



Statistical trends in agriculture in light of the future sustainable food security in Slovenia

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ABSTRACT

The concept of a sustainable food security on the national or global level includes the availability to provide sufficient amount of food also in exceptional and critical circumstances, as well as a higher level of potential rates of self-sufficiency and traceability of safely produced agricultural products. The primary purpose of this paper is to outline the state and the importance of the Slovenian agriculture and to link the available statistical data with the academic assumptions.

Agriculture in Slovenia is carried out as a traditional industry in a specific geographical and climatic situation and has therefore certain specific characteristics. At the latest agricultural census in 2010 there were just over 75,000 agricultural holdings in Slovenia, of which 61% were smaller, with less than 5 hectares of utilised agricultural areas and were cultivating 22% of total utilised agricultural areas. Larger agricultural holdings represented only 2% of all agricultural holdings in Slovenia.

The dominant type of agricultural holdings were family farms, similarly to other European countries. Slovenia is also one of the European countries with the smallest area of arable land per capita and one of the countries with above European average share of permanent grassland. Economic accounts for agriculture data on agricultural subsidies, labour input and investments also enable more in-depth knowledge of the agricultural specifics.

Slovenia is traditionally a net importer of food, since domestic production does not meet the needs for agricultural products. Data of the national supply balance sheets show that the annual domestic agricultural production varied over the past decade, partly due to changes in the area set aside for individual agricultural products and partly due to the increasingly unreliable weather conditions and the increasingly unreliable yield per hectare. Domestic consumption, which can be consumed for various purposes (food, further processing, industry, animal fodder), was mainly gradually declining in the same period, but mostly exceeded the domestic production. Rates of self-sufficiency, which show to what extent domestic production covers domestic consumption, were mostly lower than 100%. Slovenia has higher self-sufficiency rates for animal products than for crops; the rates are the lowest for vegetables (38% in 2014), potato (68% in 2014) and cereals (78% in 2014).

Nevertheless, some expert and academic assessments show that Slovenia has sufficiently big potential in availability of agricultural land to improve its food security by 2030. To ensure greater food security in the future academics propose the increase of the agricultural areas and agricultural yield, conversion to organic farming, reduction of the quantities of food waste and a change of eating habits, especially the reduction of meat consumption.

The aim of the paper is therefore to show the statistical agricultural trends of the selected agricultural indicators with the purpose to support or reject the current academic positions and proposals for the future improvement of the national food security. The paper further aims to target the potential development areas of the Slovenian agriculture in this light and offer some suggestions for the potential future improvement of some segments of food security in Slovenia.

Keywords: agricultural holdings, indicators, supply balance sheets, self-sufficiency rate

PAPER

1. Introduction

Key problems of global so-called commercial (conventional) agriculture today are unequal distribution of globally (still) sufficient food production, "chemisation" of activity, soil erosion (on more than 900 million hectares of agricultural land in the world), large water consumption, building up of agricultural

land, and a rapidly growing world population. On many agricultural areas consumption of mineral fertilisers per hectare represents an environmental burden. Conventional agriculture is distinctly capital and energy intensive, albeit productive, employs few people (in developed countries less than 5% of the population) and presents a large environmental burden (Stutz, Warf 2005). Fossil fuels are used for production and sustainable economy of local communities is neglected, since agricultural products are usually sold on distant markets.

Sustainable development model, which is a multi-layered growth of well-being among people, involves permanent protection of available natural resources. Sustainable development is development consistent with the capacity of the environment both in terms of permanent supply of the population with natural resources and in terms of the capacity to neutralise various environmental burdens (Plut 2014). It is characterised by the use of local natural resources and decentralisation of production due to the need for greater self-sufficiency (Stutz, Warf 2005).

In expected uncertain conditions of unstable food supply¹ at the global level due to climate change, local, regional and national self-sufficiency in food is becoming a very important issue. Slovenia cannot cover its needs for agri-food products on its own, but experts assess that Slovenia has sufficient potential of agricultural land to improve its food security by 2030 (Plut 2012). Due to many environmentally positive consequences, it is appropriate to treat the increase in self-sufficiency as one of the key areas of sustainable development. The concept of food security includes the ability to provide food even in exceptional and critical circumstances, secure level of potential self-sufficiency and traceability of safely produced agricultural products (Perpar, Udov 2010). Food security and own food production at the national level are again becoming the issues of strategic importance.

2. Global agricultural trends

The reasons for lack of food on the global and regional markets are negative consequences of climate change (more frequent droughts and floods), increasing prices of mineral fertilisers, use of larger agricultural area for producing biofuels (ethanol, biodiesel), extensive conversion of agricultural land into building sites, erosion, and growing wheat consumption for meat production. Large energy consumption and large emissions of greenhouse gases from traffic during the transport of food over large distances are key wider negative environmental impacts (Nierenberg, Halweil 2005). Agricultural systems contribute significantly to water consumption, to climate change, to reducing biodiversity and to soil depletion (Sage 2012). Production of 1 kilogram of wheat namely requires 900 litres of water, 1 kilogram of maize 1,400 litres of water, and 1 kilogram of beef as much as 15,000–20,000 litres of water (Nierenberg, Halweil 2005, p. 77).

In the opinion of environmental and agricultural experts, in the next few decades it might be possible to influence the expansion of agricultural land, an increase of yields on existing agricultural area, usage of new food sources, a decrease of food waste in developed countries, to distribute food more fairly and to change eating habits by not increasing the share of meat from animal farms (use of cereals) in the diet of people in developing countries and by constantly decreasing meat consumption in developed countries. Due to energy and environment reasons, meat consumption and the share of meat should decline in developed countries, while in globally and geopolitically strained conditions of food supply the consumption of wheat for meat production should be drastically limited. For a meat-based diet, on average four times more resources are necessary than for a vegetarian diet. Due to the lack of food and environmental reasons, some experts point out the need to move to a more vegetarian diet in developed countries (Maxey 2007). The predominance of the vegetarian diet of the world population would require 700–800 m² of intensively farmed agricultural land per capita, while the predominance of the diet based on meat and dairy products would require up to 4,000 m² per capita. To meet the average daily intake of 2,500 kcal per capita with 30% of animal products, around 1,500 m² intensively farmed agricultural land per capita would be needed, while a high share of meat would require around 3,000 m² per capita. To feed 10 billion people, in mid-21st century we would thus need 880–3,000 million hectares of land, most probably 1,100–1,300 million hectares. This means that in the case of a lower share of meat and dairy products in the global diet, no additional agricultural land would actually be needed (Sage 2012).

3. Slovenian characteristics in terms of sustainable development and agricultural trends

In terms of sustainable development, Slovenia is characterised by the stabilisation of the population and population pressures on the environment, smaller cities, large dispersion and small settlements, rich water resources, very well preserved nature and high-quality living environment on most of its territory. Our country is distinguished by exceptional landscape and biodiversity, but also by excessive consumption of natural resources and various forms of environmental burdening, including the existence of spatially delineated areas of intensive and multilevel landscape degradation.

¹ Food includes a set of agricultural products (meat, eggs, cereals, potato, vegetables, sugar and rice) in basic or processed form.

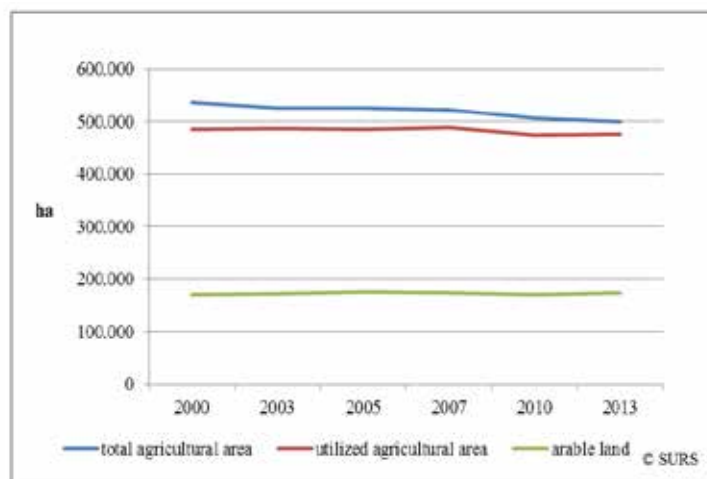
Between 2002 and 2007, 19,712 hectares of Slovenian's territory were built up, of which 65% was agricultural land (Odnos do kmetijske zemlje 2010; Perpar, Udov 2010). The draft Slovenia's Development Strategy for the 2014–2020 period points out increasing development differences among Slovenian regions.

Even though agriculture contributes only 1.2% of total GDP in the EU-27, and also in Slovenia in 2010, it is one of the most important industries. In addition to its most important task of providing people with high-quality food, agriculture takes care of preserving the cultural landscape, has a positive impact on rural development, on preserving settlement, particularly in demographically endangered areas, and creates jobs. The integration of agriculture into the environment and factors related to environmental protection – such as preservation of biodiversity, improving the well-being of livestock, sustainable farming, etc. – are being increasingly emphasized. Agriculture is an important part of the economy since it provides inputs for agro-industry, supplements tourism industry, performs municipal services, etc. The Common European Agricultural Policy focuses its increasing attention on comprehensive treatment of agriculture and rural areas and spends a considerable share of the total EU budget for these purposes (Agriculture in Slovenia and in the Rest of the EU 2014).

An average agricultural holding in Slovenia is less than half the size of an average agricultural holding in the EU-27 (according to 2010 data just over 6 hectares of utilised agricultural area). Half of agricultural holdings in Slovenia have less than 5 hectares of utilised agricultural area. Smaller agricultural holdings (less than 5 hectares of utilised agricultural area) represented 61% of all agricultural holdings in Slovenia; they were cultivating 22% of total utilised agricultural area in the country. Larger agricultural holdings (more than 30 hectares of utilised agricultural area) represented only 2% of all agricultural holdings in Slovenia; they were cultivating only a fifth of total utilised agricultural area in the country.

According to statistical data for 2010, utilised agricultural area in Slovenia represented less than a quarter of total area. Slovenia was thus one of the four EU-27 Member States with less than 0.1 hectare of arable land per capita. The most widespread crop in Slovenia was maize, which was sown on almost 37% of arable land (59% as maize for grain and the rest as green maize). Wheat was sown on almost 19% of arable land, but because the share of arable land is low, Slovenia is not self-sufficient in wheat. Cattle and milk production are the most important part of livestock production representing 58% of the total value of livestock production. Cattle breeders in Slovenia breed on average 13 cattle per agricultural holding. Pig breeding represents only 12% of the total value of livestock production in Slovenia. 23% of sheep and goats are bred on agricultural holdings having the status of organic farms or farms in transition to organic farming. In Slovenia there are more than 2,000 organic farms (Agriculture in Slovenia and in the Rest of the EU 2014). In 2014 the share of organically farmed utilised agricultural area was just over 8%.

Figure 1 - Agricultural area, utilized agricultural area and arable land, Slovenia



1) Due to rounding, the sum specified may not match.
Source: Statistical Office of the Republic of Slovenia

Around 1960 there were around 300,000 hectares of arable land and kitchen gardens in Slovenia; by 1991 the number dropped to 200,000 hectares, mostly on account of overgrowing and building up of agricultural land. In 1991 there were 246,000 hectares of arable land, which is 1.242 m² per capita and in 2010 only 170,000 hectares (in 2011 only 168,700 hectares) or only 830 m² per capita. As regards the area of arable land and kitchen gardens, Slovenia is among EU Member States with lowest values. More than half of arable land was used for producing cereals, particularly maize for grain and wheat, and almost a third was used for producing green fodder, mostly green maize, and grasses and grass-clover mixtures. Maize fields are also used for producing silage as the basis for an increasing number of biogas plants. The European provision on the necessary extent of biogas production reduces the production of crops for food (Perpar, Udov 2010). In 1991, there were 561,295 hectares of utilised agricultural area in Slovenia, which is 2,833

m² per capita; in 2000 the number was 508,960 hectares or 2,571 m² per capita, and in 2009 only 468,496 hectares or 2,297 m² per capita, which is well below the EU-27 average (3,510 m² per capita) (Keyfigures on Europe 2010). According to SURS's data and the agricultural census, in 2010 there were 474,432 hectares of utilised agricultural area in Slovenia or 2,350 m² per capita. In geographically and climatically similar conditions, secure food supply in Slovenia would require at least 3,000 m² of utilised agricultural area (arable land, permanent grassland, orchards and vineyards) per capita (Hrustel Majcen 2004).

In 2007 the global average area of cereals was 1,000 m² per capita; at that time cereals in Slovenia were sown on around 100,000 hectares, which is only 500 m² per capita; in 2010, 152,000 tons of wheat grain was produced on 7% smaller area (75 kilograms per capita), which is 8% more than the 2005–2009 average (140,000 tons). The yield per hectare of wheat (4.8 t/ha) was among the best in the five-year period. Maize output in 2010 was 300,000 tons, i.e. an average result in recent years. As regards the share of agricultural holdings breeding livestock, Slovenia is among the top EU-27 Member States (79%). As regards the intensity of livestock production, which is measured by the number of livestock units per hectare of utilised agricultural area, Slovenia is among the top ten EU-27 Member States. In Slovenia the average is 1.1 livestock units per hectare of utilised agricultural area, just above the EU-27 average of 0.8 livestock units per hectare of utilised agricultural area. To cultivate a hectare of utilised agricultural area, farmers in Slovenia spend on average a lot more hours per year (286) than farmers in the EU-27 (102).

The self-sufficiency rate, which shows the extent to which domestic production meets domestic consumption, depends on the weather conditions in an individual year, particularly for crops. In 2014, self-sufficiency in wheat was 70%, and for cereals in general 77%. Self-sufficiency was the lowest in vegetables; only 38% in 2014. As regards animal products, self-sufficiency rates were higher: meat 80%, milk (2006–2011) between 115% and 120%. Per capita meat consumption has declined over the past ten years; in 2005 it was 97 kilograms and in 2014 85 kilograms.

The most obvious reason for the strategically low self-sufficiency rates in Slovenia is decrease in arable land (and thus the area of cereals); also important is the low level of exploitation of the entire natural agricultural potential. The general decrease in agricultural land due to abandoning agricultural production and building up the most fertile flatland areas had a negative impact on self-sufficiency (Plut 2012).

Due to rich water resources, Slovenia is one of the countries that use very low shares of available water resources for water supply and is in this respect comparable to Austria, Switzerland and Finland. In the 2005–2007 period on average only 2–3% of all available water was abstracted (so-called water stress is practically non-existent) (The European Environment 2010). Nevertheless, due to climate change and expected larger needs for irrigation, it is expected that particularly in the western and north-eastern parts of Slovenia the problems with seasonal hydrological and agricultural lack of water in the vegetation period will become worse.

Among the mentioned national priority sustainable self-sufficiency issues, in the opinion of national experts (Plut 2012), achieving a secure rate of food self-sufficiency, production and consumption of locally produced, high-quality and healthy food will most probably be the most demanding strategic sustainable development task at the national level. We should also decrease the amount of food waste. According to SURS's estimate, in 2013 40% of food consumed in Slovenia was produced in Slovenia and 60% was imported. In 2013, 4 percentage points less locally produced food was consumed in Slovenia than in 2010 (44%); most of the food was imported from the neighbouring countries (Hungary, Austria, Italy and Croatia). According to SURS's rough estimates² the amount of waste food was falling in the 2010–2014 period. In 2014 a person in Slovenia generated on average 59 kilograms of food waste³; in 2010 the figure was 88 kilograms. Large enough agricultural land and preservation of natural soil fertility on around 75,000 agricultural holdings will be the key natural conditions for preserving food security in Slovenia at the time of the stabilisation of its population.

² The rough statistical estimate of the amount of food waste (food waste per capita) is the first attempt to calculate the indicator, so data should be used with caution. The national methodology for a more realistic calculation is being prepared.

³ Food waste covers the following types of waste:

02 01 02 Animal-tissue waste (wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing)

02 01 03 Plant-tissue waste (wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing)

02 02 02 Animal-tissue waste (wastes from the preparation and processing of meat, fish and other foods of animal origin)

02 03 01 Sludges from washing, cleaning, peeling, centrifuging and separation (wastes from fruit, vegetables, cereals, edible oils, cocoa, coffee, tea and tobacco preparation and processing; conserve production; yeast and yeast extract production, molasses preparation and fermentation)

20 01 08 Biodegradable kitchen and canteen waste (municipal waste)

20 01 25 Edible oil and fat (municipal waste)

20 03 01 Mixed municipal waste

20 03 02 Waste from markets

4. Strategic expert proposal for improving the level of food security for Slovenia

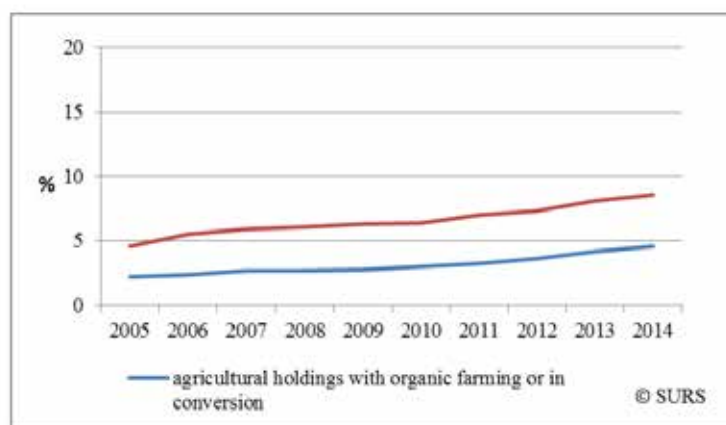
Despite relatively low self-sufficiency rates, in the opinion of experts, Slovenia has sufficiently large agricultural land potentials to be able to significantly increase the self-sufficiency rates (Plut 2013). The experts propose:

- ... Stabilisation of the extent of built-up areas
- ... Remediation of degraded agricultural area
- ... Preservation of biodiversity and landscape ecosystems
- ... Increasing the importance of hilly areas for food
- ... Protection of irreplaceable fertile agricultural area
- ... Increasing the extent of agricultural area by a third or at least a quarter of the current extent
- ... Increasing utilised agricultural area to around 600,000 hectares to achieve the strategic minimum of 3,000 m² of utilised agricultural area per capita
- ... Increasing arable land to around 250,000 hectares (or 1,250 m² per capita) instead of the current 170,000 hectares (less than 900 m² per capita)
- ... Increasing the area of cereals to 140,000 hectares (by 2030) to achieve 700 m² of area of cereals per capita instead of the current 500 m² per capita
- ... Streamlining agricultural production into producing food in an integrated and organic way (despite lower yields), with the emphasis on cereals (particularly wheat, not so much maize)
- ... Increasing the self-sufficiency in vegetables; reducing local production and consumption of meat
- ... Limiting the production of fodder in flatland areas
- ... Focusing on orchards, vineyards, pastures and traditional livestock production in hilly areas
- ... Limiting the production of biofuels on agricultural land (rape seeds and maize for biofuel) to degraded areas

Organic farming responds to key challenges by providing a high level of public goods such as soil quality and biodiversity. It also contributes to the sustainable development of rural areas by creating a larger number of jobs and acting as a promotor of innovation in rural development. In 2004, the EU adopted the European Action Plan for Organic Food and Agriculture and the Government of the Republic of Slovenia adopted the Action Plan for Development of Organic Agriculture in Slovenia by 2015, with the help of which the following goals should be achieved by 2015: 15% of utilised agricultural area with organic farming, 20% share of organic farms and 10% share of organic food in total food supply. The stated goals have not yet been achieved (Slabe 2010).

The share of utilised agricultural area with organic farming is increasing (in the structure of organic farming in Slovenia grassland prevails with a 90% share). Between 2005 and 2012 the share increased from 4.5% to 7.3%, but it is still far from the goal of 15% of utilised agricultural area with organic farming (Green Growth Indicators 2014). Organic food production is an important opportunity for creating new jobs, revitalising agriculture and rural areas, and improving the quality of life. Fresh organic vegetables in particular are imported from Italy, Spain, the Netherlands and Austria. The Institute for Sustainable Development and the Biotechnical Faculty (Slabe 2010) found that in 2009 the share of organic food in Slovenia was only 1% of total food market, but that the demand for organic food has been growing in the past five years at an annual rate of 10–15%. The two institutions also found that organic farming in Slovenia covers only about 20% of the current (still growing) needs of the Slovenian market (Slabe 2010).

Figure 2 - Share of utilized agricultural area with organic farming or in conversion, Slovenia



Sources: Statistical Office of the Republic of Slovenia, Ministry of Agriculture, Forestry and Food

5. Conclusion

There are some key obstacles facing sustainable development: bad conditions for sustainable mobility (public transport is not functional), despite some measures *still insufficient support for organic farming and the resulting insufficient quantities of locally produced organic food, unsustainable construction of tourist facilities, marginalisation of the importance of fair relations in supply chains, general ignorance of sustainable practices* (Plan B for Slovenia 2012). Slovenia has low self-sufficiency rates and downward trends in a number of key crops (vegetables, cereals, potato, etc.), while in bovine meat and milk domestic needs are covered or even exceeded. Connected to declining self-sufficiency rates, Slovenia is facing a question of current agricultural land use. Does it really make sense that livestock production expanded from mountainous regions, with mostly grassland, to more favourable but limited fertile plains on which fodder (mostly maize) for animals is grown. On flatland there is a constant conflict with other activities (e.g. transport and other infrastructure, industry, construction of dwellings), particularly protection of drinking water (Slabe 2010).

Of all expected impacts, in Slovenia extreme weather conditions (floods, droughts, storms) will probably have the most negative impact on well-being in the coming decades, since as regards the damage in recent decades they are already here. The strategy of adjusting agriculture and forestry in Slovenia points out the following key measures (Kajfe Bogataj et al. 2008):

- ... Making the construction of water reservoirs and irrigation systems one of the most important targets of agricultural policy (including the provision of food security)
- ... Sustainable provision of economic security of farms at extreme weather events – via insurance companies and co-financing of premiums
- ... Providing the possibility of implementing supplementary activities that reduce the vulnerability of farms at extreme weather events
- ... Changing land use due to repeated droughts (also due to floods and landslides)

From the point of view of the potential of natural resources, key and recommended economic direction for Slovenia is reduced consumption of energy and material and decentralised regional use of domestic resources (Plut 2014). Additional national sustainable development projects for sustainable existence should be prepared and implemented by supporting the pilot sample eco-villages and urban eco-neighbourhoods, increasing food and energy self-sufficiency of its regions and municipalities (pilot sample self-sufficient municipalities), sustainable management and use of local resources in various types of protected areas, and eco-remediation of living and management at national, regional and local levels (Plut 2014).

In the opinion of ecological and agricultural experts, in the next few decades it will be actually possible to expand agricultural land, to decrease food waste in developed countries, and decrease the consumption and share of meat in the diet in developed countries, particularly due to energy-environmental reasons. The general decrease in agricultural land in Slovenia, which is shown by statistical data, due to abandoning of farming and extensive building on the most fertile flatland areas increased its food dependency (Plut 2012).

By 2030 the extent of agricultural land should be returned to the situation around 1960. In view of geographic conditions and ownership, a large share (two thirds) of agricultural area with limited natural conditions from food production (more difficult conditions for production), the large share of protected and water protection areas (on more than half of the national territory), priority water supply role of gravel plains (mandatory subsidies to farmers for lower yields) and other reasons, agricultural production should be focused on producing integrated and organically produced food (despite the slightly lower yield) for supplying the population with a significantly larger emphasis on cereals (particularly wheat, not so much maize), as well as much larger production of vegetables (currently only around 40% self-sufficiency), fruit and partly grapes. In the next 20 years utilised agricultural area needs to be increased from 470,000 hectares to around 600,000 hectares. In this way we would achieve the strategic minimum of utilised agricultural area, which is in our geographic conditions around 3,000 (3,500) m² per capita. With a view to increasing the self-sufficiency rate of Slovenia, the key issue is increasing the area of arable land (including gardens), where at least 250,000 hectares are needed or at least 1,250 m² per capita instead of the 170,000 hectares or less than 900 m² per capita in 2010. Production of animal fodder should be limited, particularly in the flatlands; in the hilly part of the country in addition to orchards and vineyards, grassland should enable traditional, humane livestock production (cattle, sheep) (Plut 2012). The market situation shows that the supply of organic food in Slovenia is still lower than the demand; statistics shows increased share of utilised agricultural area with organic farming. The possibility to engage in such production is still not fully exploited (Perpar, Udov 2010).

A higher self-sufficiency rate (particularly in wheat) could be achieved by taking into account the assumption of reducing local production and consumption of meat (Potočnik Slavi 2010). In 2014 the self-sufficiency rate in wheat was 70% (for all cereals in general 77%), which is more than in recent years. Per capita meat consumption has declined over the past ten years; in 2005 it was 97 kilograms and in

2014 85 kilograms. According to SURS's estimates, in the 2008–2013 period the amount of food waste in Slovenia decreased. In 2013 a person in Slovenia generated on average 72 kilograms of food waste; in 2008 the figure was 197 kilograms. These statistical data (some of them should be used carefully) indicate favourable trends and changes in eating habits and draw near to expert proposals.

In view of the needs for food, very limited production of agricultural crops for biofuel would only be possible on poisoned or otherwise degraded areas. The existing forms of pollution, particularly in urban ecosystems, are not irreversible, the quality of air and water resources can be significantly improved, and more effort should be invested in financially demanding recultivation of land poisoned by heavy metals. In the opinion of environmental experts, these areas could be built up, which should in the long run be stabilised (Plut 2014).

In view of the existing knowledge, economic structure and experience, Slovenia has the greatest opportunities in the following low-carbon technologies and value added chains (Climate Change Act 2010): sustainable management of forest, wood as a construction material, wood products and use of wood residues for energy production, and organic farming. In the entire forest-processing chain in particular, Slovenia could build a "green valley" image and could be a role model for how it is possible to sustainably manage national wealth. In the 2010–2020 period, the amount of logs processed in Slovenia could be increased by 70%, i.e. from 1,125,000 m³ to 2,100,000 m³ (Humar, Kutnar, Piškur 2013).

Large effort would be needed also for very important remediation of environmentally degraded areas (e.g. gravel pits, industrial, mining and coal areas), which are usually on flatland. Together with sustainable forestry and rural tourism, increase in importance of hilly areas for food production is essential for the implementation of harmonised, sustainable regional development in Slovenia.

Based on statistical data, the article tries to indicate current agricultural trends and in light of national expert proposals for improvement of food security in Slovenia point out some potential development areas of agricultural activities in the country. Some favourable statistical trends show convergence with proposals to improve food security, while others point out the urgency of future more comprehensive and complex treatment of all stakeholders in planning one of the most important industries.

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