

Received: 01.09.2022
Acceptance: 22.09.2022
Published: 24.09.2022
JEL codes: J24, L16, L66

Annals PAAAE • 2022 • Vol. XXIV • No. (3)
License: Creative Commons Attribution 3.0 Unported (CC BY 3.0)
DOI: 10.5604/01.3001.0015.9879

MALGORZATA JUCHNIEWICZ

University of Warmia and Mazury in Olsztyn, Poland

**LEVEL AND EFFICIENCY OF USING PRODUCTION
RESOURCES FOOD INDUSTRY
IN THE EUROPEAN UNION COUNTRIES**

Key words: production resources, employment, efficiency, productivity, food industry

ABSTRACT. The research problem presented in the article concerned the diversification of the level and effectiveness of the use of production resources in the food industry in the EU countries. Production resources were determined on the basis of the number of entities and employees in food producing enterprises. The effectiveness of their use was also measured by calculating the productivity indicators. In the article, the partial productivity was calculated on the basis of the value of sold production per one employee and one economic entity. Changes in the production resources of the food industry in the EU countries and the efficiency of their use were determined in 2005, 2010 and 2019. The results of the research indicate that the largest production resources and production volume of the food industry were found in Germany, France, Italy and Spain. In terms of employment, Poland played a significant role. The efficiency of the use of factors of production, measured by productivity indicators, was the highest in Ireland, Denmark and the Netherlands. On this basis, it can be concluded that regardless of the adopted measure of productivity, these countries make the best use of their production resources. By far the lowest levels of productivity in the food industry were recorded in Bulgaria and Romania.

INTRODUCTION

The food industry is one of the largest and the most rapidly developing sectors in the European economy. It concentrates 289 000 enterprises, which constitutes 13% of all production enterprises. The considerable importance of the food sector is affected, among others, by the turnover value, which amounted to 1.093 billion euros in 2018 – 14.2% in manufacturing [Food and Drink Industry 2021]. The article focuses on the production potential of the food industry, which (according to the theory of economies of scale in production and sales) is associated with an increase in the production volume within

the enterprise and an increase in the production volume of the entire industry, and thus, inter alia, with: reduction of unit costs, increase in labor productivity, the possibility of installing new machines and improvement of production technology. Adam Budnikowski [2006] and Józef Misala [2009] emphasize that economies of scale may also result from the possibility of using cheaper services and goods of suppliers. The article highlights not only the level of production potential, but also the effectiveness of its use. This type of assumption is used in many empirical studies when assessing the competitive potential of sectors [Wijnands et al. 2008, Mroczek, Tereszczuk 2013, Wijnands, Verhoog 2016, Latruffe 2010]. The aim of the study was to assess the level and efficiency of using the production potential of the food industry (identified at the national level of aggregation of EU countries).

MATERIALS AND METHODOLOGY

The production potential of a sector can be analyzed using many measures. The article uses the most commonly adopted indicators, namely: the number of entities involved in the production of food products and the labor resources involved in them. The efficiency of using the production potential of the food industry was determined on the basis of the measurement of partial productivity [Petranov 2018]. It was calculated according to the following formula:

$$P = \frac{Q}{N}$$

where: P – productivity, Q – production value, N – inputs.

Both the level of production and the inputs used to generate it can be expressed using various economic categories. The level of production at the sector level can be measured by value added or the value of marketed production [OECD 2001]. Outlays are most often measured by the number of employees (or labor costs) and the level of other factors of production. In the article, the partial productivity was calculated on the basis of the value of sold production per one employee and one economic entity. The level of production potential of the food industry in individual EU countries was determined using two parameters of the taxonomic measure: arithmetic mean (\bar{x}) and standard deviation (S). Countries were divided into four typological groups: i.e. arithmetic mean (\bar{x}) and standard deviation (S) of the adopted indicators [Wysocki, Lira 2003]. They are divided into four typological groups: countries with a high level of the diagnostic variable: $x \geq (\bar{x} + S)$, countries with an average level of the diagnostic variable: $(\bar{x} + S) > x \geq \bar{x}$, countries with

a low level of the diagnostic variable: $\bar{x} > x \geq (\bar{x} - S)$, countries with a very low level of the diagnostic variable: $x < (\bar{x} - S)$. Changes in the production resources of the food industry in the EU countries and the efficiency of their use were determined in 2005, 2010 and 2019. Data from the Eurostat database were used for the calculations.

RESEARCH RESULTS AND DISCUSSION

The production resources of the food industry in the EU Member States, defined by the number of entities involved in the production of food products and the labor resources involved in them, were diversified. Their concentration in several countries is clearly visible. The total share of the four largest countries (Italy, France, Germany and Spain) in terms of the number of food industry enterprises in 2019 was 58.3% (Table 1). The average level of the number of economic entities producing food was recorded in Poland and Greece. However, the share of these countries in the number of food industry enterprises in the EU was more than twice lower than the aforementioned ones. However, it should be emphasized that countries with a high and medium level of the number of enterprises together accounted for as much as 70.9% of food producing entities in the EU. The number of enterprises in other Member States was relatively small.

When considering the changes in the number of enterprises in the analyzed years, there was a general tendency of a slight but systematic increase in their number. This phenomenon was heterogeneous in the system of individual member states. The largest increase in the number of food producing entities occurred in Slovenia, Estonia, Lithuania and the Netherlands. There are also countries where the number of food industry enterprises has decreased. These were mainly Luxemburg and Malta. However, the presented changes did not significantly affect the ranking of countries.

An important component of the sector's production resources is also the number of employees (Table 2). The level of employment and the efficiency of its use directly affect the productivity of work, which is the main determinant of the competitive potential and, consequently, the competitiveness of economic entities [Porter 2001].

The countries with the largest number of entities, Germany and France, occupied the highest positions in the ranking of the number of employees. There was also a high level of employment in Poland, Italy and Spain. However, the level of involvement of labor resources in these countries was almost twice lower than in Germany. In total, 67.1% of those employed in the production of food products in the EU worked in the above-mentioned countries. It should also be emphasized that Germany came first in the employment ranking, with a relatively small number of enterprises (3rd position in the ranking). As a result, one food industry enterprise in Germany had one of the largest employees among all the Member States (34 people in 2019). The food industry in

Table 1. Number of enterprises of food industry in EU countries

No.	Country	Number of enterprises			Percentage share in 2019	Level in 2019	Total percentage share in 2019
		2010	2015	2019			
1	Italy	54,349	53,096	51,094	19.4	high	58.3
2	France	57,098	56,861	50,762	19.3		
3	Germany	30,710	25,768	26,897	10.2		
4	Spain	23,471	22,215	24,713	9.4		
5	Poland	13,641	13,938	18,223	6.9	medium	12.6
6	Greece	15,325	15,690	15,093	5.7		
7	Portugal	9,428	9,337	9,566	3.6	low	29.1
8	Romania	7,861	8,149	9,564	3.6		
9	Czechia	6,508	7,436	8,773	3.3		
10	Belgium	7,373	6,665	6,741	2.6		
11	Netherlands	4,356	5,615	6,506	2.5		
12	Bulgaria	4,714	5,285	5,280	2.0		
13	Hungary	4,326	4,525	4,482	1.7		
14	Slovakia	2,615	2,390	3,874	1.5		
15	Austria	3,558	3,539	3,545	1.3		
16	Sweden	3,329	3,777	3,540	1.3		
17	Croatia	2,851	2,759	2,779	1.1		
18	Slovenia	1,079	2,066	2,405	0.9		
19	Ireland	1,269	1,637	1,741	0.7		
20	Lithuania	1,117	1,578	1,630	0.6		
21	Finland	1,650	1,742	1,603	0.6		
22	Denmark	1,498	1,458	1,394	0.5		
23	Latvia	735	987	1,111	0.4		
24	Cyprus	789	805	839	0.3		
25	Estonia	358	552	663	0.3		
26	Malta	402	353	341	0.1		
27	Luxembourg	139	128	112	0.1		

Source: own calculation based on data from Eurostat, Structural Business Statistics

Table 2. Number of people employed in the food industry of the European Member states

No.	Country	Number of people employed			Percentage share in 2019	Level in 2019	Total percentage share in 2019
		2010	2015	2019			
1	Germany	799,314	789,499	912,855	21.9	high	67.1
2	France	576,600	511,130	630,047	15.1		
3	Poland	396,635	392,721	439,082	10.5		
4	Italy	393,810	391,423	424,080	10.2		
5	Spain	322,560	316,257	396,287	9.5		
6	Romania	162,904	161,945	162,190	3.9	medium	3.9
7	Netherlands	120,449	121,943	132,532	3.2	low	29.0
8	Greece	84,276	99,482	124,136	3.0		
9	Portugal	95,428	92,336	101,295	2.4		
10	Czechia	102,884	101,586	99,587	2.4		
11	Hungary	89,649	93,256	95,262	2.3		
12	Belgium	85,566	85,050	94,431	2.3		
13	Bulgaria	87,603	82,182	81,172	1.9		
14	Austria	68,901	74,828	80,711	1.9		
15	Sweden	59,466	57,061	57,746	1.4		
16	Denmark	53,389	55,909	53,633	1.3		
17	Croatia	57,328	54,000	52,984	1.3		
18	Ireland	38,853	45,249	51,903	1.2		
19	Slovakia	37,343	34,504	38,847	0.9		
20	Lithuania	38,975	39,984	38,174	0.9		
21	Finland	34,418	36,513	36,684	0.9		
22	Latvia	23,164	21,647	20,592	0.5		
23	Slovenia	14,694	14,871	17,037	0.4		
24	Estonia	12,366	13,837	13,262	0.3		
25	Cyprus	11,243	10,855	13,175	0.3		
26	Luxembourg	4,346	5,140	5,129	0.1		
27	Malta	-	-	3,247	0.1		

Source: own calculation based on data from Eurostat, Structural Business Statistics

Italy was characterized by a significantly different situation. On average, only 8 people were employed there. In Poland, there were 24 employees per one entity producing food products, and in France – 12 people. Significant labor inputs were also involved in Romania. As a consequence, in countries with high and medium employment levels, the total share of people employed in the EU food industry in 2019 was 71%. As with the number of enterprises, there has been a gradual increase in employment in the EU food industry in most Member States. A relatively significant increase in labor input occurred in Greece, Ireland and Spain. The greatest reduction in employment was recorded in Latvia and Bulgaria. However, the presented changes did not significantly affect the positions of individual countries in the employment ranking and the production potential of the Member States measured in this way.

The level of resources involved in the food industry of the EU Member States and their proper use should be reflected in the obtained production results. The most commonly accepted result of economic processes is the value of sold production. The share of individual EU countries in creating the sector's production, as well as in the number of entities and employment, was clearly diversified (Table 3). The largest producers of food products were Germany and France. The group of countries with a high level of sold production value also included: Italy and Spain. The total share of these countries in EU production in 2019 was 63.6%. This was a consequence of the high involvement of the previously discussed production resources in the food industry of these countries. The group of countries with an average level of the value of sold production consisted of countries such as the Netherlands, Poland and Belgium. While in the case of Poland such a position can be combined with the possessed production resources, there is no such convergence in the case of the Netherlands. Romania is a country with a large production resource of the food industry and low production value. The explanation of the presented differences may result from the efficiency of the use of resources, which will be discussed later in the article.

In all EU countries, a systematic increase in the value of sold production of the food industry was recorded, although the pace of changes varied. The highest increase in the value of sold production occurred in Poland, Estonia, Luxembourg and Bulgaria. The changes that took place in the value of sales of food products, as in the case of employment and the number of enterprises, did not cause any significant changes in their positions in the ranking.

The effective use of resources owned by economic entities is the primary source of their competitiveness. The conducted research shows that the disproportions of labor productivity indices (Table 4) mainly concerned the group of countries of the so-called “old” and “new” EU. The leaders in the effectiveness of the use of labor resources were the Netherlands, Belgium, Ireland and Denmark. The studies of Małgorzata Juchniewicz and Katarzyna Łukiewska [2014] indicate that in these countries the largest – in the European Union scale

Table 3. Value of sold production of enterprises of food industry of the European Member states

No.	Country	Value of sold production [million EUR]			Percentage share in 2019	Level in 2019	Total percentage share in 2019
		2010	2015	2019			
1	Germany	135,679	153,008	174,025	20.1	high	63.6
2	France	122,491	142,493	153,974	17.8		
3	Italy	96,306	111,326	117,747	13.6		
4	Spain	74,097	88,553	105,534	12.2		
5	Netherlands	46,884	59,384	64,884	7.5	medium	18.3
6	Poland	34,499	43,176	55,595	6.4		
7	Belgium	33,499	38,615	38,534	4.4	low	18.1
8	Denmark	16,789	20,198	19,464	2.2		
9	Ireland	19,007	23,770	18,971	2.2		
10	Austria	12,091	15,055	17,279	2.0		
11	Sweden	12,954	14,038	13,920	1.6		
12	Portugal	9,740	10,743	12,348	1.4		
13	Greece	10,622	10,850	11,933	1.4		
14	Czechia	9,133	9,357	10,811	1.2		
15	Hungary	7,045	8,516	9,942	1.1		
16	Romania	6,514	7,988	9,375	1.1		
17	Finland	8,121	9,321	9,294	1.1		
18	Bulgaria	3,188	3,837	4,786	0.6		
19	Lithuania	2,539	3,336	3,772	0.4		
20	Croatia	3,570	3,587	3,597	0.4		
21	Slovakia	2,538	2,776	3,424	0.4		
22	Slovenia	1,485	1,615	1,921	0.2		
23	Estonia	1,006	1,386	1,648	0.2		
24	Latvia	1,201	1,368	1,616	0.2		
25	Cyprus	1,156	1,125	1,401	0.2		
26	Luxembourg	489	735	757	0.1		
27	Malta	-	-	353	0.0		

Source: own calculation based on data from Eurostat, Structural Business Statistics

Table 4. Labor productivity of food industry of the European Member states

No.	Country	Labor productivity [thousand euro/employed]			Percentage share in 2019	Average productivity in 2019
		2010	2015	2019		
1	Netherlands	389	487	490	high	407
2	Belgium	391	454	408		
3	Ireland	489	525	366		
4	Denmark	314	361	363		
5	Italy	245	284	278	medium	241
6	Spain	230	280	266		
7	Finland	236	255	253		
8	France	212	279	244		
9	Sweden	218	246	241		
10	Austria	175	201	214		
11	Germany	170	194	191		
12	Luxembourg	113	143	148	low	106
13	Poland	87	110	127		
14	Estonia	81	100	124		
15	Portugal	102	116	122		
16	Slovenia	101	109	113		
17	Malta	-	-	109		
18	Czechia	89	92	109		
19	Cyprus	103	104	106		
20	Hungary	79	91	104		
21	Lithuania	65	83	99		
22	Greece	126	109	96		
23	Slovakia	68	80	88		
24	Latvia	52	63	78		
25	Croatia	62	66	68		
26	Bulgaria	36	47	59	very low	58
27	Romania	40	49	58		

Source: own calculation based on data from Eurostat, Structural Business Statistics

– gross investment outlays on tangible fixed assets per employee were incurred. It was a factor increasing the production capacity of food producers in these countries.

The next group consisted of countries with an average level of labor productivity. These were the EU-15 countries such as: Italy, Spain, Finland, France, Sweden, Austria and Germany. It should be emphasized that among them there are countries with the largest production resources, measured both by the number of food producers and the number of employees. A particularly unfavorable situation in this respect was recorded in Germany, where labor productivity was more than twice lower than in the Netherlands. In countries with a low level of labor productivity, the difference was even greater (almost four times compared to the leaders). By far the lowest level of labor productivity in the food industry was recorded in Bulgaria and Romania. Compared to the countries with the highest level, this indicator was almost 7 times lower. The low level of labor productivity in Poland and Romania, i.e. in countries with large labor resources involved in the food industry, indicates the need to improve the use of this production factor as a necessary criterion for improving the competitiveness of these countries on the EU market. Katarzyna Łukiewska and Małgorzata Juchniewicz [2016] emphasize that it is «compensated» by the lower level of payment of the factors of production involved. A significant increase in labor productivity was recorded in the Baltic states and Denmark. The improvement in labor productivity in the above-mentioned countries was the result of increased sold production, which took place in the conditions of reducing employment. Ireland was one of the countries where the level of labor productivity decreased significantly. It was related to higher employment dynamics as compared to the increase in the value of sold production. However, this country is still one of those with the highest labor productivity.

The ranking of countries, taking into account the value of food industry production per entity, did not change significantly (Table 5). Countries with a high level of productivity again include: Denmark, Ireland and the Netherlands. On this basis, it can be concluded that regardless of the adopted measure of productivity, these countries make the best use of their production resources. It should also be emphasized that only in Denmark the improvement in productivity resulted from the decrease in the number of entities involved in food production in the analyzed years. In other countries, the number of food industry enterprises increased. However, the growth rate of the production value was much higher, which resulted in an improvement in the efficiency of the resources held.

Again, clear differences in productivity were found between the different groups of countries. They were at a similar level as in the case of labor productivity. A positive symptom is the reduction of productivity differences (measured both by the production value per employee and per entity) in the food industry of the new EU countries in relation to the old member states. However, this does not change the situation that they are significant.

Table 5. Entity productivity of food industry of the European Member states

Lp.	Country	Entity productivity [million EUR/enterprise]			Percentage share in 2019	Average productivity in 2019
		2010	2015	2019		
1	Denmark	11.2	13.9	14.0	high	11.6
2	Ireland	15.0	14.5	10.9		
3	Netherlands	10.8	10.6	10.0		
4	Luxembourg	3.5	5.7	6.8	medium	5.4
5	Germany	4.4	5.9	6.5		
6	Finland	4.9	5.4	5.8		
7	Belgium	4.5	5.8	5.7		
8	Austria	3.4	4.3	4.9		
9	Spain	3.2	4.0	4.3		
10	Sweden	3.9	3.7	3.9		
11	Poland	2.5	3.1	3.1	low	1.6
12	France	2.1	2.5	3.0		
13	Estonia	2.8	2.5	2.5		
14	Lithuania	2.3	2.1	2.3		
15	Italy	1.8	2.1	2.3		
16	Hungary	1.6	1.9	2.2		
17	Cyprus	1.5	1.4	1.7		
18	Latvia	1.6	1.4	1.5		
19	Croatia	1.3	1.3	1.3		
20	Portugal	1.0	1.2	1.3		
21	Czechia	1.4	1.3	1.2		
22	Malta	-	-	1.0		
23	Romania	0.8	1.0	1.0		
24	Bulgaria	0.7	0.7	0.9		
25	Slovakia	1.0	1.2	0.9		
26	Slovenia	1.4	0.8	0.8		
27	Greece	0.7	0.7	0.8		

Source: own calculation based on data from Eurostat, Structural Business Statistics

SUMMARY

The conducted research allows for the following conclusions:

1. The largest production resources and production value of the food industry in the EU were found in Germany, France, Italy and Spain. In terms of employment, Poland played a significant role. The importance of these countries' production resources in the EU food industry, compared to other Member States, is therefore relatively high.
2. The situation was definitely different with regard to the efficiency of these resources. The leaders of the EU food producers' productivity ranking were: Ireland, Denmark and the Netherlands. On this basis, it can be concluded that regardless of the adopted measure of productivity, these countries make the best use of their production resources.
3. In the context of the research results obtained, it is justified to extend the considerations to identify the relationships between the production potential and the efficiency of its use and the resulting level of competitiveness of the food industry in the European Union Member States.

BIBLIOGRAPHY

- Budnikowski Adam. 2006. *Międzynarodowe stosunki gospodarcze* (International economic relations). Warsaw: PWE.
- Food Drink Europe. 2021. *Data & trends of the European food and drink industry*, <http://www.fooddrinkeurope.eu> access: 10.08.2022.
- Juchniewicz Małgorzata, Katarzyna Łukiewska. 2014. International competitiveness of the food industry in European Union Member states. *European Journal of Social Science Education and Research* 2 (1): 254-265.
- Latruffe Laure. 2010. *Competitiveness, productivity and efficiency in the agricultural and agri-food sectors*. OECD Food, Agriculture and Fisheries Papers, no. 30. Paris: OECD Publishing, <http://dx.doi.org/10.1787/5km91nkdt6d6-en>, access: 10.08.2022.
- Łukiewska Katarzyna, Małgorzata Juchniewicz. 2016. Produktywność jako czynnik konkurencyjności przemysłu spożywczego. [W] *Konkurencyjność polskich producentów żywności i jej determinanty* (2). Seria „Program Wieloletni 2015-2019” (Productivity as a factor of competitiveness in the food industry. [In] *Competitiveness of Polish food producers and its determinants* (2). Series „Multiannual Program 2015-2019”), ed I. Szczepaniak. Warsaw: IERiGŻ-PIB.
- Misala Józef. 2009. *Historia rozwoju teorii i polityki konkurencyjności międzynarodowej* (History of the development of the theory and policy of international competitiveness). Warsaw: Wydawnictwo Szkoły Głównej Handlowej.

- Mroczek Robert, Mirosława Tereszczuk. 2013. Wydajność pracy jako jeden z elementów decydujących o międzynarodowej konkurencyjności polskiego przemysłu spożywczego (Labour productivity as a crucial factor in the international competitiveness of the Polish food industry). *Zeszyty Naukowe SGGW w Warszawie. Problemy Rolnictwa Światowego* 13 (28): 51-58.
- OECD. 2001. *Measuring productivity. OECD Manual. Measurement of aggregate and industry-level productivity growth*. 2001. Paris: OECD.
- Petranov Stefan. 2018. Estimation of labour productivity at industry level – theoretical aspects and practical application. *Izvestiya Journal of Varna University of Economics* 62 (2): 131-144.
- Porter Michael E. 2001. *Porter o konkurencji* (Porter on competition). Warsaw: PWE.
- Wijnands Jo H.M., Harry J. Bremmers, Bernd M.J. van der Meulen, Krijn J. Poppe. 2008. An economic and legal assessment of the EU food industry's competitiveness. *Agribusiness* 24 (4): 417-439.
- Wijnands Jo H.M., Harry Verhoog. 2016. *Competitiveness of the EU food industry. Ex-post assessment of trade performance embedded in international economic theory*. Wageningen: LEI Wageningen UR.
- Wysocki Feliks, Jarosław Lira. 2003. *Statystyka opisowa* (Descriptive statistics). Poznań: Wydawnictwo Akademii Rolniczej im. Augusta Cieszkowskiego.

POZIOM I EFEKTYWNOŚĆ WYKORZYSTANIA ZASOBÓW
PRODUKCYJNYCH PRZEMYSŁU SPOŻYWCZEGO
W KRAJACH UNII EUROPEJSKIEJ

Słowa kluczowe: zasoby produkcyjne, zatrudnienie, efektywność, produktywność,
przemysł spożywczy

ABSTRAKT

Problem badawczy przedstawiony w artykule dotyczył zróżnicowania poziomu i efektywności wykorzystania zasobów produkcyjnych przemysłu spożywczego w krajach UE. Zasoby produkcyjne określono na podstawie liczby podmiotów i zatrudnionych w przedsiębiorstwach produkujących żywność. Dokonano także pomiaru efektywności ich wykorzystania przez obliczenie wskaźników produktywności. Produktywność cząstkową obliczono na podstawie wartości produkcji sprzedanej, przypadającej na jednego zatrudnionego i podmiot gospodarczy. Zmiany zasobów produkcyjnych przemysłu spożywczego w krajach UE oraz efektywności ich wykorzystania określono w latach 2005, 2010 i 2019. Wyniki badań wskazują, że największymi zasobami produkcyjnymi i wolumenem produkcji przemysłu spożywczego charakteryzowały się takie kraje, jak Niemcy, Francja, Włochy i Hiszpania. W odniesieniu do zatrudnienia znaczącą pozycję zajmowała Polska. Efektywność wykorzystania czynników produkcji, mierzona wskaźnikami produktywności, była najwyższa w Irlandii, Danii i Niderlandach. Można na tej podstawie stwierdzić, że niezależnie od przyjętego miernika produktywności, państwa te najlepiej wykorzystują posiadane zasoby produkcyjne. Zdecydowanie najniższy poziom produktywności w przemyśle spożywczym odnotowano w Bułgarii i Rumunii.

AUTHOR

MAŁGORZATA JUCHNIEWICZ, DR HAB. PROF.

ORCID: 0000-0002-7672-6030

University of Warmia and Mazury in Olsztyn

Faculty of Economic Sciences

Department of Economic Competitiveness

4/203 M. Oczapowskiego St., 10-719 Olsztyn, Poland

e-mail: malgorzata.juchniewicz@uwm.edu.pl

Proposed citation of the article:

Juchniewicz Małgorzata. 2022. Level and efficiency of using production resources food industry in the European Union countries. *Annals PAAAE* XXIV (1): 70-82.