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## MARKET DEVELOPMENT IN POLAND

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**Dear Readers!**

We have a pleasure to submit you the second, successive number of scientific quarterly „Packaging Review", presenting the research and development achievements and technological progress in packaging sector.
In parallel, Alfa-Print editorial office publishes on-line item "Packaging – Lexicon of terms" which covers the alphabetically arranged collection of terms and basic conceptions in the field of packaging, in Polish and English, together with the definitions or description and, in certain cases, drawings, illustrating the discussed problems.
The initiative of developing the mentioned elaboration has been a result of many signals from manufacturing enterprises and suppliers of packaging materials and packaging, as well as other organizational research and commercial entities, the state administration and self-governing organs and, also, from the Polish Committee for Standardization.
During the performance of the present work, the authors – together with Prof. Bohdan Czerniawski and Dr Joanna Karwowska – had the dictionary of packaging terminology at their disposal. It was developed in Germany and contained 4580 terms in six languages (English, French, Spanish, German, Russian and Italian), translated from German. It was bought and donated by extremely kind-hearted Dr Monika Kassman from the Dresden University who has cooperated for many years with the Research Packaging Institute. This fact has become a significant support for our publication. We wish to express our words of gratitude for this friendly gesture and we invite to reading!

**Hanna Żakowska**, the habilitated doctor of economic sciences in the field of commodity science (Faculty of Commodity Science at the University of Economics in Poznań), Associate Professor at the Packaging Research Institute. The author of numerous research and research and development works as well as publications in the following fields: bioplastics packaging, packaging waste management, packaging waste recycling and recovery systems, packaging from renewable sources, packaging life cycle assessment (LCA) and research on greenhouse gas emission indicators (carbon footprint ) for packaging materials and packaging, eco-design of packaging.

**Drodzy Czytelnicy!**

Przed Państwem drugie wydanie kwartalnika naukowego „Packaging Review", prezentującego działania badawczo-rozwojowe oraz postęp technologiczny w branży opakowaniowej.
Równolegle wydawnictwo Alfa-Print publikuje w postaci elektronicznej pozycję „Opakowania – leksykon terminów", która obejmuje uporządkowany alfabetycznie zbiór terminów i podstawowych pojęć z zakresu opakowań w językach polskim i angielskim wraz z definicjami lub opisem, a w niektórych przypadkach rysunkami ilustrującymi omawiane zagadnienia.
Inicjatywa przygotowania tego opracowania była rezultatem licznych sygnałów ze strony przedsiębiorstw produkcyjnych i dostawców materiałów opakowaniowych oraz opakowań, a także innych jednostek organizacyjnych, zarówno badawczych, jak i handlowych, administracji państwowej oraz samorządowej, a także z Polskiego Komitetu Normalizacji.
W czasie pracy nad Leksykonem dysponowaliśmy – wraz z prof. Bohdanem Czerniawskim oraz dr Joanną Karwowską – opracowanym w Niemczech słownikiem terminologii opakowaniowej, zawierającym 4580 terminów w sześciu językach. Zakupiony i przekazany przez współpracującą od wielu lat z Instytutem Badawczym Opakowań, niezwykle życzliwie usposobioną dr Monikę Kassmann z Uniwersytetu w Dreźnie, stał się istotnym wsparciem dla naszego opracowania. Za ten przyjazny gest wyrażamy jej swoją wdzięczność i zapraszamy do lektury!

**Hanna Żakowska**, dr hab. nauk ekonomicznych w zakresie towaroznawstwa (Wydział Towaroznawstwa Uniwersytetu Ekonomicznego w Poznaniu), prof. nadzwyczajny w Instytucie Badawczym Opakowań. Autorka licznych prac badawczych i badawczo-rozwojowych oraz publikacji z następujących dziedzin: opakowania z biotworzyw, gospodarka odpadami opakowaniowymi, systemy recyklingu i odzysku odpadów opakowaniowych, opakowania ze źródeł odnawianych, ocena cyklu życia opakowań (LCA) oraz badania wskaźników emisji gazów cieplarnianych (carbon footprint) dla materiałów opakowaniowych i opakowań, ekoprojektowanie opakowań.

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# POTENTIAL SOLUTIONS DEDICATED TO THE BIO-PACKAGING MARKET DEVELOPMENT IN POLAND – THE SIMBIO PROJECT RESEARCH FINDINGS

**ABSTRACT:** The paper presents results and conclusions from the qualitative identification and assessment of potential solutions to the main problems, barriers and causes for hindering the development of the food bio-packaging supply chains. It also provides a spectrum of solutions by presenting selected social innovations from other countries. In this way, it inspires and expands the interest in transferring innovative solutions to Poland. The paper provides a well-defined scope for continuing research and development work on the rapid prototyping of potential solutions in the SIMBIO project. It opens up opportunities for the development of social innovations of different nature: product, process, technological and organizational. It also proves that an open approach to innovation development and implementation in bio-packaging supply chains is a key to identifying solutions that meet the market stakeholders' needs. The concept of research has application values, as it integrates stakeholders from private and public sectors in the pursuit of creating and implementing innovations. **JEL:** D22, O35, Q01. **Acknowledgment:** This paper is an output of the science project "New Frontiers in Social Innovation Research: Social Innovation Management for Bioplastics", no. T-AP SI/SIMBIO/1/2020, financed by the National Centre for Research and Development (NCBR) in Poland, within the Trans-Atlantic Platform: Social Innovation Call programme.
**Key words: bio-packaging, packaging, supply chain, circular economy, social innovation**

**STRESZCZENIE:** W artykule przedstawiono wyniki i wnioski z jakościowej identyfikacji i oceny potencjalnych rozwiązań głównych problemów, barier oraz przyczyn utrudniających rozwój rynku bioopakowań do żywności w Polsce. Wskazano również szereg rozwiązań w formie innowacji społecznych zidentyfikowanych w innych krajach jako benchmark kierunków rozwoju innowacji na polskim rynku. Opracowanie stanowi opis prac badawczo-rozwojowych poprzedzających prototypowanie potencjalnych rozwiązań w projekcie SIMBIO. Otwiera możliwości rozwoju innowacji społecznych o różnym charakterze: produktowym, procesowym, technologicznym i organizacyjnym. Dowodzi również, że otwarte podejście do opracowywania i wdrażania innowacji w łańcuchach dostaw bioopakowań jest kluczowe dla identyfikacji rozwiązań odpowiadających potrzebom interesariuszy rynku. Wyniki badań mają wartość aplikacyjną, gdyż integrują one interesariuszy z sektorów prywatnego i publicznego w dążeniu do tworzenia i wdrażania innowacji.
**Słowa kluczowe: bioopakowania, opakowania, łańcuch dostaw, GOZ, innowacje społeczne**

## INTRODUCTION: *THE SCOPE OF THE SIMBIO PROJECT*

The project *New Frontiers in Social Innovation Research: Social Innovation Management for BIOPlastics* (SIMBIO) has been implemented in Poland by the consortium of the SGH Warsaw School of Economics and the University of Lodz. The project is provided under a grant from the National Center for Research and Development and granted as a result of a competition procedure in the Trans-Atlantic Platform: Social Innovation Call. SIMBIO is an international project of global nature and scope. The Polish researchers team cooperates closely with scientists from foreign academic centers such as Coventry University from Great Britain, Federal University of São Carlos from Brazil and Simon Fraser University from Canada. The project is scheduled in Poland from 01/09/2020 to 31/08/2022. SIMBIO is a unique platform for stakeholders cooperation aiming at the development of the bio-packaging market and its applications in the food sector. The project's main goal is to develop social innovations to meet environmental and social challenges in the use of bio-packaging in food supply chains, taking into account product entire life cycle and the principles of the circular economy.

## RESEARCH METHODOLOGY

The scope of the project covers four stages (Figure 1).

The first stage of the SIMBIO project 'Defining challenges' was aimed at identifying key activators, drivers and barriers to the application and co-creation of packaging eco-innovations. It was also focused on bio-packaging supply chain management as well as the life cycle management of packaging produced from bio-based and biodegradable polymers.To meet all these goals, extensive dialogue with the key stakeholders of food bio-packaging supply chains in Poland was carefully designed and conducted.

The second phase of the SIMBIO project 'Understanding problems' was focused on in-depth analysis and understanding of the main problems and barriers to the development of supply chains of food bio-packaging (including compostable packaging) in Poland.

The third stage of the project, implemented in the period from 01/07/2021 to 31/03/2022, was aimed at identifying potential solutions to meet the problems in managing the supply chains of bio-packaging (including compostable packaging) in accordance with the principles of circular economy in Poland.

The starting point for the implementation of the third stage was a list of four problems and barriers to the development of the bio-packaging market in Poland and their causes. The list was prepared on the basis of information and data collected during the second stage of the project. Work began with identifying which of them are the most important from stakeholders perspective. For this purpose, a survey questionnaire was created and then sent to all participants of the SIMBIO project with a request to complete it, in accordance with the experience, observed challenges and market needs. Based on the survey results, the most important barriers and their causes for the development of the bio-packaging market, which were the main subject of discussion during the second workshop in the project, were identified. In parallel, other research tools were developed in the form of research questions

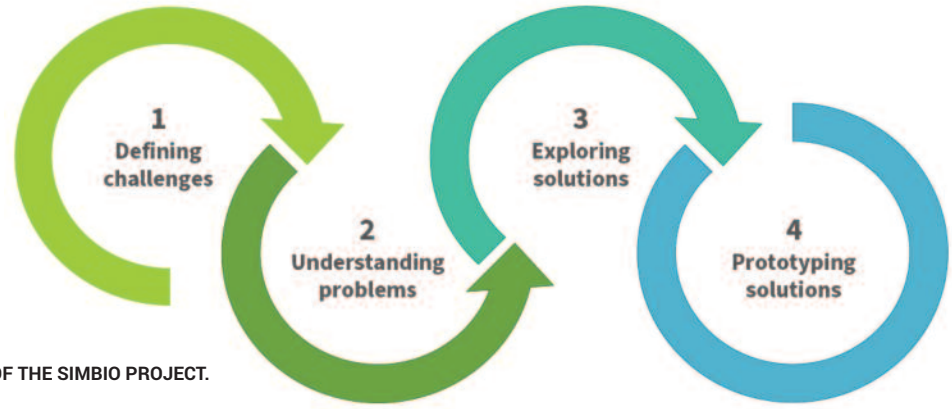


**FIG. 1. FOUR STAGES OF THE SIMBIO PROJECT.**

SOURCE: OWN ELABORATION.

and templates for collecting potential solutions, designed during the laboratory of cooperation on social innovations. In the next step stakeholders' representatives of the bio-packaging market were invited to participate in discussion panels organized during the 2 *Social Innovation Lab* workshop. The online panels were held on 28/01/2022 and 18/02/2022. An extended discussion was conducted in dialogue with 21 stakeholder representatives to identify concepts and innovations that are viable solutions enabling the management of supply chains of compostable packaging in accordance with the circular economy principles. Thanks to the assessment of new solutions, stakeholders selected social innovations with the greatest potential for rapid prototyping in the next stage of the SIMBIO project. As part of the third project's stage, team members conducted analyzes of the global market in search of innovative solutions used in the bio-packaging market. The stage ended with the preparation of the report and dissemination of the research results.

## RESEARCH RESULTS:
## *SIMBIO PROJECT KEY FINDINGS*

The main problems of the Polish bio-packaging market identified during the study are presented in Figure 2.

The key barrier to the first problem i.e., the insignificant share of bio-packaging, including compostable packaging, in the food packaging market in Poland, is the high price of bio-packaging in relation to the price of packaging made of plastics (table 1). The two main reasons for this barrier are (1) high prices of raw materials (3.5 times higher than the prices of conventional plastic raw materials), low availability of imported and domestic raw materials to produce bio-packaging, and high logistics costs related to the import of raw materials; (2) low demand for bio-packaging (resulting from low environmental awareness of consumers and difficulties in identifying such packaging). During the discussion, a set of solutions aimed at eliminating the two main causes of this barrier was developed. The most urgent solution identified during the panel was an increase in the number of production plants (producing bioplastics) in Poland and an improvement in their cooperation with research and development organizations. On the supply side, in the long run, this could have an impact on reducing the price of bioplastics by increasing the availability of domestic biopolymers for the production of packaging and reducing logistics costs related to the partial abandonment of their import. The solution could also lead to an increase in the production scale of bio-packaging but is found difficult to implement. The second solution proposed during the panel was to improve cooperation between supply chain stakeholders, including cooperation between manufacturers. It is worth emphasizing that, the respondents perceive this solution as difficult to achieve due to the reluctance to share information, know-how and low propensity to coopetition in a highly competitive, niche, early stage of market development.

The decisive barrier to the second problem, which is the low awareness and willingness of consumers to buy food products in bio-packaging, is the insufficient level of consumer knowledge about bio-packaging (including compostable ones) in a circular economy. The key causes of the barrier are the following two (1) the lack of consumer awareness of the importance of the packaging problem, accompanied by the lack of education (e.g. in schools, social media), information campaigns on bio-packaging (including compostable packaging), and the shortage of mobile applications supporting the dissemination of knowledge and waste segregation; (2) the lack of clear information on the packaging about its compostability. An urgent and important solution indicated by the participants is the inclusion of uniform information on the packaging on its compostability. Clear and visually legible information can perform two functions. On the one hand, it supports the consumer in choosing compostable packaging. On the other hand, it provides the consumer with information on how to manage the packaging when it becomes a waste. The labeling should take into account the possibilities and competencies of all consumers. The supporting activity is broadly understood education of children and youth, as well as adults and the elderly. For this purpose, innovative teaching methods can be applied, such as lectures with experiments, educational games, mobile applications, educational films, or additional waste management classes. It is important to undertake the education of all stakeholders in order to achieve the best


**FIG. 2. THE MAIN PROBLEMS OF THE BIO-PACKAGING MARKET IDENTIFIED IN THE SIMBIO PROJECT.**

SOURCE: OWN ELABORATION.

possible results regarding appropriate waste management, including compostable packaging.

The third problem is an insufficient social and environmental enterprise responsibility in packaging supply chains for a circular economy. It is determined by one main barrier described as insufficient cooperation between enterprises for the circular economy in the field of, inter alia, design and development of bio-packaging, including compostable food packaging. In fact, there is one fundamental reason inducing the above-mentioned barrier - a lack of cooperation between enterprises in the field of acquiring and sharing knowledge about bio-packaging and circular economy; a lack of joint R&D initiatives for bio-packaging resulting in difficulties in achieving economies of scale; lack of joint efforts to simplify and harmonize bio-packaging specifications; insufficient cooperation towards a single European standard; lack of interdisciplinary cooperation within enterprises. Workshop participants indicated three urgent solutions aimed at minimizing the above-mentioned limitations. The first one is designing a strategy for the empowerment of investments and entrepreneurship in the biopackaging market (including compostable packaging). The creation and implementation of a strategy defining goals, directions and pro-development assumptions would provide stable conditions for the progress of both entrepreneurship and innovation, as well as the cooperation in the supply chains of bio-packaging in accordance with the principles of the circular economy. Developing a strategy would be the basis for creating management instruments and tools, e.g. road maps and decision trees, for market participants who wish to develop their activities in the desired strategic directions. The second solution is the identification of leaders with the potential to initiate and foster the cooperation and with the ability to integrate stakeholders within the supply chain. This solution is aimed at using the leading position of selected links in the food packaging supply chains, the involvement of which can act as a catalyst for changes in the relationships of the bio-packaging market participants. Stakeholder representatives indicated large retail chains as potential leaders due to the scale of their operations, and their ability to influence many food and packaging producers, as well as their bargaining power in trade relations, that can effectively stimulate the development of the bio-packaging market offer, including compostable packaging, in the circular economy. The stakeholders' representatives also considered building an education system in the field of social and environmental responsibility, taking into account the principles of circular economy, not only end products but also their packaging, to be a very urgent, third, solution to implement.


**CLEAR AND VISUALLY LEGIBLE INFORMATION CAN PERFORM TWO FUNCTIONS. ON THE ONE HAND, IT SUPPORTS THE CONSUMER IN CHOOSING COMPOSTABLE PACKAGING. ON THE OTHER HAND, IT PROVIDES THE CONSUMER WITH INFORMATION ON HOW TO MANAGE THE PACKAGING WHEN IT BECOMES A WASTE.**

The fourth problem is the low level of development of compostable packaging waste management. The key barrier shaping this problem is the lack of uniform and transparent regulations regarding the planning and organization of closed-loop compostable packaging. It results from (1) legal regulations that are inadequate and insufficient for the market, often also inconsistent, and above all (especially in recent years) changing many times, and (2) the limited awareness of the implementation of the circular economy principles. One of the two most urgent solutions indicated by the stakeholders is the creation of a strategy for the development of the compostable packaging market (along with operational documents) as an important element of the bioeconomy development. The strategy would define the legal, financial and economic conditions in relation to the education, regulation and innovation pillars. The second urgent solution is the creation of an industry organisation for bioplastics (obtained from bio-based renewable raw materials) processors (and/or producers of compostable packaging). The organisation would play an important role in integrating internal and external stakeholders in the bio-packaging supply chains and leading regulatory lobbying activities. It would be a platform for dialogue and knowledge exchange, extensive consumer education, as well as joint initiatives, including research and development projects.

## DISCUSSION: *POTENTIAL SOLUTIONS FOR DEVELOPING THE BIO-PACKAGING MARKET*

The in-depth discussion with the stakeholder representatives revealed the multitude and diversity of potential solutions in the perspective of the strategic direction of the bio-based and biodegradable packaging market development in Poland. A strategic perspective is a foundation for designing solutions dedicated to particular problems, barriers and causes in private and public spheres. The nature of solutions and the expected importance of their impact determine the need for their co-creation by different stakeholders cooperating in various forms, e.g.: platforms or industry organisations. Considering the clear need for collaborative social innovation development in the strategic perspective to solve the most serious problems and barriers in Poland, we would like to suggest good practices observed on foreign markets based on the two key pillars, which are strategy and multi-stakeholder collaboration.

As a first example of the solution coming from foreign markets and worth following, we would like to present the strategic approach to the development of bioeconomy sectors in the United Kingdom. The UK has three complementary national development policy strategies, i.e.: *Growing the Bioeconomy. Improving lives and strengthening our economy: A national bioeconomy strategy to 2030*, an environmental plan *A Green Future: Our 25 Year Plan to Improve the Environment* and a strategy for bio-based packaging *Our Waste: Our Resources. A Strategy for England*. The bioeconomy development strategy articulates a collaborative approach between government, industry and the scientific community, particularly in biology and biotechnology, to transform the UK economy into a sustainable bioeconomy that does not depend on non-renewable resources. The strategy outlines a vision that by 2030, the UK will be a global leader in the development, production, use and export of bio-based solutions, encouraging investment and business, supporting innovation and economic growth [3]. In the same context, but more precisely focused on the compostable packaging market, it is worth pointing out the *National Compostable Packaging Strategy* in Australia. The strategy stresses the need to educate households on the proper segregation of compostable packaging and to educate

**TABLE 1. MAIN SOLUTIONS TO PROBLEMS, BARRIERS AND THEIR CAUSES.**

SOURCE: OWN ELABORATION.

| Problems I-IV | Main barriers | Causes of the barriers | Main solutions |
|---|---|---|---|
| Problem I: Insignificant share of bio-packaging, including compostable packaging, in the food packaging market in Poland | The high price for bio-packaging in relation to the price of packaging made of plastics: | High prices of raw materials (3.5 times higher than the prices of conventional plastic raw materials), low availability of imported and domestic raw materials to produce bio-packaging and high logistics costs related to the import of raw materials. | • An increase in the number of production plants (producing bioplastics) in Poland and an improvement in their cooperation with research and development organisations. |
| | | Low demand for bio-packaging (resulting from low environmental awareness of consumers and difficulties in identifying such packaging). | • An improvement of cooperation between supply chain stakeholders. |
| Problem II: The low awareness and willingness of consumers to buy food products in bio-packaging. | The insufficient level of consumer knowledge about bio-packaging (including compostable ones) in a circular economy. | The lack of consumer awareness of the importance of the packaging problem, the lack of education (e. g. in schools, social media), information campaigns on bio-packaging (including compostable packaging), and the shortage of mobile applications supporting the dissemination of knowledge and waste segregation. | • Simple and visually clear information on the packaging about its compostability as a source of education for the consumer (1) at the time of purchase (2) on how to manage packaging that is already a waste.<br>• Incorporating information on compostable packaging into existing waste management applications or creating new mobile applications.<br>• Education with the use of innovative teaching methods and additional educational classes on waste management (including packaging). |
| | | The lack of clear information on the packaging about its compostability. The participants of the discussion panel jointly proposed potential solutions to eliminate the key causes of the barrier. | |
| Problem III: Insufficient social and environmental enterprise responsibility in packaging supply chains for a circular economy | Insufficient cooperation between enterprises for the circular economy in the field of, inter alia, design and development of bio-packaging, including compostable food packaging | Lack of cooperation between enterprises in the field of acquiring and gathering knowledge about bio-packaging and circular economy; no joint R&D works for bio-packaging, no economies of scale; lack of joint efforts to simplify and harmonize bio-packaging specifications; insufficient cooperation towards a single European standard; lack of interdisciplinary cooperation within enterprises. | • Development of a national strategy for the empowerment of investments and entrepreneurship in the bio-packaging market (including the compostable packaging sector), including financial and regulatory stimuli.<br>• Use of the position and potential of selected internal stakeholders of food supply chains (especially retail chains) as leaders catalysing changes / driving changes on the packaging market.<br>• Education in the field of social and environmental responsibility provided by various and targeted at various stakeholders. |
| Problem IV: The low level of development of compostable packaging waste management | The lack of uniform and transparent regulations regarding the planning and organization of closed-loop compostable packaging | The legal regulations that are inadequate and insufficient for the market, often also inconsistent, and above all (especially in recent years) changing legal regulations | • Creation of a development strategy for the compostable packaging market with operational documents.<br>• Establishing an association of bioplastics processors (and / or producers of compostable packaging) obtained from biodegradable renewable raw materials |
| | | The limited awareness of the implementation of the circular economy idea. | |

consumers about the differences between biodegradable and compostable packaging. It is proposed to include information on desirable segregation of waste, including compostable packaging, in educational programs at the local level, as well as educational activities carried out by waste recipients in their operations. A good practice could be to educate children and youth indirectly, i.e.: through the choice of food bio-packaging used for school purposes. The development and implementation of similar strategies in Poland is possible but requires the commitment and involvement of external and internal stakeholders of bio-packaging supply chains representing both public and private spheres.

Stakeholders unite around various initiatives and collaborate to transform packaging supply chains. On the global stage, there are several examples that can be given to illustrate the scope of their collaboration. *The Plastics Pact Network* [2] is a global initiative where companies share responsibility for transforming their supply chain management in light of sustainable development requirements. On the one hand, it is worth noting the broad spectrum of the network's activities aimed at fulfilling the circular economy principles. On the other hand, it is worth noting the relatively limited attention has been given so far by its members to larger-scale research, development and implementation activities related to the use of compostable packaging. The global reach of the *Plastics Pact Network*, which influences and shapes the development trends of supply chains, provides an opportunity to see the leading role of companies (network members) in the growth of corporate social and environmental responsibility. This opportunity has also been opened in Poland by companies cooperating in the *Polish Plastics Pact*, striving for "a unique, multi-stakeholder partnership to implement systemic changes towards a closed-loop" [6]. The next interesting initiative to strengthen the bio-packaging market is the Austrian supply chain platform *Platform Verpackung mit Zukunft*, which integrates all groups of actors in the packaging supply chain, including bio-packaging: from raw material suppliers and producers to recyclers. Its overarching goal is to rationally manage packaging and seek the best solutions (for companies, consumers and the environment) based on the cooperation of all stakeholders [7].

An interesting initiative to support entrepreneurship in the compostable sector is the UK *Synthetic Biology for Growth Programme*. It consists of the creation of 6 centers of excellence in the UK and a GBP 10 million equity fund *(Rainbow Seed Fund)*. Support is provided to start-ups in the field of synthetic biology, including the development of new biodegradable materials [4]. Another example is the cooperation of waste treatment plants within the Swiss Association of Waste Management Plant Operators *(L'association suisse des exploitants d'installations de traitement des déchets, ASED)*. Approx. 6% of the affiliated organizations are involved in waste composting. The entity is committed to sustainable, responsible, ecological and professional waste management. It supports R&D initiatives for the development of the market for compostable waste [1]. Another example is the Italian composting association *(Consorzio Italiano Compostatori)* which deals with issues related to composting and biogas production and has introduced, among others, an optional label to ensure compost quality *(CIC Quality Compost Label)* or the *Circular Economy Network* operating in Italy [2]. In Poland, there is a lack of stakeholder collaboration focused on bio-packaging waste management, in particular for closing the life cycle through organic recycling (composting). A necessary condition for its initiation and application is to increase the scale of the compostable packaging market and the emergence of the need to coordinate activities in waste management in line with the circular economy principles.

## CONCLUSIONS: *SIGNIFICANCE OF SOCIAL INNOVATIONS FOR THE POLISH BIO-PACKAGING MARKET*

The SIMBIO research project is a unique study involving groups of key external and internal stakeholders of bio-packaging supply chains in the research process. The initially designed potential solutions are dedicated to specific problems, barriers and their causes of the Polish bio-packaging market. First, the research results revealed that collaborative innovation development is crucial to bio-packaging supply chain management in line with the circular economy principles. There is sufficient potential in Poland, to co-create social innovations

of different nature: product, process, technological and organizational. Second, the social innovation implementation also requires in-depth cooperation of stakeholders. Their collaboration is very important for the systemic transformation of the Polish bio-packaging market towards circularity. Third, collaborative social innovations in our country can be developed in a strategic perspective using good practices from foreign markets. However, they should be adjusted to the needs of domestic stakeholders and the possibilities of the Polish market. The SIMBIO research team takes into consideration the specificity of the domestic market while prototyping selected social innovations in the fourth stage of the project. The following three priority solutions were developed:

(1) national strategy of the compostable market development,
(2) industry organization and
(3) digital B2B multi-sided platform.

Each of the solutions is subject to rapid prototyping in cooperation with the stakeholders of bio-packaging supply chains. The development process is limited to prototyping main assumptions of innovations, without implementation projects.

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# MODULAR SYSTEM OF PRODUCTION OF PACKAGING OF SRP TYPE – TESTING OF PACKAGING IN DIFFERENT CONDITIONS. PART 2. – LOWERED TEMPERATURE

**ABSTRACT:** In the present paper, the results of the research on the resistance of packaging to a static pressure were discussed. The test was carried out on Plaform® trays without a barrier coating and with the application of UKAPhob HR 530 barrier at a reduced temperature, assuming a wide range of humidity. In order to determine the effect of the increased cardboard humidity on the value of resistance to a static pressure, the tests were carried out after air-conditioning of the packaging in six different climatic conditions.
**Key words: packaging boards, variants of research on the resistance to static pressure**

**STRESZCZENIE:** W artykule zaprezentowano wyniki badań odporności opakowań na nacisk statyczny. Badanie przeprowadzono na tacach Plaform® bez powłoki barierowej i przy zastosowaniu bariery UKAPhob HR 530 w temperaturze normalnej, przyjmując przy tym szeroki zakres wilgotności. Dla określenia wpływu zwiększonej wilgotności tektury na wartość odporności na nacisk statyczny, badania wykonano po klimatyzowaniu opakowań w sześciu różnych warunkach klimatycznych.
**Słowa kluczowe: tektury pudełkowe, warianty badań odporności na nacisk statyczny**

## INTRODUCTION

The contemporary packaging served not only a final wrapping of the product, or its protection during storage, transport or the protection of the natural environment from the harmful impacts of the discussed product. The application of packaging has become, for many years, subjected to transformations and to-day it has a more complicated status. It serves facilitation of production, transport and handling, sale and utilization itself of goods. It submits the information on the product and its application and consumer suitability and affects psychologically the consumer owing to its aesthetic values.

Producers and suppliers of packaging to the market employ the automated manufacturing process via the grouping and packaging systems, handlers and industrial robots, marking, labelling and film wrapping equipment and, finally, application of automated packaging and palletizing [1].

The present study was undertaken with the aim to conduct the tests of packaging, having the application in the market as "ready to be placed on the shelf" (SRP – Shelf Ready Packaging). It is a sort of grouped packaging which, apart from the transport function, play many other additional functions such as exposure or promotion. Their construction, properties and application

[1] Modular system of production of SRP type packaging – Testing of packaging, the tests conducted for PROTIM Ltd., Poznań

were discussed in the paper concerning the tests conducted at a normal temperature.

The planned cycle of the test of the packaging at a lowered temperature constitutes the second part of the project, aiming at the attempt to minimize the manufacturing costs of SRP packaging born by the producers as not to become a factor, significantly affecting the manufacturing costs.

Shelf Ready Packaging (SRP) is constructed in such a way that during the transport they are vertically stacked on the pallets. It is characterized by one of the basic resistance properties of the packaging employed in transport as well as during the storage and as a shop exposition. It is the resistance of the formed box to a static pressure and it is determined by Box Compression Test (BCT).

Testing of the resistance of the bow to a static pressure may be employed in evaluation of a given property of packaging in respect of its resistance to pressure or a degree of protecting its contents from the effect of crushing forces[2].

BCT test is a very good method for optimization of packing costs. We may therefore, obtain boxes with different resistance values from the same type of paper; it is determined by the technology of cardboard production. The corrugated cardboard is most frequently used in production of packaging.

The characteristic feature of the corrugated cardboard consists in its shape and level of wave; the height of the applied wave affects the properties of the corrugated cardboard. The higher is the wave, the better are the resistance parameters of the cardboard. A box that is made of such paperboard has a better rigidity but together with the increase in the height of the wave, the material consumption of the cardboard is also increased. For example, once commonly employed cardboard with a high "A" wave has good shock absorption properties and ensures relatively high stiffness of the box construction and resistance to a static pressure. Its further use is recommended but only in the cases of packing the products with a high sensitivity to mechanical damages, e.g. those made of glass. The cardboard


**SHELF READY PACKAGING, APART FROM THE TRANSPORT FUNCTION, PLAY MANY OTHER ADDITIONAL FUNCTIONS SUCH AS EXPOSURE OR PROMOTION.**

with a low "B" wave reveals a high resistance to crushing of the corrugated layer (FCT, Flat Crush Test) and should be employed e.g. in packaging of multi-piece products with a high weight e.g. tins with the preserved products or paints metal containers. We use, however, most frequently, the cardboard with "C" wave which has the intermediate values. In manufacture of double wall board or corrugated seven-layered board, the corrugated layers of different shapes are employed (e.g. B and C).

It is worthy to mention here production of paperboard with "G" microwave of 0.55 m height which has been employed in small unitary packages, obtaining a box with the walls of a high stiffness, dedicated e.g. for perfumes[3]. Also, the four-layered cardboard with "X" wave, being also called "Xitex" is the interesting solution. It consists of two flat external corrugated layers and two layers glued each other at the top sites of wave, with the wave higher than 0.8 mm than "C" wave. Such corrugated cardboard, as patented in Austria, is characterized by a high resistance to flat crushing and considerably lower

[2] PN-EN ISO 12048:2002 Packaging – Complete, filled transport packages – Compression and stacking tests using a compression tester

[3] Korzeniowski A., Commodity science of industrial products, Part III, Testing of the quality of products, Published by AE, Poznań 2006

material consumption as compared to double wall corrugated cardboard. The boxes made using the mentioned cardboard have good shock absorption properties and are more resistant to a static pressure that allows application of the cardboard with a lowered weight, with the preservation of the required resistance of the boxes[4].

The properties of multi-layered cardboards may be classified in few groups. They include strength, structural-dimensional and hygroscopic properties. The strength properties of the cardboard are greatly dependent on the length of fibres, their binding forces and the composition and type of fibrous raw materials, the employed adhesives, fillers and, also, external conditions during their use. The resistance properties are determined by testing of mechanical resistance of the cardboard; they include, inter alia: resistance to flat crushing (FCT, Flat Crush Test) and column crushing (ECT, Edge Crush Test), resistance to bursting bending and resistance to puncture (PET). In the case of determining the structural-dimensional properties, the conducted tests concern the composition and type of the raw material, thickness of the cardboard, type of wave and paper weight. The hygroscopic properties of cardboard consist in the easy absorption of humidity from the air and its return when the air is drier. In connection with the above fact, the content of moisture in the cardboard varies what affects the change in the parameters and, finally, the parameters of the produced packaging. Therefore, the cardboard packaging is tested in the standardized atmospheric conditions, most frequently at the relative humidity of 50±2% and temperature of 23±1°C. It is necessary to have the possibility of comparing the packaging made of different types of cardboards and with the different shapes.

## THE AIM AND THE SCOPE OF THE STUDIES

In the research part of the study, the program of the tests of Plaform® trays made of double wall corrugated board without barrier coating and with the application of UKAPPhob HR 530 barrier, was implemented. General assumptions of the research work consisted in determination to what degree the conditions of temperature and humidity of conditioning of the cardboard affected its properties and how the characteristics of the cardboard was changing together with the change in the mentioned conditions.

The tests of the resistance of the packaging to the static pressure (BCT) by the method specified in standard PN-EN ISO 12048:2002E[5] were conducted at a lowered temperature. The tests were carried out for six conditions of air-conditioning.

### PREPARATION OF THE SAMPLES

For the tests, the packages conditioned according to the criteria adopted for Stage 2 – Preparation of the samples at a lowered temperature, were used.

There were carried out 5 determinations for each Plaform® tray without barrier coating and with the application of UKAPPhob HR 530 barrier, successively for six climatic conditions.

### THE RESULTS OF DETERMINATION

The tests of boxes' resistance to a static pressure were conducted without the contents, until the loss of rigidity of packaging, with the registration of the level of compressing force at this moment, expressed in kN. The test of the resistance to the pressure determines the resistance of the package to compression. It is expressed by the value of force, acting directly

**TAB. 1. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 5°C, RELATIVE HUMIDITY RH 50%, BCT TEST WITHOUT BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 4,6 | 4,3 | 4,4 | 4,3 | 4,5 | 4,42 |

[4] http://ue.poznan.pl/data/upload/articles_download/22771/20140918/tekstura-falista.pdf

[5] PN-EN ISO 12048:2002 Packaging – Complete, filled transport packages – Compression and stacking tests using a compression tester

**TAB. 2. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 4,4 | 4,6 | 4,4 | 4,4 | 4,5 | 4,46 |

**TAB. 3. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 5°C, RELATIVE HUMIDITY RH 60%, BCT TEST WITHOUT BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 4,1 | 4,0 | 4,2 | 3,9 | 4,0 | 4,04 |

**TAB. 4. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 4,1 | 4,1 | 4,2 | 4,5 | 4,1 | 4,20 |

**TAB. 5. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 5°C, RELATIVE HUMIDITY RH 70%, BCT TEST WITHOUT BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 3,5 | 3,1 | 3,6 | 3,6 | 3,7 | 3,50 |

**TAB. 6. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 3,6 | 3,5 | 3,5 | 3,5 | 3,5 | 3,52 |

**TAB. 7. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 5°C, RELATIVE HUMIDITY RH 80%, BCT TEST WITHOUT THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 2,6 | 2,4 | 2,4 | 2,6 | 2,7 | 2,54 |

**TAB. 8. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 2,7 | 2,7 | 2,7 | 2,7 | 2,8 | 2,72 |

**TAB. 9. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 5°C, RELATIVE HUMIDITY RH 90%, BCT TEST WITHOUT THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 1,8 | 2,0 | 1,8 | 2,1 | 2,1 | 1,96 |

**TAB. 10. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 1,9 | 2,1 | 2,1 | 1,8 | 1,8 | 1,94 |

**TAB. 11. CONDITIONING BEFORE THE TESTS: 24 H, TEMPERATURE T 10°C, RELATIVE HUMIDITY RH 75%, BCT TEST WITHOUT THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 3,1 | 3,2 | 2,9 | 3,1 | 3,3 | 3,12 |

**TAB. 12. BCT TEST WITH THE BARRIER**

| No of sample | 1 | 2 | 3 | 4 | 5 | Mean |
|---|---|---|---|---|---|---|
| F [kN] | 3,3 | 3,2 | 3,2 | 3,3 | 3,1 | 3,23 |

on the box during its compression, causing its destruction or deformation.

The tests of the boxes' resistance to the pressure were carried out using Lorentzen& Wettre pres type CT 100 with mechanical drive. The mentioned press consists of two rigid flat plates. The upper plate is a mobile compressing plate. The maximum force of the pressure by the described equipment is equal to 100 kN. The rate of the press move during the test amounted to 5 mm/min.

## THE RESULTS OF THE TESTS

The results of the conducted tests have been given in tables and in diagrams, representing the range of the values of the examined parameters.

The tables show the results of the test of resistance to a static pressure (BCT, compression test) at a lowered temperature, successively for six conditioning variants for packaging - Plaform® tray made of paperboard without the barrier coating and with the application of the mentioned barrier.

## SUMMING UP

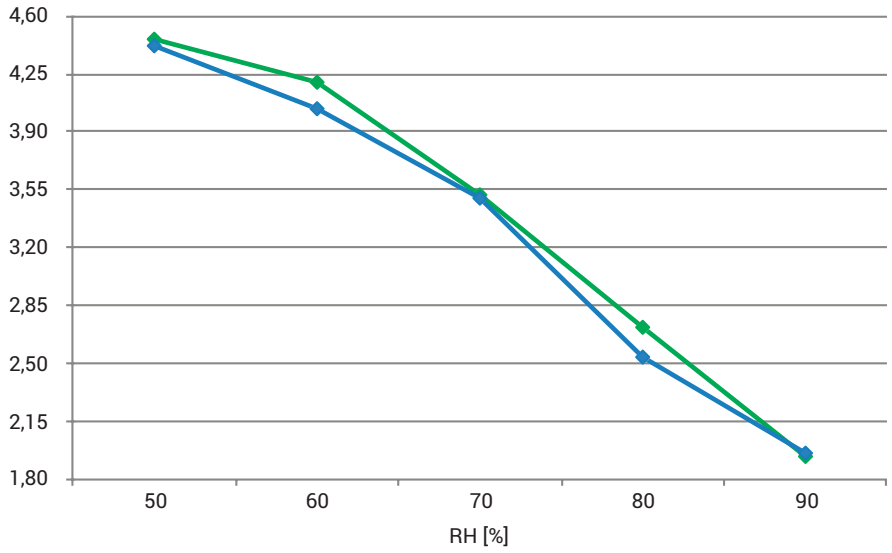
In Stage 2 – Testing of packaging at a lowered temperature, the determinations have been carried out and the results for Plaform® tray packaging made of paperboard without barrier coating and with the application of the mentioned barrier, successively for six climatic conditions have been submitted. The obtained values of determinations were given in the tables, showing the mean results for the selected climatic conditions.

BCT without barrier

The analysis of the results of the obtained values of resistance to a static pressure (BCT, box compression test) for Plaform® tray packaging indicates that the most favourable results were

**TAB. 13. BCT TEST**

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| BCT without barrier | 4,42 | 4,04 | 3,50 | 2,54 | 1,96 | 3,12 |
| BCT with barrier | 4,46 | 4,20 | 3,52 | 2,72 | 1,94 | 3,23 |
| RH [%] | 50 | 60 | 70 | 80 | 90 | 75 |
| Temp. [°C] | 5 | 5 | 5 | 5 | 5 | 10 |




**PIC. 1. THE OBTAINED VALUES OF DETERMINATIONS WERE GIVEN IN LINEAR DIAGRAM, ILLUSTRATING THE RELATION OF BCT VALUE DEPENDING ON DIFFERENT CONDITIONING VARIANTS.**

obtained for paperboard packaging with the application of barrier at the temperature of 5oC and relative humidity (RH) equal to 50%. Under the successively increased humidity conditions, BCT values were distinctly dropping for the paperboard without the barrier as well as with its application; the paperboard with the barrier revealed constantly better properties.

The obtained values of determinations were given in linear diagram, illustrating the relation of BCT value depending on different conditioning variants.

The analysis of the results of Stage 2 allows the conclusion that the conditions of packaging conditioning at various values of relative humidity affected significantly the results of determinations of the performed tests, both for packaging and paperboards without the coating and with its application.

When comparing the results for the selected conditioning variants and their mean values, certain regularities were recorded. The results of BCT determination for Plaform® tray packaging are most favourable for the conditions T=5oC and RH=50% for the packaging without coating as well as in the case of its application. Throughout the whole cycle of the test with the successive use of all conditioning variants, the more favourable results were decidedly obtained for the packaging with the barrier.

The above fact indicates that the circumstances of conditioning the paperboard have the effect on the results of the conducted tests. Higher values of relative humidity have a negative impact on BCT test, decreasing the resistance properties of paperboard. When analysing the obtained results of the performed determinations, we may observe that the highest differences were recorded in the comparison of the results obtained for the lowest and the highest conditions of relative humidity. <<

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4. PN-EN ISO 12048:2002 Packaging – Complete, filled transport packages – Compression and stacking tests using a compression tester

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# STRATEGIC AND PROCESS MANAGEMENT, SUPPORTED BY ERP CLASS SYSTEM – A NEW MANAGEMENT STANDARD

**ABSTRACT:** Strategic management is not universally employed by Polish entrepreneurs. What is interesting, the mentioned situation refers mainly to the sector of small and medium-size enterprises (SME). In such case, we should indicate the instruments supporting the process of introducing the strategic management solutions, especially ERP (Enterprise Resource Planning) class systems which support operational as well as strategic planning. The purpose of the present paper is to determine the needs of constructing the awareness of the entrepreneurs, mainly from MSP sector, in respect of strategic and process management supported by available ERP class systems. Lack of the mentioned awareness and lack of the flow of information on effect of vision, mission and processes causes a lack of basis for implementation of the assumptions of strategic and process management. Due to the above reasons, the discussed process should be supported by informatics systems of ERP class. Besides it, the enterprises seek nowadays for the methods of management which would allow optimum utilization of the available resources. It means that they try to find the answer to the following question: how to increase the number of the produced goods or the rendered services with the limited resources? The answer to the mentioned question has been given in the present paper.
**Key words: strategic management, process management, ERP class systems, SME sector**

**STRESZCZENIE:** Zarządzanie strategiczne nie jest powszechnie stosowane przez polskich przedsiębiorców. Co ciekawe, taka sytuacja dotyczy głównie sektora MSP (małych i średnich przedsiębiorstw). W takim przypadku należy wskazać narzędzia wspierające proces wdrażania rozwiązań zarządzania strategicznego, zwłaszcza systemów klasy ERP (Enterprise Resource Planning) wspierających planowanie zarówno operacyjne, jak i strategiczne. Celem artykułu jest określenie potrzeb budowania świadomości przedsiębiorców, głównie z sektora MSP, w zakresie zarządzania strategicznego i procesowego wspartego dostępnymi systemami klasy ERP. Brak świadomości i brak przepływu informacji o działaniu wizji, misji, procesów powoduje, że brakuje podstaw do wdrażania założeń zarządzania strategicznego i procesowego. Z tego powodu proces powinien być wspierany systemami informatycznymi klasy ERP. Ponadto, w obecnych czasach przedsiębiorstwa szukają metod zarządzania, które pozwolą na optymalne wykorzystanie dostępnych zasobów. Czyli szukają odpowiedzi na pytanie: jak zwiększyć liczbę produkowanych wyrobów czy też świadczonych usług przy ograniczonych zasobach? Odpowiedź na to pytanie została podana w tym artykule.
**Słowa kluczowe: zarządzanie strategiczne, zarządzanie procesowe, systemy informatyczne klasy ERP, sektor małych i średnich przedsiębiorstw**

## INTRODUCTION

The necessity of constant betterment of management systems is a condition, guaranteeing the development of enterprise. The elements connected with the strategic approach to organization development have a special meaning. The mentioned approach is directed not only to the big enterprises but also to the small and medium-size companies. The complexity and specificity of the small and medium enterprises (SME) makes that the companies are encountered before other (different than in the case of big organizations) problems, connected with management, especially with the strategic management. In the case of the small enterprises, their strategy is determined not only by the economic factors but also by those ones which result from the proprietary and inter-human relations (Cradazco, Niebles, Hernández, Hoyos, Santander De la Ossa, 2019). Strategic thinking has some mutually connected features: long-term orientation, systemic and integrating approach to solving the problems, and creativity. When concentrating mainly on

the characteristic systemic and integrating approach to solution of the problems, we think about ERP class systems (Kozlowski, 2015) which combine the strategic activities and other operations in the enterprise, for example, perceiving the enterprise as a system of processes, being closed related each other (Gelard and Ghazi, 2014).

In turn, the activity supporting the process orientation of the enterprises is aimed at constant search for the answer to the question: what is the role of the process orientation in the organizational development of a given enterprise and what are the areas of organization's functioning where the process orientation of the enterprises improves their organizational effectiveness (Baiyerea, Salmelab, Tapanainen, 2020)? Therefore, after some words of introduction, the implementation of the target of the present paper seems to be justified. The target is to indicate the need of constructing – among the entrepreneurs, mainly of SME – awareness of strategic and process management, supported by the available ERP class systems.

## METHODOLOGY

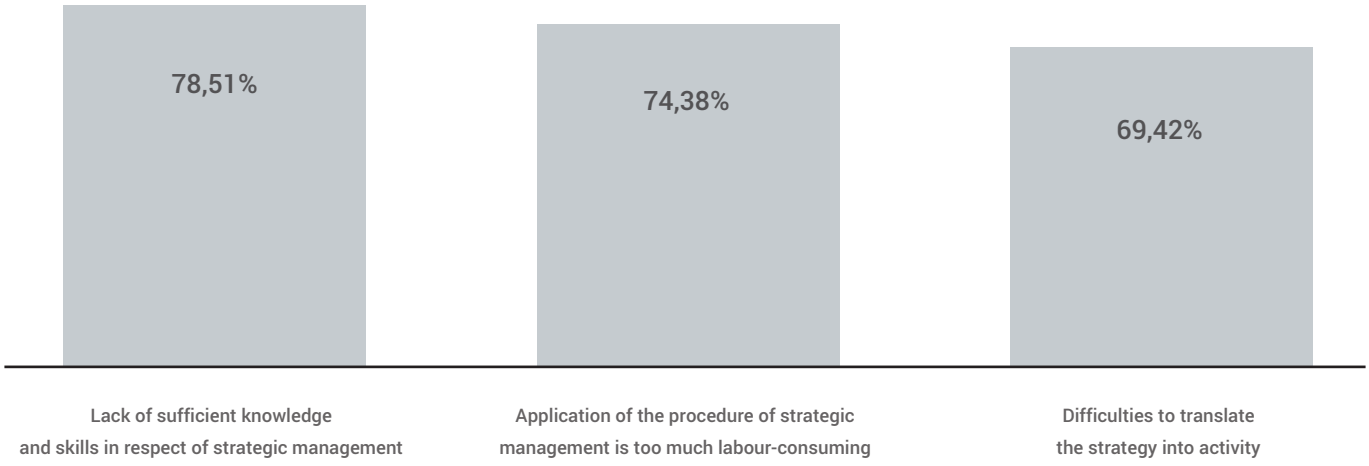
To evaluate the relations between the strategic and process management and the informatics system of ERP class, the following results were employed: a questionnaire survey and experts' assessment conducted among the transport service enterprises coming from the northern part of Poland. The mentioned survey was finally carried out and processed in 2017. The examined population included 560 SME units. Finally, the trial covered 400 enterprises, available due to the application of the survey questionnaire. There were returned 120 filled questionnaire which constituted the trial. The method of the experts' assessment allowed determination of long-term evolution of implementing the strategic management in small and medium enterprises (MSE) in the future. The group of 12 experts (representatives of business and science) helped also to evaluate the suitability of strategic management in the enterprises.

Besides it, the pilot-scale study was carried out among the intentionally selected 14 enterprises, being the leaders of the printing sector on the Polish market and, simultaneously belonging to the sector of small and medium-size enterprises. The mentioned study was conducted during the international fair RemaDays Warsaw 2020. It was performed in a form of direct survey questionnaire.

## STRATEGIC MANAGEMENT IN PRACTICE OF ENTERPRISE

The present intensive economic changes on Polish market are more and more difficult challenge to the stabile development and functioning of the enterprises. To act in the conditions of uncertainty and constant risk undertaking, the entrepreneurs and the managing staff should undertake the strategic actions with the aim to solve the problems, being critical to their presence at the market. In such situation, we should create own, unrepeatable conceptions of acting, referring to the present and future changes in the environment. One of such conception is just strategic management, that is, management in perspective of long period, with the fundamental consideration of phenomena in the environment (Nowicka-Skowron, Stachowicz, 2020). Polish small and medium-size enterprises are still learning such approach. The identification of the barriers which discourage the application of such practices is the significant task of the trial to indicate the effective method for introduction of the strategic management conception. The diagram below shows three main barriers, perceived by 120 small and medium enterprises, situated in the northern part of Poland. The transport service enterprises are dominating in the mentioned group.

The application of manager practices in SME is connected with the specified features. Firstly, it refers to the limitation of resources, especially in the period of time management and professional knowledge. It means that the routine of managerial practices is more requiring for small and medium enterprises than for greater companies. Secondly, the lack of the feeling of financial safety in the small and medium enterprises and their big dependence on the smaller number of customers require excessive attention of the managers in order to obtain the results. Finally, the more flat organizational structure requires playing many functions by the employees, with unclear limits and professional duties.




**THE ROLE OF BARRIERS TO APPLY THE STRATEGIC MANAGEMENT IN SMALL AND MEDIUM ENTERPRISES**

SOURCE: DEVELOPMENT PERFORMED ON THE GROUNDS OF OWN STUDIES

The implementation of the strategic management conception may be supported by the application of instrument of Balanced Scorecard (in Polish: SKW) which allows, inter alia, monitoring of the level of implementation of the assumed strategic (long-term) targets. Simultaneously, SKW creates the conditions for "crushing" the mentioned above barriers e.g. difficulties in transforming the strategy into activity. From the studies conducted in the European enterprises it is followed that the companies that employ SKW in management, obtain better financial results and represent a higher level of innovative solutions. Besides it, a positive effect of SKW on the obtained financial results is stronger in more well-established small and medium-size enterprises (Bochenek, 2019).

The Balanced Scorecard (SKW) in the enterprise may be treated as a key stimulus, used for control of organizational tensions, facilitating communication and supporting coordination. The mentioned SKW may also affect the development of innovative activity of the enterprise from the group of small and medium enterprises and, in consequence, increase of the level of competitiveness (Malagueño R., Lopez-Valeiras E., Gomez--Conde J., 2017).

Another area of the application of SKW includes the conception of controlling the enterprise in advance. Such approach allows constant studying of the discrepancies between the real state and the earlier fixed aim to be implemented in the future, bearing in mind facilitation of the decision undertaking and the permanent learning of organization. The advanced control has a preventive nature, anticipates hazards and leads to operational changes. The feed-back information improves monitoring of operation and promotes the immediate repair actions.

## PROCESS MANAGEMENT AS A NECESSARY CONDITION

The organizational development of the enterprises is shaped from the functional orientation, via the process orientation up to the event-directed one. Besides it, the process orientation of the companies is favourable for improvement of organizational effectiveness, reducing the intra-organizational discrepancies and, simultaneously, improving the coherence of inter-organizational relations (Chmielarz, Zborowski, Biernikowicz, 213). We may state that the more the organization is oriented to the processes, the higher its effectiveness is from the viewpoint of the inside of organization as well as of its environment.

Paul Harmon as being the main consultant and founder of BPT rends Associates has conducted the studies among the world scale enterprises, concerning the process management. The mentioned studies indicated the following most significant features and the meaning of the discussed conception: creation of the architecture of processes (39%), coordination of the activity

in respect of the changes in the enterprise processes (29%), undertaking of big projects and automation and robotization of processes (37%), implementation of the projects in respect of processes' improvement (38%). On the other hand, 65% of the surveyed enterprises indicated that the process management--supporting processes and technologies helped their organizations to improve efficiency, comprehensiveness and satisfaction of the customers. The majority of the respondents stated that their organizations were focused on a gradual improvement of the existing processes and automation of the processes in the enterprises. 59% of organizations participating in the survey are involved in one or more projects covering the total organization. 93% of the examined organizations are involved in many process-improving projects. 79% of the respondents utilized the instruments of process software for modelling of the analysed processes. The developed process models were utilized exclusively by the team for the transformation of the process but 22% of the respondents indicated that the models were available to all employees. The submitted results of the studies indicate the concentration of activity in respect of the process management in the strategic area (construction and betterment of the processes' architecture) as well as in the operational domain (within the frames of improving the processes and the related projects of their improvement and digitalization) (Harmon, Garcia, 2020).

In the present market conditions in Polish enterprises, the development of competences, and flexible adaptation to varying environmental conditions or search for new development possibilities are the necessity. The owners of organization should expect from the process approach as follows: abbreviation of the time of implementation of the orders, abbreviation of the time of introducing the new products to the market, improvement of the quality and keeping the terms, resulting from the agreements, lowering of the service costs, and increase of profit. The implementation of the process-oriented approach has an impact on perceiving the enterprise as "a living and dynamic organism", consisting of many significant and supporting activities, oriented to reaching the defined targets. Such approach in a given organization is favourable for improvement of its effectiveness and, what is more important, its efficiency (Hammer, 2015).

The problem of reengineering is also important in the activity of organization. For enterprise, it means a fundamental new rethinking and a radical transformation of designing the processes, leading to a breakdown improvement of the contemporary measures of reaching the results (such as costs, quality, service and rate). Four key words of the discussed definition are: fundamental, radical, dramatic and, first of all, process; this key word shows that the work in the contemporary organizations should be focused on processes and not on labour posts, functions or tasks. The managers should avoid concentration on single elements of the process (such as obtaining of order, purchase of materials necessary for a given operation, warehouse activities etc); they lose the sight of a wider i.e. delivery of the products to the customer. We should combine the mentioned single elements of the particular processes into one effectively functioning system (Anand, Fosso Wamba, Gnanzou, 2013). Here we absolutely need computer system of ERP class; it will be discussed more widely in the further part of the present paper. The particular operations entering the composition of the mentioned system are important but they have a small meaning for the customer if he does not obtain the ordered products. We may, therefore, say that Business Process Reengineering is a method for reversion of industrial revolution and constitutes a new beginning in searches for better models of labour organization. To meet the requirements of the more and competitive contemporary market, we need higher flexibility of internal business procedures and internal communication. The mentioned changes must include the total chain of internal communication, being dependent, of course, on the outside signals. The conception of process management may be certainly helpful in coping with the discussed challenge.

## STRATEGIC AND PROCESS MANAGEMENT AND ERP CLASS SYSTEM

The integrated computer system of ERP (Enterprise Resource Planning) class should be perceived as a system, optimizing business processes, both internal and those ones, occurring in

the nearest environment of the enterprise. It is manifested by offering of ready instruments, giving the possibility of automating the data exchange with the cooperating units in the total logistic chain. The confirmation of such method of interpreting the role of ERP class system may be found in the studies, conducted among the enterprises – participants of the International Fair RemaDays 2020.

According to the report of the Institute of Studies on Market and Public Opinion, it is considered (Bytniewski, Matouk, Hernes, 2018) that in Poland:

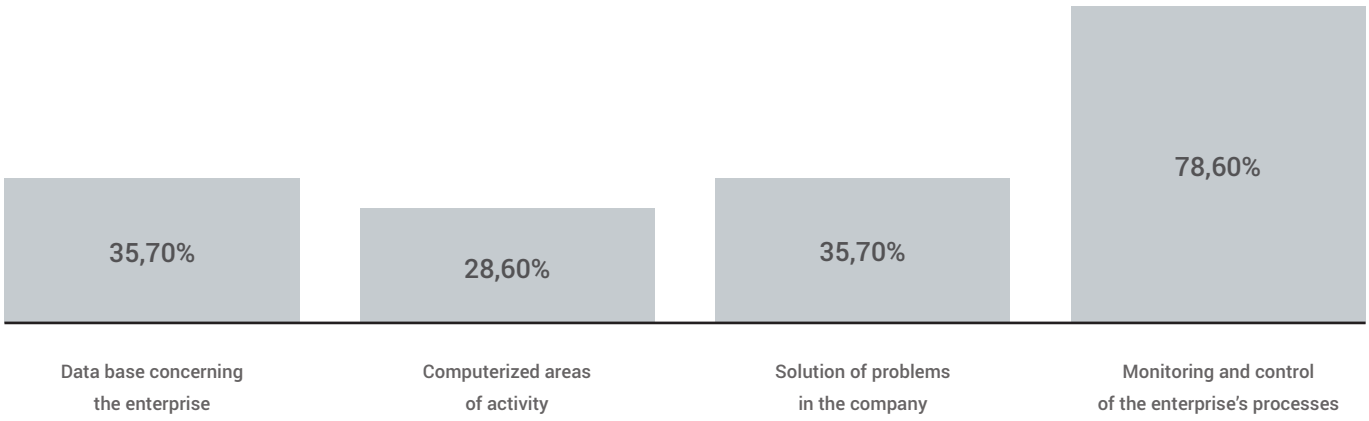
- 67% of the studies companies think that ERP system should be distinguished by the following features: practical suitability, connections with the service of business processes, optimization and automation of everyday tasks;
- 40% of the examined companies evaluate the possibility of adapting the system fot he structure of the company;
- 36% of the tested enterprises stress that ERP system should be a complex support for all areas in the company.

When taking the above results into consideration, we may observe that the role of connection of ERP class system with the service of business processes is found on the first place. We may, therefore, already now to state with a big conviction that idea of process management with the application of ERP class system is a fundamental factor responsible for the implementation success.

Nowadays, if we want, however, to construct a whole awareness of the complex support of all enterprise's activity with the application of ERP system, we have, in parallel, to be subjected to Fourth Industrial Revolution, being also called Industry 4.0. The system of ERP class is one of the elements of the mentioned revolution and, moreover, it allows the measurement of effectiveness of the employed solutions (Basl, 2017). Industry 4.0 in the contemporary enterprise should be found in the set of the key factors of the success.

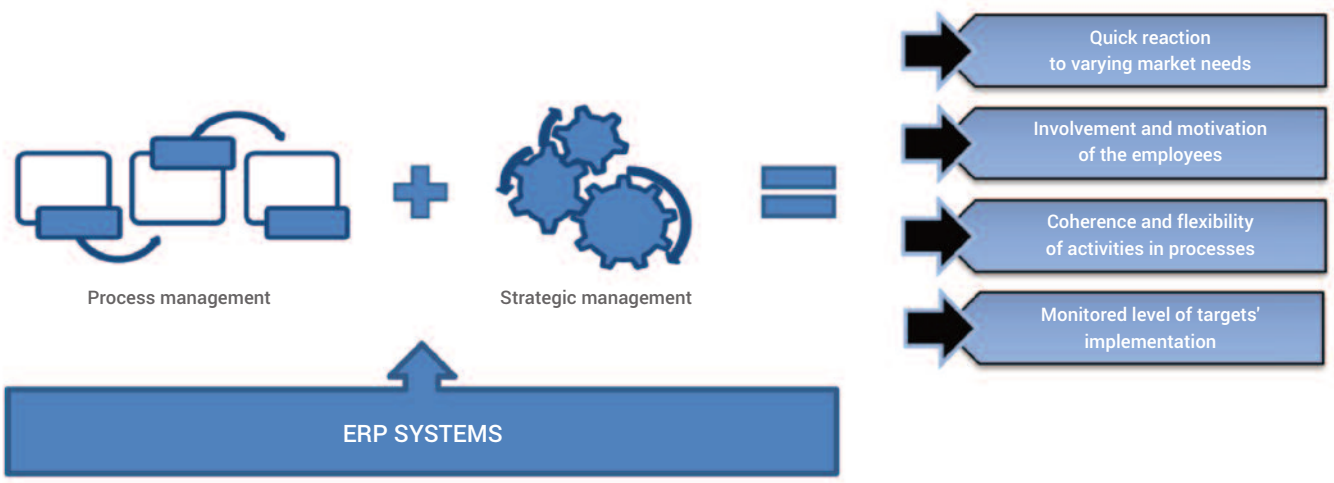
Introduction of ERP class system is the extremely requiring process. The preparatory phase is crucial for the whole process of implementing ERP. The more accurate the preparation is, the more successful the introduction process is, eliminating simultaneously the potential hazard to the company (Alavi, Peivandzani, Mirmohammadsagedhi, 2021). Firstly, the chosen ERP system must be adapted – in cooperation with the experts – to the nature of the company, type of activity, management of financial agenda and logistics. We cannot, of course, forget about verification whether a given company is managed by processes. If it is not so, we must absolutely introduce the mentioned conception. The choice of the appropriate ERP supplier has also a great impact on the success of implementation.

The answer to overcome the barriers not allowing introduction of strategic thinking in small and medium-sized enterprises means the appropriate hardware of the discussed conception; it is possible with the defined system of ERP class (Grochowski, 2019). We may also state that the strategic management exists outside the time, space and resources when supplying the innovative solutions of the rising problems of the company in




**MEANING OF ERP SYSTEMS FOR ENTERPRISE**

SOURCE: DEVELOPMENT PERFORMED ON THE GROUNDS OF OWN STUDIES




SOURCE: OWN ELABORATION

the field of competiveness. The strategic thinking includes some mutually related features i.e.: long-term orientation, systematic and integrative approach to solving the problems and creativeness (Ivančic, Jelenc, Mencer, 2021). When paying attention to "systemic and integrative approach to solving the problems", we mean ERP class systems. In such case, the function of combining the strategic activity and other operations in the enterprise is implemented. The discussed solutions exist already on the market although they function mainly in big enterprises. However, with the appropriate implementation of the mentioned solutions, there is a possibility of supporting small and medium-size companies (Haddara, Zach, 2012). The diagram given below shows the management model of the contemporary enterprise, including the problems discussed in the present paper.

The integrated RERP systems become the instrument driving the creation of new management standards and conceptions. They improve the business processes and strategies of the enterprises activities, owing to which their competitiveness is increased on the requiring and dynamic market (Estébanez, Trigo, Belfo, 2016). Therefore, the "prescription" for success of organization, irrespectively of its size, has been submitted.

## CONCLUSION

In ERP class systems, the implementation of the activity in the enterprise is measured by the creation of the detailed data base of information, constituting the basis for developmental plans in the long-term perspective (Ionescu and Podaru, 2014). They are the high-quality data which have a great meaning in undertaking the strategic decisions (Gullkvist, 2013).

The owners of the examined enterprises inform about the necessity of finding the answer to two important questions: "How to achieve the appropriate market position?" and "How to increase or at least maintain the level of the offered products in the situation of limited access to the resources?" Without elementary capacities of strategic and process management it is difficult to satisfy the mentioned needs.

Making an access to complex information on the processes of strategic and operational management to, first of all, employees of the enterprise is a meaningful solution for the contemporary companies. It means development of apparently simple management operation, that is, efficient communication inside the enterprise. In the implementation of such thesis, the computer system of ERP class may be undoubtedly helpful.

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PROF. EMERITUS STEFAN JAKUCEWICZ
DEPUTY EDITOR-IN-CHIEF OF THE PACKAGING REVIEW

# PACKAGING – LEXICON OF TERMS

In June 2022, the Publishing House Alfa Print Ltd., published on-line item "Packaging – Lexicon of terms", developed by Prof. Bohdan Czerniawski, Prof.Hanna Żakowska and Dr Joanna Karwowska. The mentioned Lexicon consists of 9 papers, which were published in the years 2020-2021 in the scientific part of the monthly "Packaging" (in Polish: "Opakowanie") and now they were collected in one publication.

As we can read in the introduction by Prof. Hanna Żakowska, the discussed publication includes alphabetically arranged collection of the terms and basic concepts in the field of packaging, in Polish and in English, together with the definitions or the descriptions; certain cases include also drawings, illustrating the discussed problems.

*Lexicon is aimed at facilitation of the communication of the specialists from different industrial sectors and of the technical arrangements connected with production and distribution. It may be helpful in running the trade negotiations and agreements concerning performance characteristics of materials and packaging and commercial orders and production* – Prof. Żakowska explains. – *In the contemporary economy, packaging is the indispensable element of the market; safety and quality of the products constitute, to a great extent, derivate of the appropriate packaging system, based upon the properly selected and designed packaging. It allows limiting the trade damages which may occur during various logistic processes in the way from the producer to the consumer. The basic function of packaging consists in protection of the contents in order to keep the quality, specified by legal regulations or expected by the customers. It means that majority of the products cannot be delivered without packaging. Apart from the mentioned protection, packaging implements also other significant functions such as promotion-marketing, logistics, information, utility and environment protection. It should be stressed the role of packaging in preventing the food loss and waste; packaging enables the effective use of resources and positively affects a reasonable management of the mentioned resources in all links of food chain (from production, processing, trade, gastronomy to the level of households).*

Although the packaging sector is usually perceived via the prism of attractive unit (consumer) packages, the collective (bulk) and transport packaging plays the important role in distribution channels. Owing to them, the processes of transport and storage as well as different handling operations are possible.

*A considerable progress made in the field of materials and packaging production, the contemporary functions of packaging, the packaging innovations, new technologies of packaging as well as legal regulations and standards connected with extended responsibility of the entrepreneurs for packaging waste have caused introduction of many definitions, developing the range of packaging terminology* – Prof. Żakowska mentions. – *For the recent years, the environmental issues, connected with the appropriate methods of the packaging waste management in compliance with the adopted recycling-preferring model of circular economy have become meaningful questions. Due to these reasons, certain*

*terminology doubts may appear, especially since the problem of packaging has a interdisciplinary nature, covering many legal and social problems, including also economic, environmental and material engineering issues.*

*The initiative of developing the discussed elaboration has been a result of many signals from manufacturing enterprises and the suppliers of packaging materials and packaging as well as from other organizational institutions, both research and trade entities, organs of the state administration and self-governing organizations and, also, from the Polish Committee for Standardization.*


Polish Standard PN-O-79000:1997, developed in the framework of Standardization Committee No 133, functioning at packaging Research and Development Institute (in Polish: COBRO) may be considered as the prototype of the national development in respect of packaging terminology, with the definition of the particular terms and diagram illustrations. The similar situation had place in the case of the earlier developed terminology dictionary [Feldman M., Polish--Russian-English-French-German Dictionary of basic concepts in the field of packaging, Warsaw, Central Technical Publishing Office, 1966]. It was a result of occurrence of newer and newer packaging solutions and constant supplementation; the updating was necessary and became implemented by the authors of the discussed publication.

During the performance of the present work, the authors had the dictionary of packaging terminology at their disposal. It was developed in Germany and contained 4580 terms in six languages (English, French, Spanish, German, Russian and Italian), translated from German.

***

You may order "Packaging – lexicon of terms" in PDF format directly at the Publisher, at the price of 50 PLN, + 5% VAT, writing to the following address: **bozena.kalbarczyk@opakowanie.pl**.

**OPAKOWANIA – leksykon terminów**

W czerwcu 2022 r. wydawnictwo Alfa-Print Sp. z o.o. opublikowało w postaci elektronicznej pozycję „Opakowania – leksykon terminów" autorstwa prof. Bohdana Czerniawskiego, prof. Hanny Żakowskiej oraz dr Joanny Karwowskiej. To zebrane w jednej publikacji 9 artykułów, które w latach 2020-2021 ukazywały się w części naukowej miesięcznika „Opakowanie".

# A NEW DIMENSION OF THE SECTOR DEVELOPMENT DURING THE VIII WARSAW PACK EDITION

**Warsaw Pack has been the most attractive event in the packaging sector for many years. The Edition of 2022 was a great success – it was visited by almost 10 000 participants!**

## THE INTERNATIONAL FAIR OF PACKAGING TECHNOLOGY AND PACKAGING WARSAW PACK – AS MANY AS 6 THEMATIC ZONES!

During the Warsaw Pack, the visitors could get familiarized with the complex offers of the greatest entities in the sector. We could distinguish a few thematic zones: packaging techniques, packaging, labels, labelling, printing, automation, e-commerce, logistics and storage. The technological process line was presented on more than 40 000 m3. All this was aimed at convincing the visitors that they obtained the complete knowledge on the development of the sector, on the competition, future of packaging industry, innovations and the existing trends.

## WARSAW PACK CONFERENCES MEAN THE PROFESSIONAL KNOWLEDGE OBTAINED FROM THE LEADERS OF THE SECTOR

If we speak about the knowledge, we cannot forget the conference zone, organized during the Warsaw Pack. The superior feature of the event consists in its complexity and focusing on development; there were also lectures and discussions concerning the future of packaging sector.

**Conference "Innovations in packaging"** was commenced by granting the awards to the laureates of the competition Pak Star. Later on, Maciej Nałęcz, the analyst from Santander bank, considered the condition, perspectives and impact of the war on the sector. Dr Jolanta Turek and Dr Beata Witeska indicated

**DURING THE WARSAW PACK, THE VISITORS COULD GET FAMILIARIZED WITH THE COMPLEX OFFERS OF THE GREATEST ENTITIES IN THE SECTOR.**


the directions of development of bio-packaging market and Dr Agnieszka Kawecka talked about its design. The recycling issue in the field of packaging was discussed by Andrzej Kornacki from Futamura; on the other hand, the market of our Ukrainian neighbours was characterised by Valeri Krivshey. The aspects of environmental protection were also the subject of speech of Krzysztof Wójcik, the manager of the team of packaging ecology at the Packaging Centre of the Institute of Technology in Łódź. The information about the trends and new technologies was delivered by Krzysztof Niczyporuk.

It was not, however, the end of the panels of professional knowledge during the Warsaw Pack. **The Conference "The Closed Packaging System"** was also a very popular meeting. It was divided into two thematic blocs: "Law and business" and "Packaging". The first one was commenced by the summing up by Magdalena Dziczek and concerned the amendments in legislation in 2021. The problems of taxonomy and its impact on business were discussed by the Advocate, Dr Radosław Maruszkin. Bartłomiej Morzycki delivered the speech on the effectiveness of the deposit systems.

The second thematic bloc was commenced by Marta Krawczuk from Rekopol who focused on the aims of the packaging recycling, Małgorzata Szymczukiewicz dedicated her speech to the innovative food packaging and Maria Jędrzejewska indicated the targets of recycling in the discussed sector in relation to the consumer's education.

## WARSAW PACK IN FIGURES

This year's edition of Warsaw Pak was a record. The event was visited by almost **10 000 participants** who paid a careful attention to the offers of 167 exhibitors. Moreover, they could admire as many as 156 machines and test 761 packaging solutions which will create the future of the sector.

## WHO COULD WE MEET DURING WARSAW PACK?

There were, inter alia, the representatives of the companies: Intrex, Pablo, Green Tree, Pol Pack, Kart, Teccon, Digital, 1Logistics Żuralski, Apacz Copacking, Beku Piast, Bizerba, Bosky, PolPak, Metro Catering System, ITA, La-Mar, Kakao and DBR 77.

## THE SUCCESSIVE EDITION OF WARSAW PACK IS COMING SOON!

The termination of the 7th edition of Warsaw Pack is the beginning of countdown to the next one. The enormous interest in the discussed event caused that as early as now the organizers may confirm that the next International Fair of Packaging Technology and Packing will be held on 18-20 April, 2023.

**Nowy wymiar rozwoju branży podczas VII odsłony Warsaw Pack**

Już od wielu lat Warsaw Pack jest najbardziej atrakcyjnym wydarzeniem w branży opakowań. Edycja 2022 cieszyła się dużym powodzeniem - wydarzenie zostało odwiedzone przez prawie 10 000 uczestników!

# PLASTPOL – A TRULY INTERNATIONAL EVENT IMPORTANT FOR THE SECTOR

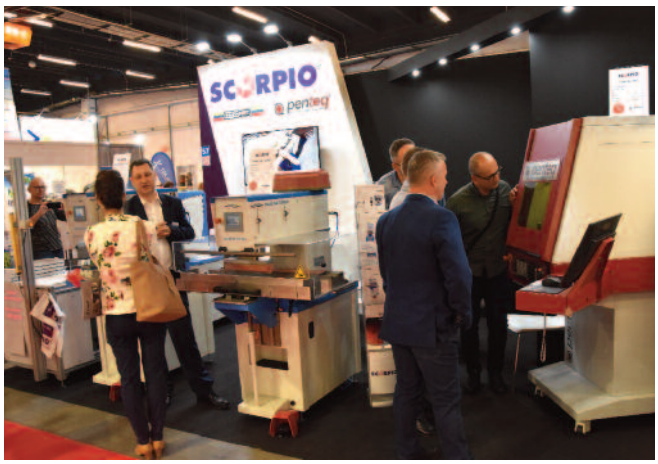
**The organizers of the Fair PLASTOL have summed up the newest, 26th edition which was held on 24 – 27 May 2022 in Kielce. As they convince, PLASTPOL is the Central Europe leader in respect of the events of plastics processing sector and the obligatory item in calendar of many national and international concerns. The same happened this year. Almost 10 000 m3 of exhibition space was visited by almost 400 companies from 26 countries.**

This year's edition of Plastics and Rubber Processing Sector PLASTPOL has significantly contributed to creation of the new supply and sale chains inside the sector of plastics processing sector; this statement may be supported, inter alia, by a successful visit of the representatives of Qatar and Angola who – during the Kielce Fair – sought for new investors not only from Poland but also from other European countries.

## GERMANY, ITALY AND NOT ONLY ... PARTICIPATE IN THE PLASTPOL EVENT

This year's edition passed under the sign of the increased participation of companies and institutions from important economic centres. For 26 years, German, Austrian and Swiss companies have perceived the Fair PLASTPOL as the site of acquiring important customers, search for new outlets and making the key business contacts. Kielce Fair was visited, inter alia, by the following companies: ENGEL, ARBURG, KRAUSS-MAFFEI, BATTENFELD-WITTMANN, EREMA, MEUSBURGER or EVONIK INDUSTRIES. Italy was also strongly represented. We could meet such enterprises as MORETTO, MEPOL, CONFINDUSTRIA POLONIA or AMBRA POLYMERS. The potential of Polish processing fair was also recorded by the international institutions. The Embassy of Angola as well as Qatar Development Bank and Qatar Financial Centre presented

**THIS YEAR'S EDITION PASSED UNDER THE SIGN OF THE INCREASED PARTICIPATION OF COMPANIES AND INSTITUTIONS FROM IMPORTANT ECONOMIC CENTRES. FOR 26 YEARS, GERMAN, AUSTRIAN AND SWISS COMPANIES HAVE PERCEIVED THE FAIR PLASTPOL AS THE SITE OF ACQUIRING IMPORTANT CUSTOMERS, SEARCH FOR NEW OUTLETS AND MAKING THE KEY BUSINESS CONTACTS.**



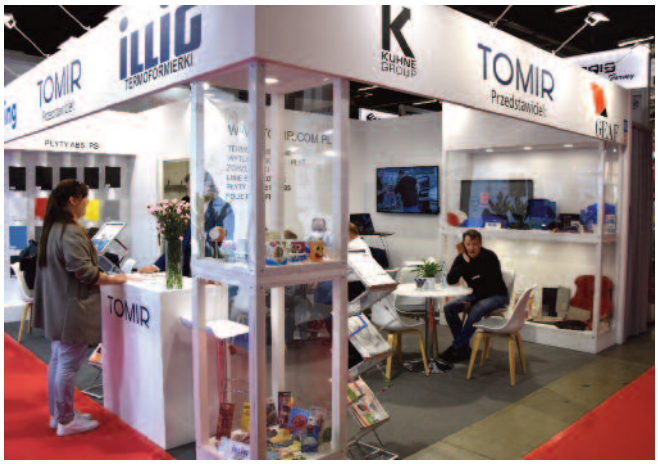

their economic potential, not only by showing their exhibition at the Fair but also by organising series of meetings, dedicated to the possibilities of investing in the mentioned countries.

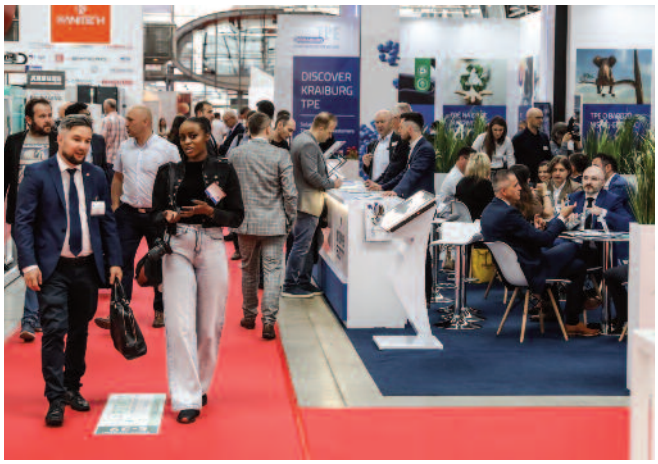
## POWER OF KIELCE FAIR

The events, organized in the Kielce exhibition space are based not only upon the abundant thematic offer and the possibility of developing business contacts but also on the attractive conference offer – a source of specialised knowledge. The same situation is in the case of PLASTPOL. Similarly as in the previous years, the event was commenced by the conference, conducted by Foundation Plastics Europe Polska which, on this occasion, submitted its annual report concerning the situation of plastics and rubber processing sector. Technical seminar PLASTECH-INFO was also valuable and interesting event. The thematic range of the meeting was greatly referred to the recent, unusually dynamic development of manufacture engineering of plastic products, first of all, by injection method.

## IMPORTANCE OF RECYCLING FOR THE SECTOR

Similarly as in the previous years, the subject of recycling and, more precisely, of action conducted in the chain: a producer







– institutions – consumer was discussed. The conference "Plastics recycling – one target, many possibilities" was dedicated to the mentioned subject. The meeting was organized by the Waste Management and Recycling Cluster – National Key Cluster. One of the topics included utilization of platforms for investigation of the circulation of raw materials and recyclable ones on the example of platform RecoTrace.

During the meeting, the opinions were expressed by the experts in the field of plastics processing and plastics recycling, associated inter alia in Foundation Plastics Europe Polska. We should mention here such names as Anna Kozera-Szałkowska, managing director of Plastics Europe Polska, Andrzej Kubik from GPR GUMA and Plastik Recycling and, also, Kazimierz Borkowski from Ambiente.

**PLASTPOL prawdziwie międzynarodowym wydarzeniem dla branży**

Organizatorzy targów PLASTPOL podsumowali najnowszą, 26. edycję, która odbyła się w dniach 24-27 maja w Kielcach. Jak przekonują, PLASTPOL to środkowoeuropejski lider imprez branżowych przetwórstwa tworzyw sztucznych i obowiązkowy punkt w kalendarzu wielu krajowych i światowych koncernów. Nie inaczej było w tym roku. Blisko 10 tys. m2 powierzchni wystawienniczej odwiedziło prawie 400 firm z 26 krajów świata.

# Packaging Review

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  - informs the Author that the review has been submitted to the journal (when the reviewer states that the article does not require corrections or it requires only minor editorial corrections),
  - forwards the review with critical comments to the Author, who is encouraged to make corrections suggested by the reviewer. If the Author disagrees with certain remarks, he/she is under obligation to prepare response letter substantiating his position.
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- Non-scientific articles do not need to be reviewed and they are accepted for publication by the Editor-in-Chief.

## INFORMATION FOR THE AUTHORS

We kindly ask to submit to the editorial office author's application form available at www.packagingreview.eu with contact details, a title of the proposed article, number of pages, illustrations and tables as well as a brief abstract. After receiving information about the acceptance of the proposed article please submit the entire text prepared according to the editorial instructions as well as a complete declaration form. Submitted articles are subjected to editorial assessment and receive a formal editorial identification number used in further stages of the editorial process. Every submitted article is reviewed. Publication is possible after receiving positive reviews.

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- Articles for publication in „Packaging Review" should have scientific and research character and focus on innovations, trends and challenges of the industry.
- Articles must be original, not previously published (if the article is a part of another work i.e. PhD thesis, habilitation etc. the information about that should be placed in the reference section).
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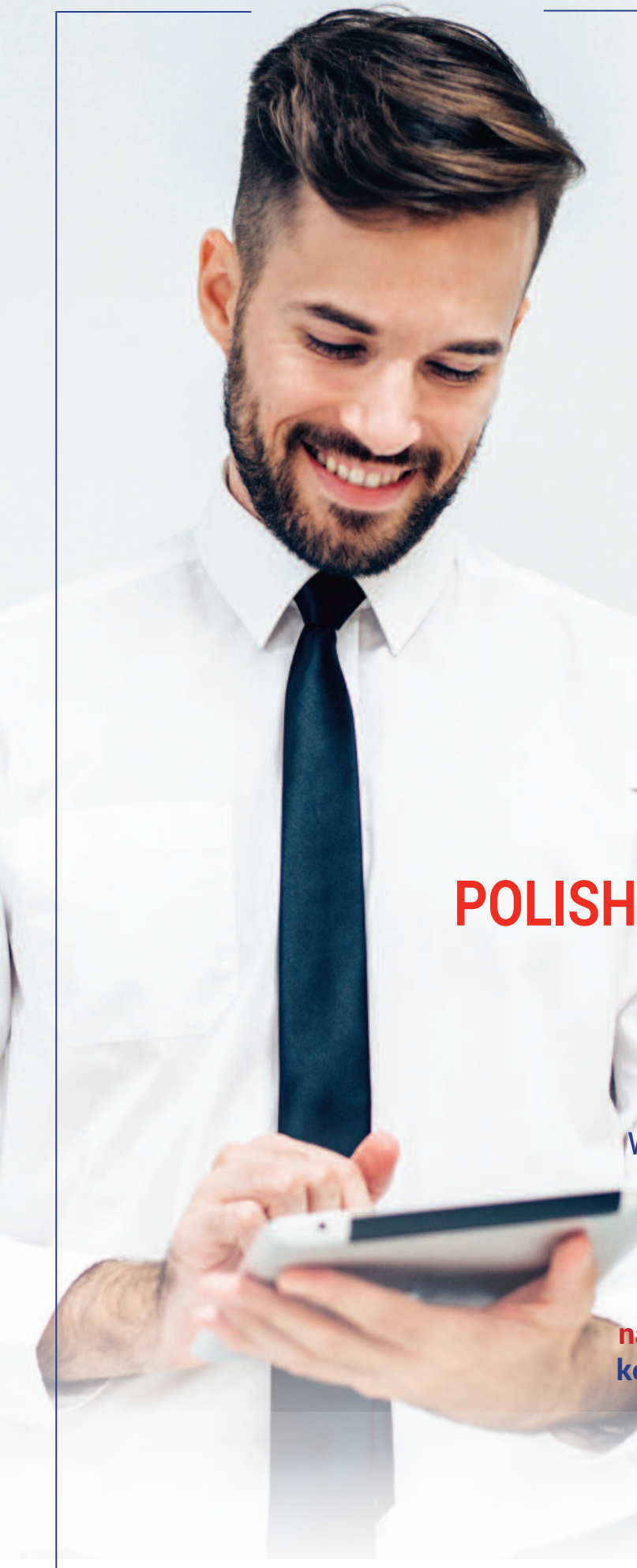


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