

TECHNICAL REVIEW

SCIENCE AND INDUSTRY IN A COUNTRY OF CHANGES

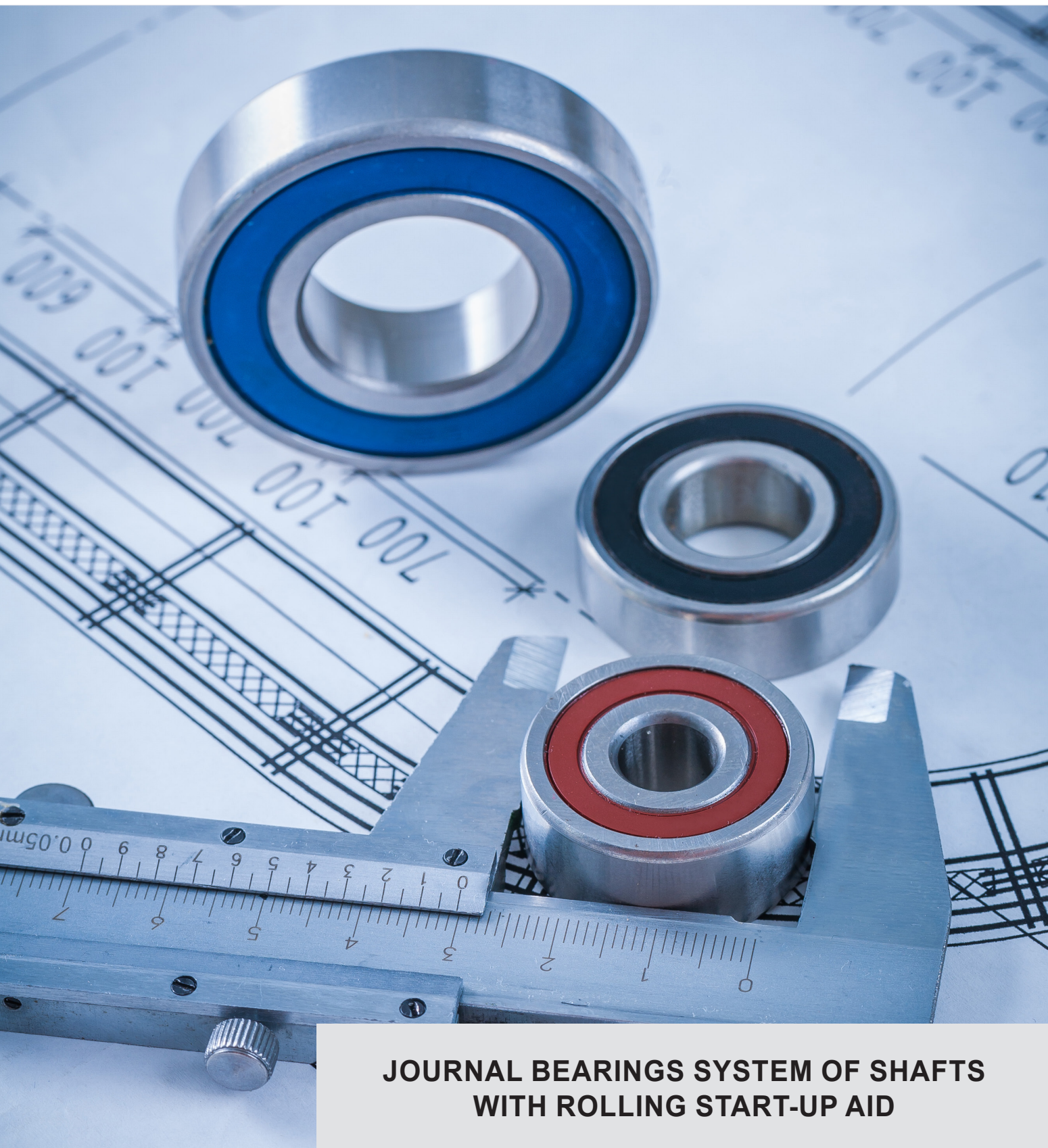
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CHANGES IN AGRICULTURAL PRODUCTION IN THE MAŁOPOLSKIE VOIVODESHIP

ZMIANY W PRODUKCJI ROLNICZEJ NA TERENIE WOJEWÓDZTWA MAŁOPOLSKIEGO

Summary: Agriculture is one of the basic branches of the national economy, which is responsible for food production. With the rapid development of agricultural production technology, especially new techniques of animal husbandry and crop production, we are seeing changes in the amount of adverse substances entering the environment. Analysts pay great attention to biogenic compounds, mainly nitrogen and phosphorus, which infiltrate deep into the soil profile and cause surface runoff as a result of precipitation. This causes eutrophication of surface waters. In the recent decades there has been an increase in agricultural productivity. At the same time, the percentage of people employed in this sector of the economy and the economic value of products produced in agriculture are decreasing. On the basis of the data obtained from the Agency for Restructuring and Modernisation of Agriculture (in Polish: Agencja Restrukturyzacji i Modernizacji Rolnictwa, Kraków delegation) [1] and the data from the Statistics Poland (in Polish: Główny Urząd Statystyczny [2], the present study shows the trends of the changes in the agricultural sector in the Małopolskie Voivodeship in 2016-2021. Unfortunately, due to the lack or incompleteness of the data obtained, some parameters were considered over a two- or three-year period. The parameters such as livestock population, number of farms, crop area, yields and fertilization levels were analyzed. The aspect of employment in agriculture was also addressed as an element indicating the level of involvement of residents in agricultural activities, both crop and livestock production. The low rate of employment in the agricultural sector may indicate the degree of familiarity of the population with the basic processes of obtaining animal products and agricultural crops. The discussed Voivodeship is characterized by a high proportion of agricultural land – more than 60% of the area. There is a slight decline in cattle and pig populations. Sheep and goat populations are low and not very variable. Analyzing crop production, despite the declining area of total crops, there was a slight increase in the area of most crops in 2021, thanks in part to a reduction in the participation of unmarked crops compared to 2020. In addition, the analysis shows that despite the downward trend in the amount of mineral fertilizers used, yields have increased, which may confirm the development of production technologies and better management of nutrient resources contained in the soil of primary importance to plants.

Keywords: agriculture, agricultural production parameters, land use, livestock population

Streszczenie: Rolnictwo jest jedną z podstawowych gałęzi gospodarki narodowej, które odpowiada za produkcję żywności. Dynamiczny rozwój technologii produkcji rolniczej, w tym szczególnie nowych technik chowu i hodowli zwierząt oraz produkcji roślinnej możemy obserwować zmiany w ilości niekorzystnych substancji wprowadzanych do środowiska. Analitycy dużą wagę poświęcają związkowi biogennym, głównie azotowi i fosforowi, które w wyniku opadów atmosferycznych infiltrują w głąb profilu glebowego oraz powodują spływ powierzchniowy. Powoduje to eutrofizację wód powierzchniowych. W ostatnich dziesięcioleciach obserwowany jest wzrost produktywności w rolnictwie. Jednocześnie zmniejsza się procentowy udział osób zatrudnionych w tym dziale gospodarki oraz wartość ekonomiczna produktów wytwarzanych w rolnictwie. Na podstawie danych uzyskanych z Agencji Restrukturyzacji i Modernizacji Rolnictwa (delegatura w Krakowie) [1] oraz danych Głównego Urzędu Statystycznego [2], w niniejszym opracowaniu przedstawiono trendy zmian w sektorze rolniczym w województwie małopolskim w latach od 2016-2021. Niestety, ze względu na brak lub niekompletność pozyskanych danych, część parametrów była rozpatrywana w okresie dwu- lub trzyletnim. Analizie poddano parametry takie jak pogłowie zwierząt gospodarskich, liczba gospodarstw rolnych, powierzchnia upraw, plonowanie oraz poziom nawożenia. Poruszono także aspekt zatrudnienia w rolnictwie jako element wskazujący na poziom zaangażowania mieszkańców w działalność rolniczą, zarówno produkcję roślinną, jak i zwierzęcą. Niski udział zatrudnienia w sektorze rolniczym może świadczyć o stopniu zaznajomienia społeczeństwa z podstawowymi procesami uzyskiwania produktów zwierzęcych oraz płodów rolnych. Województwo małopolskie charakteryzuje się wysokim udziałem użytków rolnych – ponad 60% jego powierzchni. Obserwuje się nieznaczne zmniejszenie pogłowia bydła oraz trzody chlewnej. Pogłowie owiec i kóz jest niskie i mało zmienne. Analizując produkcję roślinną, mimo zmniejszającej się powierzchni upraw ogółem, można obserwować niewielki wzrost powierzchni większości z upraw w roku 2021, m.in. ze względu na zmniejszenie się udziału upraw nieoznaczonych względem roku 2020. Ponadto w analizie wykazano, że mimo spadkowej tendencji w ilości stosowanych nawozów mineralnych, plony wzrosły, co może potwierdzać rozwój technologii produkcji oraz lepsze gospodarowanie zasobami składników pokarmowych zawartych w glebie mających fundamentalne znaczenie dla roślin.

Słowa kluczowe: rolnictwo, parametry produkcji rolniczej, użytkowanie gruntów, pogłowie zwierząt

Introduction

The primary function of rural areas is agricultural production, which is characterized by high dependence on existing natural and economic conditions. At the same time, the pace and directions of changes in agricultural production are determined by the current socio-economic state of the country, including changes in the conjuncture of the various branches of the national economy. The new alternative uses of agricultural

production, such as the production of renewable energy are also important.

The directions of the change in agricultural production should be considered from multiple angles. In addition to changes in agrarian structure and land use, an important role is played by the effectiveness of the implementation of technical progress in the broadest sense. The assessment of agricultural transformation should therefore take into account, in addition to the changes in the level and structure of crop and livestock

production, the implementation of technical progress. From a forward-looking point of view, it is also necessary to take into account the anticipated climate changes, which, in addition to a number of positive trends, may also cause various types of risks associated with, for example, the occurrence of agrophages or negative climatic water balance. It also necessitates adaptation measures and consideration of alternative scenarios. Poland is a country with significant agricultural production potential due to its large area of agricultural land compared to other EU countries. Analysis of the conditions of Polish agriculture - those of infrastructure – is conducive to improving the competitiveness of the agricultural sector.

Among other things, branches of agriculture can be divided into extensive agriculture (called small-scale or traditional agriculture) and intensive agriculture (also called high-commodity or industrialized agriculture), depending on their characteristics: the amount of inputs, the amount of yields, as well as the average area of farms and the area of farmland in the country. Based on the mentioned parameters, it is possible to analyze the state of agriculture, its impact on the environment, as well as estimate trends in these changes.

The intense changes have taken place in agriculture in the recent decades, especially at the territory of Poland, which can be analyzed from many angles. They were caused, among other things, by the socio-political transformations after 1989 and then, after Poland's accession to the European Union in 2004. The implementation of the EU's Common Agricultural Policy program, as well as technological development, further training and professional development of people working in agriculture contributed to this. It is also related to the scientific world's interest in the continuous improvement of modern agricultural production methods, taking into account not only the volume and intensity of production, but also taking into account the sustainability of the country. Scientists analyze these changes and their impact on the environment and society. The changes in the area of farms in Poland have been studied by, among others, Elżbieta Jadwiga Szymańska and Jarosław Maj[3], while the research on the development of agriculture in rural areas has been conducted by such scientists as Prof. Józef Stanisław Zegar[4] and Barbara Kryk[5].

Purpose of research

The purpose of this study is to characterize the basic parameters related to agricultural production in the Małopolskie Voivodeship and to assess the changes taking place in it. The characteristics of agriculture were also referred to the current socio-economic and infrastructural conditions of the study area.

Research methodology

Within the framework of this study, the analysis carried out is presented in several key elements. The

basic factors determining the volume and nature of agricultural production are summarized below. Based on the data obtained from the Agency for Restructuring and Modernisation of Agriculture) (Polish: Agencja Restrukturyzacji i Modernizacji Rolnictwa) in Kraków [1], the changes over 2019–2021 in the agricultural sector were exposed, except for crops, where, due to lack of data, the analysis was carried out for 2020 and 2021. The parameters analyzed include the structure of use, percentage of employment in the agricultural sector relative to other sectors of the economy, livestock population, number of farms, crop structure, yields and level of mineral fertilization.

Characteristics of the research area

The research area covers Małopolskie Voivodeship, including the following districts: Bocheński, Brzeski, Chrzanowski, Dąbrowski, Gorlicki, Krakowski, Limanowski, Miechowski, Myślenicki, Nowosądecki, nowotarski, Olkuski, Oświęcimski, proszowicki, suski, Tarnowski, Tatrzański, Wadowicki, Wielicki, and cities: Kraków, Nowy Sącz and Tarnów [2] (Fig. 1). The analyzed area borders on three provinces, i.e. Śląskie, Świętokrzyskie and Podkarpackie. The decision to select the aforementioned study area resulted primarily from a methodical approach to the analysis. This is because the Małopolska province is, from a structural and environmental point of view – a catchment area, characterized by a great similarity to the orography of the Central Polish Carpathians.

Upland and mountainous areas predominate. The province is located in three climatic regions: the mountain and foothills climate, the foothills climate of the lowlands and basins, and the central highlands climate. During the year, the average air temperature reaches 5–8°C, while the average annual precipitation is 550–1400 mm. The main watercourse flowing through the study area is the Vistula (Polish: Wisła) River [6].



Fig. 1. Study area – administrative division of the Małopolska Voivodeship [7]

Table 1. Structure of land use data 2021 [2]

Land use form	Surface area [km ²]	Percentage [% of total area]
Agricultural land	9148.46	60.25
Forest land. wooded and shrub land	4605.65	30.33
Land under surface water	224.96	1.48
Developed and urbanized land	1036.83	6.83
Ecological uses	6.71	0.04
Wastelands	113.06	0.74
Miscellaneous areas	47.13	0.31

The total area of the province is 15182.79 km², which is less than 4.9% of the national area. According to the Statistics

Poland (Polish: Główny Urząd Statystyczny), the mentioned Voivodeship is dominated by agricultural land, which in 2021 accounted for 9148.46 km² (60.3%) of the voivodeship area, including wooded and shrub land on agricultural land, until 2016 included in "forest land, wooded and shrub land", followed by forest land and wooded and shrub land – 4605.65 km² (30.3% of the voivodeship area) [2].

Results of the research

The level of employment in the agricultural sector in Małopolska province is low and has recently been less than about 10%. Residents find employment mainly in the service sector (about 60%), and less than a third of people work in industry. Employment in agriculture declined slightly from 2016 to 2017, and then increased by 0.2–0.4% from 2019. The figure is 9.6% on average for Poland in 2020 (Figure 2).

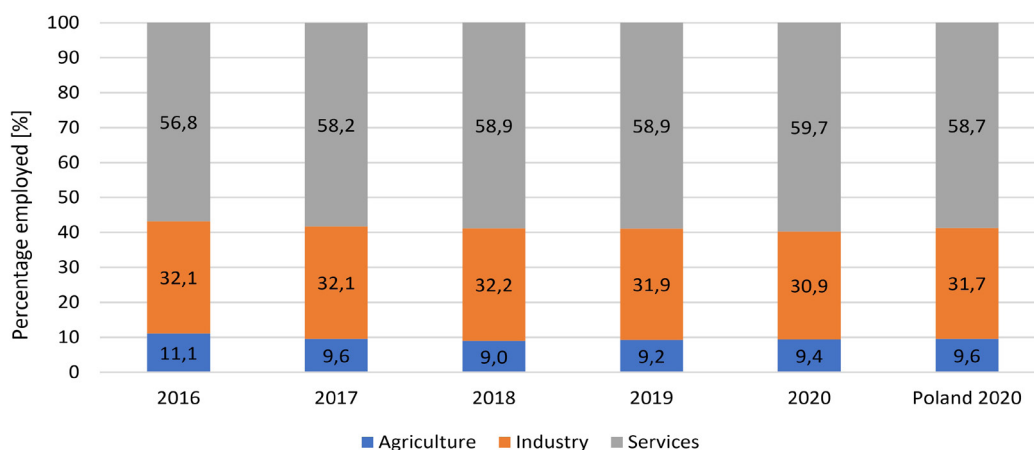


Fig. 2. Percentage of employees by economic sector [2] [%]

Livestock population in Małopolskie Voivodeship

Over the period of 2019–2021, the Małopolska region has seen a reduction in livestock numbers. In the case of cattle, the value decreased by about 8% during this period. A similar,

although more intensive, trend was observed in the case of the pig population (a decrease of about 13%). In the case of sheep numbers, the decrease in stocking rates concerned only 4%. An increase in the stocking rates was noted only for goats, from 3,123 head in 2019 to 3,964 head in 2021 (about 26%) (Fig. 3).

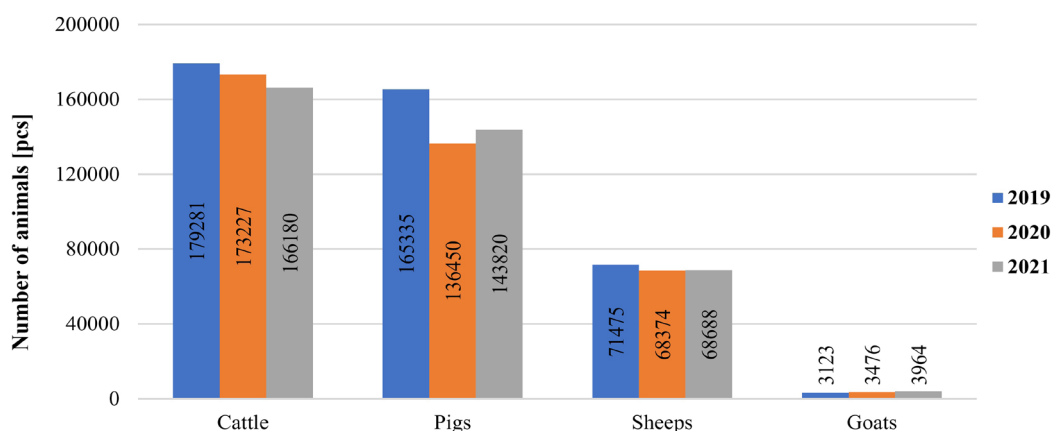


Fig. 3. Changes in livestock production in Małopolska Voivodeship from 2019 to 2021 [1] [pcs]

Number of farms engaged in livestock production

In the chart below (Figure 4), it can be observed that the number of farms in the period of 2019–2021 decreased similarly

to the cattle and pig population. The largest reduction was found in the number of farms oriented to cattle and pig breeding. In 2021, their number accounted for only 56.6% of the value of two years ago (9705 pcs in 2019, 5393 pcs in 2021).

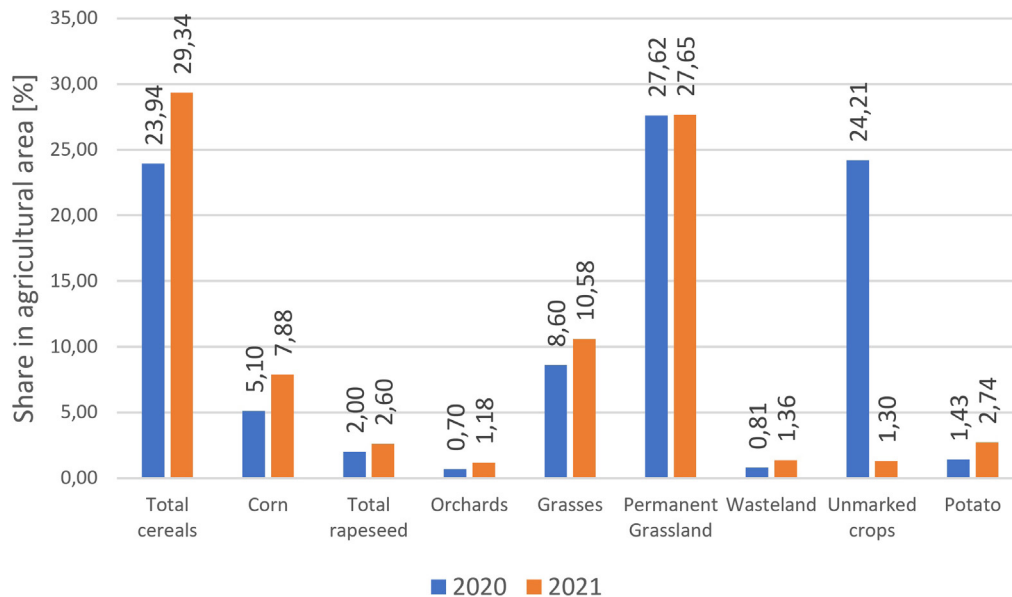


Fig. 4. Changes in the number of livestock production farms Małopolskie Voivodeship from 2019 to 2021 [1] [pcs]

Crops

Based on Figure 5, it can be seen that the area of arable land in Małopolska province has decreased slightly. According to ARiMR[1] data, the total area of agricultural land (understood as areas occupied by arable land, permanent grassland and permanent pasture or permanent crops) is decreasing. In 2021,

it was 481302.48 hectares, to decrease to 477819.81 hectares the following year. Thus, there was a loss of 3482.7 hectares of agricultural land, which is only about 1% of all agricultural land in the province. It can be assumed that this is related to the allocation of land for residential or other non-agricultural developments.

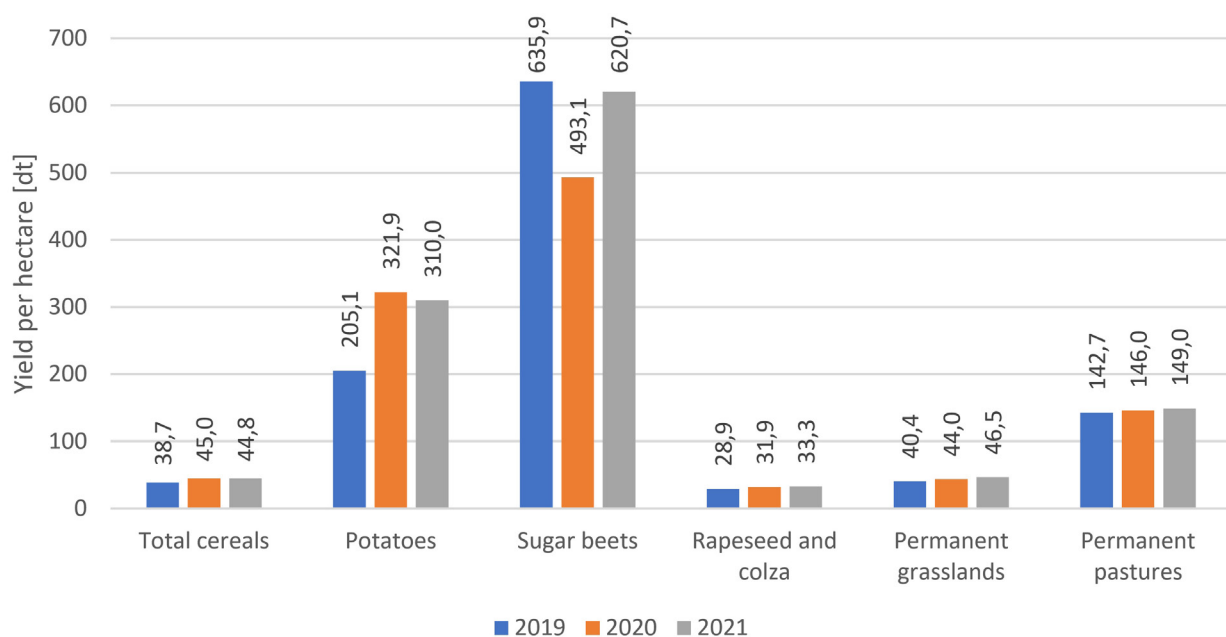


Fig. 5. Crop structure of selected plants in Małopolskie Voivodeship in 2020–2021 [1] [%]

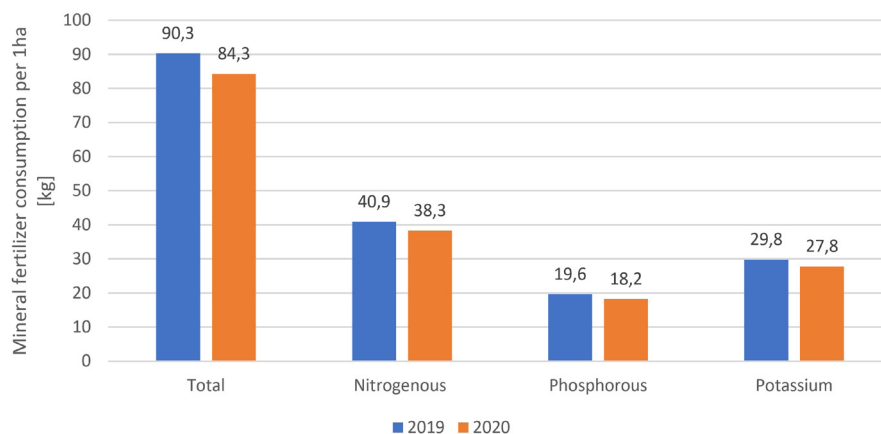


Fig. 6. Yield per hectare of staple crops in Małopolska in 2019–2021 [2] [dt]

It can be noted that despite the decreasing area of land devoted to cultivation, the share in the area of staple crops is increasing. In the case of cereals, the province in 2021 cultivated more than 5% more relative to the area of agricultural land than in the case of 2020. Increases can also be seen in the popularity of cultivation of, among others, corn (about 2.78%), grass (about 1.98%), rape (about 0.60%) or the establishment of orchards (about 0.48%). At the same time, it is shown that the area of fallow land, i.e. areas temporarily excluded from agricultural use, is increasing (by about 0.5% per year). Special attention can be paid to potato crops, which, despite their small share of the total crop area, almost doubled (by about 1.31%) during the period under review. There was a significant decrease in the area of undesignated crops (almost 23%), suggesting that the crops were more accurately classified or previously unused land was put under cultivation. There was a slight decrease in the area occupied by TUZ (permanent grassland) – by about 0.03%.

Based on the data from the Local Data Bank (Polish: Bank Danych Lokalnych) of GUS [8], it is possible to verify the obtained yields of basic crops grown in the province (Figure 6) and the applied fertilization in 2019–2021 (Figure 7).

In the case of total cereal crops, despite the decreasing area of crops from 226532 hectares in 2019 to 199927 hectares (according to ARiMR Krakow [1]) in 2021, there has been a total increase for the entire area of the crops in the province in cereal yields from 8762659 dt to 8948764 dt [2]. Digging deeper into the analysis of changes in the production of individual types of cereals, it can be seen that regardless of the increasing yields of all types, the area of staple cereals is decreasing in favour of cereal mixtures. A similar pattern can be observed in the case of the other major crops, where, despite the decreasing area, yields are increasing. These data may indicate improvements in technique and technology in cultivation, the support measures used and fertilizer doses.

A special attention can be paid to potato production, where the yield per hectare increased significantly from 205 kg per hectare of crop in 2019 to 310 kg in 2021. Sugar beet yield, on the other hand, despite a significant decline in 2020 compared to the previous year (by about, 142.8 kg/ha), rose to 620.7 kg/ha the following year. This may suggest that the province has experienced changes in climatic conditions to which this crop was sensitive in 2020.

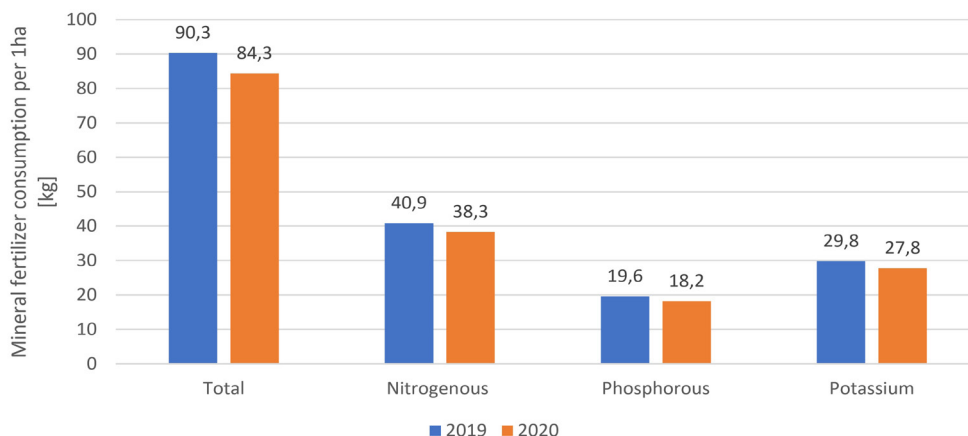


Fig. 7. Mineral fertilizer consumption per hectare on the territory of Małopolska Voivodeship in 2020–2021 [2] [kg/ha]

Analyzing the data of the CSO Local Data Bank, one can observe a decrease in the amount of mineral fertilizers applied per hectare of crops. For fertilization in the province in question, 51568 tons of total mineral fertilizers were applied in 2019, where in 2020 it was 46982 tons. Thus, the decrease over the year was nearly 10%. The reason for this trend may be the increase in fertilizer prices and the development of farmers' awareness, who more rationally select the dosage of treatments to meet the needs of each crop.

Summary and conclusions

Based on the above analysis, it is possible to observe significant changes in the agricultural sector in Lesser Poland province, over a period of just 3 years. A significant reduction in agricultural production was observed in each of the production elements. There have been reductions in livestock production, i.e. in the size of cattle and pig breeding. Minimal equilibrium was observed in the sheep population, and a slight increase was recorded for the goat population. An interesting case, and an exception in the overall analysis, appears to be the pig population, where the number of heads in 2020 decreased compared to the previous year, and increased in the following year, 2021. On the other hand, the number of farms engaged in pig production has drastically decreased (down about 45% in 2021 compared to 2019). This indicates a significant concentration of production in a smaller number of farms that have specialized in pork production. The total agricultural area in the province also decreased from 481302.48 hectares in 2020 to 477819.81 hectares in 2021[1]. Thus, it can be seen that agricultural activities, including both crop and livestock production, are losing strength and are less popular. This situation can be attributed to a number of factors, including a decline in the profitability of small farms through rising fertilizer, fuel and machinery prices. In the recent years there has also been declining rainfall, which adversely affects the yield of crops grown.

As a positive aspect, a reduction in the amount of mineral fertilizers used per hectare of crops can be observed, which does not translate significantly into a drastic reduction in yields, which in most cases are increasing. This may be due to a more rational and conscious use of fertilizers by food producers, as well as to the development of technology and improvement of crop production. This is, of course, a positive phenomenon from the point of view of environmental protection, especially water resources.

The data presented can be used to prepare a broader analysis and study of the impact of agriculture on environmental changes in the Małopolska province. The structure of agricultural production, livestock or crops will allow determining, *inter alia*, the balance of NPK or biogenic compounds, and then, estimating the impact on eutrophication processes. It can also allow an up-to-date assessment of the state of the environment, and thus plan to supply crops with the right amount of components to ensure better yields without excessive fertilization.

To sum up – the level of agricultural production in Lesser Poland Voivodeship – against the background of the volume of this production in the country – is at an average level. This is due, among other things, to the fact that the voivodeship can be territorially divided into a northern part (intensive agriculture – mainly vegetable farming) and a southern part, where the level of agricultural production (mountains and foothills) is characterized by extensive farming. There are mainly grasslands and traditional herding of sheep and partly cattle.

Literature and sources

- [1] Dane udostępnione przez Dyrektora Małopolskiego Oddziału Regionalnego Agencji Restrukturyzacji i Modernizacji Rolnictwa w Krakowie, dnia 16.08.2022 r.
- [2] Główny Urząd Statystyczny, Rocznik Statystyczny Województwa Małopolskiego 2021, stan z dnia 05.12.2022 r.; <https://krakow.stat.gov.pl/dane-o-wojewodztwie/wojewodztwo-918/>; <https://svs.stat.gov.pl/>
- [3] Elżbieta Jadwiga Szymańska, Jarosław Maj, „Zmiany w powierzchni gospodarstw rolnych w Polsce w latach 2010-2017”, *Roczniki Naukowe Ekonomii Rolnictwa i Rozwoju Obszarów Wiejskich* (tom 105, numer z. 2, s.50-58), 2018 r.
- [4] Stanisław Zegar, J., „Rolnictwo w rozwoju obszarów wiejskich”, *Wies i Rolnictwo*, (2 (179), s. 31–48), 2018 r.
- [5] Barbara Kryk, „Zrównoważony rozwój obszarów wiejskich. Aspekty ekologiczne”, Wydawnictwo: Economicus, Szczecin 2010 r.
- [6] Charakterystyka województwa małopolskiego; http://www.krakow.pios.gov.pl/Press/publikacje/raporty/raport15/1_charakterystyka_wojewodztwa.pdf
- [7] Biuletyn Informacji Publicznej, Regionalny System Biuletynów Informacji Publicznej w Małopolsce, stan z dnia 06.10.2022 r.; <https://bip.malopolska.pl/>
- [8] Główny Urząd Statystyczny, Bank Danych Lokalnych, stan z dnia 05.12.2022 r.; <https://bdl.stat.gov.pl/bdl/start>

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JOURNAL BEARINGS SYSTEM OF SHAFTS WITH ROLLING START-UP AID

UKŁAD ŁOŻYSK POPRZECZNYCH WAŁÓW Z TOCZNYM WSPOMAGANIEM ROZRUCHU

Summary: The article describes a radial journal bearing adapted to, e.g. high-speed rotating machinery, and a special radial-thrust bearing used for the bearing system of vertical shafts of water and wind power plants of the proconsumer type. In both of the described designs, the start-up and run-out of the slide bearings are supported by the rolling bearings that are activated by the shaft reaching the assumed rotational speed.

Keywords: rolling bearings, radial bearing, water power plants, wind power plants

Streszczenie: W artykule opisano łożysko poprzeczne przystosowane m.in. szybkoobrotowych maszyn wirujących oraz specjalne łożysko promieniowo-oporowe stosowane w systemie łożyskowania wałów pionowych elektrowni wodnych i wiatrowych typu prokonsumenckiego. W obu opisanych konstrukcjach rozruch i wybieg łożysk ślizgowych wspomagany jest przez łożyska toczne, które uruchamiane są poprzez osiągnięcie przez wał założonej prędkości obrotowej.

Słowa kluczowe: łożyska toczne, łożysko promieniowe, elektrownie wodne, elektrownie wiatrowe

Introduction

In the high-speed shaft bearings arrangement, there are a number of difficulties when frequent starts and run out under full load take place. The problem is then in choosing the type of bearing.

In the range of high and very high rotational speeds, slide bearings work well when the conditions for full hydrodynamic lubrication are provided [2, 3]. Occurrence of frequent starts and stops under load causes problems with mixed friction conditions and greater frictional wear; then the conditions for liquid lubrication are not met. This may lead to bearing seizure symptoms, leading to premature failure of the bearing, and even a fire hazard

In many cases, a significant increase in the starting resistances of the tribological system of slide bearings is very undesirable particularly, when there is a lack of lubricant in the area between the journal and the bearing sleeve. This requires the use of excess power of the drive motors due to starts. Also, when the machine runs down under load, unfavourable phenomena occur in the slide bearings that can lead to their destruction; the viscosity of the lubricant is significantly lowered. In the situation of their immediate start-up, the tribological conditions in the bearings become particularly critical.

At the Department of Mining Mechanization and Robotization of the Silesian University of Technology, a number of bearing arrangements have been developed, the main feature of which is the use of supporting the start-up and run-out of slide bearings by additional rolling bearing, which is automatically switched off. When the bearing reaches the assumed rotational speed, the automatic changeover system is turned on again, when the slide bearing overruns exposed to constant heavy load [15, 16, 17].

The article describes a radial journal bearing adapted to, e.g. high-speed rotating machinery, and a special radial-thrust bearing used for the bearing system of vertical shafts of water and wind power plants of the proconsumer type.

In both of the described designs, the start-up and run-out of the slide bearings are supported by the rolling bearings that are activated by the shaft reaching the assumed rotational speed.

Bearing of the vertical shaft of the proconsumer power plant with the use of a sliding bearing with a rolling start and run-out aid

For the needs of proconsumer wind energy, in which turbine rotors with a vertical axis are used, it is necessary to efficiently support the vertical shafts. The shafts are subjected to considerable constant loads resulting from the sum of the rotor weights,

the shaft itself of considerable length and weight, and all elements mounted on the shaft.

The nature of the proconsumer wind power plant operation requires frequent start-ups and stoppages of the systems, making the operation of the bearing systems difficult. Considerations of environmental protection require high, low-noise bearing running, because these systems most often operate in the immediate vicinity of users' premises. Similar conditions and requirements occur in the case of bearing arrangements of small water power plants, which most often use Pelton or related rotors with a vertical axis of rotation [17, 18].

The concept of shaft bearing arrangements for such applications is illustrated in Fig. 1. The following subassemblies can be distinguished in the bearing assembly: A - main slide bearing with hydrodynamically lubricated ball journal to carry full load in the range of higher rotational speeds, B - rolling bearing supporting start-up and run-out, C - automatic load switching system between A and B bearings depending on the rotational speed, D - bearing pre-adjustment system, E - stabilizing the transverse position of the shaft, auxiliary plain bearing. All components operate with the vertical shaft of the engine room that is made of a section of thick-walled pipe in the raw condition, i.e. without the need to perform machining operations on it, which significantly simplifies the construction of the engine room and significantly reduces costs. The elements fixed on the tubular shaft, including the turbine rotor and power generator drive components, are mounted in place by means of series-produced snap rings. Such connections enable the transmission of significant torques and longitudinal forces in a backlash-free way with easy adjustment of the position of the elements in relation to the shaft.

On the shaft 1, the spherical journal bearing 3 and the load switching support sleeve 4 are mounted with the use of clamping rings. The spherical pin 3 cooperates with the sleeve (support) 5 when immersed in the lubricating liquid 6 closed in the lubricating space 6 and enclosed in a sheet metal housing 7 (fixed in relation to the base of the plain bearing 8 by hard solder). The rolling bearing 9 aided in starting and run-out of the bearing assembly rests on a spherical support 10 embedded in the ring 11; the position in relation to the base 12 is controlled by a fine threaded connection with the gasket 26.

When the bearing arrangement is at a standstill, the full thrust load Q is transferred by the supporting rolling bearing 9 and the sliding sleeve 14, that is supported by a compression spring 13 embedded in the support sleeve 4.

In such a situation, the starting of the bearing system takes place with very reduced starting resistances only of the rolling bearing, as there is a

predetermined initial clearance in the slide bearing.

When the rotational speed increases after such a facilitated start-up, the automatic load switching system starts to operate from the auxiliary rolling bearing 9 to the main slide bearing, in which the conditions for full hydrodynamic lubrication have already occurred. Smooth switching of the load takes place as a result of the action of increasing centrifugal force acting on inertial weights 16 closed in housings 15. The housings 15 are engaged by means of thread connection with the control levers 20 mounted on the axles 18. The control levers 20, preferably in the number of 3, evenly seated in the recesses of the supporting sleeve 4, generate the lift of the sliding sleeve 14 upwards, as a result of which the bearing load is gradually released 9. When the load is completely removed, the bearing stops and the full radial thrust load, Q is transferred by the main plain bearing thanks to its spherical shape; there is no transverse loads generated by the wind pressure to the turbine rotor of the power plant.

During run-out when the speed is gradually reduced, the au-

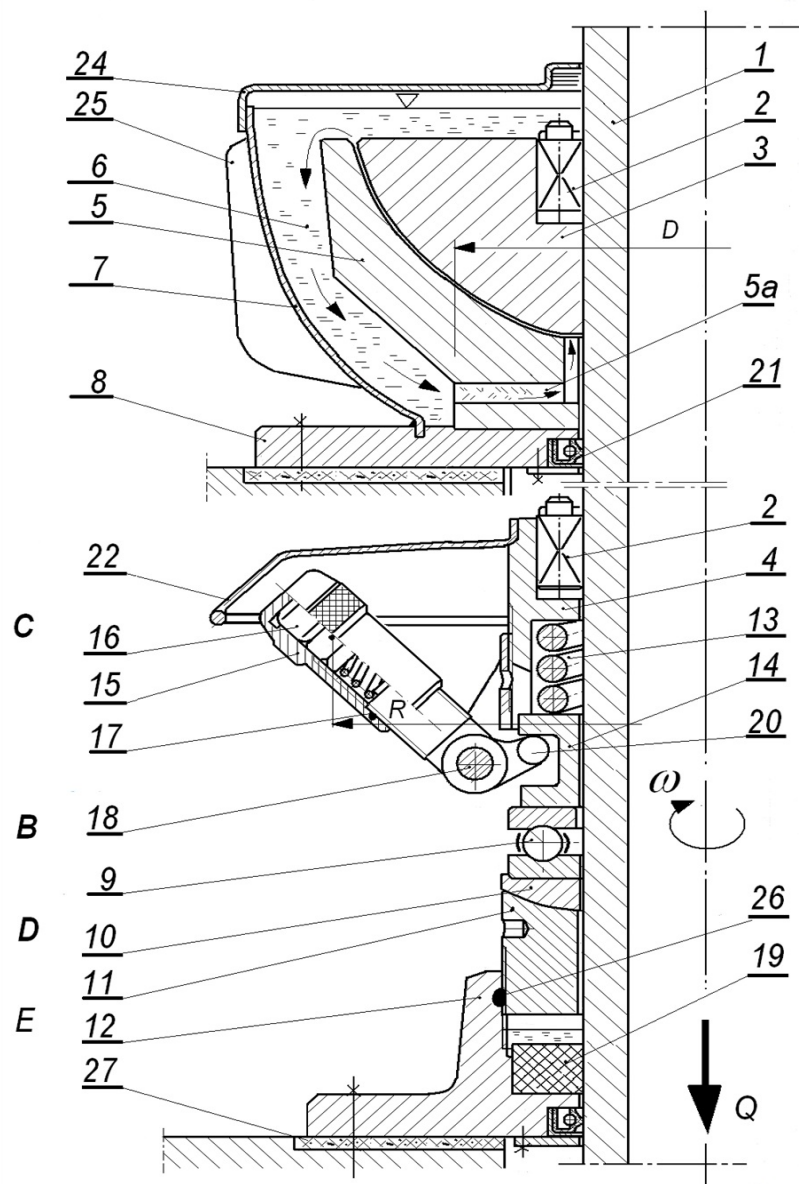


Fig. 1. Plain bearing arrangement with rolling start and run-out assistance

tomatic load changeover operates in the opposite direction. The plain bearing is then smoothly relieved with the load being transferred to the supporting rolling bearing, which is gradually engaged by the sliding sleeve 14. In the final phase of run-out, only the rolling bearing operates until it stops. After stopping, the system is fully ready for start-up, even immediately. The described start-up and run-down process shows that the main plain bearing operates only under full liquid lubrication conditions and is protected against harmful tribological start-up processes, especially when running out under full load.

The automatic load switching system allows a wide range of speed control at which the load is switched. It is obtained initially by selecting the number and mass of inertial weights and more precisely by turning the fittings 15, as a result of which the radius R of the rotating of the mass S of the weights 16 changes. The weights 16, depending on the needs can be made of materials of different density, e.g. of lead or copper.

Turning the sleeve 11 performs the initial adjustment of the plain bearing clearance. The fine thread of the sleeve 11 enables a very precise adjustment of the bearing clearance.

During the operation of the plain bearing, intensive circulation of the lubricant occurs, as illustrated by the arrows in Fig. 1. The lubrication efficiency of the spherical pin is increased by spiral or radial grooves made on its sliding surface. These grooves additionally have appropriately formed wedge cuts, facilitating the formation of many unit-lubricating wedges. In addition to increasing the lubrication efficiency, these grooves act as the blades of a centrifugal vortex pump and intensify the circulation of the lubricant. This ensures the efficient dissipation of the heat generated in the slide bearing; the heat is absorbed by the sheet metal casing 7 and discharged to the environment by convection and radiation assisted by cooling ribs 25.

In this situation, the natural cooling of the bearing is fully sufficient. After cooling, the lubricant returns to the entrance through the openings 5a, which is favoured by the suction effect of the lubricating grooves in the rotating journal.

The described bearing of the wind turbine shaft is characterized by low starting resistance, and enables the power plant to operate at a significantly reduced wind speed. A special feature of the system is a very long service life, resulting from the operation of the main plain bearing only under conditions of full hydrodynamic lubrication. There is practically no wear and the supporting rolling bearing works for short periods of time and is at rest for the rest of the time.

A particularly advantageous feature in proconsumer applications is the high low-noise running of the bearings. A rolling bearing operates at a reduced rotational speed for a relatively short time, while an oil-lubricated plain bearing is, by its nature, practically noiseless. The nature of the operation of the slide bearing allows the use of a lubricant with a much lower viscosity, which additionally serves to improve energy efficiency, thanks to the reduction of heat generation as a result of the movement of the lubricating liquid.

It is possible to use a water emulsion and even water for lubrication. This is favoured by a large bearing surface and a large di-

ameter D of the cooperation zone, hence high sliding speeds. The resulting reduced average contact pressures, high sliding speeds, and in particular the nature of the operation of the slide bearing allow for the compensation of low viscosity of the emulsion or the water itself.

The use of water as a lubricant makes the bearing completely immune to fire hazards.

The described features are particularly desirable when used for bearing the shafts of a proconsumer-type wind or water power plant. The bearing can operate in sub-zero temperatures.

The shape of the container 7 for the lubricating liquid protects it against frost damage, and the possible ice layer between the pin and the pan does not significantly change the starting resistance when the water freezes (see ice skates), moreover, it quickly melts during operation.

Radial plain bearings with rolling start and run-out assistance

Radial plain bearing with liquid lubrication, adapted as the bearing of the shaft of a high-speed rotating machine, is shown in Fig. 2. Due to the nature of the work associated with frequent starts, it was desirable to use rolling start and run-out support.

With the journal mounted at the end of shaft 1 2 cooperates the sleeve with a sliding bushing 3. The sleeve 2 is fixed by the tilt with edge support in the tubular housing 4 and is fixed longitudinally with Seger rings 16.

Covers 15 and 17 with appropriate rotary seals 18 close the lubrication space of the plain bearing. A frame 5 with a fixed journal 5a is attached to a special cover 15, on which a rolling needle bearing 6 is mounted, supported longitudinally with Seger rings 7 and 8. Four clamps are periodically frictionally coupled to the roller bearing 6 segments 9 with a sliding fit in the holes made in the recess of the shaft end 1 (see section A-A - fig. 2).

When the stop of the system, the segment clamps 9 are pressed against the outer ring of the rolling bearing 6 by means of springs 10, the preload of which is regulated by screw plugs 11 with fine thread.

By correspondingly tightening /loosening the three set screws 14 at the loosened screw connections 20, the fixed pin 5a is also displaced transversely so that, via the rolling bearing 6, segment clamps 9, springs 10 and plugs 11, the pin 5a takes a position as close as possible coaxial to the shaft 1. Then the journal of bearing is raised above the sliding surface of the sleeve 3 by an amount corresponding to half the clearance in the plain bearing.

The plain bearing is then fully relieved and the rolling bearing carries the full load.

In practice, a sign of this may be the occurrence of only a slight shaft rotation resistance resulting from the resistance to movement of the rolling bearing itself. This adjustment is the best-done before filling the slide bearings with lubricant.

After reaching the aforementioned position of the journal 5a in relation to the shaft 1 axis, the threaded connection 20 must be tightened firmly in order to fix the permanent positions of both pins through the friction insert 13. This operation is performed

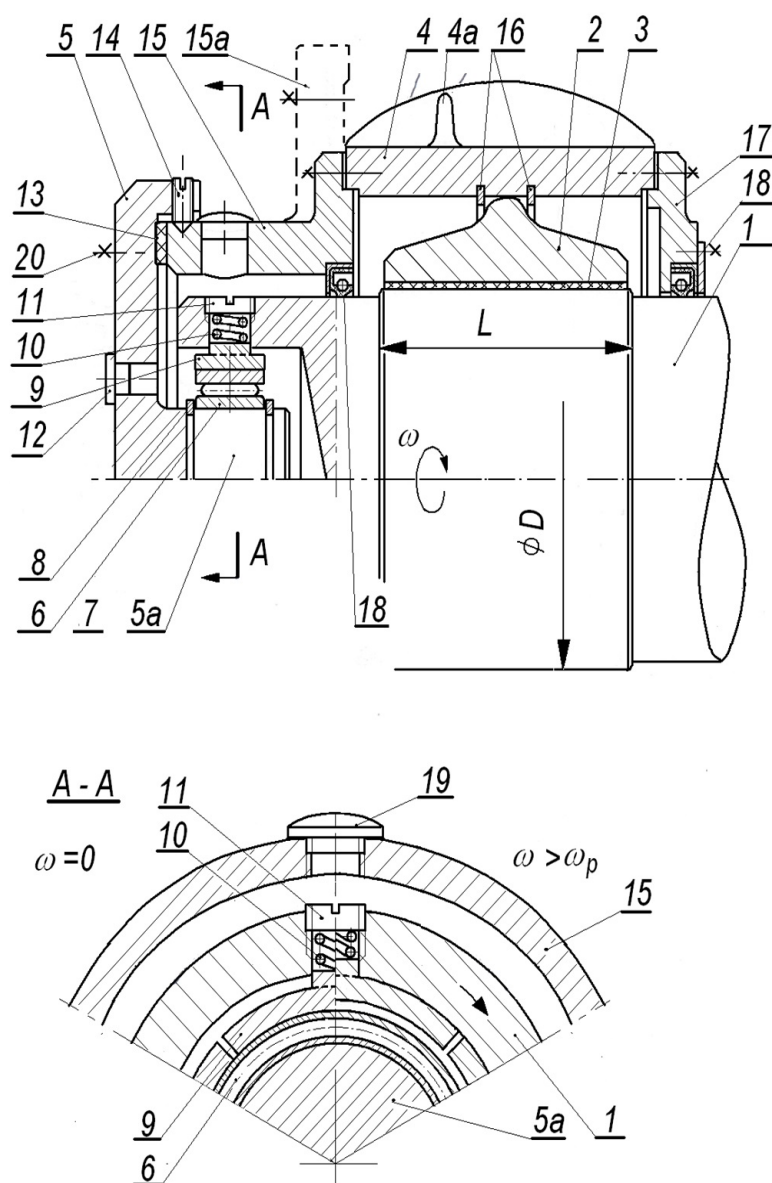


Fig. 2. Axial cross-section of journal bearing with the rolling aided start-up and run-out

once, whereby the space of the slide bearing should be filled with the lubricating liquid up to the level of the bearing shell 3 with an appropriate reserve.

Such adjustment causes, that, the star of the bearing takes place with significantly reduced resistance to movement, only the rolling bearing, because the slide bearing is completely relieved.

After the easier start-up, as the rotational speed of the shaft increases, the centrifugal force acting on the segment clamps causes additional deflection of the springs 10; the rolling bearing is smoothly relieved, and the relief is successively transferred to the slide bearing, in which a sufficiently high sliding speed has already occurred to enable the hydrodynamic lubrication effect. During the transitional period, both bearings operate with a smoothly changing proportion of the load distribution. When the supporting rolling bearing is unloaded, it stops. This can be easily checked through a transparent sight-glass 12. On the A-A section

(Fig. 2), the left side shows the position of the segment clamps at rest and in the first phase of the start-up, the right side shows the position of the segment clamps after full start-up, when the angular speed ω is regulated by switching speed ω_p . With full movement, the segment clamps rest against the inner surface of the shaft recess, which eliminates the possibility of generating vibrations caused by imbalance.

During coast-down, when the rotational speed of the automatic changeover system decreases, the loads act automatically in the opposite direction. As a result, the run-out to a stop is only carried out with the load on the supporting rolling bearing. The required switching speed is determined by simultaneously tightening/loosening the plugs 11 after loosening the plugs 19. As the lubricant in the slide bearing does not provide hydrodynamic lubrication at start-up, it becomes possible to use agents with a much lower viscosity, e.g. water, as a lubricant in the bearing and oil-water emulsions. This is to reduce heat generation and to take advantage of natural cooling. The heat dissipation to the environment is facilitated by the ribbing 4a around the entire circumference of the tubular body 4, especially in its lower part, filled with lubricant. To facilitate heat dissipation in this part of the fuselage, its suspension can be used with the use of a reinforced collar 15.

In addition to all the previously described advantages such as long service life, ease of starting, increased quiet running and improved energy efficiency, the bearing also has a very important feature in many applications. Appropriate regulation allows for obtaining the stability of the axis position of the entire bearing system in the full range of rotational speeds, which is particularly desirable in many rotating machines. This allows for the reduction of clearances in the vane system of rotating machines in relation to the position of the fixed steering systems. This increases the energy efficiency of a range of rotating machinery, including gas turbines and high-speed rotor gas compressors.

Summary

Hybrid plain bearings with speed-activated rolling start and run-out aid can overcome the difficulties that arise in the case of the bearings of shafts operating under constant load and exposed to frequent starts and stops.

The article presents two selected concepts of bearing arrangements that can be adapted to various applications in mechanical engineering.

Plain bearings equipped with an automatic system of load

switching to supporting rolling bearings during starting and run-out are characterized by increased service life, reduced starting resistance and increased overall energy efficiency. They allow the use of lubricants of much lower viscosity, including oil-water and water emulsions, and are especially intended for high-speed mechanical systems as well as systems with high variability of rotational speeds in operation. The use of bearings of the described structure allows achieving many technical and economic effects, including ecological values and increased safety of use.

Bibliography

- [1] Barwell F.T., Bearings. WNT, W-wa. 1984.
- [2] Kiciński J., Theory and research of hydrodynamic slide bearings. Ossolineum. 1994.
- [3] Korytkowski B., Calculations of hydrodynamic slide bearings. Mechanical Review. No. 11. 1064.
- [4] Krzemiński-Freda H., Rolling bearings. PWN. W-wa. 1989.
- [5] Dietrich M., Fundamentals of Machine Design. Vol. 2. WNT. 2015.
- [6] Bartz W., et al., Keramiklager, Expert Verlag. 2003.
- [7] Nieman G., Winter H., Höhn B., Maschinenlemente. Band 1. Auflage. Berlin, Heidelberg, New York. Springer Verlag. 2005.
- [8] Skoć A., Spałek J., Fundamentals of Machine Design. T 2. WNT. W-wa. 2008.
- [9] Lawrowski Z., Lubrication Technique. PWN. W-wa. 1998.
- [10] Strzelecki S., Journal Bearings. Identification of the operating characteristics of multi-lobe, hydrodynamic journal bearings. Editor: Silesian University of Technology. 2021.
- [11] Dadouche A, Fillon M., Bligoud J.C., Experiments on thermal effects in hydrodynamic thrust bearing. Tribology International. Vol. 33, 2000.
- [12] Iliev H., Failure analysis of hydro-generator thrust bearing. Wear. 1999.
- [13] Mikula A. M., Gregory R. S., A comparison of Tilting-Pad Thrust Bearing Lubricant Supply Methods. Trans. ASME. 1983.
- [14] Rotte G., Wasilczuk M., Modelling lubricant flow between thrust bearing pads. Tribology International. Vol. 41 2008.
- [15] Wang X., Zhang Z., Zhang G., Improving the performance of spring-supported thrust bearing by controlling its deformation. Tribology International. Vol. 32 1999.
- [16] Grzegorzek W., Adamecki D., Mikuła J., Borek W., Głuszek G., Mikuła S., Shaft bearing of wind turbine with vertical axis of rotation. Tribology 2022.
- [17] Szelka M., Szveda S., Szyguła M., Mikuła J., Mikuła S., Bearing node of a wind power plant with a vertical axis of rotation. Patent description. Polish Patent Office. No. 440590.
- [18] Mikuła J., Mikuła S., Strzelecki S., The concept of proconsumer hydro power plant with a special bearing for the main shaft. Polish Technical Review. Yeah. 1/2022.
- [19] Dąbrowski Z., Neyman A., Wasilczuk M., Axial Bearings – Contemporary operational problems. Machine Operation Issues. Book 3 (139). 2004.

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THE FUTURE OF PHARMACEUTICALS' PACKAGING

DOKĄD ZMIERZAJĄ OPAKOWANIA NA FARMACEUTYKI

Summary: Pharmaceutical industry is nowadays the most dynamically developing branch of the industry. Packaging plays the important role in this respect. The present paper contains the results of the survey studies concerning the packaging of pharmaceuticals, including their most significant features, with the consideration of those which satisfy the expectations of the consumers. From the mentioned above questionnaire it is followed that the safety of the packaging is the most important aspect and their environment-friendly feature is the least important factor.

Keywords: packaging of pharmaceuticals, type, properties

Streszczenie: Przemysł farmaceutyczny jest obecnie chyba za najdynamiczniej rozwijającym się. Opakowania odgrywają tu istotną rolę. W pracy zawarto wyniki badań ankietowych dotyczących opakowań na farmaceutyki, obejmujące najbardziej istotne ich cechy, z uwzględnieniem tych, które najbardziej odpowiadają Konsumentom. Wynikło z nich, że najważniejsze jest ich bezpieczeństwo, zaś najmniej istotnym czynnikiem okazała się ich proekologiczność.

Słowa kluczowe: opakowania farmaceutyków, ich rodzaje i właściwości

Introduction

Pharmaceutical industry is recognized as one of the most profitable sectors of the industry. Its leaders include the United States of America, the European Union and Japan. Polish pharmaceutical market occupies the 6th place in respect of the size in Europe what gives ca. 5-% participation in the European market and ca. 1.4% share in the world market. The value of sales of pharmaceuticals in Poland in February 2014 was estimated at the level of 2 256 million PLN. According to Polish law, the direct packaging of medicinal product is the packaging which has a direct contact with the mentioned medicinal product. The external packaging of the pharmaceutical product serves for placing the direct packaging inside [1].

The packaging of pharmaceuticals is, therefore, a special type of packaging. It is subjected to legal regulations. It should also satisfy very restrictive requirements of safety. At the same time, the packaging should play the basic functions, and namely:

- protective
- logistic
- informational,
- utility,
- marketing.

The significant aspect of pharmaceutical packaging production consists in the fact that the packaging material does not have any effect on the product and the product does

not have any influence on the packaging material. More and more frequently, plastics are employed in manufacture of pharmaceutical packaging; they are lighter, easier to be moulded in diverse shapes and, in comparison to other materials, they give greater possibilities. In pharmaceutical industry, the polymer nanocomposites are a novelty. They are able to ensure the appropriate barrier capacity, resistance and other desired properties of the future packaging of pharmaceuticals. Similarly as in other branches of packaging market, there is also more intelligent packaging in pharmaceuticals, the task of which is to make the communication with the user easier in respect of the drug's stability. Moreover, the mentioned packaging may affect positively the quality of the product.

Packaging of medicinal products belongs to the group in the packaging industry which is characterized by a high innovativeness. Hence, the pharmaceutical market shows more and more intelligent packages which have smart closures, special properties, etc. The example may be the simplest packaging of eye drops, utilizing a mechanism of non-sucking the air inside of the packaging what makes that dosage of the drops is more precise: after squeezing the bottle, only one drop flows out from the bottle. Another type of the closure which is more and more frequently employed in the containers of pills: they contain only the caps with the protection of Child Resistant type. Owing to this arrangement, a small child, for whom a given substance is harmful, will have a problem with opening of the discussed

packaging. To remind the patient about the daily dose of the drugs, there are installed the closures with electronic micro-circuits, strictly controlling the date and time of each opening and closure of the packaging, and with LCD display, showing the number of doses, taken on a given day [2]. Such solution allows also the physician to control whether a patient followed his recommendations.

The application of automatic pens, i.e. automatic injectors becomes also more and more popular. It is connected with the increase of the number of adult diabetics all over the world. At present their number is equal to ca. 415 million persons and until 2040, the mentioned number is expected to reach 642 million cases [3]. Such alarming data cause greater demand on insulin and its appropriate packaging. It may be administrated in ampoules, using a syringe, and also, pens may be used with a ready-to-use cartridge. The pharmaceutical industry follows this way. The mentioned cartridge is sealed with the rubber stopper at the end part; from the front part, there is an aluminium membrane which may be punctured by the needle before administration of the medicinal product. The discussed device is also supplied with an easy-to-use dosing mechanism which facilitates injection of the appropriate volume of insulin. Another innovation in respect of drug therapy includes automatic injectors which replace long-lasting waiting for visit at doctor's room in the case of rare oncologic or hormonal diseases [3]. Owing to the discussed solutions, the patients may become more independent and, moreover, they can save their time and stress.

Marking of the packaging is a significant factor of packaging production. In the case of medicinal products, it is especially important to protect them against adulteration or falsification. Owing to the appropriate marking, it is possible to trace a given product and control whether it reached its target. The systems such as track and trace, or UDI, i.e. unique system for identification of devices, are most frequently used, for example, for tracing the route of dispatched parcels. Pigments Iriotec 8000 are the interesting technology of marking the packaging. They are adapted to UDI system and require only pigment and appropriate laser which makes that the marking becomes more stable [4]. The discussed technology is characterized by a high level of contrast and contact-free processes. It may be employed on delicate, curved surfaces such as certain pharmaceutical packages. Nowadays, the era of applying the holograms and special closures as the method for protection of the product against fraud is passing away. Pharmaceutical industry moves rather towards the application of RFID (radio-frequency

identification) micro-tags and invisible or miniaturized overprints. At present, the producers are also focusing their attention on emphasizing the integrity of packaging in connection with the Falsified Medicines Directive/2011/62/EU, published on 1 July 2011 and applied since 2 January 2013 [2]. According to the mentioned document, the prescription medicines bear the unique number and the element, preventing the earlier opening; it allows the pharmacists to verify whether a given product is really intact. The on-line pharmacies are marked with one logo, owing to which the number of falsified medicines sold in the Internet has been limited.

The most significant properties of pharmaceutical packaging

To examine the preferences of the users of pharmaceutical packaging, the survey was carried out among 100 persons at different age and with different education level. It allowed obtaining information what are the properties and types of pharmaceutical packaging which are most important and convenient from the viewpoint of its user. The answers of the respondent are given in Tables 1–5 and Fig. 1.

Table 1 contains the presentation of the answers to the question concerning the features of pharmaceutical packaging.

From the results of the below survey it is followed that safety of pharmaceutical packaging is the most important factor. Eco-friendliness of the mentioned packaging is the least significant aspect.

Table 2 presents the answers concerning the mentioned above question but considering gender of the respondents.

On the grounds of the obtained results we may state that women were mostly focused on readability of information and

Table 2. The averaged results of the respondents' answers to the question: "what properties of pharmaceutical packaging are most significant in your opinion?" according to gender

Gender	Women	Men
Number of respondents	52	48
Eco-friendliness	3.45	3.39
Graphical form	3.83	3.62
Safety	3.94	4.03
Readability of information	4.02	3.61
Possibility of complete emptying	3.63	3.22
Convenience of use	3.89	3.33

Table 1. The averaged results of the respondents' answers to the question: "what properties of pharmaceutical packaging are most significant in your opinion?"

Number of respondents	Eco-friendliness	Graphical form	Safety	Readability of information	Possibility of complete emptying	Convenience of use
100	3.4	3.71	4	3.75	3.6	3.55

Table 3. The averaged results of the respondents' answers to the question: "what properties of pharmaceutical packaging are most significant in your opinion?" according to age

Age	<18 years	18-25 years	26-35 years	36-45 years	45-60 years	>60 years
Number of respondents	9	43	13	20	9	6
Eco-friendliness	3.16	3.66	3.88	3.93	3.29	3.20
Graphical form	3.25	3.21	3.35	3.16	3.48	3.39
Safety	3.4	3.67	3.58	3.57	3.79	3.59
Readability of information	3.3	3.77	3.28	3.47	3.75	3.73
Possibility of complete emptying	3.3	3.62	3.81	3.24	3.81	3.29
Convenience of use	3.88	3.99	3.6	3.8	4.02	3.86

safety of packaging; eco-friendliness was evaluated at the last place. Men paid their greatest attention to the safety of packaging whereas the possibility of complete emptying was the least important aspect for them.

Table 3 contains the results considering the age of the respondents.

From the results of the survey studies, it may be followed that the eco-friendliness of the pharmaceutical packaging is the most important aspect for the persons at the age of 36-45 years whereas for the persons below 18 and more than 60 years, it is the least significant factor. Graphical form is most important for the users at the age of 45-60 years and least meaningful for the respondents at the age of 36-45 years. The safety of pharmaceutical packaging occurred to be the most important aspect for the persons at the age of 45-60 years whereas for the users at the age under 18 it is least important. The readability of information is most important for the persons at the age of 18 – 25 years and above 45 and least important for the respondents at the age below 18. The possibility of complete emptying of the packaging is the most significant factor for the persons at the age of 26-35 years and 45-60 years. The mentioned aspect is least important for the respondents above 60 years of life. The convenience of use is the most important feature of pharmaceutical packaging for the users at the age of 18-25

years and the least important aspect for the persons at the age of 26-35 years of life.

Table 4 shows the results of the survey studies, considering the level of education of the respondents.

For the persons without education, the convenience of use of pharmaceutical packaging is its most important aspect and its eco-friendliness and graphical form are the least significant factor. For the persons with the primary education, the eco-friendliness of packaging is most important and its graphical form is the least significant aspect. The persons with vocational education appreciate the readability of information of the packaging as the most important factor; on the other hand, the graphical form and convenience of use is the least meaningful factor for them. The persons with secondary education pay mostly the attention to the eco-friendliness of packaging and the possibility of their complete emptying is for them the smallest problem. For the persons with the higher incomplete education, the graphical form and the possibility of complete emptying of the packaging are the most important factors. The convenience of use is the least significant factor for this group. The persons with the higher education pay the greatest attention to the readability of information and graphical form of the packaging is the least important aspect for them.

Table 4. The averaged results of the respondents' answers to the question: "what properties of pharmaceutical packaging are most significant in your opinion?" according to education level

Education	Lack	Primary	Vocational	Secondary	Incomplete higher	Higher
Number of respondents	7	6	7	19	32	29
Eco-friendliness	3.28	4.02	3.79	4.03	3.67	3.75
Graphical form	3.26	3.36	3.23	3.22	3.81	3.24
Safety	3.96	3.83	3.61	3.97	3.42	3.83
Readability of information	3.73	3.49	3.97	3.90	3.36	4.01
Possibility of complete emptying	3.99	3.41	3.39	3.38	3.82	3.59
Convenience of use	4.07	3.6	3.29	3.78	3.43	3.47

The most satisfying types of pharmaceutical packaging

In this part of the survey, the responders indicated the types of pharmaceutical packaging which were most satisfying for them. The question was not obligatory, so not everybody respondent answered this issue. It was dictated by the fact that not everybody used the submitted types of packaging. The answers of the respondents were given in Tab.5 and Figure 1.

Table 5. Numerical presentation of the respondents' answers to the question: "Which types of the pharmaceutical packaging are most satisfying for you?"

Type of packaging	Number of respondents	Mean evaluation
Sachets with a powder to be dissolved	96	4.00
Cardboard box	98	3.67
Blister sold separately	91	3.43
Plastic container with a cap	99	3.00
Plastic tube with a cap	100	3.93
Aluminium tube with a cap	93	2.89
Glass bottle with a cap	96	3.43
Glass bottle with a drop feeder	94	3.53
Ampoules	61	3.70
Laminated tubes	92	4.01
Pre-filled syringe	42	3.72

The sachets with the powder to be poured to water and dissolved and laminated tubes are the most satisfying type of pharmaceutical packaging for the respondents. On the other hand, they put the aluminium tubes with caps and plastic

containers for pills at the last place of evaluation. 58% of the respondents do not use pre-filled syringes and 39% do not use ampoules.

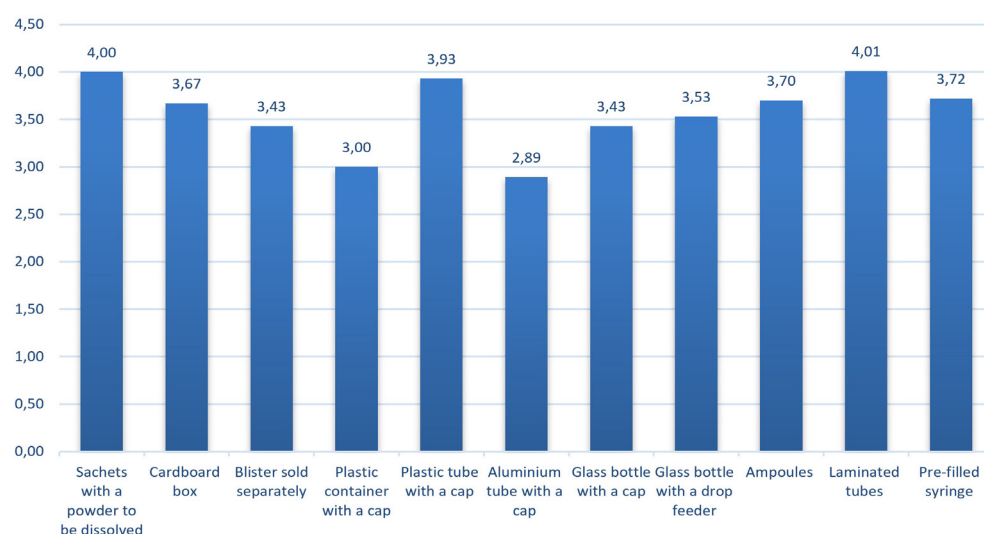
Summing up and conclusions

The results of the studies indicate that the respondents pay the greatest attention to the **safety of the pharmaceutical packaging**. Their **eco-friendliness** occurred to be the least important factor. The respondents recognized **the sachets with the powder to be poured** and **laminated tubes** as being the most satisfying pharmaceutical packaging. They are the most convenient packaging. It is enough to tear a sachet and pour the powder to water; the tubes can be opened and closed many times. Moreover, the tablets wrapped in the mentioned tubes are arranged one after another, so their removal is quite convenient. The respondent evaluated the **aluminium tubes with caps** and the plastic **containers for the pills** at the last place. It was also revealed that 58 % of the respondents did not use pre-filled syringes and 39% did not use ampoules.

From the above considerations, it is followed that pharmaceutical sector is vigorously developing. Nowadays, when we speak so much about the effect of waste on the natural environment, the answers of the respondents, who chose the eco-friendliness of pharmaceutical packaging as the least important aspect, are surprising. It may be concluded that the packaging which is practical, safe and easy in everyday use, is most popular. The introduction of innovative packaging to the market is undoubtedly a specific challenge to the designers and producers. The created packaging should simultaneously meet the requirements of the users and satisfy the eco-promoting legal regulations.

Bibliography

Fig.1. The column form of presentation of the respondents' answers to the question: "Which types of the pharmaceutical packaging are most satisfying for you?"



- [1] Ustawa z dnia 6 września 2001 r. Prawo farmaceutyczne
- [2] Wasiak W. i inni, Kierunki rozwoju opakowań. Wybrane problemy. Monografia., Warszawa, 2014
- [3] Mali pomocnicy – duże efekty, Packaging Polska 10/2019, str. 20-21
- [4] Jak dotrzymać kroku? Packaging Polska 10/2019, str. 26-27

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THE "OGNIK" ROOM OF THE STATE FIRE RESCUE TRAINING IN LUBARTÓW

„OGNIK” W PAŃSTWOWEJ STRAŻY POŻARNEJ W LUBARTOWIE

Summary: It is more and more frequent that we hear about children who have saved the lives of adults by calling the emergency services. The promotion of knowledge in the field of safe behaviour was introduced by the Minister of Education to the core curriculum of preschools, and constituted the stimulus for State Fire Service units to prepare special educational rooms, along with lesson plans describing the desired actions in emergency situations. The practical training in the field of fire safety using play and games allows children to become familiarised with the steps which should be taken, for example in the event of fire. The purposes of the educational meetings in the "Ognik" rooms are fostering appropriate behaviour and habits in life- or health-threatening situations, teaching caution in using household electrical devices, memorising emergency numbers, warning and informative signs, expanding the knowledge of first aid, promoting safe games, play and leisure, and familiarising children with the fire fighters' work and fire equipment. The article aims at presenting the mode of operation of the "Ognik" education rooms created under the "Bezpieczna+" State project and dedicated in particular to pre-school children.

Keywords: education room, threat, science, fire protection, safety, play

Streszczenie: W serwisach prasowych można usłyszeć informacje o tym jak dzieci dzwoniąc na numery alarmowe ratują życie i zdrowie dorosłych. Promocja wiedzy z zakresu bezpiecznych zachowań została wpisana przez Ministra Edukacji Narodowej do podstawy programowej wychowania przedszkolnego. Był to również impuls dla jednostek Państwowej Straży Pożarnej aby przygotować specjalnie wyposażone sale edukacyjne wraz z konspektem zajęć opisującym zachowania w sytuacjach zagrożenia zdrowia i życia. Prowadzenie praktycznej nauki z zakresu bezpieczeństwa przeciwpożarowego z wykorzystaniem technik zabawy pozwala dzieciom poznać sposoby postępowania w przypadku np. zaistnienia pożaru. Celem spotkań edukacyjnych w salach „Ognik” jest kształtowanie prawidłowych zachowań i nawyków w sytuacji zagrożenia życia i zdrowia. Nauka prawidłowych nawyków w zakresie używania domowych urządzeń elektrycznych, utrwalenie znajomości numerów telefonów alarmowych, znaków ostrzegawczych i informacyjnych. Umiejętność udzielania pierwszej pomocy przedmedycznej, promocja bezpiecznej zabawy, wypoczynku. Zapoznanie ze specyfiką pracy strażaka i sprzętem przeciwpożarowym. W artykule podjęto próbę przedstawienia sposobu działania sal edukacyjnych "Ognik" powołanych w ramach rządowego programu „Bezpieczna+”, a które dedykowane są w szczególności dzieciom w wieku przedszkolnym na przykładzie KP PSP w Lubartowie.

Słowa kluczowe: sala edukacyjna, zagrożenie, nauka, ochrona przeciwpożarowa, bezpieczeństwo, zabawa

Introduction

Ensuring safety and promoting safe behaviour among pre-school children are some of the most important goals of education. As children of preschool age and early schoolers very quickly adopt appropriate patterns of behaviour, educational institutions intensively cooperate with the Police, Fire Service and medical rescue workers. Ensuring safety involves all kinds of activities, forms and methods of organising and shaping reality around people in order to create optimal conditions for living [1]. The basic objective of education for safety is to shape appropriate attitudes among children, including respect for health and life, and being prepared to rescue and provide help to those who have been injured. Thanks to the cooperation of educational institutions with the uniformed services, children learn how to behave on the road, handle fire and electrical equipment, and stay safe during storms.

The impact of play on fostering safe behaviour in children

Play affects a child's development in multiple ways. It fosters intellectual development and motor skills, while also contributing to emotional and social growth. It is a creative activity bringing multi-level benefits to the child's creativity. The development of cognitive processes, such as impressions, perceptions, skills, memory and thinking is the most significant in the pre-school period. Activities involving physical movement are aligned with the developmental features and are based on such forms of movement as running or crawling. They allow the development of spatial orientation, foster perceptiveness and knowledge of numerical relations. Thematic play is derived from manipulative movements, where content, subject and props are important factors. Didactic play is bound by rules of conduct imposed by adults who provide the child with tasks to carry out independently. Thanks to play, children, both independently and

indirectly from adults, gain knowledge about the world around them, learn to tell the real world from fiction and discover the rules of cooperation. Researchers emphasise that play is the attribute of childhood and the source of learning, as well as the first school of a person's being in the world [2].

"Ognik" Educational Rooms also take into account the role of play. The outlines for activities are based on the core preschool curriculum, preschool departments in primary schools and other forms of preschool education. Learning how simple firefighting equipment works fosters habits connected with protecting life and health. Motor play activities help children remember what they should do if they find themselves in a dangerous situation. This is also facilitated by an appropriate selection of equipment for the "Ognik" rooms and instructors from the State Fire Service.

The "Bezpieczna +" Programme

The promotion of knowledge about safe behaviour and prevention of hazardous situations is a task prescribed by the Minister of National Education in the core curriculum of preschool education and general education across schools. This curriculum assumes that children finishing preschool education should know how to behave in dangerous situations and where and how to seek help. Within their abilities, they should be aware of their own behaviour and predict its consequences. Situations in which children used their knowledge of emergency numbers and rules of conduct in dangerous situations to save their families demonstrate how important it is to educate small children in this regard. This inspired both the authorities responsible for education in Poland and firefighters to establish properly equipped education rooms at the State Fire Service units. The "Bezpieczna+" (Safe+) Programme was used for this purpose. [3]. It is a programme implemented as part of the government's support provided to entities governing schools in ensuring safe conditions for study, education and care. It is a framework programme. Activities are identified on the basis of an analysis for a given school to help implement positive changes and eliminate adverse phenomena in the mid- and long-term perspective. For this programme to be implemented properly, schools must receive support from other institutions and units active in the community, including the State Fire Service, Police and NGOs. Specific targets are focused on improving the competencies of school employees, students and their parents in terms of the safe use of cyberspace and responding to dangerous situations, fostering the ability to identify dangerous situations and knowledge about the rules of conduct in such situations. The most important objective of "Bezpieczna+" is to create conditions for conducting, at State Fire Service units, practical

educational activities focused on safety, particularly fire safety. This involves providing funds for equipment and furnishing education rooms where the practical educational activities in fire safety will be conducted, creating educational resources to conduct practical activities, preparing instructors-consultants from the voivodeship in-service teacher training centres, training firefighters from the State Fire Service to conduct practical educational activities with students, preparing activity scenarios, as well as recording videos for children about safety in and out of school. This made it possible to create a network of "Ognik" education rooms across districts in all voivodeships. As part of the programme, firefighters conduct training activities in theoretical and practical safety, using multimedia presentations and genuine firefighting equipment.

"Ognik" Education Room in Lubartów

Activities at the "Ognik" Education Room at the District Headquarters of the State Fire Service in Lubartów are divided into stages. The first stage introduces children to the room. The children sit on the floor and are not allowed to cross the barricade tape. This is teaching them to make appropriate associations with the barricade tape and learn about its uses and situations in which it may be used. The next stage involves watching slides about the adventures of Florek the cat. Children are asked to provide captions to the different stories shown in the slides. As part of educational activities, the children will also:

- unroll the W-52 fire hose and attach it to the nozzle,
- see how a smoke detector works and learn about the methods and types of extinguishing fires,
- climb the ladder with the help of Florek the cat and ring the manual bell, which is hanging from the ceiling,
- learn the rudiments of pre-medical first aid (correctly pressing down on the chest and performing the rescue actions),
- become prepared to correctly report a fire by phone, with a focus on providing the necessary information to allow the



Fig. 1. "Ognik" Education Room.
Source: District Headquarters of the State Fire Service in Lubartów

- identification of the location and extent of the fire,
- volunteer to report a fire (with a discussion afterwards),
- discuss the evacuation and warning signs with a particular focus on evacuation signs and learn the rules of safe evacuation in the case of a fire or other hazard.

Preschoolers who have completed the activities at the “Ognik” education room remember that they cannot use electrical equipment on their own, are able to assess their own behaviour and the actions of their peers in terms of safety, know where to seek help in dangerous situations and the emergency numbers to call, and know what to do when there is a fire hazard.

Conclusion

Learning through play is the method used at the “Ognik” rooms, which are part of the “Bezpieczna+”, which fosters the popularisation of appropriate behaviour in dangerous situations for preschool children. A survey conducted in 2016 among adult Poles by the Ministry of Internal Affairs and Administration provides an insight into the level of public awareness of fire safety hazards. As many as 53% of respondents thought that carbon monoxide can be recognised by its smell and 22% chose somebody starting a fire as the main reason for fires [4].

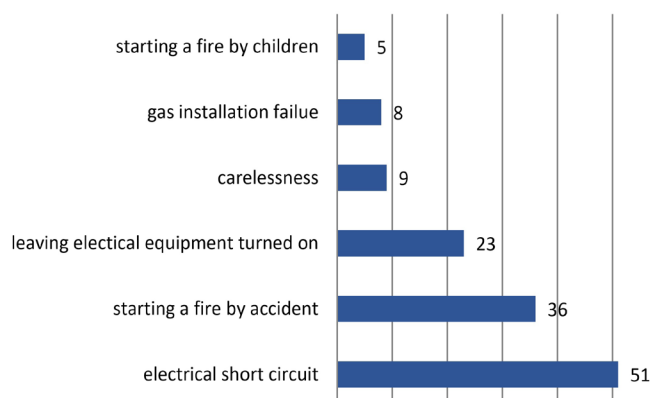


Fig. 2. Fire hazard reasons
Source: The authors on the basis of an Ipsos survey

The National Headquarters of the State Fire Service prepared a number of information materials about hazards, but it also focused on the need to disseminate knowledge about fire safety among small children. Practical ways of responding to dangerous situations are taught at district (city) headquarters of the State Fire Service, in the “Ognik” Education Rooms. The experience of firefighters and instructors cooperating with the units helped create engaging activity scenarios and provide the necessary equipment for the educational rooms. The idea to teach small children about how to behave under a controlled hazard brings great benefits, mainly because children are not afraid to act. This leads to the conclusion that they will be able to use the knowledge gained from the activities and carry it home to their parents who did not have the opportunity to attend such practical educational activities. Teaching children is an investment made in the future generation and also an element of broadly understood social prevention measures.

Bibliography

- [1] Pieczywok A. “Education for safety in the world of contemporary challenges and solutions” *Mazowiecki Kwartalnik Edukacyjny” Meritum* (2010) 4, pp. 23-27.
- [2] Muchacka B. “Educational Aspects of Children’s Plays”, Kraków 2008.
- [3] Regulation of the Council of Ministers of 23 June 2015 on the implementation of government programme for 2015–2018 to support entities governing schools in ensuring safe conditions for study, education and care in schools, Bezpieczna + (Journal of Laws of 2015, item 972).
- [4] “Study of fire and carbon monoxide poisoning hazards” conducted using the CATI (Computer Assisted Telephone Interviewing) method on a representative sample of 1001 Polish individuals aged 16+ by Ipsos Sp. z o.o. for the Ministry of Internal Affairs and Administration, October 2016.

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EVALUATION FOREVER – EXAMPLES OF PUBLICATIONS IN ENGINEERING DISCIPLINES

EWALUACJA BEZ KOŃCA – NA PRZYKŁADACH PUBLIKACJI W DYSCYPLINACH INŻYNIERYJNYCH

Summary: The article presents the issues of evaluation of researchers in Poland. The work related to the evaluation of the achievements of the achievements becomes particularly important, especially in the period just before the evaluation of the institution. Depositing of publication data takes place in the systems intended for evaluation in Poland: POL-on (PBN). The presented aspects of evaluation are related to the first criterion, i.e. the publication (criterion 1). For engineering sciences, the contribution is 50%. The assessment took place within the discipline/s declared by the employees of individual units. Publishing the results of research work is the responsibility of every person employed in a research or research and teaching position. The article presents examples related to the assessment of the publications in the field of occupational health and safety and broadly understood electrical engineering. The journals in the article are assigned engineering disciplines, including environmental engineering, mining and energy.

Keywords: evaluation, evaluation of scientific achievements, science communication, POL-on, SEDN, PBN, engineering disciplines, publishing activity

Streszczenie: Artykuł dotyczy zagadnień ewaluacji pracowników naukowych. Prace związane z oceną dorobku nabierają szczególnego znaczenia zwłaszcza w okresie tuż przed ewaluacją instytucji. Deponowanie danych publikacyjnych odbywa się w systemach mających służyć ewaluacji w Polsce: system POL-on (baza PBN). Zaprezentowane aspekty ewaluacji są związane z pierwszym kryterium tj. publikacyjnym (kryterium 1). Dla nauk inżynierskich wkład wynosi 50%. Ocena odbywała się w ramach dyscyplin/ny deklarowanej przez pracowników poszczególnych jednostek. Publikowanie wyników prac badawczych jest obowiązkiem każdej osoby zatrudnionej na etacie badawczym, czy też badawczo dydaktycznym. Zaprezentowane przykłady związane są z oceną dorobku publikacyjnego z zakresu BHP i szeroko pojętej inżynierii elektrycznej. Czasopisma przywoływane w artykule mają przypisane dyscypliny inżynierskie, w tym inżynierię środowiska, górnictwo i energetykę.

Słowa kluczowe: ewaluacja, ocena dorobku naukowego, komunikacja naukowa, POL-on, SEDN, PBN, dyscypliny inżynierskie, aktywność publikacyjna

Introduction

Evaluation of the scientific achievements takes place cyclically in the scientific institutions within the frames of the assessment of scientific achievements of the researcher. In the all-national scale, the evaluation of the achievements in period of 2017–2021 was performed in 2022. For the first time, the evaluation of scientific establishments was carried out within the frames of scientific disciplines and included publication activity, impact on the society and financial issues. It has been adopted for the needs of the present paper that the publication aspect is most important for the persons who are conducting the studies. The mentioned aspect induced many emotions, mainly due to the changes in the lists of periodicals in the years 2019–2021. Publishing was the element of assessment within Criterion I i.e. scientific level of the conducted activity, measured by the quality of publications within parametric evaluation and the number of patents [1]. Depending on the field of scientific disciplines in respect of engineering and technical sciences, and in the field of agricultural sciences, publishing gave 50-% contribution to

evaluation. In the case of Criterion II – financial effects of the research and developmental work – 35%, a Criterion III – the effect of scientific activity on functioning of the society and economy (expert assessment) gave 15%.

Evaluation in 2022

For the first time, in the assessment, there were considered the publication slots (slot – a measure of the single author's participation in a given work) of the authors (formal limitation is maximum 4 slots per one person) where one slot corresponded to a single-author publication (100%), or participation in the publications of many authors. The definition "publication slots" is referred to authorship (of article, chapter in monograph, conference materials), editing (monographs), translations and editorial elaborations. The publishing activity was evaluated in a different way and the reference point included disciplines and lists of periodicals, conference materials and publications. In the assessment of the scores for the period of 2019–2021, the list announced by MEiN (Ministry of Education and Science) in De-

cember 2021 was utilized [1]. It was possible to obtain 20–200 scores for the authorship of the paper from the mentioned above list. It was announced many times, and by this, guaranteed (to the journals and also, the authors) that the mentioned periodicals would not lose their so-far existing score evaluation in the successive lists. Moreover, they might change their position in the discussed list, i.e. in evaluation, after having increased the number of scores in the MEIN list.

Unfortunately, it is not the first time when the principles of evaluation are changed; they are repeatedly changed during the parametric assessment. The evaluation was prolonged from the planned range of 2017–2020 by 2021 (due to Covid-19 pandemic). The earlier evaluation, conducted in 2017, concerned the period of 2013–2016 [2].

What were the duties of the person whose publication achievements were evaluated?

- introduction and supplementation of the data in ORCID system – in certain units, the indication of individual ORCID identifier by the researcher was carried out together with the submitting of declaration, authorizing the given unit to indicate the achievements of the mentioned researcher. In September 2021, the duty of joining ORCID with PBN (POL-on system) was withdrawn [3]. It occurred at the moment when the researchers in many units possessed already ORCID identifiers. In the opinion of the authors of the present paper, it is helpful in the identification of the publishing achievements. The majority of the recognised international publishers suggest indication, and some of them, even require indication of the author's identifier during submitting his paper (e.g. Wiley, IEEE, and Springer).
- introduction of the publishing data and their verification in PBN base (POL-on system) - sometimes in the cooperation with library employees or information centres.
- indication of discipline, submitting the declaration about classification as N, authorization of the institution to indicate the publication – at least participation in the mentioned publication (article, chapter in monograph).
- In each of the assessed institutions, the work on verification of publishing data in PBN base was carried out in respect of correctness and completeness of the data in publishing records, i.e. bibliographic information on the publication, the referrer links, DOI identifier, introduction of data of the authors' affiliation, verification of the correctness of the data on the journal. During the mentioned work, many changes occurred in POL-on system, and by this, in SEDN system (System of Scientific Achievement Assessment) which was accessible in DEMO version in 2020 [4]. RTM (ready to manufacture) version of SEDN based upon the data introduced to POL-on, i.e. publication in PBN, was accessible in January 2022 [5]. In the evaluation, there was considered the recent list of periodicals and conferences materials, announced by the Minister of Education and Science for the years 2019–2021. The similar situation is in the case of list of publishing houses, the scores acknowledged for publishing of monographs, or chapter in the monograph are dependent on the category of

the publishing office and the ascribed amount of scores (level 1 = 80 scores (36 publishing hoses), level 2 = 200 scores (779 publishing houses) [6]. Monographs outside the mentioned list obtain 20 scores and chapter – 5 scores. It is, of course at the situation when there is the only one author; if there are many authors, the scores are divided in every case. The varying scores of the journals constitute one aspect (Electrotechnical Review in 2019 = 20 points; in 2020 = 20 points, in 2021 (February) = 20 points, in 2021 (December) = 70 points. Another aspect concerns disciplines ascribed to the periodicals. Thus, Electrotechnical Review has the following ascribed disciplines: automation, electronic and electrical engineering, technical information science and telecommunication, biomedical engineering, land engineering and transport, material engineering, mechanical engineering, environment engineering, mining and energetics; "Bioelectromagnetics" publication (100 scores in the lists of 2019–2021) has the following disciplines ascribed: automation, electronic and electrical engineering, biomedical engineering, pharmaceutical sciences, medical sciences, biological sciences, and physical sciences. Another example (from BHP range) is International Journal of Occupational Safety and Ergonomic (40 scores in the list of 2019–2021) has the following disciplines ascribed: biomedical engineering, land engineering and transport, mechanical engineering, environmental engineering, mining and energetics, pharmaceutical sciences, medical sciences, forestry sciences, sciences on safety and science on management and quality.

The narration concerning publishing in the periodicals in the so-called declared discipline and the planned, limited to 20-% publication in periodicals outside the discipline, was changing. Finally, the suggestion of such limitation was not maintained. According to the record in guide to evaluation, we can read: *As a result of the comments obtained within the frames of public consultations concerning the draft regulation in the matter of evaluating the quality of scientific activity, the discussed above limit was removed from the final version of the regulation; it concerned the admission of the articles published in the journals which in the list of the periodicals had another discipline than the evaluated one. The achievements should, however, have the thematic relationship with the scientific studies conducted within the frames of a given discipline* [7].

For evaluation, the data collected in PBN base, with the utilization of SEDN system will be taken into consideration.

The example of the record fragment with the publishing achievement is given below.

Tytuł czasopisma	Przegląd Elektrotechniczny
ISSN	0033-2097
eISSN	2449-9544
Liczba punktów zgodna z wykazem	14

Fig. 1. View in the SEDN base – a fragment of publishing record – article from Electric Engineering Review of 2018 – score assessment for Electric Engineering Review according to the list of January 2017 (in evaluation for the years 2017-18) = 14 points

Tytuł czasopisma	Przegląd Elektrotechniczny
ISSN	0033-2097
eISSN	-
Liczba punktów zgodna z wykazem	20

Fig. 2. View in the SEDN base – a fragment of publishing record – article from *Electric Engineering Review* of 2019 – score assessment according to the list of December 2019 = 20 points

Tytuł czasopisma	Przegląd Elektrotechniczny
ISSN	0033-2097
eISSN	-
Liczba punktów zgodna z wykazem	70

Fig. 3. View in the SEDN base – a fragment of publishing record – article from *Electric Engineering Review* of 2019 – score assessment according to MEiN list of 21 December 2021 = 70 points

Unfortunately, the evaluation consisted not only in calculation of scores for publications. The scientific unit could obtain negative scores when the authors:

- indicated the discipline, delivered the declaration on classifying as N but did not authorize the unit to indicate any of the publications (-3 slots);
- indicated the discipline but did not submit the declaration on classification to N number (-6 slots);
- did not submit the declaration on the represented disciplines (-6 slots).

In the situation of the death of the author who did not meet the formalities of declaration on discipline/publication, the directors (managers) of the given entity could submit such declaration.

Calculation of the points/slots

The publishing slots appeared as a new, unknown earlier element in the parametrical procedure for the year 2017–21. They were the measure of unitary participation of the author. One author = one slot. In the case of publication developed by many authors, the share in the slot and the number of scores per one author was dependent on the number of all authors, co-authors from the subject/discipline and score value of a given publication. Many institutions made the calculator available in order to calculate the participation in the slot and in score number falling on the representatives of discipline, for a given institution [8]. It is worthy to remind that the multi-author publications in the periodicals evaluated above 100 points gave just 100 points to each of the authors from different institutions. The below given table (Tab. 1) shows the example of calculations for different variants of the share of the particular authors in the publication.

Why it is worthy to speak about evaluation as the continuous process when assuming the stability in respect of the principle of assessment criteria. It is worthy, irrespectively of the evaluation, to publish the results of the studies, being the element of the scientific achievements, without waiting until the last moment to the end of the year, preceding the successive evaluation. The publishing process may be prolonged and from few months it may last for a year. The evaluation covered only the materials published until 31 December 2021. Therefore, the publications already submitted to printing, even possessing DOI, having the index in bases as *Article in Press* (Scopus) *Early Access* (Web of Science) were not taken into consideration.

Publishing in cooperation with other authors from other unit had a special meaning for the mother institution. The assessment of the achievements was performed on the grounds of the results within the frames of a given discipline which was declared in a given research/academic unit. Evaluation work resulted in ascribing category (A+, A, B+, B, C) to the unit what will be translated into the level of financing.

Table 1. Simulation of calculations for different variants of the authors' shares in the publication

Articles from periodicals (2019–2021)	Total number of scores for article (Pc)	Number of all authors (m)	Number of researchers from a discipline (k)	Number of scores for discipline	Share of slot for discipline	Number of slot falling on one researcher from discipline	Share of slot falling on one researcher from discipline
Article from journal from the list 2019–2021	200	3	2	200	1	100	0,5
	140	3	2	140	1	70	0,5
	100	3	2	100	1	50	0,5
	70	3	2	57,1547607	0,816496581	58,57738033	0,40824829
	40	3	2	32,6598632	0,816496581	16,32993162	0,40824829
	20	3	2	13,3333333	0,666666667	6,66666667	0,33333333
Article from journal outside the list	5	3	2	3,3333333	0,66666667	1,66666667	0,33333333

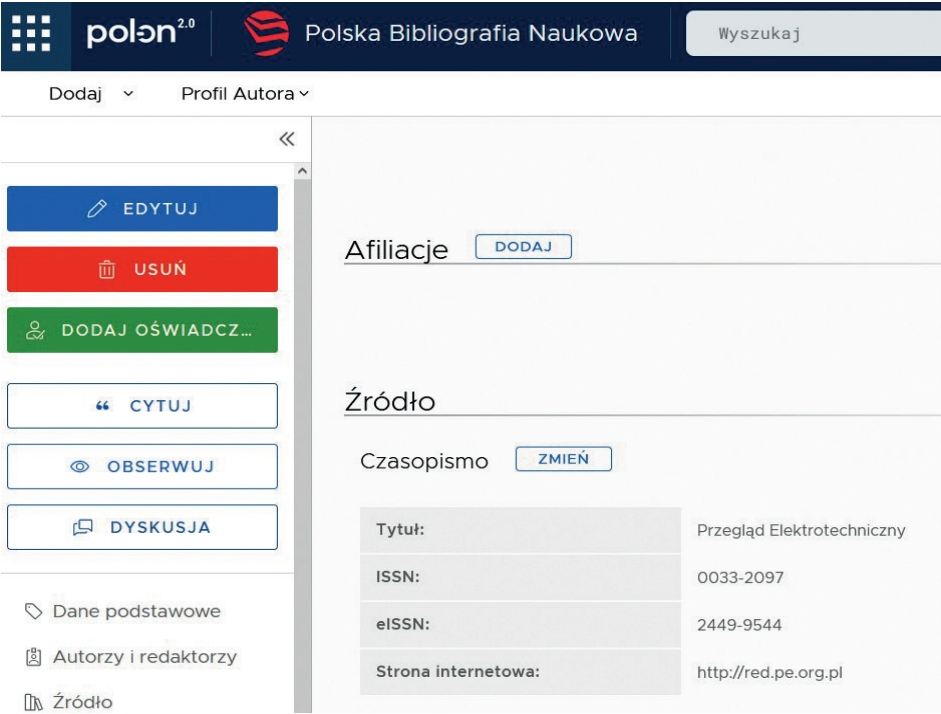


Fig. 4. View of a fragment of publishing record in PBN (POL-on system) base without icon of MNiSW/MEiN (access [www: 19.09.2021](http://www.19.09.2021))



Fig. 5. View of a fragment of publishing record in PBN (POL-on system) base with icon of MNiSW/MEiN (access [www: 2.10.2022](http://www.2.10.2022))

Summing up

The introduction of successive changes in the principles of each evaluation, during its course, without the appropriate preparation of the persons whose achievement is assessed (within the frames of a given discipline) as well as of the persons who verify the published data in PBN, may result in the errors and by this, inadequate evaluation of the achievement and underestimated assessment. It may be a result of time pressure, system errors and the changes introduced in POL-on system, including e.g. addition of new functionalities in PB or loss of the data as a result of migration. It happened that the particular institutions lost the publishing data and were forced, apart from the continuous verification, to introduce the data again. The process of evaluation is still subjected to discussions and we still do not know what will be the new principles of evaluation and will the parametric assessment look like. Logical reference or assumption,

ing the meaning of only highly scored publications, may not find coverage in reality. It is also worthy, in the future, to take care of the process of evaluation as the pretext to develop high quality publications. It should be not only the search for highly scored periodical or editorial house of monographs [9]. In the frames of evaluation of the following disciplines: environmental engineering, mining and energetics, 42 academic and research establishments were assessed. None of the evaluated units received category A+; 13 obtained category , 23 – category B+ , 5 – category B and 2 obtained category C [10].

The information given below illustrates evaluation in the period of 2017–2021 in figures [11].

List of evaluated entities	291
Number of persons evaluated in SEDN	117 855
Number of publications	707 862
Number of protection rights	12 138
Number of artistic achievements	53 903

Number of research projects	27 556
Number of entries with the sums of income from commercialisation	16 002
Number of entries with the sums of incomes from research services at the order	155 867
Number of descriptions of the impact	2 659

In the list of the scientific periodicals dating back to December 2021, from among 32701 journals, 1813 were Polish scored magazines (2019–2021) which were considered in the evaluation [12]. The common activities were undertaken by scientific environments, including those ones resembling the meaning and role of Electrical Engineering Review in the engineering environment (PE publications indexed in Scopus in 1969–1984, since 2005, and WoS CC, 2007–2012 and since 2018), being published since 1919. All this mentioned above activity has contributed to rise of scoring evaluation in the list of periodicals. Owing to this fact, the articles from 2019–2021, considered in the assessment, obtained 70 points instead of 20. We all would like to know what will be changed in the successive parametrical assessment, whether the slots will remain, perhaps new parameters will appear, or maybe, we will come back to the earlier systems of evaluation.... Again, as previously, we do not know the new guidelines. The first year of publishing (2022) which will be subjected to evaluation has already passed, and the scientific environment builds the successive assessment on the so-far known rules which, in the next variety may be changed. "It is not known what will they consist in, or even in what direction they will go" [13].

The present publication was developed on the grounds of the results of the stage V of multiannual programme: "Improvement of labour safety and conditions", financed in the years 2021–2022 in respect of the tasks of state services from the means of the minister specific of the labour (task no 4.SP.25 entitled: Altmetric and bibliometric analyses of publications in the field of human safety in the workplace environment – indexed in bibliographic-abstract bases, by the authors affiliated in Polish and foreign scientific and research institutions). Coordinator of the Programme: Central Institute for Labour Protection – National Research Institute.

Literature

- [1] Komunikat Ministra Edukacji i Nauki z dnia 21 grudnia 2021 r. o zmianie i sprostowaniu komunikatu w sprawie wykazu czasopism naukowych i recenzowanych materiałów z konferencji międzynarodowych. - <https://www.gov.pl/web/edukacja-i-nauka/komunikat-ministra-edukacji-i-nauki-z-dnia-21-grudnia-2021-r-o-zmianie-i-sprostowaniu-komunikatu-w-sprawie-wykazu-czasopism-naukowych-i-recenzowanych-materiałow-z-konferencji-miedzynarodowych> (dostęp: 12.09.2022.).
- [2] Rozwiązania dla szkolnictwa wyższego i nauki w tzw. drugiej tarczy antykrzysowej. Informacja on-line, dostęp do WWW: <https://naukawpolsce.pap.pl/aktualnosci/news%2C81801%2C-Crozwiązania-dla-szkolnictwa-wyższego-i-nauki-w-tzw-drugiej-tarczy?fbclid=IwAR1irtJ03U89q7Ql-MHsz9TThqbuCao1vCsnXT4r2pnKkEpYXXHtDVXJJ4s> (data dostępu: 2.10.2022.).
- [3] Komunikat MEiN w sprawie zniesienia obligatoryjności posiadania ORCID dla celów ewaluacyjnych. (data komunikatu: 3.09.2021.) Dostęp [www: https://polon.nauka.gov.pl/informacje/aktualnosci/o/20/komunikat-mein-w-sprawie-zniesienia-obligatoryjnosci-posiadania-orcid-dla-celow-ewaluacyjnych/493808](https://polon.nauka.gov.pl/informacje/aktualnosci/o/20/komunikat-mein-w-sprawie-zniesienia-obligatoryjnosci-posiadania-orcid-dla-celow-ewaluacyjnych/493808) (data dostępu: 4.10.2022.).
- [4] SEDN w wersji demo. Dostępne w [www: https://sedn-cp.opi.org.pl/2020/09/24/nareszcie-sedn-urzy-swiatlo-dzienne/](https://sedn-cp.opi.org.pl/2020/09/24/nareszcie-sedn-urzy-swiatlo-dzienne/) (data dostępu: 4.10.2022.).
- [5] Wersja produkcyjna SEDN – harmonogram dalszych działań. Dostępne w [www: https://pbn.nauka.gov.pl/centrum-pomocy/wersja-produkcyjna-sedn-harmonogram-dalszych-dzialan/](https://pbn.nauka.gov.pl/centrum-pomocy/wersja-produkcyjna-sedn-harmonogram-dalszych-dzialan/) (data dostępu: 4.10.2022.).
- [6] Komunikat Ministra Edukacji i Nauki z dnia 22 lipca 2021 r. w sprawie wykazu wydawnictw publikujących recenzowane monografie naukowe. Dostępny w [www: https://www.gov.pl/web/edukacja-i-nauka/komunikat-ministra-edukacji-i-nauki-z-dnia-22-lipca-2021-r-w-sprawie-wykazu-wydawnictw-publicujacych-recenzowane-monografie-naukowe](https://www.gov.pl/web/edukacja-i-nauka/komunikat-ministra-edukacji-i-nauki-z-dnia-22-lipca-2021-r-w-sprawie-wykazu-wydawnictw-publicujacych-recenzowane-monografie-naukowe) (data dostępu: 4.10.2022.).
- [7] Przewodnik po systemie ewaluacji jakości działalności naukowej. Dostępny w [www: https://konstytucjadlanauki.gov.pl/jak-bedzie-wygladac-ewaluacja-publicujemy-przewodnik-z-przykladami](https://konstytucjadlanauki.gov.pl/jak-bedzie-wygladac-ewaluacja-publicujemy-przewodnik-z-przykladami) (data dostępu: 12.08.2021.).
- [8] Kalkulator Uniwersytet Ekonomiczny w Katowicach. Obliczenia slotów i ich wartości punktowej w zależności od rodzaju publikacji można dokonać samodzielnie z użyciem kalkulatora. Dostęp w WWW: <https://www.ue.katowice.pl/jednostki/dzial-parametryzacji-i-pozycjonowania-uniwersytetu/ewaluacja-jakosci-dzialalnosci-naukowej-2017-2021-dotyczy-nauk-hst/kalkulator-punkty-sloty.html> (data dostępu: 4.10.2022.).
- [9] Radościński E. (2021). Ewaluacja dyscyplin w środowisku punktozy. Forum Akademickie 7-8, s. 48-51.
- [10] Wyniki ewaluacji działalności naukowej za lata 2017-2021. Dostępne w [www: https://www.gov.pl/web/edukacja-i-nauka/wyniki-ewaluacji-dzialalnosci-naukowej-za-lata-2017-2021](https://www.gov.pl/web/edukacja-i-nauka/wyniki-ewaluacji-dzialalnosci-naukowej-za-lata-2017-2021) (data dostępu: 2.10.2022.).
- [11] Ewaluacja w liczbach, informacja na stronie SEDN. Dostępny w WWW: <https://sedn.opi.org.pl/> (data dostępu: 2.10.2022.).
- [12] Informacja o polskich czasopismach punktowanych w wykazie z grudnia 2021 dostępna w bazie Arianta. Dostęp w WWW: <https://arianta.pl/#/aktualnosci> (data dostępu: 2.10.2022.).
- [13] Drozdowicz Z. (2022). Czas na poważne dyskusje. Forum Akademickie 9, s. 21–22.

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THE 28TH INTERNATIONAL SCIENCE CONFERENCE

THE PROBLEMS OF SUSTAINABLE AGRICULTURE, PROTECTION OF RURAL AREAS, WATER RESOURCES AND ENVIRONMENT

PROBLEMY ZRÓWNOWAŻONEGO ROLNICTWA,
OCHRONY OBSZARÓW WIEJSKICH, ZASOBÓW WODNYCH I ŚRODOWISKA

On 21 and 22 September 2022, the 28th International Scientific Conference: "The problems of sustainable agriculture, protection of rural areas, water resources and environment" was held at the Institute of Technology and Life Sciences – National Research Institute in Falenty. The Conference was conducted under the patronage of the Vice-Premier, the Minister of Agriculture and Rural Development, Henryk Kowalczyk. The event was *on-line* transmitted.

During the Conference, the following problems were discussed and analysed:

- Sustainable agricultural production, circular economy, with the consideration of environmental protection, organic agri-

culture and preventing the climate changes;

- Innovative technological solutions for the sustainable agricultural production, including animal husbandry, together with renewable energy sources (Polish: OZE), with the particular consideration of employment of agricultural micro biogas plants;
- Innovative and intelligent agriculture, application of drones and artificial intelligence with the aim to improve the production effectiveness;
- The application of industrial hemp in agriculture and bio-economy, and in bio-energetic sector, e.g. production of construction elements (hemp blocs, insulating materials, chip-board panels), fibres being a raw material e.g. for production



Fig. 1. Presidium table – the 1st day of the Conference, from the left: dr hab. Andrzej Karbowy, Eng., – West Pomeranian University of Technology in Szczecin, dr Adam Brysiewicz, Eng., – Institute of Technology and Life Sciences, National Research Institute, dr hab. Adam Koniuszy, prof. of the West Pomeranian University of Technology in Szczecin, prof dr hab. Henryk Sobczuk – Institute of Technology and Life Sciences, National Research Institute, dr Kamila Mazur, Eng., – Institute of Technology and Life Sciences, National Research Institute, Prof. dr hab. Wacław Romaniuk – Institute of Technology and Life Sciences, National Research Institute, Dr Dorota Kluszczyńska, Eng., – Institute of Technology and Life Sciences, National Research Institute, dr Andrzej Seliga, Eng., – Institute of Technology and Life Sciences, National Research Institute



Fig. 2. Presidium table – the 2nd day of the Conference, from the left: Dr Adam Brysiewicz, Eng., – Institute of Technology and Life Sciences, National Research Institute, Prof. dr hab. Wiesław Dembek – Institute of Technology and Life Sciences, National Research Institute, Dr Kamila Mazur, Eng., – Institute of Technology and Life Sciences, National Research Institute, Dr Dorota Kluszczyńska, Eng., – Institute of Technology and Life Sciences, National Research Institute

- of cloth materials, bandages, underwear and production of biogas and manufacture of oils for the needs of medicine;
- Management of natural resources and soils, and nature protection;
 - Water and sewage and waste management and rural infrastructure;
 - Water protection and ecology, contamination of waters and impact on biodiversity.

The mentioned above presentations were delivered on the thematic sessions:

on 21 September 2022:

- Training session, conducted by the National Centre for Research and Development – national Contact Point: Horizon Europe – Cluster 6: Food, bioeconomy, natural resources, agriculture and environment;
- Energetics and OZE (renewable energy sources) at rural areas;
- Innovations in agriculture- drones and artificial intelligence;
- Innovations in agriculture – hemp;

The problems of sustainable agricultural production – part I

on 22 September 2022:



Fig. 4. The participants of the Conference



Fig. 3. Prof dr hab. Maciej Kuboń, PhD., – The Hugon Kołłątaj Agricultural University in Cracow

- Problems of the sustainable agricultural production – part II;
- Energetics and OZE (renewable energy sources) at rural areas;
- Water at rural areas, including sewage management;
- Environmental protection and infrastructure of rural areas.

The themes of the Conference and also, the suggested solutions, may contribute to the popularization of the sustainable development in agriculture. The subject-dedicated sessions may be summed up by the following statements:

- we should develop further agricultural farms in accordance with the principle of sustainability, with the particular consideration of introducing the innovations, reasonable management of fertilizer components, including natural manure and production of energy from alternative sources and also, waste coming from agri-food processing.
- We should take care of water in our country and all over the world due to its limited resources, by, *inter alia*, the choice of the reasonable management method.



Fig. 5. From the left: Dr Kamila Mazur, Eng., – Institute of Technology and Life Sciences, National Research Institute, Dr hab. Andrzej Borusiewicz, Eng., – International Academy of Applied Sciences in Łomża, prof. dr hab. Jerzy Barszczewski PhD., – Institute of Technology and Life Sciences, National Research Institute, Dr Kinga Borek, Eng., – Institute of Technology and Life Sciences, National Research Institute, prof. dr hab. Wacław Romaniuk, PhD., – Institute of Technology and Life Sciences, National Research Institute



Fig. 6. From the left: Dr Anna Konieczna, Eng., – Institute of Technology and Life Sciences, National Research Institute, Dr Kinga Borek, Eng., – Institute of Technology and Life Sciences, National Research Institute

The 28th International Scientific Conference was attended by more than 100 participants from Poland and abroad, representing the following institutions:

- Ministry of Agriculture and Rural Development,
- Koszalin University of Technology,
- International Academy of the Applied Sciences in Łomża,
- West Pomeranian University of Technology in Szczecin,
- Warsaw University of Life Sciences,
- The Hugon Kołłątaj University of Agriculture in Kraków
- The University of Life Sciences in Poznań,
- The University of Life Sciences in Lublin,
- Białystok University of Technology,
- Bydgoszcz University of Technology,
- University of Zielona Góra,
- Institute of Flow Research, Polish Academy of Sciences in Gdańsk,
- Mazovian Agricultural Advisory Centre,
- Polish Association of Hemp Producers and Processors,
- University of Ecology and Management,
- The University of Szczecin,
- Latvian University of Agriculture, Jelgava, Latvia,
- Università degli Studi di Palermo, Italy,
- University in Bologna, Italy,
- University in Bucharest, Rumania,
- University of Jaen, Spain,
- School of Life Sciences, University of Hyderabad, Haryana, India,
- Agricultural University in India,
- University Banja Luka, Bosnia and Herzegovina,
- University of Applied Sciences, Lubeka, Germany
- McGill University, Canada,
- Université 20 Août 1955, Skidda, Algeria,
- Flinders University, Adelaide, Australia,
- Lulea University of Technology, Sweden,
- University of Exeter, Great Britain,
- Agriculture and Biology Research Institute, Egypt,
- Bahaudin Zakariya University, Pakistan,
- Alanya Alaaddin Keykubat University, Turkey,

and also, private entrepreneurs:

- Ekolaby.net,
- barszcz.edu.pl,
- byteLAKE,
- drone-eye.pl,
- Smart Secure Networks,
- AGRAVES Ltd.,
- TRUSTT,
- Polish Cluster IoT and AI SINOTAIC,
- Cannabotanique,
- TESTMER Warszaw SA,
- WOLF System Ltd.,
- Plantalux.



Fig. 7. Mariusz Nazaruk – Cannabotanique Ltd.

During the Conference, 48 lectures in Polish and English language were delivered. The simultaneous translation was assured for all the participants of the mentioned event.

Organization of the 28th International Scientific Conference was possible owing to the co-organizers:

- Department of Engineering of Renewable Energy Sources, West Pomeranian University of Technology in Szczecin,
- International Academy of Applied Sciences in Łomża,
- Warsaw University of Life Sciences,
- The Hugon Kołłątaj Agricultural University in Cracow.

The sponsors of the Conference were:

- WOLFSystem Ltd.,
- TESTMER Warsaw, SA,
- Polish Association of Beef Cattle Breeders and Producers.

The media patronage:

- "Polish Technical Review" magazine,
- Internet Daily B2B "And now environment"
- Internet Portal 'Energy for Rural Areas'

As a result of the submitted papers by the Participants of the 28th International Scientific Conference, two monographs will be published:

1. Monograph entitled: "Problems of sustainable agriculture, including OZE (renewable energy sources) elements, protection of rural areas, water resources and environment"
2. Monograph entitled: "Problems of sustainable development in agriculture including environment protection and alternative energy production as well as biogas".

We express our words of gratitude to all Co-organizers, Sponsors, Patrons and Participants for their support and active participation in the Conference!

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