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MEDICAL WASTE – LEGAL AND ORGANIZATIONAL CHALLENGES FOR MEDICAL ENTITIES

Dear Readers!

The enemy of humanity is attacking again!

We already thought that the peak of the COVID pandemic is behind us, and here again, a significant increase in infections in Italy and Germany. National monitoring of wastewater also indicates an increased number of patients in Poland. Healthcare sector and the medical industry must prepare for the next wave of coronavirus. All the more comforting is the fact that Polish regulations on infectious waste neutralization methods are among the most restrictive in Europe. You can read more about this topic on the following pages of the "Polish Technical Review". The issue also covers health and safety training as a tool for activation of disabled people and the current analysis of the concentrated juice market. The future of the packaging market, and more specifically, the requirements of the consumers regarding the materials in which food products should be packed, constitute a supplement to the food issues.

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Good reading!
Magdalena Borek-Daruk
Deputy Editor in Chief

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MEDICAL WASTE – LEGAL AND ORGANIZATIONAL CHALLENGES FOR MEDICAL ENTITIES

ODPADY MEDYCZNE – PRAWNE I ORGANIZACYJNE WYZWANIE DLA PODMIOTÓW MEDYCZNYCH

***Summary**: The article tries to answer the question of what legal and organizational challenges are faced by producers of medical waste today. Defining medical waste in the over 100-year history of waste management in Poland was not always clear and simple. Over the years, Polish law has not only failed to define medical waste, but also the waste itself. And even when the law specified the rules of handling waste, these provisions were not always precise.*

***Keywords**: medical waste, environmental protection, medical entities, legal and organizational challenges*

***Streszczenie**: Artykuł stara się odpowiedzieć na pytanie przed jakimi wyzwaniami prawnymi i organizacyjnymi stają dziś wytwórcy odpadów medycznych. Zdefiniowanie odpadów medycznych w całej, przeszło stuletniej historii gospodarki odpadami w Polsce, nie zawsze było jednoznaczne i proste. Na przestrzeni wielu lat prawo polskie nie tylko nie definiowało odpadów medycznych, ale także samych odpadów. A nawet, gdy przepisy prawa określały zasady postępowania z odpadami, to zapisy te nie zawsze były precyzyjne.*

***Słowa kluczowe**: odpady medyczne, ochrona środowiska, podmioty medyczne, prawne i organizaacyjne wyzwania*

Introduction

According to the current binding regulations in Poland (Act on waste, Official Journal of Laws 2022, item 699, consolidated text), **medical waste** mean the waste, generated in connection with **rendering the health benefits and running the scientific tests and experiments in the field of medicine** and, as such, in accordance with the regulation of the Minister of Climate *on the matter of waste catalogue* (Official Journal of Laws 2020, item 10), they are classified as:

- group: **18**
- subgroup: **1801**
- type: from **180101** to **180182***

It has not been, however, always univocal; throughout many years, Polish law has defined neither medical waste nor the waste themselves. Even in the case when the legal regulations specified the principles of proceeding with the waste, the mentioned provisions were not always precise. Therefore, in the present publication, we will try to answer the question: what are the legal and organizational challenges faced to-day by the producers of medical waste.

Historical aspect of defining the waste, including medical waste

Definition of medical waste in the total, over a hundred year's old history of waste management in Poland, has not been always simple. When considering the way of defining the waste, we may distinguish three periods when:

- the waste were defined as impurities (1919–1980);
- there was a general binding definition of the waste from among which municipal waste and hazardous waste were distinguished (1980–2001); and
- the definition of medical waste was introduced (since 2001 until now).

The rules concerning the principles of proceeding with the waste in Poland date back to the interwar period. The first time the duty of *…" care of the purity of air, soil and water and appropriate removal of impurities"…* was introduced by Principal Health Law of 19 July, 1919 (Official Journal of Laws 1919, No 63, item 371). The detailed principles of proceeding were specified in the Regulation of the President of the Republic of Poland of 16 march 1928 on disposal of impurities and rain water (Official J. of Laws 1928, No 32, item 311) which, as defining **the impurities** as *"… human and animal excretions, sewage, garbage and **municipal waste**…"* included also waste management. The mentioned

regulation imposed, inter alia, the duty of collecting, storage and disposal of the impurities by the communes. The Regulation had a biding force for 31 years.

During the post-war period, the problem of waste management was regulated by the Law of 22 April 1959 on maintenance of cleanness and order in the cities and settlements (Official Journal of Laws 1959, No 27, item 167); the mentioned act extended the definition of impurities, defining them as *"... domestic waste, street sweepers, human and animal excretions and urban sewage and rainwater on the streets, squares and other places, intended for public use..."*. The mentioned Act was obligatory for the next 21 years.

The successive legal act, the Law of 31 January 1980 on protection and shaping of environment (Official J. of Laws, 1980, No 3, item 6) introduced, first time in Polish legislation, the **definition** of the waste, describing them as: ..."*used products and solid substances, also liquid substances, being not sewage, resulting in the connection with living of man or economic activity, unsuitable at the site or time at which they were generated and being strenuous for the environment*".... One year later, the Act of 13 September 1996 on maintenance of cleanness and order in the communities (Official J. of Laws 1996, No 132, item 622) introduced the conception of **municipal waste**, defined as "... *solid and liquid waste, generated in households, objects of public utility and public service* (...) *excluding hazardous waste coming from health care entities...*".

Year 1997 in respect of waste management in Poland is considered as the breakthrough year as since that date, the first Polish act on the waste became to be binding. Apart from the defined earlier municipal waste, the Law on the waste of 27 June 1997 (Official J. of Laws, No 96, item 592) distinguished a new group of the **hazardous waste**, describing them as "*.... the waste which due to their origin, chemical and biological origin and other properties constitute a hazard to life of health of humans and for the environment...*".

The successive milestone in the respect of the rules, regulating the waste management in Poland was passing of a new Act on the waste (27, April, 2001) (Official J. of Laws 2001, No 62, item 628). The mentioned Law has changed not only the so-far existing definition of municipal and hazardous waste but first of all, it made a general definition of **the waste** more precise, specifying them as "*... each substance of object, belonging to one of the categories, listed in Annex 1 to the Act, which the holder disposes of, intends to dispose of, or is obliged to dispose of them...*" Besides it, the discussed Law has considerably extended the so-far existing catalogue of the waste, introducing the new definitions of: **neutral waste, biodegradable waste, biological waste, green waste, veterinary waste and the waste coming from accidents**. First of all, however, the mentioned law introduced currently valid definition of medical waste, understood since that moment as "*... the waste generated in connection with rendering health benefits and running scientific tests and experiments in the field of medicine...*" .

As it can be seen, **medical waste** in Polish legislation has officially functioned only for 21 years; perhaps it causes that we are constantly encountered with the problems with their appropriate classification. Three most important (in the opinion of the author of the present paper) problems which constitute the serious challenges for the producers of medical waste, have been discussed in the present publication.

Challenge No 1. Who produces medical waste in practice and who does not definitely produce them?

In spite of the binding definition in Polish legislation, the answer to the above question still causes many emotions. Especially it is the case when it concerns production of the waste which is generated during the treatments, infringing the continuity of human tissue.

According to the obligatory definition, medical waste is produced by:

- medical entities and the persons, rendering health benefits, including, *inter alia*:
  - hospitals, clinics and sanatoria,
  - basic and specialist ambulatories and advisory centres,
  - physicians and nurses within the frames of individual care,
- medical diagnostic laboratories,
- research institutes performing the scientific research activities in the field of medicine.

At the same time, the separate regulations (in spite of apparently the same group of sick patients as it is found in the hospitals) are referred to the sick persons, staying at home of the inhabitants of social aid houses (DPS) which do not enter the composition of medical entity. The waste generated during the care of the mentioned above group of the sick people are classified as:

- medical waste – only when it is generated during rendering the health benefits at the site of stay of a sick person (*inter alia*, at home, DPS) (e.g. performance of injections) by medical employee (*inter alia*, physician, nurse, medical rescuer). Such waste is then taken away by the mentioned employee, transported according to the adopted procedure and transmitted to be neutralized at the site, specified by a separate agreement;
- municipal waste – when it is generated at the site of stay of a sick person (*inter alia*, at home, DPS) by the sick person himself or by the person who is not a medical employee and who takes care of the mentioned patient (e.g. performs injections). The discussed waste is disposed then as:
  - mixed municipal waste;
  - on the grounds of art. 3 par. 2 point 6 of the Act on maintenance of cleanness and order in the communities (Official J. of Laws 2021, item 888) they may be transmitted to the points of selective collection of the municipal waste, as indicated by the competent authorities.

Besides it, according to the currently binding law, we should remember that medical waste **DOES NOT** include the waste, generated during performing of cosmetic service, inter alia, during the treatments like manicure, pedicure, tattoo, piercing or needle mesotherapy. In spite of the fact that the mentioned cosmetic procedures infringe the continuity of human tissue, they are not classified as health benefit; it causes that the waste produced during their performance **IS NOT** medical waste. Consideration of the waste, generated in cosmetology as medical waste is not consistent with the current binding law in Poland.

Challenge No 2. How should be the disposable diapers and diaper pants classified? (Which waste group?)

It is the next problem which causes great emotions. Until 2014, on the grounds of the binding regulations in Poland, the disposable (single-use) diapers and diaper pants produced in the sphere of medicine – unless they were contaminated with biological material, containing living pathogens – were disposed as mixed municipal waste (200301).

The regulation of the Minister of Environment dated December 9, 2014 on the matter of waste catalogue extended the qualifications of the waste group having code 180104. The mentioned code group instead of the so-far existing provision sounding: "*...other waste than that one listed in 180103**..." received the following text: "*... other waste than in 180103* (e.g. material and plaster dressings, bedclothes, single-use clothes, diapers)...*". Owing to it, all used disposable clothes (including also aprons, masks and gloves) and the disposable diapers and diaper pants must be considered as medical waste. And, although they will be placed in different bags/containers as follows:

- those contaminated with infectious material (single-use diapers, diaper pants coming, *inter alia*, from the patients with the contagious diarrhoea or infection of urinary system, disposable bedclothes and single-use clothes, contaminated with human biological material – to red bags/containers marked with code 180103*;
- the remaining disposable diapers or diaper pants (coming, *inter alia*, from healthy newborn infants or patients of long-term care at whom the diarrhoea symptoms or infections of urinary system were not recognized) or single-use bedclothes and disposable clothes, being not contaminated with biological material – to bags/containers in colour different than red or yellow, marked with code 180104;
- in connection with the lack of an access to alternative methods of neutralization of medical waste, not possessing infectious properties, they shall be neutralized by thermal treatment in hazardous waste incineration plants. As the mentioned plants dictate the price, neutralization of all disposable diapers, diaper ants, bedclothes and clothes may be a great challenge for the medical entities due to the increase of costs. In turn, the increase of the costs may cause the restrictions in the application of single-use bedclothes and other clothes and disposable diapers and diaper pants in the hospitals what may result in the increased risk of transmission of biological pathogens in the hospital environment and by this, spreading of infections and infectious diseases; such situation remains in the contradiction with the provisions of Art. 11 and 14 of the Law *on prevention and control of infections and infectious diseases in humans* (Official Journal of Laws 2008.234,1570 with later amendments).

The described procedures cause that the disposable diapers and diaper pants, employed in the sphere of medicine, irrespectively of the epidemiological status of the patient from whom they derive, are always treated as medical waste. Differentiation of code (180103* or 180104) has not greater meaning because due to the limited availability of methods D9 and D5, they will be neutralized by thermal transformation (D10), in the process which causes emission of harmful gases (inter alia, SO_2, HCl, SO_3) and heavy metals and dusts

Challenge No 3. What are the methods of neutralizing the disposable diapers and diaper pants if they have been classified into group 180104?

At present, in conformity with the provisions of art.2 par.1 of the Regulation on the matter of requirements and methods for neutralization of medical and veterinary waste, binding since 22 November 2016, the following methods of neutralizing medical waste are admitted:

- thermal transformation on land (D10) is referred to:
  - ALL medical infectious waste (180102*, 180103*, 180180* and 180182*)
  - THE SELECTESD medical waste, not possessing infectious properties (180101, 180104, 180106*, 180107, 180108* and 180109);
- physico-chemical treatment excluding autoclaving, thermal disinfection, microwave impact if the technology, employed in the discussed treatment ensures the neutralization of the waste (D9) which is safe to environment and human health and life . It concerns:
  - EXCLUSIVELY THE SELECTED medical waste, not possessing infectious properties (180104, 180106*, 180107, 180110 and 180181);
- landfill storage of the waste different than dangerous and neutral (D5) is referred to:
  - EXCLUSIVELY THE SELECTED medical waste, not possessing infectious properties (180104, 180181).

The provisions of art. 95 par. 2 of the Law on waste, in the case of neutralizing infectious medical waste, **demand** the thermal transformation in the incineration plants for hazardous waste, and at the same time, **it is forbidden** to neutralize infectious medical waste in the waste co-incineration plants (art. 95 par. 3).

The above mentioned legal provisions, due to a limited availability of the physico-chemical treatment methods (D9) and of the possibilities of landfill storage of waste different than dangerous and neutral (D5) in practice:

- restrict the methods of neutralization of infectious medical waste exclusively to thermal transformation of the waste on land (D10);
- univocally **repeal** the so-far existing possibility of neutralizing the infectious medical waste by the **autoclaving method, thermal disinfection or microwave action**.

Meanwhile, other European countries (*inter alia*, the Czech Republic, Germany, Italy, Hungary, Spain, Portugal, Sweden, Lithuania, Latvia) – in respect of infectious medical waste – admit the application of modern technologies of autoclaving and microwave operations as the methods equivalent to thermal transformation of the waste.

We should remember that any of the European directives has not introduced the demand of transforming the infectious medical waste exclusively with the application of thermal transformation in the waste incineration plants (D10). Other neutralization processes, including process D9 (e.g. application of microwaves or autoclaving) are considered as equivalent always when they guarantee environment and human life protection. Polish regulations relating to the methods of neutralization of infectious medical waste belong to the most restrictive in Europe.

Summing up

The principles of disposal of medical waste in the sites of their origin cause still many practical problems in spite of the fact that they have functioned in the provisions of Polish law for many years. We should also remember that the provisions of law introduce the minimum requirements and in the cases where the safety aspects speak for tightening up of the regime of proceeding with the waste, in comparison to that one dictated by the regulations, we should be guided by the experience and opinion of experts.

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PRELIMINARY OCCUPATIONAL HEALTH AND SAFETY TRAINING AS A TOOL FOR THE OCCUPATIONAL ACTIVATION OF INTELLECTUALLY DISABLED PEOPLE

WSTĘPNE SZKOLENIA Z ZAKRESU BHP JAKO NARZĘDZIE AKTYWIZACJI ZAWODOWEJ OSÓB Z NIEPEŁNOSPRAWNOŚCIĄ INTELEKTUALNĄ

***Summary**: The article presents initial instructions on occupational health and safety (OHS) for the vocational training provided to people with intellectual disabilities within the framework of the "The differently-abled" and "Academy of equal chances" projects. The research carried out and the way in which the vocational training was conducted, were among the first within the said projects. The author conducts employment-support training courses which involve instructions on occupational health and safety. After completion of the training course, the participants of the mentioned projects undergo to a three-month internship at a local employer. The awareness and observance of occupational health and safety regulations by intellectually disabled people at their workplace has significantly increased employers' reliance upon employees belonging to this group.*

***Keywords**: employee, intellectual disabilities, OHS, employment support*

***Streszczenie**: Artykuł omawia wykorzystanie instruktażu wstępnego bhp do szkolenia zawodowego osób z niepełnosprawnością umysłową, które odbywało się w ramach projektów „Pełnosprawni" i „Akademia równych szans". Przeprowadzone badanie i sposób prowadzenia szkolenia zawodowego było jednym z pierwszych tego typu w ramach w/w projektów. Autorka artykułu prowadzi szkolenia aktywizujące zawodowo właśnie poprzez instruktaż bhp. Uczestnicy projektów po zakończeniu szkolenia odbywają 3 miesięczne staże zawodowe u lokalnych pracodawców. Przestrzeganie i znajomość przepisów bezpieczeństwa i higieny w miejscu pracy przez aktywizowane zawodowo osoby z niepełnosprawnością umysłową zdecydowanie zwiększyło zaufanie pracodawców do tego typu pracowników.*

***Słowa kluczowe**: pracownik, niepełnosprawność umysłowa, bhp, aktywizacja zawodowa*

Introduction

Adult learning is a significant aspect of modern teaching methodologies, especially as regards people with intellectual disabilities. These constitute the target group of the training activity in question as they tend to show much passion for learning at the beginning, and then quickly become impatient or discouraged. By defining in detail the profile of the participant in vocational training, the teaching curriculum can be tailored to specific objectives, e.g. finding a job. It is noteworthy that no single teaching method exists that would suit a certain group of recipients [1]. This article aims at outlining the method of providing vocational training to people with mild intellectual disabilities, based on occupational health and safety training which puts emphasis on safety and the proper work performance. This form of teaching brings numerous benefits, at the same time encouraging further activities extending the range of applications of occupational health and safety training.

Characteristics of the learning process

Learning objectives define the anticipated changes to knowledge and skills resources, which concerns in particular the objective aspect. As regards the subjective aspect, they reflect the changes regarding motivation, intellectual abilities, attitudes and value systems. Learning objectives are defined, *inter alia*, in terms of

- perceptibility, i.e. determining how they will be accomplished,
- performance, i.e. accomplishment within a given time framework,
- logicality,
- concision and precision,
- measurability [2].

In other words, learning objectives are the planned outcomes which we want to achieve. At this point, it is also worth presenting another division of learning objectives based on the prioritisation criterion, i.e.

— general (long-term) objectives,
— intermediate objectives (activities),
— specific objectives defining the knowledge to be acquired [3].

We should bear in mind that adult learning is generally aimed at expanding one's knowledge (supplemental education) or at continuous professional development (mastery learning), which allows one to bring more value to their occupational or social functions, while also opening better prospects of promotion. In learning processes which lead to gaining occupational skills, on-the-job training constitutes a significant method, especially when it comes to practical professions. Practical activities in this case make it possible to learn to perform the tasks discussed in an operational (training) instruction. Errors in human work result directly from what is known as the human factor. This may include, *inter alia*, being unaware of occupational risks specific to a given position, having inadequate qualifications, acting improperly in an unexpected situation or not concentrating on the performed task. It may happen that people conducting such training have technical knowledge of a given subject but the only teaching method they employ is a multimedia presentation. Reaching to a student who is additionally intellectually disabled seems twice as hard if we fail to engage him or her in a discussion or if we merely provide ready-made solutions to emerging problems. Activity-based methods constitute an interesting and diversified way of learning and acquiring knowledge [4]. They make it possible to reach to every participant at various stages of the learning process.

Occupational problems of intellectually disabled people

Intellectual disability is characterised by a limited mental capacity, especially as regards the processes of perception, interpretation, understanding the reality, drawing conclusions, planning or solving problems [5]. Occupationally disabled people display certain occupational abilities and potential which let them perform some job-related tasks. Although their activation may appear rather hard, it is feasible as long as a proper assessment of occupational abilities is made, coupled with socio-occupational rehabilitation. In terms of the occupational abilities of intellectually disabled people, the following division can be made:

— people with mild functional capacity impairments (who face some occupational problems),
— people with moderate functional capacity impairments (who require specialised support),
— people with severe intellectual disability (who do not qualify for occupational activation programmes) [6].

For many people, and in particular for those with dysfunctions, having a job makes their life meaningful, and lets them feel valuable and useful members of society. In numerous studies, the level of education has also proven to impact on life satisfaction of occupationally active people, regardless of their income and dysfunctions [7]. Option of taking part in occupational training and professional development programmes is also a source of work satisfaction [8]. What is more, any attempts to find a job or participate in occupational training require personal involvement [9].

Intellectual disability can have different origins, including genetic factors, congenital disorders, childhood diseases, insufficient living conditions and improper care-taking in childhood and adolescence. In occupational life, it can pose difficulties related to the perception and interpretation of complex situations at work, communication with co-workers, acquisition of knowledge, independent job-related problem-solving, and – last but not least – socio-occupational adaptation at the initial stage of employment. Prospective workers with mild occupational disability should be able to deal with all sorts of blue-collar jobs. They should not be entrusted with executive or managerial duties which usually involve a high degree of responsibility. At the initial stage of employment, in order to be able to effectively perform the entrusted duties, they frequently need auxiliary on-the-job training and assistance in developing the appropriate attitudes to occupational health and safety. As regards people with more severe intellectual disability, supported employment enterprises are the recommended solution, as these people often show a low degree of manipulative and motor coordination abilities. Previous teaching and labour market activation experience has shown that providing the adequate support, supervision and assistance to this group of people is likely to generate outcomes satisfactory to employers.

Preliminary occupational health and safety training (research results)

Unconventional learning methods make use of various activities that are not strictly related to education. These can include elements of play, experimentation, exploration or even circus activities, all of which require special props, or even places to conduct observations [10]. Occupational training for intellectually disabled people in the position of maintenance worker it began rather atypically – from a preliminary multiple-choice test of general occupational health and safety knowledge (the Academy of Equal Opportunities-project implemented in Association of Local Initiatives Lubartów-february 2019). It consisted of 29 questions, with a maximum of 44 points, including the following: which health and safety training should a newly hired worker complete, does the employer have to provide the worker with protective clothing, what should you do when you see fire, what medical examinations should the worker undergo.

The training participants did the test based on their general knowledge, with only two participants having some job experience. Most of the participants had secondary (vocational) education, and their age ranged between 45 and 56.

During the occupational training in the aforementioned projects in the position of maintenance worker, the participants picked and tried on a set of protective clothing and equipment, including a protective helmet, hearing protectors, protective glasses, goggles, filtering full-face masks and half-masks, gloves and aprons. Individual sets were prepared for the prospective internship locations reported by the participants,

considering that maintenance workers may be hired in various industrial and service sectors. The participants were also familiarised with elements of the first aid kit, and were tasked with identifying an indoor hydrant, a fire extinguisher and evacuation route markings in the building. All the participants individually were asked to outline the procedure of calling 112 to report a fire; to identify the tools usually used by maintenance workers from among a sample set and discuss their basic maintenance procedures; and to demonstrate the right body posture when lifting, for instance, heavy packaging. This exercise made the participants familiar with the applicable heavy object lifting standards both for women and men, and drew their particular attention to the need to take care of the osteo-articular system. On the last day of the training, the participants redid the test with exactly the same questions, which made it possible to verify their knowledge.

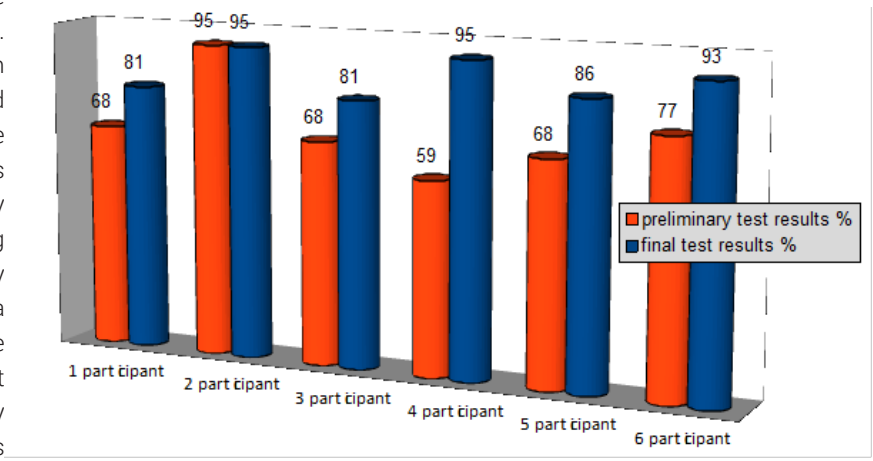

Fig. 1. Layout of the system of a proconsumer hydropower unit
Source: own elaboration

Occupational activation of mentally disabled people through preliminary occupational health and safety training makes it possible to consolidate the knowledge indispensable for the proper performance of job-related duties, and in particular to:

- take proper care of the machinery, devices and equipment,
- adequately use protective clothing and workwear,
- immediately notify supervisors of any accidents at work and threats to human life or health. All these activities form part of occupational health and safety training, considering that occupational health and safety by definition refers to the conditions, work organisation and workers' behaviours ensuring the required level of protection of human life and health against various threats emerging in the working environment [11] .

A range of positive conclusions can be drawn from observations of the mentally disabled people taking part in occupational activation. They understand work processes and know how important it is to use personal protective equipment, to obey their supervisors and to report equipment failures and any events that may put human life or health at risk. With a view to extending the participants' experience, subsequent training will also include outdoor activities in a municipal park, which is where some maintenance workers and groundskeepers perform their duties in order to put more emphasis on work processes specific to these positions. The participants' engagement was even greater than expected by the organisers of this occupational activation and stimulated interest in searching for other equally interesting ways of reaching to people with intellectual disabilities:

Concluding remarks

The described concept of a proconsumer small hydropower unit is characterized by simple design and reduced investment costs thanks to the use of largely recycled components.

The design of a small hydropower unit can be implemented with a large participation of direct users of the generated electricity. The system enables to achieve high technical and economic effects in the form of network energy savings. It is especially designed for the applications where the availability of energy is limited. Hybrid bearing of the main shaft of the unit ensures easy start-up and high-energy efficiency with a particularly long service life.

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FUTURE OF PACKAGING INTENDED FOR FOOD PRODUCTS

PRZYSZŁOŚĆ OPAKOWAŃ NA ARTYKUŁY SPOŻYWCZE

Summary: *Packaging of food products must meet many requirements. In the present paper, the trends of development of packaging destined for food and drinks in Poland have been discussed. Besides, on the ground of the conducted studies, the most significant properties of packaging of food products were highlighted, with the consideration of the knowledge of terms; "active packaging" and "intelligent packaging" and their role. The summing up of the mentioned studies would give the answer to the question concerning the most approved types of food products from viewpoint of the consumers.*

Keywords: *packaging of food products, survey questionnaires, significant properties of the packaging, active packaging, intelligent packagingr*

Streszczenie: *Opakowania na artykuły spożywcze muszą spełniać liczne wymagania. W artykule przedstawiono trendy rozwoju opakowań do żywności i napojów. Ponadto – na podstawie przeprowadzonych badań ankietowych – wyeksponowano najbardziej istotne cechy opakowań na artykuły spożywcze, z uwzględnieniem znajomości terminów: „opakowanie aktywne" i „opakowanie inteligentne" oraz ich wadze. Niejako podsumowaniem tych badań jest uzyskanie odpowiedzi na pytanie dotyczące najbardziej odpowiadających respondentom rodzajów opakowań do spożywczych artykułów.*

Słowa kluczowe: *opakowania na artykuły spożywcze, badania ankietowe, istotne cechy tych opakowań, opakowania aktywne, opakowania inteligentne*

Introduction

The contemporary packaging plays not only the protective or transport function but also represent the producer and supply information about the packaged product. Due to these reasons, to survive in the specific market race, the contemporary packaging becomes more and more innovative. The task of the producers is to pay attention – via the mentioned packaging – to the product, according to the principle what the first impression is most important and it is done "only" once. When staying before the shop shelf, the consumer – before he makes a choice – fist of all, pays nowadays attention to the appearance of the product and then, to its friendliness and convenience of use. In a few years, we will focus on the possibility of repeated use of the packaging and on its ecological aspects [1, 2, 4]. There are many factors affecting the directions of development of the packaging; many studies were conducted and many papers were developed. We should mention here the study of C. Olsmats and Jari Kaivo-oja (2014) where the following 5 main trends, shaping life all over the world in the coming years have been distinguished:

- world of limited resources;
- personalization of services;
- urbanization and increased mobility;
- demographic changes and
- popularization of digital world [3].

The first factor is focused on the decrease of the amount of food waste via the application of packaging which may be completely emptied and closed again, on prolongation of shelf life of the packed food and on recycling of packaging materials. The authors of classification indicate a very quick consumption of non-renewable resources which are utilized in food production and the intended packaging. It results from the increase of population, and development of economy. There is more and more ecological and biodegradable packaging. Also, its friendliness to environment is stressed. The second direction is concentrated on presentation and innovations, employed in a given packaging. During the successive several years, the next dominating trend will include designing of the packaging which allows communication with the user, with the simultaneous rise of its value. The fourth factor, shaping the packaging sector stresses the role of migration of human population, its lifestyle, labour market and housing needs. The last mentioned above factor is a passage from the analogue world to digital one due to the addition of electronic markers or intelligent labels. Owing to it, the user may also save time. There is no need to wait for computer game, wrapped in the packaging as it may be ordered and in the case of possessing the appropriate platform, it may be normally installed, using the appropriate code or link, being on-line enclosed.

Directions of development of packaging for foods and drinks

Packaging intended for food and drinks is the vastest sector in the packaging branch. Due to a quick life rate of the Poles, the change in the structure of family at the space of several recent years, producers of food packaging place the emphasis on the following:

- functionality of packaging;
- friendliness in utilization, via assistance in everyday operations such as easier dosing of the product or rationing of loose products;
- decrease of portions;
- designing of packaging for ready-to-use products for the users who do not have time to cook due to their active lifestyle and
- prolongation of the shelf-life of the product.

In respect of the convenience of use, the greatest development in the field of designing the packaging has been observed for the dairy products. The way of evolution led from the milk, packed in glass bottles, via film bags and cardboard packaging to interesting plastic packaging with a handle, facilitating dosage of the milk, or plastic biodegradable packaging in a form of jug. Earlier, we shopped the milk with own vessels. We should also mention innovative small cartons or bottles for milk and other drinks. Such packaging may be quickly emptied and dispose later. Their undoubted advantage lies in the fact that they are small and can be taken for excursion, to school or to work place. Unfortunately, the contents of such packaging should be consumed at once as they when once opened, cannot be closed again.

Also, yoghurts are packed in convenient, functional and interesting packaging. The packaging with the *corner* have not lost their popularity for many years; it is the additional baffle in the packing where any food additives may be placed, for example, candies, fruit mousses, pulps etc. The discussed element may be separated from the whole packaging what is especially attractive for the youngest users as when torn, it yields a characteristic funny click. Yoghurts are sold in the bottles of 330 ml volume; they are also functional and convenient; their advantage includes also the possibility of close the bottle cap. Owing to this fact, the user does not have to consume the whole product at once, he may close it and place in the bag or backpack and may be sure that yoghurt does not flow out from the bottle.

We may also record development in respect of packaging for cheeses, butcher's products and meat. Their producers concentrate mainly their attention on prolongation of the stability of the packed product. The problem connected with the discussed products includes their quick deterioration, desiccation, being connected with the contact with oxygen and with microorganisms what, consequently, deterioration of their quality, constituting a hazard to human health and even to life. Impact of oxygen is well visible, especially in the case of meat as the oxidised product changes its colour into grey-brownish and the oxygenation products have unpleasant odour. Therefore, the packaging material for the discussed products must constitute a special protective barrier from the external environment. It may be obtained owing to the application of the advanced packaging systems such as:

- vacuum packaging,
- modified atmosphere packaging (MAP) and
- controlled atmosphere packaging (CAP) [1].

Coating of fruits and vegetables with the edible layer, containing lipid compounds is an interesting solution, prolonging the shelf-life of the products [2]. The mentioned substances limit the migration of water vapour, oxygen, carbon dioxide and aromatic compounds from a given fruit or vegetable and improve its properties. They are employed as preservatives, antioxidants and substances and colour and aroma enhancers. They make also that the appearance of the product is more attractive for the consumer's eyes. The apples may be coated with the discussed substances owing to which they are shining. Another innovation of the similar type includes application of edible films. They are independent structures, formed outside the product and may constitute a protective layer, active component as well as independent packaging. The main problem concerning fruits and vegetables – apart from their short shelf-life – consists in the easiness to be damaged during the transport. It should be also taken into consideration. At the same time, it must be such material which would ensure the possibility of "breathing" to the products. At present, the unit packages are most popular. They include the following solutions:

- perforated polypropylene films (foils) in which the vegetable or the selected fruits are packed; sometimes in order to adapt the packaging to the contemporary demand on eco-friendly solutions – instead of polypropylene, PLA (polylactic acid) is added. It is a biodegradable polymer, obtained from renewable raw materials;
- polystyrene trays, wrapped with stretch-type foil, mainly for fruits and vegetables, e.g. for vegetable mix (in Polish: włoszczyzna);
- wrapping with film, e.g. celery or ice lettuce;
- small trays, wood split baskets and boxes made from cardboard, thermoformed pulp or plastic.

In spite of such possibilities, the customers are urged to buy fruits and vegetables in a "bulk" form, that is, without unit packaging, especially when it is made from eco-unfriendly plastic. It does not mean, however, that in the perspective of several dozen of years the need of producing the packaging for the mentioned products will disappear. At the different small markets and in small vegetable shops, the merchants employ the collective packaging in a form of boxes made from wood, from solid cardboard, woven bags and also, from plastic. At the Polish markets, we cannot, unfortunately, meet many innovations in respect of packaging for fruits and vegetables, in the contrary to the western markets where active and intelligent packaging is used. It is a trend in development which allows prolongation of the shelf-life of the discussed products by twice-three times, with the application of all types of ethylene absorbers. The recent substances are placed in the boxes or in

bulk packaging. The employment of freshness indicators on the product is another interesting solution. In this case, the customer has a chance to buy a product with a specified freshness, that is satisfactory for him, and moreover, he will not throw it away. The submitted example is the answer to the global problem of food wastage. In 2020, it was estimated that in Poland, about 5 million tonnes of food are discarded, including agricultural waste (15%), production waste (the same quantity); 7% of food waste come from trade, more than 60% – from households, and ca. 1% comes from gastronomy and transport [I]. The conducted studies reveal the scale of the appalling phenomenon and, also the need of designing such packaging which will be not only functional but also prolong the shelf-life of the product and give maximum information to the user as to prevent deterioration of a given product. We may, therefore, state that the direction of development of food packaging includes, first of all, active packaging, informing about the shelf life of the product, and intelligent packaging ensuring the information about the product's freshness state and communication with the user. The intelligent packaging appear in a form of the already mentioned indicators of freshness state and, also, as the indicators of the history of TTI (time and temperature indicators) and the sensors of its exceeding e.g. in the packaging of the products intended for their heating up in the microwave kitchen, or thermochromic paints indicating the level of cooling down e.g. of beer, or the indicators of oxygen presence and tightness of the packaging.

Packaging for food and drinks nowadays is more and more subjected to ecological trends. The described solutions – especially in Poland – can be not always defined as those which are not harmful to the environment. Many active packages for meat and dairy products being found in the shop freezers and coolers is produced from plastics which are not biodegradable and additionally, are petrochemical, for example: PE, PP or PET. Due to these reasons, we may observe the ecology-related trends, as affected by numerous studies and opinions on environment protection in packaging sector. The most important include:

- search for replacing materials, being an alternative to traditional, non-ecological polymers;
- employment of raw material from recycling in manufacture of packaging, for example, in 2020, Żywiec Zdrój company produced and sold the bottles for water, being produced from recycling materials;
- production of packaging in the way which makes the smallest carbon print;
- utilization of degradable and compostable materials.

In connection with the mentioned trends, in the nineties of the 20th century, there were introduced bioplastic materials including non-biodegradable plastics, produced from non-renewable and petrochemical resources and the biodegradable ones, obtained from renewable resources. The greatest popularity was obtained by poly (lactic acid), being called polylactide (PLA) and produced from completely renewable resources. It is employed in production of flexible packaging, extrusion of rigid and thermoformed films, for shaping of packaging by the injection method, and lamination of paper by the extrusion method. Other materials, as being more and more universal on the market, include the group of polymer-starch composites under the trade name MateriBi and cellulose foils. MateriBi is currently used for manufacture of flexible and rigid films, and those subjected to thermoforming, destined for trays and the containers or foamed material, filling a free space in transport packaging. Cellulose films are produced from cellulose pulp, obtained from Eucalyptus tree wood and belong to compostable materials. They are characterized by very good optical properties, possessing a good barrier to oxygen and aromas, controlled barrier to water vapour and natural antistatic. Moreover, they are resistant to fats, chemical substances and changes of temperature.

Food packaging will be subjected to transformation due to the EU Directive which was introduced in July 2021 (II). One of the first changes covers elimination of plastic straw, containers for milk type beverages or juices in cardboard packaging of 200 cm3 volume, trays and polystyrene (Styrofoam) containers. The mentioned Directive is focused on recycling, so since 2023, the producers of plastic packaging will have to take care of manufacture from renewable materials at least in 25% and since 2030, the mentioned ratio will be increased at minimum to 30%. Since 2025, the plastic bottles with freely screwed caps will disappear and there will be only those with permanently fixed caps. The additional ecological factor is the Plastic Tax, being imposed by the EU authorities and introduced into effect since January, 1, 2021. Is includes plastics which will be not subjected to recycling. For each kilogram of the unprocessed plastic, it will be necessary to pay 80 Eurocents of tax. In the situation of such legal regulations, the producers of plastic packaging will be forced to concentrate on manufacture of the biodegradable packaging to the possible highest degree; it will be connected, first of all, with higher manufacturing costs.

The most significant properties of packaging intended for food products

To test the preferences of the users in relation to food packaging, the survey was carried out during which it was examined what properties and types of food packaging were most significant from the viewpoint of user of a given packaging. The knowledge of such terms as "active packaging" and

Table 1. The averaged general results of the respondents' answer to the question: "Which properties of food packaging are, in your opinion, most significant?"

Number of respondents	Eco-friendliness	Graphic layout	Safety	Readability of information	Possibility of complete emptying	Convenience of use
100	3.45	3.59	3.88	4.07	4.03	4.08

"intelligent packaging" was checked. The respondents evaluated the packaging in the score scale from 1 to 5 where "1" meant the least significant properties and "5" was referred to the most significant ones. The answers of the Respondents were given in tables 1–9 and in diagrams 1–5. In tables 1–4, general answers were illustrated, according to gender, age and education of the examined persons.

On the grounds of the results of the survey, we may conclude that the convenience of use of food packaging, possibility of reading out the information and the possibility of complete emptying of the package were the most important factors of choice. Eco-friendliness was the least important aspect.

From the analysis of the results, shown in the above table it is followed that women – when choosing food packaging – focus their attention on readable information about the product inside and they are less interested in graphic layout and eco-friendliness of the packaging. In turn, men pay greater attention to convenience of use of the packaging and eco-friendliness is for them the least important aspect.

On the grounds of the results, presented in the above table, it may be concluded as follows: the friendliness of packaging is most important for the persons between 26th and 35th year of life; however, it is not most important aspect for them. The persons younger than 18 years and those between 45 and 60 years of life do not pay much attention to eco-friendliness. Graphic layout is more attractive for the underage youth and the least attractive for the persons between 36 and 45 years of life. Safety of food packaging seems to be most important for the persons at the age of 36–45 years and the least significant for the youth below 18th year of life. For the young people, the aspect of the possibility of complete emptying the packaging is least important but the mentioned aspect is most significant for the persons above 60 years of life. For this latter age group, the convenience of use of the packaging is also the most important issue. The recent aspect is least significant for the persons at the age of 45–60 years

Table 2. The averaged results of the respondents' answer to the question: "Which properties of food packaging are most important for you?" according to gender

Gender	Women	Men
Number of respondents	52	48
Eco-friendliness	3.81	3.06
Graphic layout	3.65	3.52
Safety	4.15	3.58
Readability of information	4.27	3.85
Possibility of complete emptying	4.17	3.88
Convenience of use	4.17	3.98

Table 3. The averaged results of the respondents' answer to the question: "Which properties of food packaging are, in your opinion, most important?" 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	2.44	3.78	4.22	4	2.67	4.17
Graphic layout	4.22	3.51	3.92	3.35	3.44	3.5
Safety	3.22	3.77	4.08	4.35	3.56	4.17
Readability of information	3.22	4.28	4.85	4.15	3.78	4.5
Possibility of complete emptying	3.44	4.21	4.31	4.05	3.77	4.5
Convenience of use	3.78	4.33	4	3.85	3.44	4.67

Table 4. The averaged results of the respondents' answer to the question: "Which properties of food packaging are, in your opinion, most significant?" according to education

Education	Lack	Basic	Vocational	Secondary	Uncompleted higher	Higher
Number of respondents	7	6	7	19	32	29
Eco-friendliness	2.86	1.87	3.00	3.44	4.00	3.67
Graphic layout	4.00	3.67	3.43	3.00	3.63	3.86
Safety	3.71	2.33	4.00	3.58	3.81	4.48
Readability of information	3.71	2.50	3.71	4.37	4.06	4.38
Possibility of complete emptying	3.86	2.50	3.57	4.26	3.94	4.45
Convenience of use	3.57	3.33	3.29	3.95	4.28	4.41

Graphic layout is the most important aspect of food packaging for the persons with lack of education; eco-friendliness is least significant for them. For the persons with vocational education, safety of packaging is most important and ecological problems are also least significant. The persons with the secondary education are mostly focused on readability of information and graphic layout is less significant for them. The convenience of use is most important for the persons with uncompleted higher and higher education; graphic layout is least important for them. Additionally, the persons with higher education focus mostly their attention on the possibility of complete emptying of the packaging and pay the smallest attention to eco-friendliness of the packaging.

The knowledge of term: "active packaging"

Within the frames of the conducted questionnaire, the awareness of the respondents in respect of active packaging was carried out. The results are given in tab. 5 and circular diagram 1.

Table 5. Presentation of the respondents' answer to the question: " Do you know the term: "active packaging?", in figures

YES	22
NO	69
I DO NOT KNOW	9

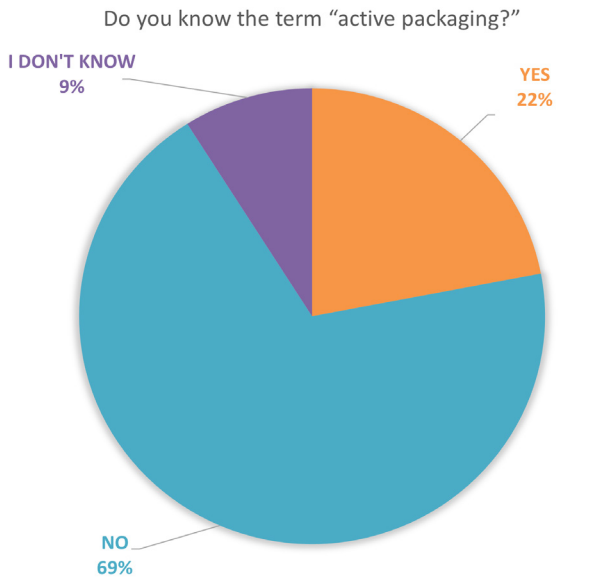

Fig. 1. Presentation of the respondents' answers to the question: "Do you know the term "active packaging?", in %

As it can be seen in tab. 5 and diagram 1, almost 80% of the respondents did not have any contact with active packaging or they do not know whether they had it. Only 22% of the respondents know what the active packaging is.

Meaning of active packaging

In this part of the questionnaire, the respondents indicated the properties of active packaging which, in their opinion, are most important. Only those persons who marked a positive answer in the previous question could answer this question. The answers have been given in tab. 6 and diagram 2.

Table 6. Presentation of the respondents' answer to the question: "Which aspects of active packaging are important for you?"

Prolongation of shelf- life of the product	9
Improvement of the product's quality	10
Separation of the product from the environment	12
Safety of active packaging	11
Improvement of sensory properties of the product	5

Fig. 2. Presentation of the respondents' answer to the question: " Which aspects of active packaging are important for you?" in a form of columns

In the opinion of the Respondents, the most important aspect is whether active packaging is able to separate the product from the environment and whether it is safe for the consumers. The improvement of sensory properties occurred to be least significant for the consumers.

Knowledge of the term "intelligent packaging"

The questionnaire contained the question concerning the awareness of the respondents in respect of intelligent packaging. The results are given in tab.7 and circular diagram 3.

Table 7. Presentation of the respondents' answers to the question: "Do you know the term "intelligent packaging?" in figures

YES	28
NO	62
I DO NOT KNOW	10

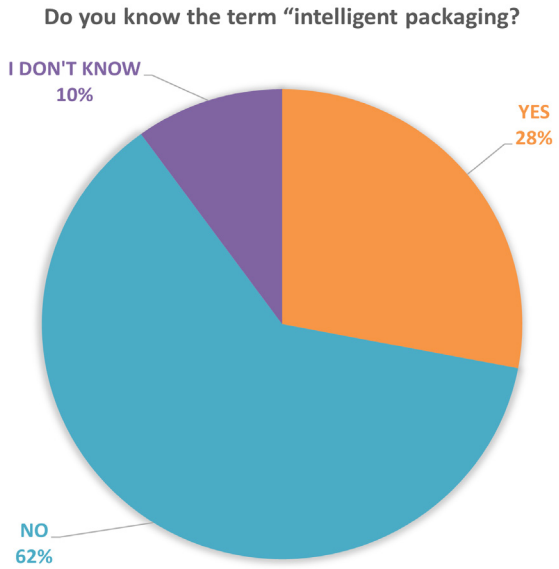

Fig. 3. Presentation of the respondents' answers to the question: "Do you know the term "intelligent packaging?" in %

As it can be seen in tab. 7 and fig. 3, almost 80% of the respondents did not have any contact with the intelligent packaging or they do not know whether they had it. Only 22% of the respondents know what the active packaging is.

Meaning of intelligent packaging

In this part of the questionnaire, the respondents indicated the properties of intelligent packaging which, in their opinion, are most important. Only those persons who marked a positive answer in the previous question could answer this question. The answers have been given in tab. 8 and diagram 4.

Table 8. Presentation of the respondents' answer to the question: "Which aspects of intelligent packaging are important for you?"

Control of suitbaility of the product to use	22
Safety of intelligent packaging	16
Temperature of the product	10
Control of tightness of the packaging	11
Other	1

Fig. 4. Presentation of the respondents' answer to the question: "Which aspects of intelligent packaging are important for you?"

According to the results submitted in diagram 4, it is most important for the respondents that the intelligent packaging could indicate whether a given product is suitable for consumption. Indication of the product's temperature is the least significant aspect.

The most suitable types of packaging for food products

In the successive part of the questionnaire, the respondents indicated the types of packaging for food products which suited them best. The question was not obligatory; therefore, not every respondent answered it. It was dictated by the fact that not everyone uses the submitted types of packaging. The answers of the respondents have been shown in tab. 9 and diagram 5.

Table 9. Presentation of the respondents' answer to the question: "Which types of food packaging suit you best?", as expressed in figures

Type of packaging	Number of respondents	Mean score evaluation
Bags	96	3.63
Tubes	79	3.02
Cardboard packaging	91	4.11
Bottles	89	3.54
Containers	87	2.76
Cans	86	3.67
Jars	82	3.98

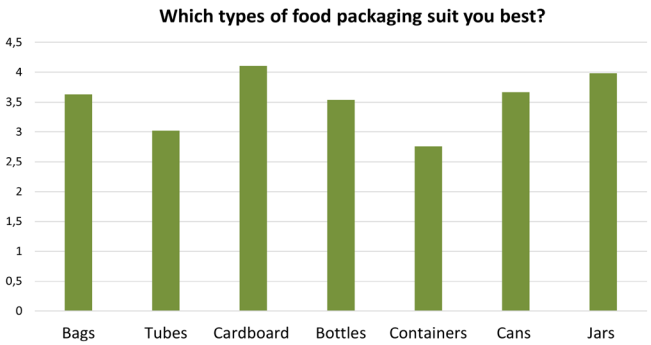

Fig. 5. Presentation of the respondents' answer to the question: "Which types of food packaging suit you best?", as expressed in columns

Summary

The respondents preferred the most cardboard packaging and jars as type of food packaging. The least preferred were containers, especially the thermoformed ones, for example for packing of cake. Apart from the submitted types of food packaging, there were suggestions of using returnable glass bottles, Ziploc bags, and paper bags, and of creating the packaging by wrapping the product with aluminium foil of breakfast paper.

For the users of food packaging, the most important aspects include convenience of use and readability of information. The mentioned aspects were highest rated by the majority of the respondents. What surprising, the eco-friendliness and graphic outlay of the packaging were least significant. The cardboard packaging and jars were the types which suited best the responders. The containers for food are the least popular type of package. Perhaps it results from the fact that it is easy to open them and often their contents get outside. The examples include cake or small fragile cakes, packed in thermoformed container. Besides it, they cannot be crushed by any heavy object as they may crack. A very high percentage of the respondents do not know the terms "active packaging" and "intelligent packaging". The most important aspect of active packaging was the ability to separate the food product from the environment and the safety of the consumer. The improvement of sensory properties of the product occurred to be least significant aspect of active packaging. In the case of intelligent packaging, the most desirable properties consisted in the indication whether a given product is suitable for consumption and least one includes indication of the product's temperature in the packaging.

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SECTOR OF CONCENTRATED FRUIT JUICES IN POLAND

SEKTOR ZAGĘSZCZONYCH SOKÓW OWOCOWYCH W POLSCE

***Summary**: In the paper, the following problems have been discussed: position of Poland in the world trade of concentrated fruit juices and in production and export of fruit products in our country as well as the tendencies in production and turnovers of foreign trade of fruit juice concentrates in the season of 2021/22. The coefficients of production variability and of export and prices have been calculated. Due to the availability of data, the main attention was focused on the market of apple juice concentrate. The data of the Main Statistical Bureau (GUS), the Ministry of Finances and the unpublished data of the Polish Association of Juices Producers, have been utilized.*

***Keywords**: concentrated fruit juices, foreign trade, export of fruit products, apple juice concentrate*

***Streszczenie**: W artykule przedstawiono: pozycję Polski w światowym eksporcie zagęszczonych soków owocowych i w produkcji i eksporcie przetworów owocowych w naszym kraju oraz tendencje w produkcji i obrotach handlu zagranicznego koncentratami soków owocowych w sezonach 2011/12–2020/21 i na rynku tych produktów w sezonie 2021/22. Obliczono współczynniki zmienności produkcji, eksportu i cen. Ze względu na dostępność danych główną uwagę skupiono na rynku koncentratu soku jabłkowego. Korzystano z danych GUS, Ministerstwa Finansów oraz niepublikowanych danych Krajowej Unii Producentów Soków.*

***Słowa kluczowe**: zagęszczone soki owocowe, handel zagraniczny, eksport przetworów owocowych, koncentrat soku jabłkowego*

Introduction

The concentrated fruit juices (participation of ca. 50%) are dominating in the world sales of fruit products. In the international export of concentrated juices, the concentrated orange juice plays a basic role. In the years 2018–2020, the participation of the mentioned juices in the volume of the world export of juices was equal to 37%, in average. The second place (the participation of 18%) was occupied by the apple juices and the third place – by the juices from citrus fruits (without orange juice) amounted to 7%. The participation of grape juices was equal to 6% and that of pineapple – 3%. The juices produced from other fruits (cherry, raspberry, currant, chokeberry, pears, strawberry, papaya and other south fruits constituted 29%[1].

Poland is a meaningful world exporter of the concentrated apple juice but also, the exporter of juices, produced from the remaining fruits of the temperate zone, being not so much significant in the world sales. Only China is a greater net exporter and producer of the concentrated apple juice. Poland is the greatest supplier of apple, chokeberry, currant and cherry juice to the countries of the European Union.

Besides the frozen fruits, the concentrated juices are dominating in the domestic production of fruit products. In the period of 2019–2021, their participation in volume of fruit products' manufacture amounted to ca. 34% and 38%, respectively and in value of production to 35% and 32%, respectively. The discussed products constitute also the basis of Polish export of fruit products. In the years 2019–2021, the concentrated juices constituted ca. 24% of export volume of fruit products and 23% of value of export of the mentioned products. The participation of frozen fruits was equal to 31 and 35%, respectively.

Tendencies in production of concentrated fruit juices in Poland

In production of concentrated fruit juices in Poland, the apple juice concentrate is dominating. In seasons 2016/17–2020/2021, the participation of the mentioned juice in the total volume of the produced concentrated fruit juices was equal to 87%. The participation of currant juices was 4%, of cherry juices – 4%, of strawberry – 2%, of chokeberry 2% and of raspberry – 1%. The participation of juices, produced from the remaining fruits, mainly from black lilac and cranberry does not exceed 0.5%,

The concentrated apple juice is manufacture mainly from domestic fruits. The total production is higher as a result of import of apple juice concentrate, mixed with the juice, produced from domestic raw material. The increase import has place e seasons of relatively low production of apples for processing, i.e. in the years of small crops in the country.

[1] There is a lack of data allowing determination of the level of export of the particular juices, classified as "other"

During the recent ten seasons (2011/12–2020/21), the total production of the concentrated apple juice and of the juices produced from domestic apples did not reveal growth tendencies. In the seasons 2016/17–2020/21 the total average production of apple juice concentrate amounted to 247 thousand tonnes in relation to 298 and 255 thousand tonnes, averagely, during the previous five seasons. At the same time, the discussed production shows a strong variation, caused by fluctuation of production of apples, destined for processing. In the seasons 2011/12–2020/21, the variation of production of concentrated apple juice, produced from domestic raw material was equal to 52% and of total production – 39%. The variation of total production of concentrated apple juice lower than that of production manufactured from the domestic raw materials indicates and supports a significant impact of import on limitation of variability of apple production in the country. We should clearly emphasize that the deliveries of apples for processing, including those for production of concentrated juice in the high-crop years increase more than production of the discussed fruits due to a distinct stabilization of their consumption in Poland and lack of the increasing export tendency. In the seasons of 2018/19, after record-high production in 2018, the supplies for processing constituted as much as 70% of apple production, including production of concentrated apple juice (62%). in the seasons of average harvests, the supplies for processing constitute 52–60% of the domestic production of apples.

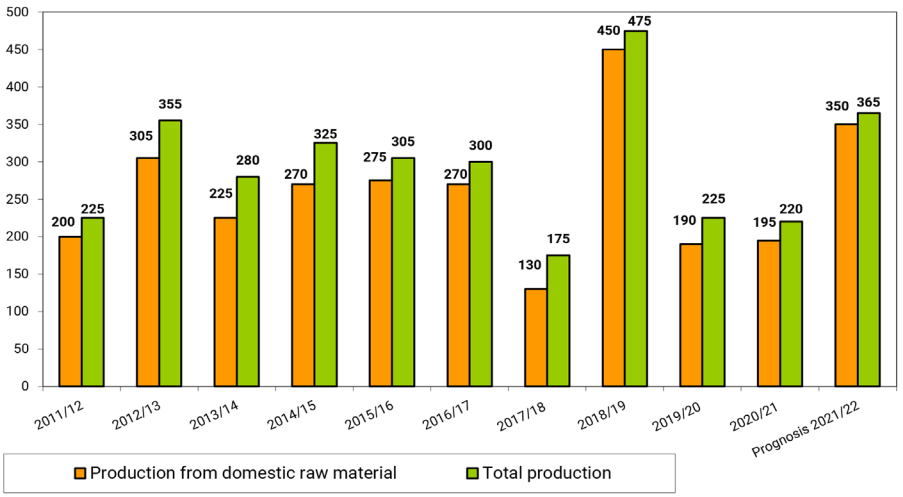

Fig 1. Production of concentrated apple juice in Poland (in thousand tonnes)
Source: Estimates on the grounds of data of Polish Association of Juices Producers (KUPS) and the Ministry of Finances (MF)

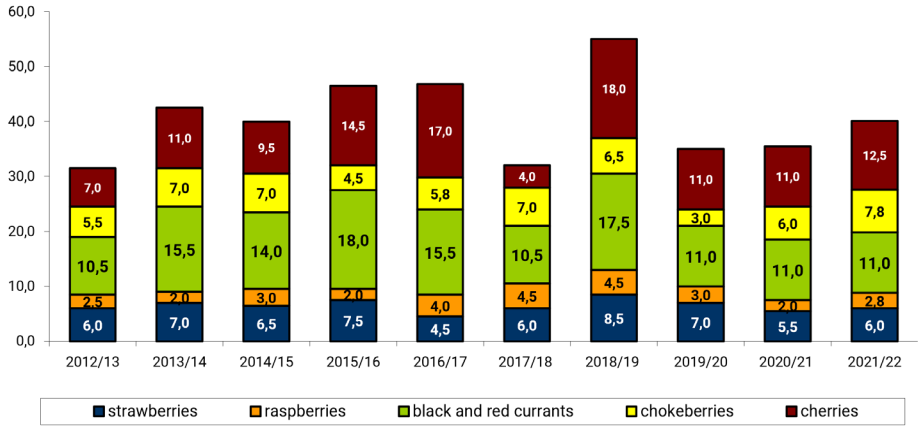

Fig 2. Production of the concentrated juiced manufactured from berry fruits and cherries (in thousand tonnes)
Source: KUPS data

The total production of concentrated juices produced from berry fruits and cherries varied during the recent ten seasons from 31.5 tonnes (season 2011/12 and 2012/13) to 55 thousand tonnes in season 2018/19, including cherry juices from 4 thousand tonnes (season 2017/18) to 18 thousand tonnes (season 2018/19) and black currant juices from 9.5 thousand tonnes (season 2012/13) to 17 thousand tonnes (season 2015/16). Variation index of total production of juices produced from "soft fruits" in seasons of 2011/12–2020/21 amounted to ca. 20%; it was lower when compared to concentrated apple juice. It results from the changes in the structure of production of juices manufactured from "colour fruits", depending on the level of the crop and prices of the particular species of fruit.

It should be added that production of juices from "soft fruits" is almost exclusively produced from domestic raw material. Import of concentrated juices takes place only in seasons with a small production of the discussed fruits in Poland.

Export and export prices

The participation of export in production of concentrated fruit juices exceeds 90% in majority of seasons. Hence, the level of foreign sales of the mentioned above products is almost functionally connected with the level of production. In certain seasons, the size of export exceeds the size of production due to the sale of resources from the previous season. For example, in season 2019/20, export (260 thousand tonnes exceeded the production level by 35 thousand tonnes due to the sale of the resources coming from extremely high production, obtained in season 2018/19 (475 thousand tonnes). Index of variation of foreign sale of the discussed products is similar to index of variations in production. As regards concentrated apple juice in seasons 2011/12–2020/21, export variability amounted to 33 % and was by 5 percentage points lower as compared to production fluctuations.

In seasons 2011/12–2020/21, variation of export prices of the concentrated apple juice, in average, amounted to ca. 27%, of cherry juice – 52%, of chokecherry juice – 28%, of the juice produced from black current – 54% and from raspberries – 38%.

Fig 3. Export of concentrated apple juice from Poland (in thousand tonnes) and export prices (in Euro/kg)
Source : on the grounds of the data of the Ministry of Finances

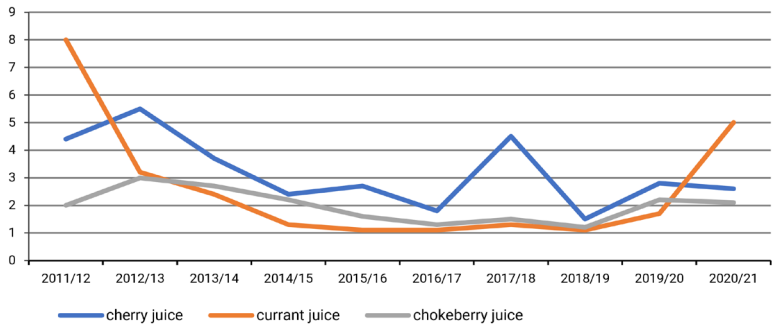

Fig 4. Export prices of the selected concentrated juices, in Euro/kg
Source: data of Polish Association of Juices Producers (KUPS)

A strong fluctuation of prices is caused by the changes in production in our country and production to the world market from other countries – exporters of the discussed products and, also, by a degree of approval of the prices of juices, nectars and drinks, produced from fruit juice concentrates by the consumers in the countries – receivers of the mentioned products (it refers to the seasons with a small production and relatively high prices at the world market). Higher fluctuation of the prices of concentrated juices, produced from "soft fruits" as compared to concentrated apple juice results, to a great degree, from relatively small meaning of juices, nectars and drinks, produced from the concentrates of the mentioned above juices. At the situation of high retail prices, their consumption decreases but it has no greater influence on the total level of consumption of juices, nectars and drinks.

In the seasons 2011/12–2020/21, export prices of the concentrated apple juice were highest in seasons 2017/18 (1.45 Euro/kg) and lowest in season 2014/15 (0.88 Euro/kg). As regards cherry juice concentrate, the discussed values amounted to 5.5 Euro/kg (season 2012/12) and 1.8 Euro/kg (season 2016/17), respectively; in the case of juice produced from black currant, the mentioned value was equal to 8 Euro/kg (season 2011/12) and 1.1 Euro/kg (seasons 2015/16, 2016/17 and 2018/19) respectively; for chokeberry juice, the discussed values were: 1.3 Euro/kg (season 2016/17) and 3 Euro/kg (season 2012/13), respectively.

Poland is the exporter of the concentrated apple juices mainly to the EU countries, first of all, to Germany. In the seasons 2016/17–2020/21, the average participation of Germany in volume of the export of the mentioned product amounted to 42.1%. The participation of Great Britain was 12.3%, of the Netherlands 9.5% and of the USA 6.8%.

The EU countries are also basic importer of the remaining concentrated fruit juices from Poland[2]. We should stress that the increase in the number of customers or the increase of export to the countries outside the EU has place in the seasons when the offer from Poland is relatively cheap. As regards the semi-processed products, including concentrated juices, export prices are a basic element considered by the importers in the choice of the suppliers.

Import and balance of foreign trade

Imported concentrated apple juice is destined, in 60–70%, for mixing with the juice, produced from domestic fruits. The total import of the discussed products varies in the particular seasons according to the level of domestic production. In seasons 2011/12–2020/21, the highest import was found in season 2017/18 (76.0 thousand tonnes) and the lowest one was recorded in season 2014/15 (34.8 thousand tonnes). The average import of concentrated apple juice in seasons 2016/17–2020/21 amounted to 61 thousand tonnes as compared to 54.7 thousand tonnes, averagely, in seasons 2011/12–2015/16.

[2] Non-consideration of CN codes concerning concentrated juices, produced from soft fruits (apart from cherry juice) in customs tariff does not allow to specify the size of geographic structure of export of the discussed products in Poland and other countries

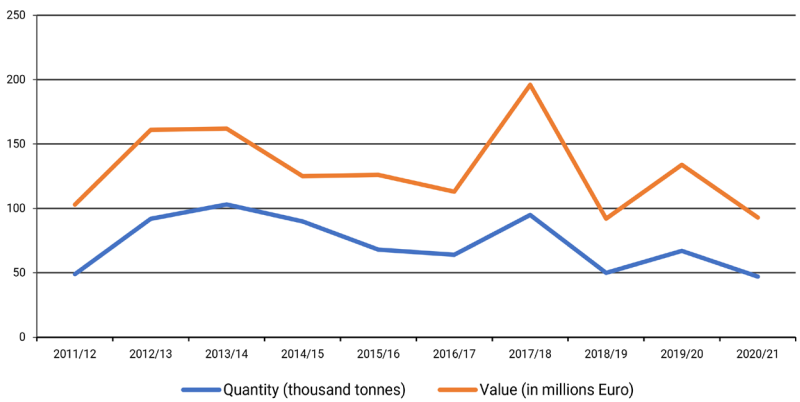

Fig. 5. Import of concentrate of apple juice to Poland
Source: on the grounds of data of the Ministry of Finances

Ukraine and Moldova are the main suppliers of the concentrated apple juice to Poland. In the low-price seasons, the export offer of China includes also import from the mentioned country. In seasons 2016/17–2020/21, total participation of Ukraine and Moldova in volume of the imported concentrated apple juice was equal to 69%. In Moldova and Ukraine, i.e. the countries with relatively low costs of production factors there are the branch offices of the companies that produce concentrated juices in Poland.

Balance of foreign trade in respect of the concentrated apple juice is highly positive. The mean amount in seasons 2016/17–2020/21 was equal to 194.6 thousand tonnes and the value amounted to 220.2 million EUR. The balance of turnovers of foreign trade of the remaining concentrated juices, produced from berry fruits and cherries is also positive.

Producers of concentrates apple juice in Poland

In Poland, there are ca. 50 companies that produce concentrated apple juice. The number of the companies which deal with the manufacture of the remaining concentrated juices is smaller. Production is dominated by companies with German and Austrian capital. The participation of the entities with Polish capital in total production is 30–50%. The sale of concentrated juices is implemented, first of all, by the processing plants themselves.

The majority of the plants that produce concentrated fruit perform their purchase of raw material via the commercial brokers. The latter are mainly private trade companies. Also, the producer organizations and horticultural cooperatives play the role of brokers in the purchase. The dominating role of mediators (brokers) in the purchase of fruits for production of concentrated juices and, for processing in general, results from disintegration of fruit production and still low degree of the producers' organizing, i.e. small meaning of producer organization in production. It causes also a mall role of cultivation contracts concerning obtaining of the raw material.

Situation on the market of concentrated juices in season 2021/22

Increase of the fruit crops in 2021 as compared to the previous year has caused the rise in the raw material production for the processing plants, including those producing concentrated juices. Production of concentrated apple juice, produced from the domestic raw material exceeded considerably 300 thousand tonnes as compared to 195 thousand tonnes in seasons 2020/21. The total production of cherry juices and those produced from berry fruits increased from 35.5 to 40 thousand tonnes. The increasing tendency of non-concentrated apple juices, intended for export to a great degree, has been maintained.

The average export prices of the concentrated apple juice and cherry juice were lower compared to season 2021/22 and those of the juices, produced from berry fruits, mainly from raspberries were increased. Import decreased and the import prices of juices, including mainly the apple juice, did not differ significantly from those recorded in the previous season.

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WAR HAS CHANGED EVERYTHING – THE 27TH EDITION OF THE COMPETITION GOLDEN ENGINEER 2021

WOJNA ZMIENIŁA WSZYSTKO – 27 EDYCJA PLEBISCYTU ZŁOTY INŻYNIER 2021

The 27th final of prestigious Competition "Golden Engineer 2021", being called for few years as "Engineering Holiday" which was celebrated on March, 30, 2022 in Warsaw House of Engineer was different in many aspects as compared to the previous 26 events.

Never before, during the mentioned final, the missiles burst near Polish borders and the frightened mothers with children passed to our territory, expecting - with the hope - a true help from Poland. Luckily for them, Polish society had opened their hearts and the activists of self-governing organizations and politicians created the conditions of good receipt and ensuring the fair stay and for many, also the possibility of longer stopping in civilized conditions.

No wonder that almost each presentation or speech of the persons, running the event or of the officials was commenced from referring to the going war, which was called a special intervention by one side, and from ensuring the weaker side, Ukraine people, about our good wishes and willingness to help in different ways. Although the news about the situation in Ukraine were coming to several hundred Polish engineers during the lasting ceremony, this year's final of "*Golden Engineer*" was conducted similarly as in the previous years. Gala was traditionally led by the popular radio journalist, Roman Czejarek (graduate of Szczecin University of Science and Technology), honoured few year ago with a title

PREZYDENT RZECZYPOSPOLITEJ POLSKIEJ
Andrzej Duda

Warszawa, 30 marca 2022 roku

Organizatorzy i Uczestnicy finału
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Serdecznie pozdrawiam wszystkich zgromadzonych na uroczystości finałowej XXVIII edycji plebiscytu „Złoty Inżynier". Gratuluję tegorocznym laureatom otrzymanych tytułów. Niech przyznane nagrody będą uhonorowaniem Państwa osiągnięć i zasług dla rozwoju wiedzy i gospodarki narodowej. Proszę przyjąć wyrazy mojego uznania i wdzięczności za nieoceniony wkład, który polscy inżynierowie wnoszą w wielkie dzieło modernizacji naszego kraju i budowę pomyślności rodaków.

W tym szczególnym dniu chcę z serca podziękować całemu Państwa środowisku za aktywne włączenie się w niesienie pomocy Ukrainie, która padła ofiarą bandyckiej napaści ze strony Rosji. Dziękuję Federacji Stowarzyszeń Naukowo-Technicznych – Naczelnej Organizacji Technicznej za zorganizowanie zbiórki na zakup sprzętu inwalidzkiego, rehabilitacyjnego i ortopedycznego dla inwalidów wojennych z Politechniki Kijowskiej. Dziękuję też za wszelkie indywidualne i społeczne działania i inicjatywy, które wspierają naszych ukraińskich przyjaciół broniących swojej ojczyzny, a także miliony uchodźców, którzy znaleźli schronienie w Polsce.

Raz jeszcze gratulując nagrodzonym i uczestnikom XXVIII plebiscytu „Złoty Inżynier", życzę wszystkim Państwu satysfakcji z dokonań oraz wielu kolejnych sukcesów, które tak wydatnie przyczyniają się do umacniania dobrobytu i bezpieczeństwa Rzeczypospolitej. Ale przede wszystkim życzę, abyśmy my, Polacy, zawsze byli pełni solidarności, gotowi do poświęcenia i dzielenia się z sąsiadami i bliźnimi owocami naszej codziennej dobrej pracy.

Z wyrazami szacunku

Ewa Mańkiewicz-Cudny, the President of FSNT-NOT

Andrzej Dera,
the Secretary of the State in the Office of the President of the Republic of Poland

Tadeusz Więckowski – Diamond Engineer 2021

Wojciech Murdzek,
the Secretary of the State in the Ministry of Educaiton and Science

Stanisław Latek – Honorable Golden Engineer 2021

Prof. Jacek Semaniak,
the President of the Central Office of Measures

Waldemar Pytel – Honorable Golden Engineer 2021

"Honourable Golden Engineer". The diplomas and statuettes were handed by the ministers: Andrzej Dera, the Secretary of the State at the Office of the President of the Republic of Poland, Wojciech Murdzek, the Secretary of the State at the Ministry of Education and Science and Ewa Mańkiewicz-Cudny – this time only as the President of FSNT-NOT because Martyna Jachimowicz appeared the first time as the Editor-in-Chief of "*Technical Review*".

The Ballroom, as comprising about 250 guests, was filled to the very last seat. It included this year's Laureates (26 persons, i.e. somewhat more than previously) and the invited guests –

MINISTER INFRASTRUKTURY
Andrzej Adamczyk

Warszawa, dnia 30.03.2022 r.

Pani
Ewa Mańkiewicz-Cudny
Prezes Zarządu Głównego
Federacji Stowarzyszeń Naukowo-Technicznych
Naczelna Organizacja Techniczna

Szanowna Pani Prezes,

dziękuję za zaproszenie na uroczystość finałową XXVIII edycji plebiscytu o tytuł Złotego Inżyniera Przeglądu Technicznego. Żałuję, że ze względu na liczne obowiązki nie mogę wziąć udziału w tym wydarzeniu.
Plebiscyt przez te wszystkie lata zdobył zasłużoną renomę i jest wysoko oceniany zarówno przez środowiska biznesowe, jak i naukowe.

Dla inżyniera ważna jest nie tylko umiejętność konstruowania rzeczy nowatorskich, ale także sztuka opowiadania o nich – tę rolę pełni organizowany przez Państwa konkurs. Plebiscyt i tytuł Złotego Inżyniera są bardzo dobrą okazją do promocji i uhonorowania osiągnięć oraz kreatywności polskich inżynierów.

Gdy uczestniczę w różnych wydarzeniach, np. zakończeniu inwestycji drogowych i kolejowych, zawsze w pierwszych słowach dziękuję tym, którzy przyczynili się do ich realizacji, a więc polskim inżynierom i technikom. To bowiem od Państwa codziennej ciężkiej pracy, determinacji i odpowiedzialności zależy sukces realizowanych inwestycji. Chcę zapewnić, że Ministerstwo Infrastruktury docenia pracę polskich inżynierów.

Pragnę wyrazić zadowolenie, że również wśród tegorocznych laureatów znaleźli się inżynierowie reprezentujący różne specjalności, w tym komunikację oraz infrastrukturę. Bardzo się cieszę, że każdego roku tylu młodych ludzi decyduje się na podjęcie wyzwania i związanie swoją przyszłości z jedną z tak wymagających, lecz bardzo potrzebnych naszej gospodarce i obywatelom profesji z szeroko rozumianej branży techniczno-budowlanej.

Laureatów XXVIII edycji plebiscytu cechuje kreatywność. Często potrafią wychodzić poza utarte schematy. Są otwarci na nowe wyzwania. Jestem przekonany, że staną się oni godnymi spadkobiercami i kontynuatorami polskiej myśli technicznej tej klasy inżynierów co Ernest Malinowski – budowniczy kolei w Andach, Rudolf Modrzejewski – budowniczy mostów w USA, Stefan Bryła – pionier polskiego spawalnictwa czy Gabriel Narutowicz – jeden z prekursorów wykorzystania energii wodnej do produkcji energii elektrycznej.

Dzisiejsza sytuacja geopolityczna, a zwłaszcza inwazja Rosji na Ukrainę pokazuje, jak wielkie znaczenie mają takie inwestycje jak budowa drogi wodnej łączącej Zalew Wiślany z Zatoką Gdańską, budowa kolejowego tunelu średnicowego w Łodzi czy tunelu drogowego łączącego wyspy Uznam i Wolin. To dzięki pracy polskich inżynierów te inwestycje są sprawnie realizowane.

Dla przyszłości polskiej gospodarki kluczowa jest współpraca uczelni technicznych, biznesu i administracji państwowej. Cieszę się, że podejmują Państwo wyzwania związane z tą współpracą.

Życzę Pani Prezes oraz wszystkim Państwu wytrwałości na wybranej przez Państwa drodze oraz wszelkiej pomyślności w realizowanych przedsięwzięciach.

Z wyrazami szacunku
Andrzej Adamczyk

Ministerstwo Infrastruktury, ul. Chałubińskiego 4/6, 00-928 Warszawa
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PREZES
GŁÓWNEGO URZĘDU MIAR
prof. dr hab. Jacek Semaniak

Warszawa, 28 marca 2022 r.

Szanowna Pani
Ewa Mańkiewicz-Cudny
Prezes Zarządu Głównego FSNT-NOT

Szanowna Pani Prezes,

bardzo dziękuję za zaproszenie na Galę XXVIII edycji plebiscytu o tytuł Złotego Inżyniera Przeglądu, organizowaną przez Naczelną Organizację Techniczną.

Jestem głęboko przekonany, że działalność Naczelnej Organizacji Technicznej na rzecz nauki i techniki jest nieocenionym wsparciem dla twórczych wysiłków polskich inżynierów i techników. Dzięki aktywności w międzynarodowych wspólnotach i organizacjach, polskie środowisko techniczne jest reprezentowane nie tylko w kraju, ale również poza jego granicami a dbałość o ciągły rozwój współpracy przekłada się na wzmacnianie jego roli jako współtwórcy postępu cywilizacyjnego i zrównoważonego rozwoju.

Realizowana przez Naczelną Organizację Techniczną misja jest bliska wartościom Głównego Urząd Miar, który jako wiodąca instytucja w krajowym systemie miar również aktywnie angażuje się we współpracę z otoczeniem naukowym. Jestem przekonany, że trwałe wspieranie środowiska inżynierów i techników jest nieodzownym warunkiem efektywnego funkcjonowania społeczeństwa i konkurencyjnej gospodarki w skali krajowej, regionalnej i globalnej.

Będę zaszczycony mogąc uczestniczyć tym Wydarzeniu, niezwykle ważnym dla integracji środowisk zajmujących się nauką i rozwojem technologii.

Z wyrazami szacunku
Jacek Semaniak

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including ministers and heads of the central offices, laureates of the past years and the activists of the association from the whole territory of Poland. There was also present the representation of Publishing House SIGMA-NOT with the President of the Board, Magdalena Borek-Daruk.

The introductory speech was traditionally delivered by Ewa Mańkiewicz-Cudny who greeted the guests and recalled the ideas of the Plebiscite. After the mentioned speech, the Minister Andrzej Dera read out the letter from the President of the Republic of Poland, Andrzej Duda. Then, the floor was taken, inter alia, by the Minister Wojciech Murdzek and by the President of the Central Office of Measures, Prof. Jacek Semaniak. Besides it, the representative of infrastructure sector read out the letter from the Minister Andrzej Adamczyk; and the representative of the Marshal of Mazovian (Mazowieckie) voivodeship read out the letter from the Marshal Adam Struzik.

Honouring of Laureates was traditionally commenced from distinction of the "*Young Engineers*" and, then, Roman Czejarek who led the Gala, invited, successively, the distinguished persons, awarded with the statuettes of "*Silver*" and "*Golden*" Engineers". Last of the laureates received the distinction of "*Diamond Engineer*". This time, the mentioned honourable distinction

MARSZAŁEK
WOJEWÓDZTWA MAZOWIECKIEGO
ul. Jagiellońska 26, 03-719 Warszawa

Warszawa, 30 marca 2022 r.

Szanowne Panie

Ewa Mańkiewicz - Cudny
Prezes
FSNT – NOT

Martyna Jachimowicz
Redaktor Naczelna
„Przeglądu Technicznego"

Szanowni Państwo,

Serdecznie dziękuję za zaproszenie na uroczystość przyznania tytułów „Złotego Inżyniera 2021".

Gratuluję laureatom tego prestiżowego wyróżnienia. Jako wybitni wynalazcy, inżynierowie i twórcy techniki mają Państwo wpływ na rozwój ekonomiczny nie tylko naszego regionu, ale i całego kraju. Organizowany co roku konkurs, już trzecią dekadę promuje Państwa dorobek i zwraca uwagę na rolę jaką odgrywacie Państwo w budowaniu innowacyjnej i konkurencyjnej gospodarki. Państwa rozległa merytoryczna wiedza, kunszt i konsekwencja, owocują kreatywnym podejściem i spektakularnymi rezultatami.

Wspieranie działalności badawczo-rozwojowej jest współcześnie warunkiem budowania silnej, konkurencyjnej i wykorzystującej nowatorskie osiągnięcia techniczne gospodarki. Dlatego jako Samorząd Województwa Mazowieckiego tak bardzo wspieramy wszelkie inicjatywy z nią związane. Jestem dumny, że tak wielu kandydatów do tytułów to Mazowszanie, że na Mazowszu nie brakuje utalentowanych naukowców, którzy w pełni wykorzystują swój potencjał i stawiają na edukację oraz rozwój.

Serdecznie gratuluję nominowanym i laureatom. Życzę wielu nowych osiągnięć i pełnej satysfakcji z osiągania kolejnych, ważnych sukcesów.

Z wyrazami szacunku

was granted to Prof. Tadeusz Więckowski – the former Rector of Wrocław University of Science and Technology, who when playing the function (008–2016) was also the president of the Conference of Rectors of Polish Technical Universities. He is a prominent ICT specialist and also, doctor *honoris causa* of the Lvov Technical University and cooperates with the National Mining University in Dniepropeitrovsk, as well.

After the words of thanks which were delivered – in behalf of all Laureates – by Diamond Engineer from Wrocław, the diplomas were handed to two Honourable "*Golden Engineers*": 1. Dr Stanisław Latek, MSc., – passionate of nuclear energy; and 2. the construction technician from Świdnica, Waldemar Pytel playing also a function (something completely new!) of bishop of Evangelical Augsburg Church. His Eminence bishop was especially active during the traditional meeting of this year's laureates with the members of the Club of Golden Engineer, associating the Laureates from the previous years.

We should also mentioned that after termination of the ceremony of handing over diplomas and statuettes, a small party – snacks and refreshments – was prepared by Restaurant Awangarda, owing to the following sponsors: Activ company from Belsk, Trusted Information Consulting, Gränges Konin S.A., and Mazovian District Chamber of Construction Engineers, FSNT-NOT, companies: SIGMA-NOT, editor of *Technical Review* and Warsaw House of Engineer. We are grateful to all sponsors.

The Ukrainian successes of Polish anti-aircraft missiles defence system PIORUN (in Polish: thunderbolt) produced by Mesko company were not mentioned, so a separated article will be dedicated to these issue. On the other hand, many Laureates learned during the Gala that in the Ukrainian Mariupol the invaders bombarded the greatest European metallurgical plants. Who knows, perhaps it will be necessary to open again the already extinguished Polish metallurgical plants... We have a deficit, *inter alia*, of railway trails. Such information has confirmed the statement that war has changed everything.

Developed by Henryk Piekut
Photography by Janusz M. Kowalski

LAUREL OF INNOVATION

LAURY INNOWACYJNOŚCI

On May 30, 2022, in the Warsaw House of Technology NOT, the best innovative products were awarded named after Stanisław Staszic Laurel of Innovation, organized for the 10th time by FSNT-NOT.

The competition was held under the patronage of the Ministry of Development, Labor and Technology, the Ministry of Agriculture and Rural Development, the Central Office of Measures, the National Center for Research and Development, the Patent Office of the Republic of Poland, the Polish Academy of Sciences, the Polish Agency for Industry Development, the patronage of the marshals of several provinces and the media patronage of a group of magazines.

The aim of the competition was to promote innovative products, technologies and services. The organizers are convinced that the key to the development of the Polish economy should be precisely the promotion of innovative products and their creators, and assistance in the implementation of innovative solutions, which are supposed to contribute to the economic development and competitiveness of the Polish economy.

A nice tradition of this Competition was the Gala being conducted by the well-known and popular theater and film actress – Laura Łącz.

The guests and participants of the Gala – in addition to the winners and accompanying persons – were presidents, directors or representatives of patrons and partners, high-ranking representatives of the world of science and economy, as well as members of the FSNT-NOT Board, numerous representatives

of scientific and technical associations and journalists of public media.

The competition jury chaired by dr hab. Eng. Tadeusz Pawłowski, vice-president of FSNT-NOT, awarded 11 Laurels and 2 Awards to innovative projects in 7 competition categories. Statuettes, popularly known as "Staszice" and awards were given to the following companies:

- ***in the category of construction and public utility facilities, safety and fire services***, the Golden Laurel was awarded to the Central Institute for Labor Protection – National Research Institute (CIOP-PIB) for the project: Ecological flame retardant system for use in epoxy resin, and the Silver Laurel – MMT Małgorzata Tasiemska for the project: Quick Level Pro;

- ***in the mining and metallurgy category*** the Golden Laurel won KGHM Polska Miedź S.A. Division-Zakłady Górnicze "Polkowice-Sieroszowice" for the project: *Milling and peeling machine 3230-AD for maintaining the geometry of excavations and cutting breakout layers in underground mines*;
- ***in the IT category, the Golden Laurel software*** was awarded to ICsec S.A. for the project: *Scadvance XP – an IDS (intrusion detection system) solution for monitoring and early warning against cyber-attacks*, dedicated to industrial networks with industrial automation infrastructure;
- ***in the automation category***, the Golden Laurel was awarded to the Łukasiewicz Research Network – Industrial Research Institute for Automation and Measurements PIAP for the project: *SPDST traction network diagnostics system*;
- ***in the military technique category,*** the Golden Laurel was won by the Military Institute of Armament Technology for the project: *Special explosive charge "TAPIR"*, and the Silver Laurel by the Air Force Institute of Technology for the project: Implementation of the prototype of the Technical Condition Monitoring System for the Mi-8 helicopter. PCO S.A. received a distinction in this category. for the project: NPL-1T Thermal Binoculars;
- ***in the category of textiles, materials engineering***, the Golden Laurel was awarded to the Łukasiewicz Research Network - Institute for Engineering of Polymer Materials and Dyes and the Research Institute of Roads and Bridges in cooperation with the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Stuttgart for the project: *A new generation of zinc-pigmented paints with improved anti-corrosion, utility and ecological properties*, and the Silver Laurel – Poznań University of Technology, Institute of Materials Technology for the project: *A method of continuous production of biodegradable polymer granules reinforced with long fibers*;

- ***In the category of services and other solutions and innovations of a socio-economic nature***, the Golden Laurel was awarded to T-Master for the project: T-*MASTER System of Individual Waste Segregation (SISO)*, the Silver Laurel was awarded to the Motor Transport Institute for the project: *Development of an electric bicycle prototype for people with disabilities*. The distinction was awarded to KGHM Polska Miedź S.A. Głogów Copper Smelter Branch for the project: *Development and implementation of a modern method of improving employees' qualifications in the field of maintenance in the electrical industry*.

Developed by
Janusz M. Kowalski

CREATIVE YOUTH, I.E. THE FINALS OF THE ENGINEERS FOR INDEPENDENT POLAND AND YOUNG INNOVATOR COMPETITIONS

KREATYWNA MŁODZIEŻ, CZYLI FINAŁY KONKURSÓW INŻYNIEROWIE DLA NIEPODLEGŁEJ POLSKI I MŁODY INNOWATOR

On May 18, 2022, at the Warsaw House of Technology NOT, a gala was held with the winners and finalists summarizing two competitions for primary and secondary school students, organized by FSNT-NOT. The winners of the competition for the board game "*Engineers for Independent Poland*" and the 15th edition of the "*Young Innovator*" competition met

The "*Engineers for Independent Poland*" competition consisted in developing a board game devoted to the history of Polish technical thought, biographies and the achievements of famous inventors and constructors operating in the country and abroad. The aim of the competition was to recall the role of Polish engineers in the past and to disseminate knowledge about their contribution to the construction of the Second Polish Republic.

46 teams of young artists from primary and secondary schools (general secondary schools, technical secondary schools and first-cycle industry schools) entered the competition. In the three-stage qualifying rounds to the finals, the Competition Jury selected 10 works, which were assessed by the Jury, which included: Ewa Mańkiewicz-Cudny – chairwoman of the Competition Committee (president of FSNT-NOT), Bronisław Hynowski (president of the Society for Technical History and Culture) and Tomasz Misterka – game development expert. The youth showed exceptional knowledge, imagination and creativity in implementing ideas for creating both a board game and innovative solutions. The participants of the competition "*Engineers for Independent Poland*" significantly deepened their knowledge about Polish inventors and engineers, contribution to the construction of independent Poland and their involvement in the civilization development of the world.

Laureates of the competition for a board game entitled "Engineers for independent Poland"

In the primary school category:

- ***The team consisting of:*** Karolina Stelmachowicz, Michał Romaniuk, Filip Dziemidowicz from the Public Primary School named after Bolesław Krzywousty in Wolin won ***the first place*** for the game Engineers of Independent Poland, PSP Wolin, prepared under the supervision of Fr. Marcin Miczkuła, MA.
- ***2nd place:*** Maksymilian Sobociński from the Private Primary School with Bilingual Branches No. 2 in Krakow for the

game Engineers for Independent Poland, prepared under the supervision of Joanna Kozłowska, MA.

- *3rd place:* Małgorzata and Mateusz Drzewiecki and Milena Zdanowicz from Primary School No. 79 in Gdańsk for the game *Pyramid of Inventions*, prepared under the supervision of Mrs. Magdalena Bocheńska.

In the category of post-primary school:

- ***The team consisting of:*** Martyna Czekała, Aleksandra Weres from the Center for Vocational and Continuing Education in Strzelce Opolskie won ***the first place*** for the game "*Interwar Departure*" prepared under the supervision of Grzegorz Łukasik.
- *2nd place:* Kornelia Czaja, Weronika Gwóźdź from II High School for them. A. Mickiewicz in Słupsk for the game "*World of Inventions*" prepared under the direction of Iwona Tłuchowska.
- *3rd place:* Patryk Rutkowski, Maciej Szczęsny, Dominik Szumczyk from the School Complex no. 1 them. prof. B. Krupiński in Lubin for the game "*Engineers*" prepared under the supervision of mgr inż. Justyna Kędzis.

XV edition of the YOUNG INNOWATOR competition

For the 15th time, FSNT-NOT, together with the Association of Polish Inventors and Rationalizers (SPWiR) and the Society for Culture and History of Technology (TKiHT), organized the Polish Young Innovator competition. The competition was held under the slogan "*I have an idea for an innovative solution*" and the subject of the submitted idea could be any solution consisting in improving the existing one or developing a new project with the features of originality. The aim of the competition was to use and stimulate the creative abilities of children and adolescents.

SPECIAL AWARD THE PRESIDENT OF FSNT-NOT

Jan Ignacy ŁUBIŃSKI (3rd grade), Bartosz KOSTARCZYK (3rd grade), Robert MIŚKIEWICZ (3rd grade) from the 3rd Liceum Ogólnokształcące im. Navy in Gdynia for the "*EXTREMEBOX*" project, prepared under the supervision of Anna Rzepa, Jakub Zdroik, and Adam Nawrot, PhD

In the primary school category AWARD OF THE FSNT-NOT

Antoni JĘDRASZAK (4th grade) from the Primary School in Wierzonka for the project "*FULL OF BOWL FOR PUPIL*" prepared under the supervision of Ewelina Tyranowska, MA

1st place

Zofia CHRAPKO (7th grade) from the Primary School Janusz Korczak in Józefosław for the project "*MEASUREMENT OF THE INVISIBLE ELECTROMAGNETIC WAVE WITH A TAILOR METER AS A TEACHING AID FOR PHYSICS*", prepared under the supervision of MSc. Marian Chrapko.

2nd place

Monika NIEMIEC (7th grade) from the Primary School in the School and Kindergarten Complex in Paleśnica for the project "*AIR-CONDITIONED SUIT FOR A FIREFIGHTER*", prepared under the supervision of Andrzej Niemiec

3rd place

Ignacy JEZNACH (5th grade), Sebastian KRÓL (5th grade), Michał JĘDRASIK (5th grade) from Primary School No. 2 in Radzymin for the project "ECOLOGICAL AIR PURIFIER" prepared under the supervision of Aleksandra Starszak, MA

In the general secondary school category

1st place

Konrad OLIFIER (2nd grade), Michał ŁUKASZUK (2nd grade), Jakub KOKOSZKIEWICZ (2nd grade), Paweł BUCZYŃSKI (2nd grade), Ewa KARP (2nd grade) from the Academic Secondary School of the Białystok University of Technology for the project "*SENSORYCZNY TRANSLATOR" SIGN LANGUAGE - STJM ""*, prepared under the supervision of Grzegorz Nowik, MA

2nd place

Jan SZYDŁOWSKI (2nd grade) from the 1st Secondary School of General Education named after Fr. J. Kompałła and W. Lipski, Karolina BŁASZCZYK (1st grade) from the 3rd High School, Karol WIECZOREK (2nd grade) of the Technical School Complex in Ostrów Wielkopolski for the project "*HEALTHY FOOD ALL YEAR? YES - BIONIC CAPSULE – SALVINE*", prepared under the supervision of MSc. Tomasz Szydłowski, Marcin Grzybek, MA

3rd place

Alan SOLIŃSKI (3rd grade), Mateusz PIETRZAK (3rd grade), Szymon JANUSZEK (3rd grade) from the 3rd Liceum Ogólnokształcące im. Marynarki Wojennej in Gdynia for the project "*RACKET WITH DRAFT VECTOR CONTROL – EDUCATIONAL PACKAGE FOR SECONDARY SCHOOLS*", prepared under the supervision of Anna Rzepa, MA

In the technical school category:

1st place

Tytus SOKOŁOWSKI (3rd grade), Mikołaj STOLARCZYK (3rd grade), Kacper MURSZEWSKI (3rd grade) from the Mechatronic Technical School No. 1 in Warsaw for the project "*GPS (Green Power Segments). DESIGN AND CONSTRUCTION OF A MODULAR TEACHING POST ON RENEWABLE ENERGY SOURCES AND ITS USE WITH INSTRUCTIONS FOR EXERCISES*", prepared under the supervision of MSc. Eng. Kazimierz Okraszewski

2nd place

Bartłomiej OWCZARZ (4th grade) from the Complex of Technical Schools No. 1 in Ostrów Wielkopolski for the project "*SPOTBOT - INSPECTION ROBOT*", prepared under the supervision of Dr. Paweł Sobczak

3rd place

Mikołaj TUPAJ (3rd grade from the Mechatronics Technical School No. 1 in Warsaw for the project "*DESIGN AND CONSTRUCTION OF A HAND MOTION MODULAR TEAM FOR MECHANICAL HAND CONTROL*", prepared under the supervision of Kazimierz Okraszewski, MSc, Eng.

AWARDS BY THE ASSOCIATION OF POLISH INVENTORS AND RATIONALIZERS (SPWIR)

- Primary School category

Adrian DUDEK (7th grade) from Primary School No. 24 with Bilingual Units for them. Nicolaus Copernicus in Tarnów for the project "*ECOLOGICALLY HEATED STATION OF PUBLIC COMMUNICATION*", prepared under the supervision of Joanna Przygoda, MA

- High school category

Zofia DZIEKAN (3rd grade) from Secondary School No. 12 Henryka Sienkiewicza in Warsaw, Elżbieta DZIEKAN (3rd grade) from the Secondary School Complex for them. Adam Mickiewicz in Lubań Śląski for the project: "*BOOK – AID FOR THE HATCHING OF BIRDS THANKING OF EXTINCTION. AUTOMATIC AND AUTONOMOUS BOOTH WITH ECOLOGICAL INSULATION, INCUBATOR AND GRAPHIC ANALYZER* ", prepared under the supervision of Paweł Sokołowski, MSc

- Technical school category

Piotr NIERADKA (3rd grade) Michał ŁOKAJ (3rd grade) Marek GOŁĘBIOWSKI (3rd grade) from the Regional Center for Vocational Education in Nisko for the project "*DIGITAL SOUND PROCESSOR*", prepared under the supervision of MSc. Eng. Marian Chrapko

For the finals of the 15th edition of the competition, after two-stage school and district verification, a total of 62 individual and collective works, prepared by students of primary, technical and secondary schools, were qualified. Most, 36 applications were received from technical schools, 14 from primary schools and 12 from high schools.

The Competition Jury assessed the works in terms of ingenuity, originality of the solution, usefulness, impact on the improvement of safety conditions, availability of the materials used, aesthetics of workmanship, prepared documentation and design, and teamwork skills. It is worth emphasizing that all the works that passed to the third stage were of high quality and demonstrated the creativity of children and youth, as well as the great commitment of their carers. The works prove that young people have many great ideas, and the idea of the competition "I have an idea for an innovative solution" is understood by the caregivers.

During the Gala, the Association of Polish Inventors and Rationalizers (SPWiR) also awarded and presented the winners.

Developed by
Janusz M. Kowalski

16 LAUREATES OF THE 48TH OLYMPIAD OF TECHNICAL KNOWLEDGE

16 LAUREATÓW 48 OLIMPIADY WIEDZY TECHNICZNEJ

On June 8, 2022, at the Warsaw House of Technology NOT, a gala was held with the winners and finalist of the XLVIII edition of the Olympiad of Technical Knowledge closing school year of 2021/2022.

The Olympiad of Technical Knowledge has been organized since 1974 for secondary school students in two thematic groups; electric-mechanical and electric-electronic. According to the regulations, the competition is three-stage and scored. To qualify for a higher-level competition, a participant must earn no less than 50% + 1 of the possible points. 2279 students representing 230 secondary and technical schools participated in the 1st degree competition (school qualifying) on October 22nd last year. The competitors had to solve a test consisting of 15 questions and 3 tasks, after logging in individually on the internet platform prepared by NOT-Informatyka.

After the next qualifying rounds at the district level (04/01/2022), the participants of the 3rd degree competition – the central finals were selected. They took place on April 2, 2022 at the Military University of Technology.

Based on their results, the Olumpiad Main Committee selected 16 laureates of this year's edition, 8 in each thematic group. The organizers and sponsors of the Olympiad met with them and their guardians at the ceremony.

It is worth presenting the winners of the first places. In the mechanical and construction group, it was Stanisław Pańkowski, a student of the II Secondary School of General Education. Duchess Anna Jabłonowska née Sapieha in Białystok, whose guardian is Mr. Piotr Chomienia. On the other hand, in the electric-electronic group, the title of the laureate of the 1st place was won by Jakub Halfar, a student of the School Complex No. King Jan III Sobieski in Jastrzębie-Zdrój. Mr. Jacek Kluba was the tutor of the laureate.

Congratulations to the winners on their success.

Developed by
Janusz M. Kowalski
The member of the Main Committee of OWT

THE LAUREATES OF THE 35TH EDITION OF THE COMPETITION *NUMERUS PRIMUS INTER PARES*

LAUREACI 35 EDYCJI KONKURSU *NUMERUS PRIMUS INTER PARES*

Gala of Numerus Primus Inter Pares was held on June 8, 2022 in Warsaw House of Engineer. The purpose of the competition Numerus Primus inter Pares, organized for the 35th time by the Society of Culture and History of Engineering is to select the best number of technical and popular-technical periodical in respect of popularization of engineering knowledge and culture, dating back to the previous calendar year. The editorial offices themselves choose the number of the suggested periodical and they apply it for the participation in the discussed Competition.

This year's edition was attended by 8 publishers who submitted 20 titles in total.

The Jury of the Competition Numerus Primus, as acting under the guidance of Prof. dr hab. Czesław Waszkiewicz, Eng., appreciated highly the professional and graphic level and editorial shape of all sent journals. The Jury awarded the titles of Laureates, i.e. Numerus Primus inter Pares to the following publications:

- *In the group of the periodicals, popularizing science and technique*, the title of Laureate goes to number 3/2021 of the **WATER MANAGEMENT** (Polish: Gospodarka Wodna), publisher: SIGMA-NOT
- *In the group of specialized periodicals*, the title of the Laureate goes to:
  - number 1/2021 of **PAPER REVIEW**, publisher: SIGMA-NOT
  - number 3/2021 of **JOURNAL OF MACHINE ENGINEERING,** publisher: Publishing House of the Wrocław FSNT-NOT Council

Developed by
Janusz M. Kowalski
Secretary of the Jury of the Competition

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