

Senior Assist. Prof. Maria Kotseva-Tikova, PhD*, Prof. Jaroslav Dvorak, PhD**

THE BIOECONOMY DURING A COVID-19 PANDEMIC: THE CASE OF BULGARIA AND LITHUANIA

The bioeconomy is seen by the EU as an important part of the idea of achieving sustainable development that is carbon neutral and is accompanied by technological modernization and resource efficiency. For that reason, the European Commission has formed a strategy for its development, with the separate Member States having each adopted their own documentary approach towards it. The aim of the present article is to examine the resilience of the bioeconomy to the emergence of a health risk (COVID-19) by tracking the changes in production in some of its sectors. The methodology includes a case study of the bioeconomic peculiarities of two EU Member States – Bulgaria and Lithuania. The level of resilience is tested through a comparison of quantitative data. Contrary to the expectations of a slow recovery of the national economies, the main branches of the food industry show stability. They can rely on their ability to meet the demand for reorientation of the participants in the agri-food chain towards local goods, which provides an opportunity for the implementation of sustainable development practices.

JEL: O10; O13; O52; O57

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The health crisis caused by COVID-19 has had a significant socio-economic and political impact as a result of the measures taken by the national governments. The COVID-19 infection has tested the health systems along with the ability of the public and private sectors to respond and manage risks. It is important to note that by this point there are no clear operating models or well-established good practices that would indicate how to respond appropriately to the crisis at the level of the business organization and the supply chain. The uncertainty and lack of specific treatment necessitate the implementation of measures such as maintaining distance, redevelopment of production premises and restriction of activities with high probability of infection, as this is the only possible solution for managing the morbidity, taking account of the available medical staff.

The economic consequences of the lockdown and other restrictive measures have had the strongest impact on restaurant, hotel, transport, real estate, machinery, sports and cultural activities, as well as on the trade of certain non-food products in all of the countries affected by the pandemic, including Bulgaria and Lithuania (BCRA,

* Economic Research Institute at the Bulgarian Academy of Sciences, Regional and Sectoral Economy Section; Sofia University "St Kliment Ohridski", maria_kotseva@yahoo.com

** Klaipėda University, Lithuania, Department of Public Administration and Political Sciences, jaroslav.dvorak@ku.lt

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2020; Dvorak, 2020). Some industries are experiencing a slight decline (construction, textile and leather products, metallurgy), while others will maintain and even expand their levels of production and sales (food production, pharmacy, online trade, courier and health services).

Surveys by the National Statistical Institute (NSI) of Bulgaria among non-financial corporate entities reveal that 42% of enterprises have experienced a decrease in revenues in November as compared to October 2020, for 46% there was no change, and 12% registered growth. The largest decline during the period under review was observed in the fields of culture, sports, repair of household appliances and others (52.8%), trade, transport and restaurants (48.3%), and industry (43%). The most serious risk to the business activity is observed for closed enterprises, as well as for activities that depend on global supply chains or consumer behaviour. Eurostat data also confirm the main negative effects observed mainly during the second quarter of 2020 in Bulgaria: a decline in industrial production by -11.6%; in revenue from services by -10.5%; and in construction by -1.5%. After the initial shock, with the acquired knowledge and experience with the disease and the government's support for dealing with the economic consequences, a certain level of improvement can be observed, as the expectations are for a contraction of the country's economy of between -4.1% (Fitch Solutions, 2020) and -5,1% (EC, 2020) in 2020. The economic recovery is projected to bring the economy back to its pre-crisis levels by the end of 2022. Both exports and consumption are set to contribute positively to the expansion in the next two years, in line with positive external demand and labour market developments (EC, 2020). The World Bank (2020) predicts that in order to overcome the economic consequences, Bulgaria will have to increase its productivity by at least 4% per year, in order to reach the average levels in the EU.

Throughout 2020, the Lithuanian industrial confidence indicator², which is provided by Statistics Lithuania every month, was negative. Most of the confidence in the industry declined over the period of quarantine imposed during the first wave of COVID-19, which happened in April. Even though it grew over the following months, it remained at a negative level. Such a change in the indicator means a decrease in the level of demand, production and inventories of manufactured goods (Official Statistics Portal, 2021). The EC forecast for Lithuania (2020) is for a -2.2% decline in GDP and an economic recovery in 2021. The faster recovery will be accompanied by a level of inflation similar to that in Bulgaria, but with a higher unemployment rate and a two times higher budget deficit.

Crises provide an opportunity to redirect the national economies towards circularity and efficiency in the use of materials, towards the use of new technologies and in the creation of new products and services. The activities that continue to

² According to the Official Statistics portal of Lithuania, the industrial confidence indicator can be described as a simple arithmetic mean of the balances of the assessment of demand, the production expectations and the level of stocks (the latter with an inverted sign).

develop relatively sustainably during the health crisis are the ones engaged in the production and processing of bioeconomic products. After the initial shock of the economic lockdown, the producers of bioeconomic goods succeeded to maintain their volumes and to adapt to the new sales and distribution channels, as well as to the demand for local and environmentally friendly goods.

The following research question guides the present research: how and to what extent does the COVID-19 virus influence the bioeconomic sectors in Bulgaria and Lithuania? This article discusses the behaviour of some industries within the bioeconomy in both countries in the context of the COVID-19 pandemic and the implemented governmental measures for virus prevention and control. The choice of countries for analysis was made based on the following criteria: both are young post-communist democracies; both have agriculture-based industries; and both have joined the EU in 2004 and 2007, respectively. It is important to note that a previous study (Qingbin et al., 2020) suggests that comparative economic research is needed in order to understand the mechanisms by which the COVID-19 pandemic directly or indirectly affected the branches of the bioeconomy, such as the production of dairy products. Qingbing et al. (2020) argue that it is important to conduct a comparative economic analysis of two nations with large (in this case dairy) sectors. However, in the case of the present research, the authors argue that the comparison of two small states, which even demonstrate path dependency, can provide a solid basis for further research. This notion is further supported by the fact that both of the case studies included in the present paper provide rich empirical data for answering the abovementioned research question despite the fact that they have different socio-economic characteristics³.

A comparative research method is used to further analyse the production dynamics in some sectors of the bioeconomy of Bulgaria and Lithuania in 2019-2020. The comparative study shows the similarities and differences between the bioeconomic production yields of the two countries prior to the COVID-19 pandemic (i.e., under normal economic conditions) and their reaction during the pandemic. The data on the bioeconomic sectors consolidates the empirical information into explanatory schemes that could be developed into an evaluation model in the future. The benefits of this method have found recognition in the macroeconomic research conducted by other researchers (Babones, 2013).

European bioeconomic policy

The twentieth century gave birth to new concepts and theories for the synchronization of the ecological with the economic and social spheres and offers approaches towards achieving this mainly through innovations and technologies, including biotechnologies. Sustainable development is reviving its popularity as a strategic landmark along with the search for operationalizing tools to achieve it. Along

³ The population of Bulgaria is 2.5 times higher while the GDP per capita is 1.6 times lower than that in Lithuania.

with the ideas of a green and circular economy, the bioeconomy is emerging as a concept for combining innovative and circular approaches in the sectors dealing with products of organic origin. As early as 1994, the European Commission (EC) saw biotechnology “as one of the most promising and crucial technologies for sustainable development” in the XXI century and began to focus economic activities on its development and use. Bioeconomy is seen as a field in which biotechnologies have a significant share in production and are based on the principles of sustainable development (OECD, 2009). The European Union is establishing a policy for the development of a resource-efficient and sustainable economy. In this regard, a bioeconomy strategy and action plan have been developed, which will support the bioeconomic sectors through new technologies, increased competitiveness and closer cooperation between the various stakeholders (EC, 2012). An emphasis is placed on the need for a holistic approach for tackling the issues in several areas: ecology, the environment, energy supply and food supply, as well as the challenges of natural resource depletion that Europe and the world face today.

Six years later, the strategy was updated, and a definition of bioeconomy was formulated (EC, 2018): “The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste), their functions and principles. It includes and links together: land and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources, i.e., agriculture, forestry, fisheries and aquaculture; and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services”.

The main sectors covered by the concept of bioeconomy, which are expected to create sustainability for EU development, include: agriculture, the production of food, soft beverages and tobacco, bio-based textiles, forestry, wood processing and furniture, paper, fishing and aquaculture, liquid biofuels, bio-based chemicals, pharmaceuticals, plastics and rubber (excluding biofuels), and bio-based electricity.⁴

Circular development is the most significant element in the vision for the development of a European bioeconomy. The intersection of the circular economy and the bioeconomy is the goal of both to add value to waste. The circular economy aims to preserve the value of different types of resources (not only biological) in the economic cycle for as long as possible, including renewable biological resources, and focuses on how products and materials are designed, manufactured, used and disposed of. The bioeconomy includes additional activities, representing a new strategic view of the sectors that produce and use organic products. In 2017 these efforts resulted in an annual turnover of the bioeconomy in EU-28 of over 2 trillion EUR and the employment of over 18 million people (EC, 2017). These sectors are crucial for each country, and this is particularly felt during the global coronavirus

⁴ However, there are authors (Ramcilovic-Suominen, Pülzl, 2018; Liobikiene, et al., 2019) who suggest looking not at sectoral sustainability, but at the sustainability dichotomy, which is defined as being either weak or strong. Weak sustainability means a wide range of substitutes, while strong sustainability does not assume a substitute.

pandemic. The long-term provision of basic food products is a prerequisite for the successful implementation of isolation measures in order to limit the number of people infected with COVID-19. The strength of these sectors lies in their search for a new way to transform and produce bioproducts with higher added value.

The Bioeconomy in Bulgaria and Lithuania

The process of transformation towards bioeconomic activity depends on the level of development of a country, its resources and its political system. Some researchers (McCormick, Kautto, 2013; De Besi, McCormick, 2015; Zeug et al., 2019) believe that the most important factors affecting the bioeconomy include government policy, regulatory regime, intellectual property rights, human resources, market structure, societal change and stakeholder involvement.

More than 40 countries in the world have a strategy for the development of the bioeconomy (Dietz et al. 2018). Most countries with bioeconomic strategies pursue transformations, implementing at least two of the four pathways⁵, including at least three of the four most popular public support measures⁶. More than half of the introduced strategies do not address the risks and conflicts that may arise when achieving the goals through the development of the bioeconomy. European countries are most sensitive to these problems, with Germany and the United Kingdom developing some of the most advanced bio-strategies. In Eastern European countries, there are no explicit documents aimed at the development of the bioeconomy (Wohlgemuth et al., 2020) despite the fact that they have a long tradition in the development of agricultural sectors. Out of the 27 EU Member States only 15 already have, or are going to have in a short time, dedicated bioeconomy strategies, as the CEE countries are behind the Western countries in this process (Voicilas, 2020).

Bulgaria does not have a dedicated strategy for bioeconomic development unlike Lithuania, where such a strategy is currently under development (Kotseva-Tikova et al., 2019; Motola et al., 2018; Brizga et al., 2019). Since the end of 2018, the National Scientific Program “Healthy Foods for a Strong Bioeconomy and Quality of Life” has been operating in Bulgaria, which funds scientific institutes to conduct basic and applied research to create adapted modern models and technologies for the production of healthy foods for a strong regional bioeconomy and to improve the quality of life of the population. Other studies on the development of the bioeconomy, which are focused on its individual branches and regions, are the draft “Strategy for the development of the bioeconomy in the Stara Zagora district in 2017”, which was funded by the BioSTEP program, and the “Strategy for strengthening the role of

⁵ The four pathways of bio-based transformation are: (1) replacement of fossil fuels with bio-based raw materials; (2) increasing productivity in key biological sectors; (3) increasing the efficiency of biomass utilization; and (4) creating and adding value through the application of biological principles and processes separate from large-scale biomass production.

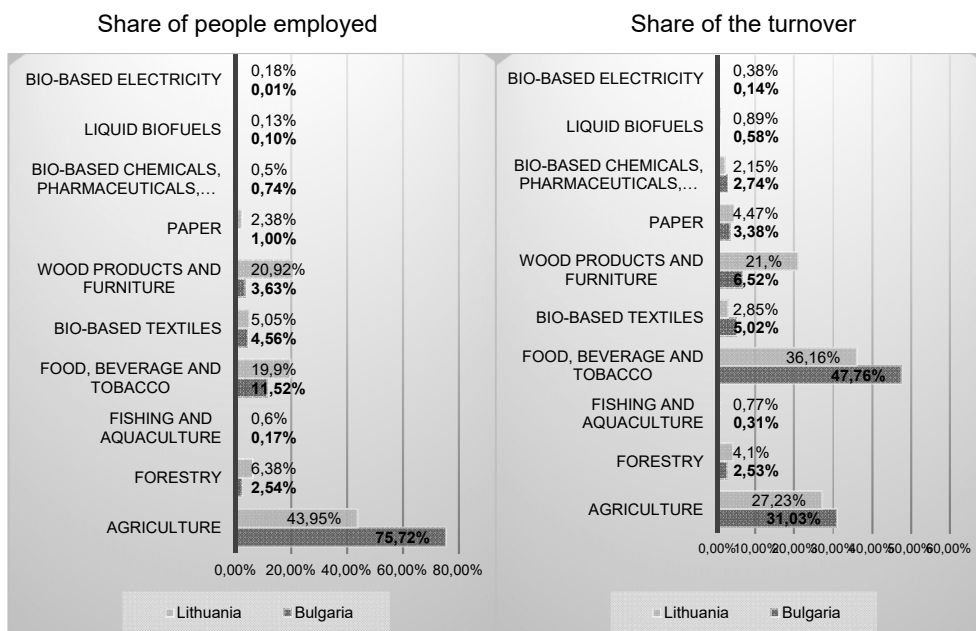
⁶ Public support measures include: 1) R&D; 2) subsidies to increase competitiveness; 3. industrial localization policies; 4) policies for bio-social change.

agriculture in the bioeconomy”, which was created by the Agricultural Academy (2020) in 2020. Bioeconomic activities are sporadic, stimulated by the availability of funding and the introduction of plans at the EU level.

The Bulgarian bioeconomy relies on traditional industries – agriculture and forestry, fishing, food processing, woodworking and paper production – as new bio-based products have a small share in production and employment (biofuels, bioenergy, biotextiles, biochemicals). In 2017, all the sectors of the bioeconomy created employment for 848 thousand people and a turnover of 14 billion EUR (EC, 2017), with large differences between the sectors (Figure 1 and 2). The country ranks eighth according to the number of people employed among the EU-28⁷. The differences between Bulgaria and EU-28 are in respect to the number of people employed and the added value per person. Bulgaria is among the 10 EU Member States⁸ that have low value added and turnover from bioeconomy and the country takes the final position (together with Romania) in respect to value added per person employed (5 thousand EUR).

Figure 1

Figure 2



Source: EC, 2017.

⁷ The first seven positions are held by Poland, Romania, Germany, Italy, France, Spain and the UK.

⁸ The other 9 countries are: Croatia, Cyprus, Estonia, Latvia, Lithuania, Luxemburg, Malta, Slovakia and Slovenia.

In 2017 Lithuania had a turnover of 12 billion EUR and 206 thousand people employed in bioeconomy. Some authors (Liobikiene et al., 2020) have recently criticized Lithuania for being less productive than the developed countries, however, it performs better than Bulgaria in terms of productivity (17 thousand EUR in value added) in the ten bioeconomic sectors. Both countries have the largest share of employment in agriculture. In the case of Bulgaria, the share of persons employed in the agriculture sector is the most significant while the rest only make a small contribution – below 5% (with the exception of only the food, beverage and tobacco sector, which has a greater share – 11%). In Lithuania there is a more favourable employment structure – there is no industry with a share greater than 50% of the employed, which meets the criteria for strong sustainability. There are three important sectors with significant employment and two others that have an employment share greater than 5%. The fact that the highest share of people employed in Bulgaria is in the agriculture sector (1.7 times higher) results in more than 3 times lower value added per person and a little bit higher share of the turnover in the total bioeconomic turnover.

Bulgaria performs better in the food, beverage and tobacco industry in terms of its turnover structure. The country relies mainly on food processing. Agricultural production and the food industry create around 80% of the bioeconomic turnover with the other sectors having an under 7% share each, unlike Lithuania, where there are three bioeconomic activities with a significant contribution of over 89% of the turnover. Both countries develop only a few of their respective industries. Enlarging the contribution of other sectors is a way to improve the efficiency for both states in order for them to move towards stronger sustainability.

In Bulgaria, the main employment and turnover are generated in the agriculture, food, beverage and tobacco, and wood processing sectors. According to data of the NSI for the period from 2015 to 2019, the number of employees in Bulgaria increased by 2.5% and it reached 3.5 million people. 597 thousand people (17% of the total number of employed) are employed in the agriculture and forestry and fisheries sectors, with 101 thousand employees and the highest share of self-employed persons – 56% of the total in 2019. The agriculture, forestry and fishing sectors have suffered a significant decrease in employment – by 68 thousand people since 2017 in contrast to the other industries, with the decrease in agriculture being a persistent trend. The number of agricultural enterprises is about 19 thousand in 2019, with over 90% of them having a staff of up to 9 people. This sector created about 4% of the gross added value in the country in 2019. Data for 2017 shows that the number of people employed in the other bioeconomic sectors was 183 thousand. It can be assumed that this number has remained unchanged in 2019, which would mean a share of about 5% of employees, i.e., the bioeconomy provides employment for almost 22% of the employed in the economy.

These industries are currently considered important not only because they contribute to employment and production but also because of the opportunities they offer for new research and development, for the development of new technologies,

for achieving a higher degree of efficiency and for applying circularity in the use of resources. Such activities can generate economic growth together with their strong contribution to the achievement of the climate objectives and to greater efficiency in the rational use of resources.

The results of some bioeconomic sectors during the COVID-19 pandemics in both countries

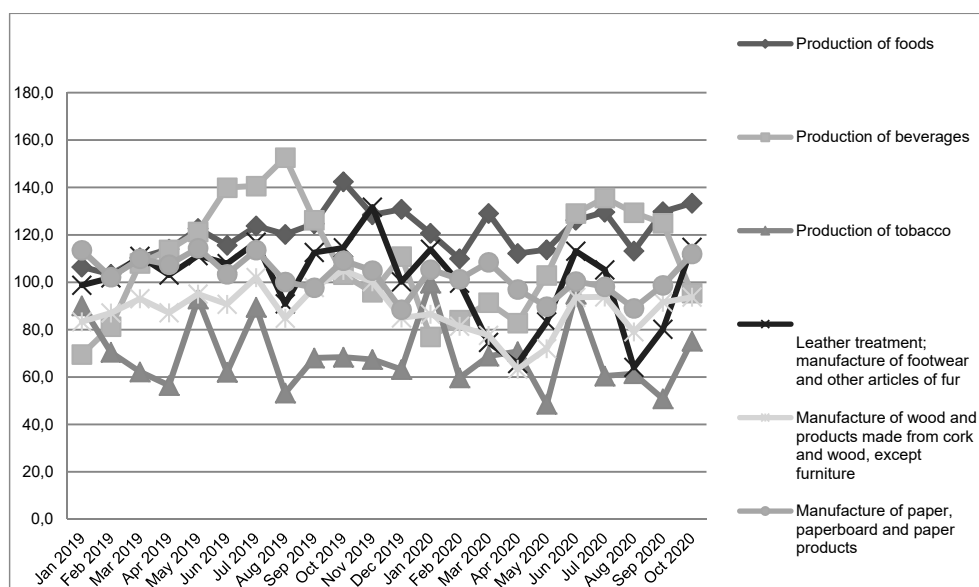
Bulgaria

During the COVID-19 pandemic in 2020, agriculture and the food industry were less affected than other economic sectors and showed resilience to this shock. The turnover in some of the branches of the manufacturing industry in Bulgaria is presented in Figure 3.

During the first lockdown in March and April of 2020 there was a decline in production in the separate sectors as compared to the same period in 2019, followed by a subsequent recovery. These productions provide basic foodstuffs, which is why the effect of the pandemic upon them is weaker.

Figure 3

Industrial turnover index (2015 = 100)



Source. <https://www.nsi.bg/bg/content/909/общи-индекси-на-оборота-в-промишлеността-2015-100>

In Bulgaria, food, beverage and tobacco production is the sector with the second largest share of people employed and the highest result in respect to turnover. The

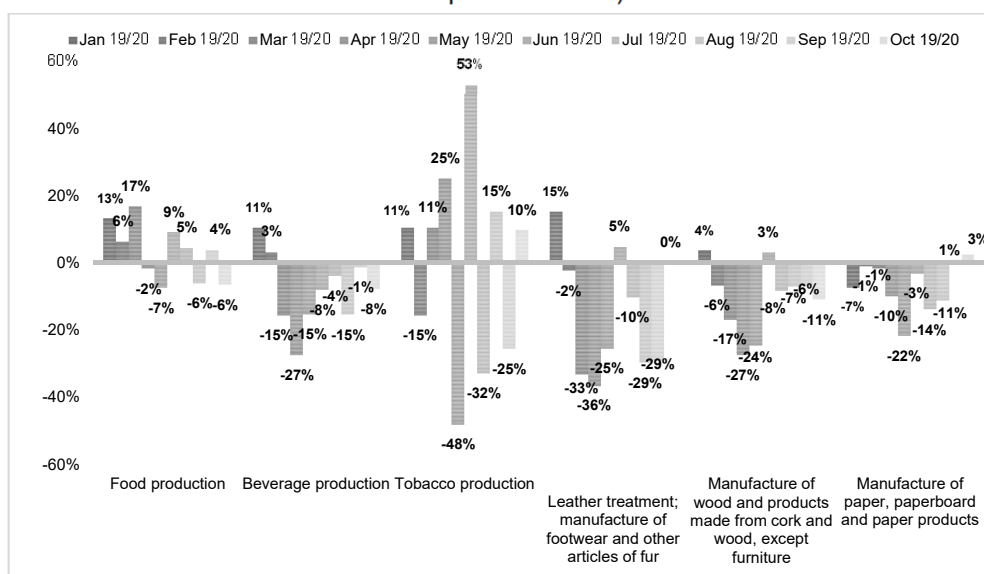
food and tobacco industries were affected the least, and they recovered quickly from the initial shock of the COVID-19 pandemic. The production of beverages and timber are the sectors that reduced their production and failed to recover to the volumes from the previous year by October 2020.

The enterprises in the sector of leather processing, footwear production and other articles of fur, which reduced their production by more than 1/3 during the first lockdown, managed to recover in October 2020, reaching the volumes of the previous year. Companies producing paper, cardboard, etc., whose production continued to shrink throughout 2020 (with the exception of October, which is the last month for which data are available) were the most severely affected.

In 2020, the differences in the rate of recovery are observed (Figure 4) and the monthly percentage change in production during 2020 compared to the respective month of 2019 is clearly visible.

Figure 4

Industrial turnover index (change in 2020 as compared to the same period in 2019)



Source. Own calculations based on NSI data.

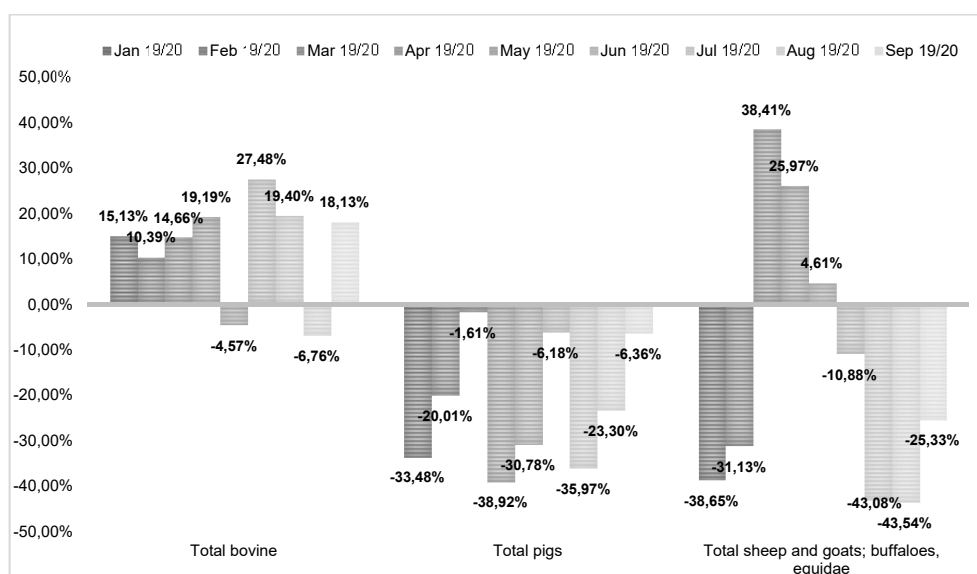
In some major sectors of the food industry – those involved in meat production and processing – there is a decline in production, which is not only a result of the health crisis (Figure 5).

The country used to produce between 6 and 7 thousand tons of red meat per month in 2019, with pork making up the largest contribution. At the beginning of 2020, the volume of meat produced in the country fell sharply due to the African swine fever disease which affected pig farming in 2019 and led to the destruction of many

pigs and entire farms. The processing of pork and the production of meat products is difficult due to the lack of animals in the country, as the coronavirus infection has an additional complicating effect on the import of raw materials. Difficulties in supply are observed not only in the case of basic raw materials, but also with regard to packaging and auxiliary materials. Despite the difficulties, these activities show a relatively high degree of sustainability, which is especially evident from the slaughter weight obtained from bovine animals.

Figure 5

Slaughter weight from red meat slaughterhouses (change in 2020 compared to the same period in 2019)



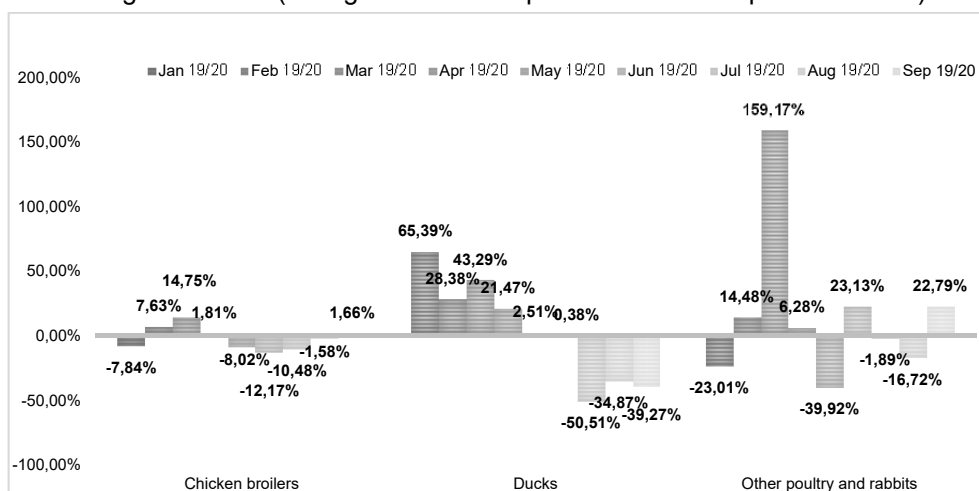
Source: <https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovdstvo/danni/>

White meat production is currently not at risk of animal health pandemics (see Figure 6). The slaughter weight increased in the first half of 2020 and decreased in the third quarter of the year. The meat obtained from ducks, other birds and rabbits increased, while the chicken meat decreased slightly.

The problems for the companies processing white meat are related to the import of raw materials for cutting and the production of meat products and semi-finished products, as well as packaging materials. Difficulties also exist with regard to the required staff and the process of providing them with protective equipment in order to reduce the risk of infection and cessation of production. Small meat processing enterprises are particularly vulnerable to this risk.

Figure 6

Slaughter weight (including by-products and fatty liver) from white meat slaughterhouses (change in 2020 compared to the same period in 2019)

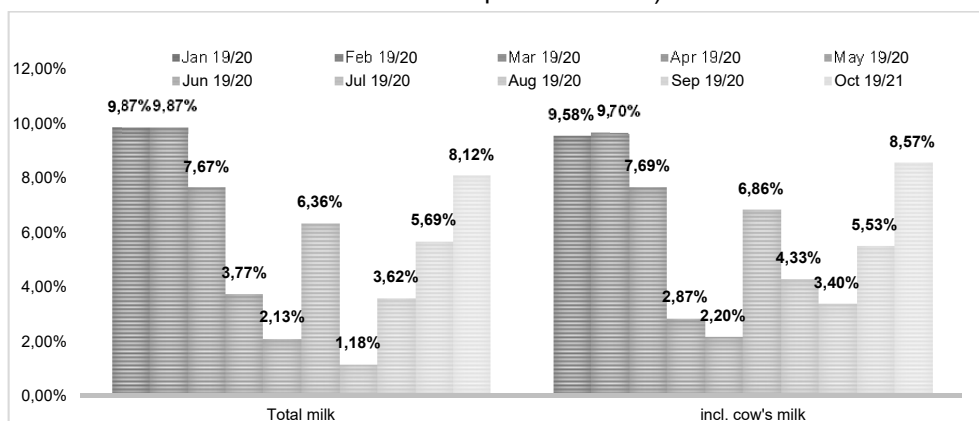


Source: <https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovdstvo/danni/>

In the dairy sector there is no general decline in the volumes of processed milk (Figure 7).

Figure 7

Processed milk in processing enterprises (change in 2020 compared to the same period in 2019)



Source: <https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovdstvo/danni/>

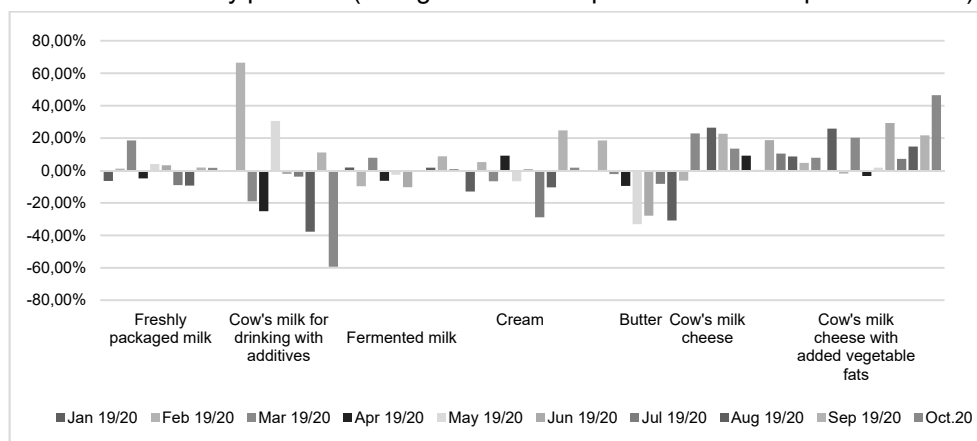
Processed milk from dairy companies is growing, mainly due to cow's milk. There are about 4,000 farms with more than 9 animals in Bulgaria, which raise dairy cows and partially provide the necessary raw materials. However, the raw milk that meets the regulatory requirements is insufficient. The problems here stem not only from the declining number of producers and the labour shortages, but also from the need to ensure that the milk meets the criteria for hygiene and quality, as well as the requirements for investment in breeding and milking conditions.

The growth in the volumes of processed milk is accompanied by an increase of 2% in dairy production for the ten months of 2020 compared to the same period of the previous year. This is mainly due to the enhanced production of cheese from cow's milk, and to a lesser extent due to the production of cheese with added vegetable fat and freshly packaged milk (Figure 8).

Milk processing factories import raw materials, which was difficult, especially during the first lockdown of the economy due to the COVID-19 pandemic. There is a positive change in the structure of production towards certain dairy products such as products without vegetable fats, i.e., the demand is reorientated towards healthier items.

Figure 8

Production of dairy products (change in 2020 compared to the same period in 2019)



Source. <https://www.mzh.government.bg/bg/statistika-i-analizi/izsledvane-zhivotnovodstvo/danni/>

In the main sectors of the processing industry – the production of food, beverages and tobacco – there is a decrease in production as a result of the closure of restaurants. Difficulties in international trade⁹ have an additional negative impact on the bioeconomic sectors as a result of the lockdowns, limitations and difficulties in

⁹ According to NSI data, Bulgarian imports decreased by 8,9% in 2020 in comparison with the previous year, while the exports decreased by 6,4%.

transporting goods and resources in the EU countries. The crisis has also had a somewhat positive effect on them. These sectors have traditionally experienced labour shortages; however, in the conditions of the coronavirus, they turned out to be among of the main sources of employment for the unemployed from other sectors. The data of the Ministry of Labour and Social Policy (MLSP) for September 2020 show that the largest share of vacancies was observed in the manufacturing industry (28.2%), with the largest number of newly employed individuals also reported there – 20.6% of all started jobs. They are also becoming major suppliers of goods to individual consumers and food chains. For the participants in the different stages of the agro-processing chain, the source of sustainable growth is the demand from individuals for local products, as well as for products with less adverse effects on the environment (IAI, 2020), which is visibly increasing in the country.

The production of ecological energy in Bulgaria does not take up a great share in the added value and turnover but has higher results per person and thus, the country is not ranked on the final position among the EU Member States. It performs better than Romania (which holds the last position) and Lithuania. The production of green electricity is not expected to lead to any changes in the energy mix in the country.

The data of the Electricity System Operator (ESO) for the period 01.01.2020-20.12.2020 compared to the period 01.01.2019-20.12.2019 is presented in Table 1.

Table 1

Data on electricity production in Bulgaria (MWh)

Indicator	2019	2020	Change (in %)
Production	42,740,285	39,461,340	-7.67
Consumption	37,041,221	36,083,417	-2.59
Balance (export – import)	5,699,064	3,377,923	-40.73
Basic power plants	36,582,266	33,009,085	-9.77
RES in transmission network, incl.:	1,150,581	1,279,327	11.19
Wind	641,011	731,739	14.15
Photovoltaic	379,950	411,477	8.30
Biomass	129,620	136,111	5.01
RES in distribution network, incl.:	1,763,918	1,868,990	5.96
Wind	588,737	663,728	12.74
Photovoltaic	1,007,646	1,038,644	3.08
Biomass	167,535	166,618	-0.55
Hydro power plants	3,243,520	3,303,938	1.86

Source. <http://www.eso.bg/?did=39>

There is a decrease in the volume of consumed electricity. Production, on the other hand, is also declining, with basic power plants reducing sharply. The generation of electricity from different types of renewable energy sources is increasing. In 2020, 135 sites generating solar electricity and two hydropower plants, which are registered by SEDA, were put into operation. The development is similar on a global level. Measures against COVID-19 limit electricity use and industrial production in most

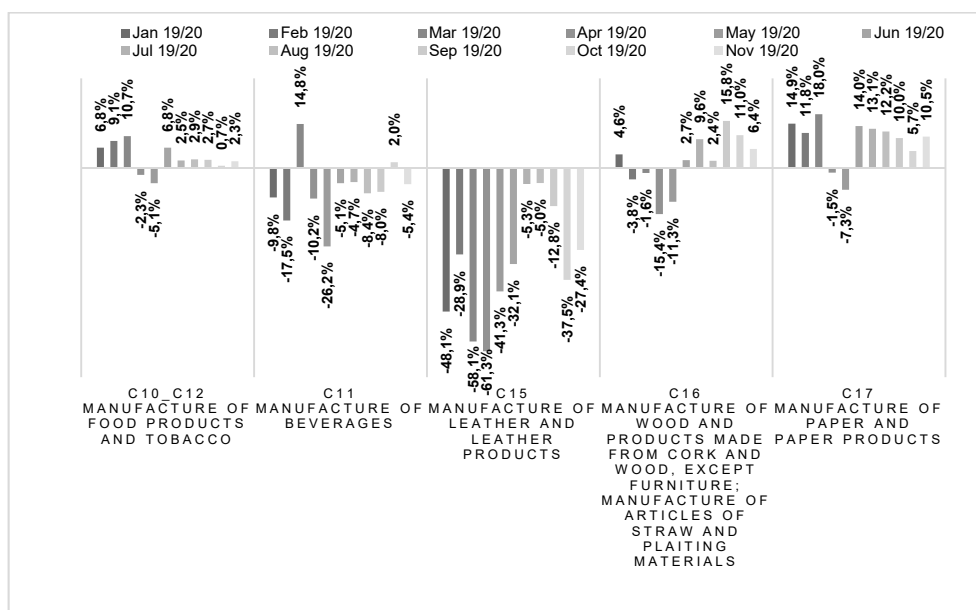
countries, reducing the global coal consumption. RES proved to be resistant to measures against COVID-19. Renewable electricity generation has not been affected by the pandemic. Consumption of biofuels is declining as a result of the decline in transport. Expectations are for a growth in renewable energy by 1% in 2020 (IEA, 2020). The crisis provides an opportunity for reorientation towards sustainable and environmental initiatives as they are connected to local production, which in addition ensures the independence and diversification of the energy mix.

Lithuania

In Lithuania, the results of the main manufacturing and food processing industries show decreases in the volume of production during the initial shock of COVID-19 (Figure 9).

Figure 9

Industrial turnover index (change in 2020 compared to the same period in 2019)



Source. Own calculations based on the Statistical data for Lithuania.

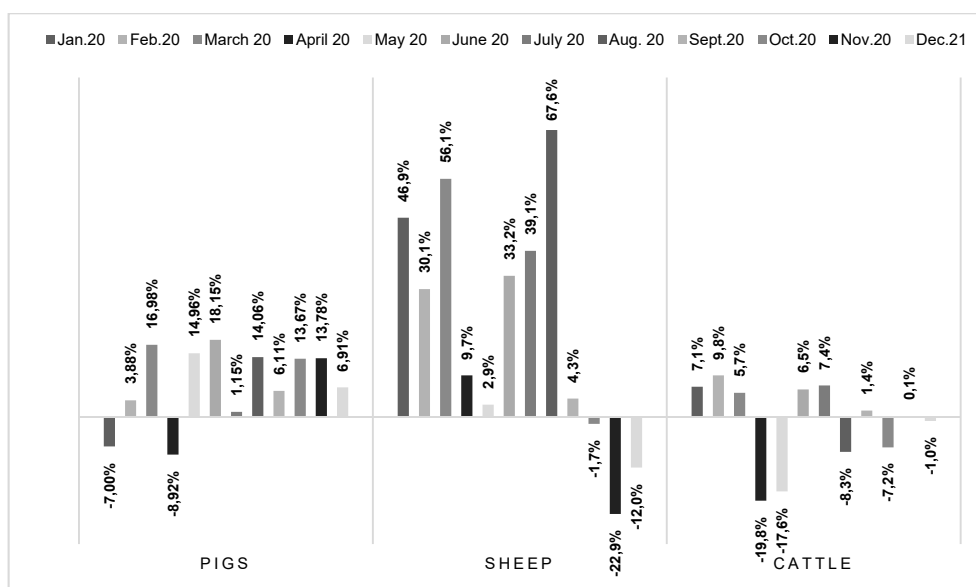
The year 2020 was difficult for the manufacturers of leather and leather products. Their production volumes declined throughout 2020 and the dynamics of the decrease is particularly evident during the first and second quarantines. Beverage production also lessened almost throughout the year (with the exception of two months). In other industries, the decline in production was recorded only during the first quarantine in the spring of 2020. The downward trend during the first quarantine may have been due to

the fact that many businesses were forced to stop their activities and downtime was announced. Another factor for food and beverage producers was the fact that the cafes and hotels had to shut down during the quarantine.

In Lithuania, pork production accounts for the largest share of red meat produced (Figure 10). In 2020, the volumes of pork meat decreased only in January and April, and in all other months there was a growth that fluctuated by between 1% and 18% per months. During 2020, the production increased by over 7% as compared to 2019. The amount of produced sheep meat increased from January to October, with the output starting to decline only at the end of the period, which may have been the result of shifts in production and market demand. The sector registered a 16% growth during the final months of the year. Cattle production was accompanied by dynamics of ups and downs. The observed decline in production during April and May of 2020 is likely due to quarantine, but later production both grew and declined without a clear direction reaching an annual decrease of 2% in the end.

Figure 10

Slaughter weight from red meat slaughterhouses (change in 2020 compared to the same period in 2019)



Source. Own calculations based SOE Agricultural information and rural business centre, 2020.

White meat production in Lithuania is represented only by broiler chickens, as there is no prominent duck and rabbit meat production and therefore there are no available statistics on it (see Figure 11).

In 2020, milk processing in Lithuania grew steadily throughout the months (see Figure 12). However, it seems that at least at the beginning of the year, the COVID-19 disease wave did not have a significant impact on this subsector. At the beginning of the year production was declining and then rose back up in March and April, after which it once again began declining in May. Clearly, this is a consequence of the closing down of cafes and restaurants. However, the end of the first quarantine restored the positive change in production once more, and until the end of November 2020 the decrease was insignificant – 1%.

According to data from October 1, 2020, there were 17.8 thousand farms selling milk in Lithuania. 216 thousand cows were kept in these farms (SOE Agricultural information and rural business centre, 2020). It can be assumed that small farms that previously supplied milk directly to hotels, restaurants and cafes, schools and kindergartens submitted their products to milk processing enterprises during the COVID-19 quarantine. Most large milk processing enterprises in Lithuania could offer free capacities for more milk products. The growth in milk processing (about 4% for the 11 months of 2020 in comparison with the previous year) is in line with OECD/FAO (2020) forecasts, according to which milk production will intensify and grow over the next decade. According to Ozoliņš (2013), the high price of milk is the factor that encourages farmers to produce more raw milk in the Baltic States.

Figure 11

Slaughter weight from white meat slaughterhouses (change in 2020 compared to the same period in 2019)

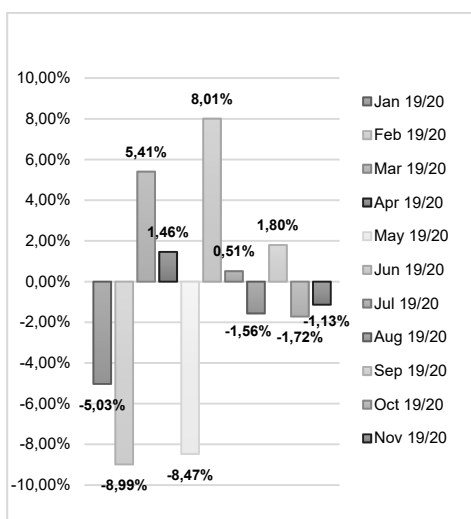
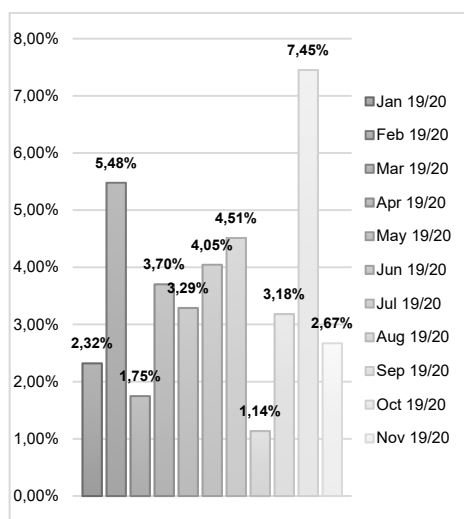


Figure 12

Processed milk in processing enterprises (change in 2020 compared to the same period in 2019)

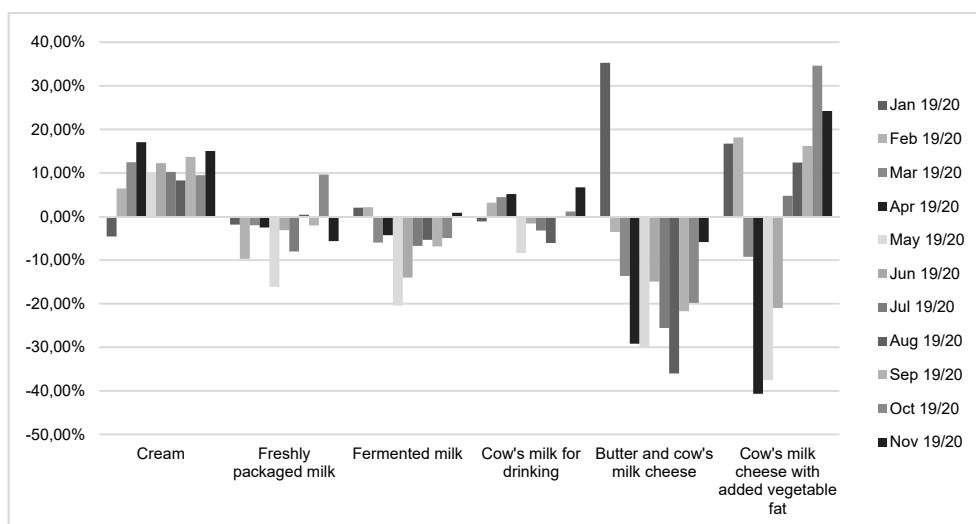


Source. Own calculations based on SOE Agricultural information and rural business centre, 2020.

The production of dairy products is decreasing (Figure 13) and the larger part of the processed milk is exported. Cream production showed a 10% increase in 2020 compared to 2019. The production of cow's milk cheese with added vegetable fat decreased during the first quarantine, but growth was recorded at a later point. The second quarantine in 2020 had no effect on this subsector of production and it experienced a slight increase – by 1% in comparison to 2019. In contrast, the production of other dairy products (freshly packaged milk, fermented milk, butter and cow's milk cheese) declined both during the quarantines and over the rest of the year. The strongest decrease was observed in the volumes of butter and cow's milk cheese (by 17%). The above-mentioned tendencies can be explained by the fact that during the quarantine the population prepared more food at home and abandoned *premium* class dairy products (better cheeses, better yoghurts, etc.)

Figure 13

Production of dairy products (change in 2020 compared to the same period in 2019)



Source. Own calculations based on SOE Agricultural information and rural business centre.

In summary, it can be stated that the Lithuanian bioeconomy sectors showed different tendencies in their development. Despite the decline in production associated with the quarantine, during the first wave of the COVID-19 virus, food, tobacco, wood and paper production subsequently increased. Similar trends were observed in red meat production (pigs, sheep). In turn, milk processing grew during the eleven months of 2020 as a result of an increase in the production of a single dairy product, while the rest of the dairy productions experienced a decline.

Conclusions

The bioeconomy establishes a new approach towards the sectors that manufacture products of biological origin. Its aim is to add value to product chains, as well as to utilize the waste more efficiently. An important part of the realization of these goals is the development and application of new technologies and new ways for the organization of production and sales. The traditional industries can receive an additional incentive to increase their efficiency through circularity and improved technological solutions. The new industries are a prerequisite for improving the results of the bioeconomic performance of countries and expanding the environmental benefits of production activities, which will in turn contribute to the signing of international agreements on climate and the fulfilment of the Millennium Development Goals.

COVID-19 has adversely affected all areas of human life, including political decisions. The lack of experience with an infection of such a scope and duration puts pressure on national health systems and requires variability in public risk management measures. The private sector is trying to adapt to the health and political restrictions through new approaches. The initial lockdown had a negative effect on the various branches of the bioeconomy, but some of them succeeded to recover and change their production and sales channels and adapted to the new conditions. As a whole, these sectors show resilience to the health risk, with food and green energy production even demonstrating growth.

All of the potential benefits are evaluated by the EU and the Member States in a dedicated strategy. Some countries have developed strategic documents, some are currently in that the process of doing so, while others apply different strategies. Bulgaria and Lithuania are post-communist countries with a significant share of agriculture in their GDP and well-developed food processing industries. They do not have an explicit bioeconomy strategy (in Lithuania it is currently under development) but they recognize its benefits. Both countries experienced an economic slowdown at the beginning of the pandemic and soon after that some bioeconomic branches such as food processing recovered, while others continued decreasing their production. Of course, there are differences between the two countries which stem from the differences in the structure of their national bio-economies. Lithuania has a more diversified bioeconomic structure in respect to employment and turnover – with employment in the agriculture sector making up less than 50% of the total and other sectors with a significant share with more branches contributing to the turnover. In contrast Bulgaria shows a strongly dependent bioeconomy – relying on employment in agriculture with over 75% and on food processing with 11%, while the remaining 8 industries hold a very small share. Its turnover structure is dependent on two sectors: food processing and agriculture.

Food processing is important for both countries and shows resilience during the COVID-19 pandemic. Bulgarian food processing covers different types of meat and milk production, as growth is observed in duck and other white meat productions, while the broiler production slightly decreases, contrary to Lithuania, which is fully dependent on chicken meat processing. With respect to red meat, the situation in 2020

shows that Bulgaria is strongly vulnerable to African swine fever while Lithuania is not affected by that disease and its production increases. In the case of sheep and goat meat production there is a significant difference – a decrease in production in this traditional activity in Bulgaria and a 16% increase in Lithuania. In both countries, a growth in fresh milk production is observed, however, based on the demand on the respective market, differences can be observed when it comes to processed dairy products. In Bulgaria there is a growth in the production of cow's milk cheese, cow's milk cheese with added vegetable oils and freshly packaged milk, with a significant decrease in the production of fermented milk. In Lithuania, the volumes of freshly packaged milk and cheese with added vegetable oils increase while those of all the other dairy products decrease, with a significant impact on cow's milk cheese. The trend in milk production in Bulgaria, together with the well-performing green energy production, could have a positive effect on the future development of products that are ecologically friendly and have few negative impacts on the environment.

Both countries need to increase the participation of technologies in their bioeconomic activities in order to grow the share of the different bioeconomic sectors in the turnover, as well as to increase the efficiency. All the means of bio-based transformation are suitable and applicable for the achievement of bioeconomic improvements. Bulgaria has potential and has started the process of replacing fossil fuels with biologically based raw materials, which will improve energy efficiency and reduce dependence on imported raw materials. Biomass as a resource and as waste is important for the efficiency of the bioeconomy, but also for reducing the carbon footprint and improving the climatic and ecological living conditions. The principles that exist in nature are insufficiently applied, which is an opportunity for both countries to create and add value by applying biological principles and processes that are separated from large-scale biomass production.

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