Soil Market and Soil Fund Analysis in Slovakia

Jana Ladvenicová1, Dominika Čeryová2, Zuzana Bajusová3, Lubomír Gurčík4
Slovak University of Agriculture in Nitra1, 2, 3, 4
Faculty of Economics and Management, Institute of Economics and Management
Tr. A. Hlinku 2, 949 76 Nitra
Nitra, Slovakia
e-mail1, 2, 3, 4: jana.ladvenicova@uniag.sk, dominika.ceryova@uniag.sk, zuzana.bajusova@uniag.sk, lubomir.gurcik@uniag.sk

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Abstract
Soil is considered an irreplaceable factor of production. Its properties are important for life on the Earth. The main goal of the paper is to analyze the development of individual components of the soil fund in the Slovak Republic in the period 2014-2020, to quantify indicators related to the production factor of soil and evaluate the development and structure of organically farmed agricultural land. The soil fund is divided into two categories, namely agricultural land, and non-agricultural land. From the point of view of the soil market, we will focus on the development of soil prices, the evaluation of land sales, and land lease. The area of agricultural land as well as its individual components decreased by 2020, except for the area of orchards, which increased by 3.55%. On the contrary, by 2020, the area of non-agricultural land increased, which was affected by the growing areas of its individual components. Arable land is 59% from all agricultural land. Agricultural land makes up about 49% of the total land area. There was an average of 0.438 ha of agricultural land and 0.035 ha of organically farmed agricultural land per capita for the whole period. The price of agricultural land has a growing trend from year to year. The rental price for agricultural land increased by 18% over the period under review. From the point of view of this indicator, Slovakia has the largest share of leased land in the total land area within the entire EU, at the level of about 90%. The area of ecologically farmed agricultural land is increasing from year to year, the support from the Rural Development Program of the Slovak Republic has a positive effect on the increase of its area.

Keywords: soil fund, soil market, soil price, soil lease

JEL Classification: Q11, Q15, Q57

1. Introduction
(Azul & Aragão, 2020) define soil as a natural non-renewable resource with a diverse composition and structure influenced by geographical factors, climatic factors, rock, and the activity of living organisms, including humans. In these last decades, the awareness that soil is a very important resource for humans has noticeably increased ( (Dazzi & Lo Papa, 2021)).

According to (Brevik & Arnold, 2015), the pedological definition of soil contains key elements:

- soil is a natural formation,
- soil is spatial and temporal,
- soil is formed on the Earth surface,
- soil is the result of complex biochemical and physical processes,
- soil can support a life,
- soil can be mapped to appropriate scales.
Soil functions are important for society in ensuring food production and safety and in protecting natural resources (Bamba et al., 2019). Soils play a key role for the functioning of terrestrial ecosystems. Thus, soils are essential for human society not only because they form the basis for the production of food (Vogel et al., 2019). This has long been recognized, and during the last three decades the need to establish methods to evaluate the ability of soils to provide soil functions has moved toward the top of the agenda in soil science. According to (European Commission, 2006) soil functions include a) production function - biomass production; b) filtration and transformation function - collection, filtration and conversion of nutrients, substances and water; c) source of biological diversity as biotopes, species and genes; d) physical and cultural environment for humans and their activities, landscape environment; e) source of raw materials; f) carbon storage; g) preservation of geological and cultural heritage.

From an economic point of view, the soil fertility is considered as the basic property of soil. It is defined as the ability of soil to supply plants with nutrients, the necessary amount of water and air during vegetation (Zoborský, 2006). It is affected by soil fund, soil type, soil and topsoil depth, soil structure, content of available nutrients, favorable soil water, air and heat regime, soil reaction, humus content and its quality, biological activity, and content of harmful compounds in soil (Kime, 2012). To increase soil fertility are important e.g.: proper use and tillage, crop rotation, weeds killing, maintenance of optimal soil moisture, control of soil erosion, removal of surplus water or maintenance of proper soil reaction (Berner et al., 2013).

The structure of the soil fund is divided according to the way it is used into agriculture land (arable land, hop garden, vineyards, gardens, orchards, permanent grassland) and non-agricultural land (forest land, water areas, built-up areas, and other areas) (Geodesy, 2020), (Koreňová, 2020).

Organic farming is becoming more popular and contributes to the sustainability of the Earth. (Kročková, 2020) processed information concerning the state of organic farming in the Slovak Republic. There has been a gradual increase in organic farming and land use. Slovakia is succeeding in approaching the goal of the "Strategy of the Environmental Policy of the Slovak Republic until 2030" - to increase the share of area under cultivation in an ecological way to at least 13.5 % of the total land area. Organic farming depends (among other things) on equitable access way to land and natural resources. One of its goals is therefore to create a sustainable system which respects natural systems and increases the health of water, soil, animals, and plants. It must responsibly use natural resources and respects the needs of animals (Schlosserová, 2012). The (Council of the European Union, 2007) has issued a decree on organic farming (we selected examples that focus of the production factor of soil):

- the use of practices that maintain or increase the organic matter content of the soil while preventing soil erosion and soil compaction,
- maintain of soil fertility without contamination of the environment.

The main goal of the paper is to analyze the development of individual components of the soil fund in the Slovak Republic in the period 2014-2020, to quantify indicators related to the production factor of soil and evaluate the development and structure of organically farmed agricultural land.

2. Data and Methods

The basis for processing of the contribution is the Statistical Office of the Slovak Republic database, the Eurostat database, the task of which is to prepare statistical data for the needs of the EU from all member countries and data from the Central Inspection and Testing Agricultural Institute in Bratislava. The time period which goes under analysis is 2014 - 2020.
To assess the development, we will use index series formed by basic indices. In the case of calculation of increments and quantities of individual components of the land fund, we will use the calculation of absolute changes.

\[
\text{Degree of ripening} \, (\%) = \frac{\text{arable land in ha}}{\text{agricultural land in ha}} \cdot 100
\]  
(1)

\[
\text{Degree of agricultural use} \, (\%) = \frac{\text{agricultural land in ha}}{\text{total land area in ha}} \cdot 100
\]  
(2)

\[
\text{Coefficient of ecological stability (CES)} = \frac{\text{acreage of relatively stable areas}}{\text{acreage of relatively unstable areas}}
\]  
(3)

Relatively stable areas are orchards, vineyards, permanent grasslands, forest land and water areas. Relatively unstable areas are arable land, built-up area, other area. If the CES < 0.10 we are talking about areas with maximum disruption of natural structures, if the CES > 1, the country is balanced, natural structures are preserved in it.

3. Results and Discussion

Based on the data in tab. 1 we see that agricultural land has a smaller share on the total land area than non-agricultural land. Agricultural land is registered in the cadaster and is used exclusively for agricultural production. The owner of such land is obliged to protect it, and this protection consists of the use of land that does not endanger its ecological stability, of the implementation of agrotechnical measures to maintain soil quality, it should protect it from erosion, compaction, etc.

**Table 1: Development and structure of the land fund in Slovakia in the period 2014 – 2020 (in ha)**

| Acreage/year | 2014   | 2015   | 2016   | 2017   | 2018   | 2019   | 2020   | Index (20/14) |
|--------------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Agr. land    | 2397041| 238961 | 238532 | 238195 | 2379101| 2376712| 2375025| 0.9908        |
| Arable land  | 1412228| 141129 | 1409778| 140866 | 1407729| 1406399| 1405263| 0.9951        |
| Hop garden   | 512    | 511    | 511    | 510    | 503    | 503    | 503    | 0.9824        |
| Vineyards    | 26513  | 26359  | 26266  | 26258  | 26237  | 26216  | 26080  | 0.9837        |
| Gardens      | 76362  | 76287  | 76206  | 76111  | 75996  | 75890  | 75763  | 0.9922        |
| Fruit orchards| 16793 | 16565  | 16685  | 16658  | 16951  | 17101  | 17389  | 1.0355        |
| Permanent grassland | 861681 | 858601 | 855882 | 853757 | 851685 | 850600 | 850027 | 0.9865        |
| Non-agric. land | 2506450| 251384 | 2518107| 252146 | 2524306| 2526694| 2528380| 1.0087        |
| Forest land  | 2017105| 202011 | 2022522| 202437 | 2026027| 2027099| 2027852| 1.0053        |
The area of agricultural land had a declining trend until 2020 compared to 2014 by 0.92%. This is due to the loss of almost all components of agricultural land except orchards. We recorded a growing trend by 3.55%, which represents 596 ha. The area of arable land is decreasing from year to year, for the whole monitored period it decreased by 6,965 ha. In the last three years analyzed, hop gardens have reached a constant area of 503 ha. Overall, its area fell down by 1.76% by the end of 2020. The area of vineyards is decreasing from year to year, overall, we record a decrease in the area of vineyards by 1.63%. The area of gardens decreased by 0.78% by 2020 compared to 2014. The highest decrease within the area of gardens can be seen between 2019 and 2020 by 127 ha. Permanent grasslands reached the highest area in 2014, namely 861,681 ha. Subsequently, by 2020, it fell to 850,027 ha, which represents a reduction of 11,654 ha.

Non-agricultural land consists of forest land, water areas, built-up areas, and other areas. It represents approximately 51% of the total land area. Compared to agricultural land, we record the opposite trend in non-agricultural land, and this is growing. The area of non-agricultural land increased by all the categories that make it up. By 2020, compared to 2014, its area increased by 21,930 ha. The highest item of non-agricultural land is forest land. Its share of non-agricultural land was about 80%. The area of forest land increased by 0.53% by 2020 compared to 2014. The area of forests has been gradually increasing, but in comparison with the years 2020 and 2014 we record the same area, namely 92,250 ha. Built-up areas and courtyards reached their highest value in 2020, increasing by a total of 2.15%. Other areas, similarly, to the previous categories forming non-agricultural land, grew slightly from year to year, in 2020 they reached the highest area of individual years, namely 165,831 ha, which is an increase by 267 ha compared to 2014.

### Table 2: Decreases and increases in selected categories of land in Slovakia in the years 2014 - 2020

| Acreage/year          | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  |
|-----------------------|-------|-------|-------|-------|-------|-------|
| Agric. Land           | ↓7425 | ↓4288 | ↓3375 | ↓2852 | ↓2389 | ↓1687 |
| Arable land           | ↓934  | ↓1516 | ↓1118 | ↓931  | ↓1330 | ↓1136 |
| Vineyards             | ↓154  | ↓93   | ↓8    | ↓21   | ↓21   | ↓136  |
| Gardens               | ↓75   | ↓81   | ↓95   | ↓115  | ↓106  | ↓127  |
| Fruit orchards        | ↓228  | ↑120  | ↓27   | ↑293  | ↑150  | ↑288  |
| Permanent grassland   | ↓3080 | ↓2719 | ↓2125 | ↓2072 | ↓1085 | ↓573  |
| Non-agric. land       | ↑7393 | ↑4264 | ↑3360 | ↑2839 | ↑2388 | ↑1686 |
| Forest land           | ↑3011 | ↑2406 | ↑1852 | ↑1653 | ↑1072 | ↑753  |
| Water areas           | ↑28   | ↓21   | ↓1    | ↑40   | ↑15   | ↓61   |
| Built-up areas and courtyard | ↑1095 | ↑770  | ↑698  | ↑910  | ↑831  | ↑727  |
| Other areas           | ↑3258 | ↑1109 | ↑812  | ↑236  | ↑470  | ↑267  |

Source: author’s calculations
Table 2 shows the calculation of decreases and increases of individual components of the land fund in Slovakia in the years 2014 - 2020. The highest decrease of agricultural land was in 2015, almost 7,425 ha. This year we also recorded the highest increase in non-agricultural land (7,393 ha). From the point of view of individual components of agricultural land, we record it year-on-year decline. The most significant decrease in area of arable land was in 2019, namely 1,330 ha. From the point of view of vineyards, the years 2015 and 2020 can be considered as years when the vineyards limit was reduced by more than 100 ha. Orchards showed a fluctuating trend of decreases and increases in their acreage. Permanent grasslands reached from all the individual components of the agricultural land fund the most significant decrease in acreage in the years 2015 - 2018. They play an important role in landscaping, preserve and restore biodiversity, increase anti-erosion function, protect against floods.

In 2015, the highest increases in forest land, built-up areas and other areas occurred at the expense of agricultural land. Slovakia is among the European countries the country, with the highest forest cover. The share of forest land in the total land area is 41%. The gradual increase in the area of forest land is mainly due to afforestation of areas, the transfer of agricultural land covered with forest stands and the adoption of forest management programs. The increase in the area of built-up areas is mainly due to civil and housing construction, as well as industrial construction, construction of roads and motorways.

Table 3: Development of soil fund indicators in Slovakia in the years 2014 - 2020

| Indicator                                  | 2014     | 2015     | 2016     | 2017     | 2018     | 2019     | 2020     |
|--------------------------------------------|----------|----------|----------|----------|----------|----------|----------|
| Degree of ripening (%)                    | 58,92    | 59,06    | 59,1     | 59,14    | 59,17    | 59,17    | 59,17    |
| Degree of agric. use (%)                  | 48,88    | 48,73    | 48,65    | 48,58    | 48,52    | 48,47    | 48,44    |
| CES                                       | 1,672    | 1,667    | 1,667    | 1,666    | 1,667    | 1,666    | 1,666    |
| Share agric. land/inhabitant               | 0,442    | 0,441    | 0,439    | 0,438    | 0,437    | 0,436    | 0,435    |
| Share ecolog. agric. land/inhabitant       | 0,033    | 0,034    | 0,034    | 0,035    | 0,035    | 0,036    | 0,036    |

Source: author’s calculations

In tab. 3 are quantified individual indicators related to the land fund, according to the formulas given in the methodology. The degree of ripening compares arable and agricultural land. Based on the results of the calculations, we can state that the share of arable land in agricultural land is about 59%. The degree of agricultural use describes the ratio of agricultural land and the total area of the land fund. Agricultural land accounts for about 48-49% of the total area. The coefficient of ecological stability has reached values higher than one, which means that our country is a balanced country with predominant natural components. The share of agricultural land per capita has a declining trend. In 2014, there were 0.442 ha of agricultural land per capita, while in 2020 it was 0.435 ha. In terms of the share of organically farmed agricultural land, its share per capita increased slightly. In 2014, this share reached 0.033 ha and in 2020 there was 0.036 ha ecologically farmed agricultural land per capita in the Slovak Republic.

Table 4: Development of the average market price of agricultural land and rental price per 1 ha

| Indicator         | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Index  |
|-------------------|------|------|------|------|------|------|--------|
| Soil price        | 1,442| 2,175| 2,217| 3,009| 3,432| 3,789| 2,6276 |
| Rental price      | 44   | 44   | 50   | 48   | 54   | 52   | 1,1818 |

Source: EUROSTAT, author’s calculations
At the beginning of the period under review, the average price of agricultural land reached 1,422 € / ha. Subsequently, the price of land increased by 2019 € by 2019 compared to 2014. There are large price differences in Slovakia between individual regions. The most is paid for the land in the southwest of the country and, conversely, the least in central and northern Slovakia. The most significant obstacle for young farmers is access to land, as it is fragmented. This is mainly related to past events that are associated with collectivization. Acquisition of land in Slovakia is regulated by Act no. 140/2014 Coll. on the acquisition of ownership of agricultural land and on the amendment of certain laws. The main bodies that ensure the protection of agricultural land include: Ministry of Agriculture and Rural Development, District Land Office. The agricultural land market is liberal and does not contribute to the protection of land and its proper management, that is why this law has been adopted. In addition to the legislation at the time, it was necessary to pass a law that would focus on regulating the acquisition of agricultural land and preventing their speculative purchase or change in the type of land and possible misuse of property (e.g., by requiring disproportionate rent). Pursuant to the legislation in force until 11th of February 2019, the conditions for the transfer of agricultural land were laid down in §4, which stated that the owner or another person authorized to transfer ownership of agricultural land may transfer this land to a person carrying out agricultural production, is a co-owner of agricultural land, a close person and a relative. This has been abolished by the Constitutional Court, and at the present a non-agricultural person can now acquire agricultural land. The prepared amendment from the workshop of the Ministry of Agriculture should limit the acquisition of land ownership. The aim is to prevent the speculative purchase of agricultural land. An individual could not acquire more than 300 ha and a legal person more than 1200 ha of land. The amendment should stipulate a pre-emption right for the state and self-government. The low price is the driving force behind the interest in buying land, especially by foreigners. Citizens from Denmark, the Netherlands, Italy, and China are interested in our agricultural land. There is no limit to how agriculture land foreigners can buy.

The rental price for agricultural land increased by 18% over the period under review. From the point of view of this indicator, Slovakia has the largest share of leased land in the total land area in the entire EU, at the level of about 90%. In 2020, it is assumed that the lease price will increase due to the increase in the lease prices of agricultural land by the Slovak Land Fund, which leases approximately 453,000 ha of agricultural land. Farmers who rented land from the Slovak Land Fund paid a price in the period 2014 - 2019, which was calculated from the creditworthiness of the land in individual regions of the Slovak Republic. The minimum rent was adjusted for year-on-year average inflation. The lease of land with lower production potential was lower than the lease of land at the highest credit rating. Since 2020, the rental price is determined in the amount of the so-called usual rent, which represents the average amount of rent per 1 ha of agricultural land used as determined by the district authorities from data provided by tenants. If the district office does not provide data, the usual amount of rent is calculated as 2% of the value of arable land, regardless of whether it is a specific type of land or permanent grassland, respectively, for land that does not generate such yields as arable land.

| Table 5: Development of acreage of organically farmed agricultural land and its selected categories (in ha) |
| Acreage/year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Index |
| Ecolog.agric. land | 180 | 186 | 187 | 189 | 192 | 196 | 22289 | 1,235 |
| | 365 | 483 | 010 | 147 | 143 | 210 | 6 | 8 |
| Arable land | 62279 | 60890 | 60302 | 62978 | 64821 | 66560 | 75592 | 1,213 | 8 |
The support from the RDP of SR 2007 - 2013 in the sub-measure Organic Agriculture had a positive effect on increasing the area of registered agricultural land in organic agricultural production. In the years 2014-2020, farmers had the opportunity to participate in the RDP within Organic Farming, which is part of the RDP of SR 2014-2020. Their role is to promote environmental protection, preserve biodiversity and build consumer confidence in organic products. The area of organically farmed agricultural land is growing from year to year. Overall, it increased by 23.58% during the period under review. Approximately 65% of organically farmed agricultural land consists of permanent grassland where sheep and cattle are raised. Arable land accounts for approximately 32-35% of the total area of organically farmed agricultural land. Orchards (0.8 - 1%) and vineyards (0.1%) are also slightly represented. Ecologically managed land predominates mainly in the eastern part of Slovakia, namely in the Prešov region. Soil protection in Slovakia is stipulated in Act no. 220/2004, which states that the landowner is obliged to implement permanent and effective protection of agricultural land against its degradation by implementing effective protective agrotechnical measures, which include planting greenery, crop rotation, no-plow agrotechnics or the correct choice of crops.

### 4. Conclusion

Physiocrats already considered soil to be a real factor of production. Soil is a basic factor of production, it is a creation of nature. Agricultural production is dependent on land. Therefore, it is necessary to pay attention to its protection, maintaining quality, production capabilities. Agricultural land consists of several components, arable land, vineyards, hop gardens, orchards, gardens, permanent grasslands. The acreage of agricultural land has been declining from year to year since 2014. The acreage of all its components except orchards has fallen by 2020. Arable land (average 49%) and permanent grassland (average 36%) have the largest share on agricultural land. The share of agricultural land in the total land area is at the level of 49% on average. Non-agricultural land, on the other hand, increases its area every year, which is influenced by the increase in the area of the items that make it up, namely: forest land, water areas, built-up areas and courtyards, other areas. The share of agricultural land per capita is declining from year to year. On the contrary, the share of organically farmed agricultural land per capita is growing, which is due to the increase in the area of this type of land. Organic farming is a form of land management without industrial fertilizers, sprays, chemicals. The share of organically managed land in the total area of agricultural land within the analyzed period was 8-9%. By 2030, one of the goals of the Environmental Policy Strategy 2030 is to increase this share to the level of 13.5%. Most of the agricultural land is leased. In Slovakia, the fragmentation of land ownership is characteristic, which results from the historical development. Fragmentation hinders various investments. Land rents are growing every year. Since May 2018, the amendment to Act no. 504/2003 introduced the concept of usual rent. This is focused to the price for the use of agricultural land in the operation of the holding per 1 ha, which is published each year by the relevant district office for each cadastral area.
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