in the country. According to the calculations, to provide a MIL 2, the situation across the regions is similar to that for a MIL 1. The smallest minimum land area is needed in Zemgale region, 93.6 ha (the quantity of products produced is the greatest as well as the amount of support received is the greatest), whereas the largest minimum land area is needed on Pieriga region's farms, 117.3 ha.

A similar situation is observed on grazing livestock farms in Latgale and Vidzeme as well as in Kurzeme where farms are only slightly in a poorer situation, receiving a comparatively smaller amount of support.

Conclusions

Yields of agricultural crops and, thus, the size of land area needed to provide the minimum income are significantly affected by land quality. In field crop farming, at the average land qualitative estimate of 39.6 points, the minimum land area needed is 65.5 ha , while at a lower estimate, 32 points, it is 120.1 ha and at an estimate of 50 points, the area needed decreases to 41.7 ha. In dairy farming and in the sector of grazing livestock, the smallest effect of the difference in land quality is observed for field crop farming, as the minimum land area needed to generate the minimum income varies from 32.8 ha to 79.4 ha, while for grazing livestock it ranges from 37.7 ha to 82.9 ha.

Regionally, the financial assistance received only partially offsets the differences created by land quality. Regardless of the sizes of support payments, among the groups of farms specialising in dairy and meat livestock, slightly better performance results are presented by Zemgale region's farmers; to earn the minimum income, 57.3 ha are needed in field crop farming, 42.7 ha in dairy farming and 51.1 ha in grazing livestock farming, while 65.8 ha, 53.5 ha and 64.2 ha, respectively, are needed in Pieriga.

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