

Mariusz Salwin¹, Jan Lipiak², Michał Przeczka³

Warsaw University of Technology
Faculty of Production Engineering

¹e-mail: mariusz.salwin@onet.pl

²e-mail: janlipiak@etigraf.pl

³e-mail: m.przeczka@wp.pl

Product-Service Systems as an Opportunity for the Enterprise Producing Injection Molds

JEL codes: L60, M11.

Keywords: Product-Service System, product, service, servitization

Summary. The aim of this article is to present the results of the literature analysis concerning products, services and production and service systems. On the basis of the analysis the differences between the product and services as well as the most important features of PSS systems were presented. Using the literature analysis, a conceptual model of a PSS system for a manufacturing company was created and discussed.

Introduction

The changes in the global economy, such as fast development of the service sector and servitization of the economy, together with strong competition among entrepreneurs and the demand for customers, are forcing producers to implement new solutions in their companies. Moreover, the clients' needs are becoming more and more complex. These needs are no longer met by the product itself, but by its utility, possibilities and results that it provides. The combination of all these factors prompts companies to go beyond production, to focus also on services and development of new solutions. An example of such solution are product-service systems, which combine the features of the manufactured products and the whole

set of services associated with them, provided by the given production company. Providing the systemic solutions based on the combination of services and physical products is not only a possibility for a production company, but it is becoming a necessity to increase revenues and ensure a competitive position on the market. The goal of the article is to present the issues concerning products, services and product-service systems as business solutions for both producers and customers. The paper also aims at showing a conceptual model of a product-service system for companies producing injection molds and their clients.

The concept of a product

The product is a very dynamic category with different degrees of complexity. The marketing concept defines a product as a set of features and properties serving satisfaction of specific needs of the buyer, owner or user. In the economic meaning a product is an outcome of a production process, satisfying the consumer's needs. Holistically speaking, products can be: services, ideas, physical things, organizations, projects, meetings and other creations of human potential, interacting with the environment (Malcolm, Hugh, 2013, p. 45).

In the marketing theory, on the other hand, a product is anything that satisfies the human needs and what can be offered on the market. In other words, anything, service, idea or a connection of these elements, that can be an object of a market transaction. A product is a set of material and immaterial features including usability and functional, psychological and social benefits. For a manufacturer, a product is something that must be sold with a profit, whereas for the consumer, it is everything that can bring him satisfaction or provide some benefits (Boothroyd, Dewhurst, Knight, 2011, p. 30).

It is possible to distinguish various elements of a product, which together form the whole piece. An exemplary concept presents three components of a product:

- a) the core – includes the elementary benefits referring to customers' needs, it is the essence of the product;
- b) the real product – is made out of elements influencing the customers' perception of the product, among the mentioned components quality, brand, material, customer service or price can be distinguished;
- c) the extended product – consists of additional benefits for the client, including: spare parts, delivery, user manual, warranty, credit, service (Michalski, 2009, p. 167).

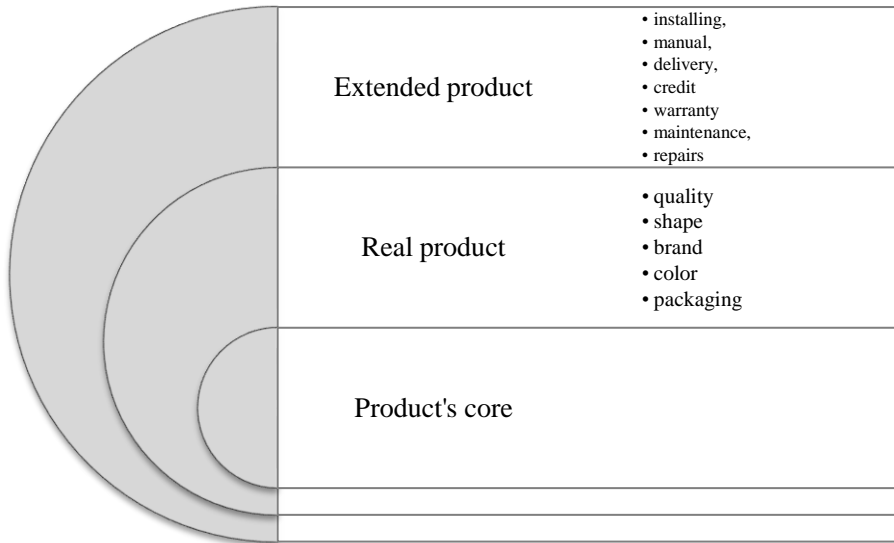


Figure 1. Product level structure

Source: Mruk, Pilarczyk, Szulce, 2005, p. 105.

Products can be divided into consumable and industrial. Consumable products are purchased in order to satisfy the individual needs of the buyer, the needs of his family or household. Industrial products, on the other hand, are purchased for the needs of producers, service enterprises, intermediaries and other organizations (Michalski, 2009, p. 169).

Characteristics of services

In the classical understanding, a service is defined as all activities that are directly or indirectly related to the satisfaction of human needs, however not to the production of objects (Lange, 1959, p. 50).

A service can be defined as a set of actions aimed at providing service content through service channels from their suppliers to their final recipients. A service is an activity in which the service provider seeks to change the existing state to the new one, requested by the customer (Sakao, Sandstrom, Matzen, 2007, pp. 590–604).

Another possibility is to describe a service as a set of functions offered to the client by the company. It is the effect of the activities carried out between the service provider and the client. In other words, a service is a number of activities done by the service provider in order to satisfy the customer’s needs (Hollins, Shinkins, 2009, p. 23).

A service can be presented as any activity or benefit one party may offer to another. In the most cases it is immaterial, it does not lead to obtaining property. The process of providing a service may be related to a material object, but does not have to (Kotler, 1994, p. 465).

Thanks to the service, a new value is created or the value of already existing material product is enhanced (Flejterski, Panasiuk, Perenc, Rosa, 2005, p. 41). Services may arise in the processes of providing (customer service), manufacturing, delivery of value (tangible or intangible), sales, including the buyer into the process (the buyer is part of this process, without him obtaining the result of the service is impossible) and experiencing a service (it is based on trust or material confirmation of service provision) (Borowski, Gaworski 2009, p. 28).

The service is a benefit or intangible activity, which is offered by one party to the other one. In comparison with the product, it does not necessarily have to be related to the sale of goods or services that can be purchased.

Differences between the product and the service

The first feature differentiating the product and the service is tangibility. The product is a material thing, it can be measured, touched, smelled and the client is ready to buy it at a specific price, while the service is immaterial, it cannot be seen or touched, it is a result of human activity. The next difference is the property right. The product is someone's property and can be resold to another person, e.g. house, flat, car. The service is not transferable and cannot be resold to another person. The service is the benefit offered by another person. Another issue differentiating a product and a service is the way of evaluation. The product is tangible, therefore it is easy to evaluate it. The items can be touched, they have some shape and appearance, quality, durability so that a client can immediately assess one. The evaluation of services is more difficult. Different service providers have different attitudes towards their activities so that every service is unique and unrepeatable. An important difference is also the client's satisfaction from the product and service. A customer can complain about the product or return it to the seller when he is displeased, whereas the service cannot be replaced while being provided. The client's engagement during purchasing products and services can be included in the differences too. The sale of the product can be one-time, the customer comes to buy the item and usually it takes place once. There is no personal interaction with the buyer, except for some particular circumstances. In the sector of services the clients' engagement is much greater than of products. The service provider must build a personal relationship with the buyer and next take care of it, otherwise the sale will be unsuccessful. Resources can also be included in the differences. Products usually must be stored, in order to be used afterwards. The storage of services is unnecessary, they are used at any given time if needed. The last difference is the way of generation. The product is manufactured and

later it is the object of a transaction, the service, on the other hand, is being generated and consumed at the same time.

Characteristics of product-service systems

Times Product-service systems are significantly related to productization and servitization. Servitization is the phenomenon of offering a product together with services in order to satisfy all the needs of people interested in buying them or by expanding the service that is an element of a given product. Productization is a holistic approach, aimed at systematizing development and creation of services, without omitting any of their elements (Jaakkola, Orava, Varjonen, 2007, p. 15). This also refers to activities related to offering services related to the product itself, systematizing its various components (Valminen, Toivonen, 2012, pp. 273–289).

Product-service systems are described as a marketable set of products and services capable of meeting the user's needs together. The product service ratio in that set can vary depending on the function or the economic value (Goedkoop, van Halen, te Riele, Rommens, 1999). In these systems traditional methods of product exploitation are replaced by the possibility of satisfying the customers' needs by providing dematerialized services, which are often associated with changes in the ownership structure (Mont, 2002, pp. 237–245).

Product-service systems are the market offers combining products and services, presenting them as separate solutions for consumers (Goedkoop et al., 1999). In contrast to traditional services connected to products (guarantees), the service in the system is significantly increasing the consumers' utility value.

For example, by purchasing a copying machine the customer can get access to service warranty. However, that warranty does not have particular influence on the interaction between the customer and the machine or experiences related to it. On the contrary, in the case of product-service systems, both the product and the service are part of the solution, and therefore are important for the customers' interactions and experiences connected to them. An example of such system can be a system of copying machines. Such product-service system is made up of photocopiers (products) which are easily accessible to consumers for self-service purposes (service). The benefits of this system for consumers include the unique cost of purchasing professional machines, but also the access to on-site services, such as designing, binding, folding, cutting, laminating and document scanning by staff of the service place.

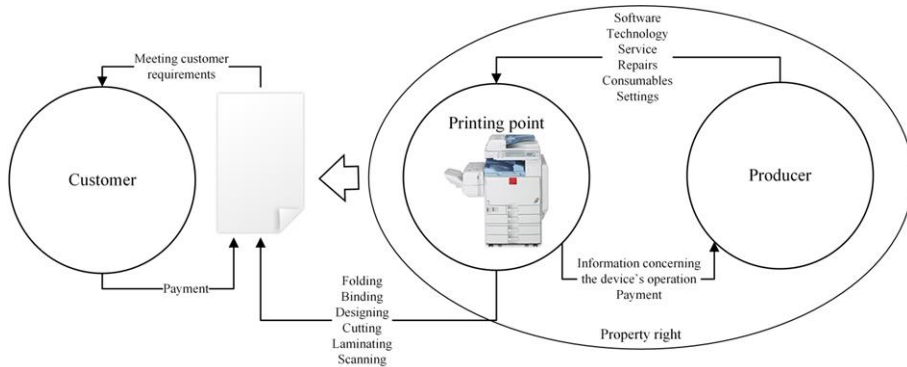


Figure 2. Product-service system scheme

Source: own elaboration.

Evaluating such a system the clients will take into consideration the aspects of the product such as effectiveness and productivity, but also the aspects connected to the customer service such as politeness of the staff, the atmosphere of the printing place and also the quality of the final result.

Product-service systems consist of three fundamental elements:

- the product – the physical right good manufactured in order to be sold, satisfying the buyer's requirements and needs,
- the service – the activity, which is an added value for the recipient, which is implemented on the basis of commercial rules,
- the system – the set of elements and dependencies between the product and the service (Baines et al., 2007, pp. 1543–1552).

To other very important elements of described systems, which influence the delivery of solutions and satisfaction of the customer's needs, belong also:

- infrastructure – artefacts of various type required mainly to deliver a product or service (IT systems, technologies),
- suppliers' net – producers/suppliers and partners (repair workshops, services, sellers) (Lim, Kim, Hong, Park, 2012, pp. 42–53).

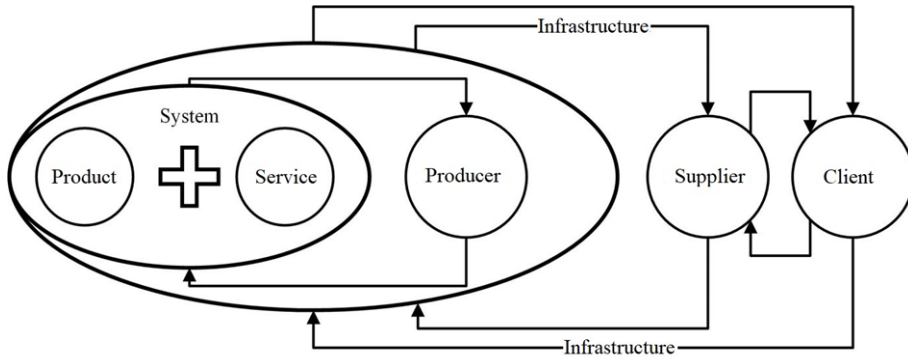


Figure 3. Elements of a Product-Service System

Source: own elaboration.

Product-service systems lead to re-recognition and re-understanding of development strategies and valuable goals of manufacturing enterprises. In addition, the traditional product values are changed for service-oriented values. Product-service systems are classified on product-oriented, use-oriented and result-oriented (Tukker, 2003, pp. 109–118; Baines et al., 2007, pp. 1543–1552; Sakao, Shimomura, 2007, pp. 590–604; Yang, Moore, Pu, Wong, 2009, pp. 224–235). In the product-oriented systems, manufacturers provide products and services related to the consumers who have the ownership of the products. The services include maintenance, repairs, distribution, reuse, recycling and helping customers to optimize the product’s use through trainings and counselling. In such a case, the product is perceived as the means of delivering services. In the use-oriented systems producers owning the products give the customers a possibility to use the products and their features. Typical examples of systems from this category is lending/renting, leasing or sharing a product. In the result-oriented systems producers supply clients with a result or ability instead of a product. The producer offers adjusting the service in order to grant a particular result and the customers pay only for that result.

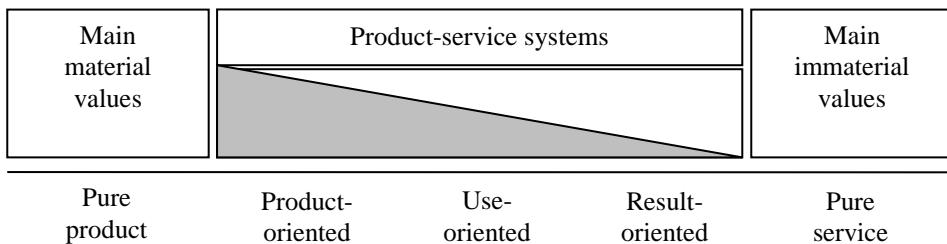


Figure 3. The essence of Product-Service Systems

Source: Tischner, Verkuijl, Tukker, 2002.

Changing the way of functioning, to base it on product-service systems, is the strategic decision for a traditional enterprises. The organization has to move from designing and selling physical products to designing and selling systems of products and services which together can satisfy the needs and requirements of the users. Such a shift requires high level of innovation and the ability to change structural aspects of the organization (Manzini, Vezzoli, 2003, pp. 851–857). It is worth noting that the use of discussed systems may put the producer in a better strategic position, closer to clients, which would enable making more flexible and convenient offers for them.

Product-service systems presuppose various benefits. For the companies they bring primarily new market possibilities related to broadening their offer, possibility to increase the value added for the customers and also improvement and continuity of the relations with the customers. Another very important issue for the enterprise in this model refers to the access to the data and information about the product while it is being used by the client. One of the major advantages for the client in this system is high quality and big number of offers. The supplier bears the responsibility for the product, which frees the customer from certain obligations. From the customers' perspective, the fact that their needs are better satisfied thanks to these systems plays also an important role. There are some benefits for the environment too, they are connected mainly to dematerializing, lower flow of materials and consumption of energy, longer product's life-cycle, decreased waste production and more efficient use of products. Social benefits are associated with the creation of cooperation networks, diversification of markets, awareness of the roles of stakeholders and access of poor people to basic services through municipal support systems. In economic terms, the benefits are related to new market possibilities, increased competition, more efficient operations and strong concentration on innovations (Mont, 2002, pp. 237–245). From technical perspective, the benefits concern the possibility of continuous monitoring of product operation and collection of information regarding possible errors in its work by the manufacturer, as well as the development of more innovative and more durable products with a range of related services.

A technical product-service system – the case of injecting forms

An example of servitization in production companies may be a product-service system for injection molds. In such a case, the enterprise manufacturing injection molds instead of only selling their product, offers to their clients a wide range of services related to it.

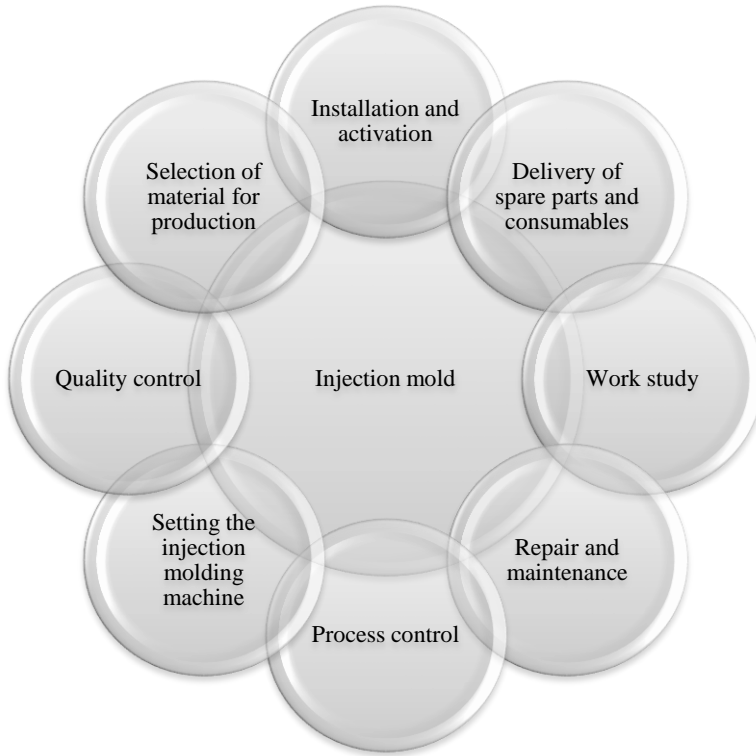


Figure 4. The essence of Product-Service Systems

Source: own elaboration.

It is worth noting that in this model the supplier maintains the property right of his product, here – the injection mold. The company delivers injection molds to the client, charging the previously determined fee per each molded piece, as well as the monthly subscription fee. In this case, the manufacturer of a form offers services related to exploitation and professional maintenance of a form. The supplier provides repairs, cleaning and alterations of the product too. On the client's request, with additional payment, organizes trainings of safe and efficient usage of forms, as well as counselling regarding the whole injection process or work study. It is worth noting that the client's need refers only to using the injection mold and to making molded pieces, not possessing the form and managing its work and exploitation.

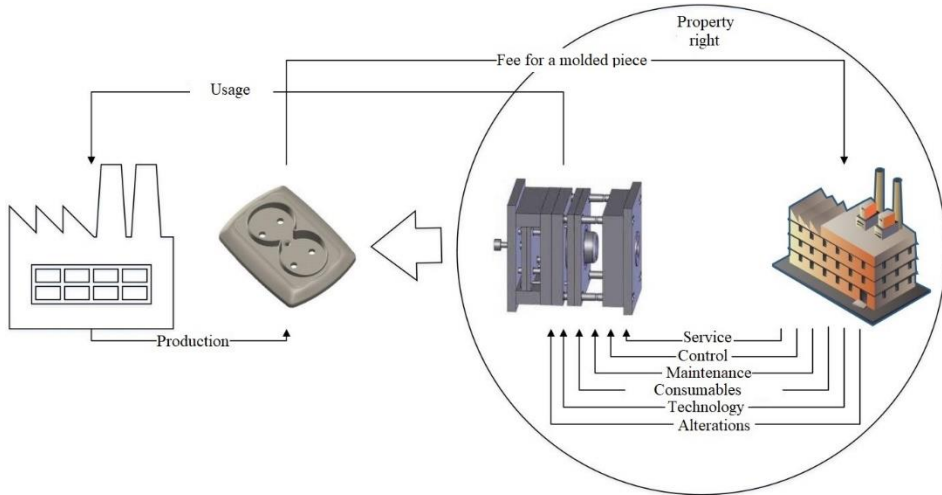


Figure 5. The concept of a Product-Service System for injection molds

Source: own elaboration.

Table 1

Characteristics of the Product-Service System for the injection molds concept

The system characteristics	
Ownership of the product	Producer/supplier
User	Client
The level of product use	Adjusted to client's needs
Relationship between the producer/supplier and the client	Permanent during the use of the form by the client
Financial flows	Subscription fee plus a fee per each molded piece produced
Impact on the environment	Low

Source: own elaboration.

This approach presupposes a number of benefits for both parties of the transaction. The client is focused solely on his core business – production and sales of molded pieces. He is neither interested in the activities related to the manufacturing of a new injection mold, machines used in this process, nor needs additional designers. The company saves also time and resources. Thanks to this approach, the customer can increase his production, open an additional department instead of the toolroom (if he had one).

While using product-service systems the manufacturer has constant access to them, therefore he controls their work and collects data about their usage, failure frequency and possible faults in the production process caused by the injection molds. This information enables improving the molds' or cooling systems'

parameters, but also modifying or creating a completely new injection method. It contributes to the development of recommendations on how to use the form in a particular company as well. The data collected in this way let to optimize the maintenance schedule, reducing costs and the impact on the environment. Another benefit of that information for the producer is a possibility to introduce new services related to them, such as assembly, optimizing exchange of die, trainings or production counselling. Solutions of this type enable better modernizations and creation of innovative ideas for injecting molds. It is worth noting that thanks to this solution, the mold producer gets access to plastics technology. The supplier of injection molds earns both on production of molds and on services connected to them. It is also in his interest, to produce molds from high quality materials, so that the product has a long life-cycle and is failure-free, reducing therefore costs of potential repairs. Thanks to that, the negative impact on the environment is diminished, so are the company's expenses.

An important issue is the property right that, as mentioned before, is not transferred to the client. The customer pays only for the number of produced molded pieces, so for the actual use of the mold. After the period of usage by the client, the mold is returned to the producer and can be shared with another customer on the same basis. The enterprise can also renovate or alter the mold according to the requirements of the current or new client. This approach significantly reduces costs for both the producer and the customer.

Conclusion

Until now, products and services were perceived as two separate sectors of the market economy. Product-service systems give the possibility to join products and services in various combinations that satisfy the customers' needs. Thanks to these systems, products and services no longer go as two separate concepts, but merge into one. The integration of tangible products with intangible services becomes inevitable even for the production companies, which used to focus mainly on manufacturing and sales of the products. The integration of the product and the service in the industrial sector or beyond it can lead to creation of many innovative solutions. Product-service systems presuppose many economic, social and environmental benefits. The benefits of these systems concern all parties of the transaction.

The goal of the article that was achieved was to present issues related to products, services and product-service systems, as well as to show a conceptual model of a product-service system for enterprises producing injection molds and their clients.

Bibliography

- Baines, T.S., Lightfoot, H.W., Evans, S., Neely, A., Greenough, R., Peppard, J., Roy, R., Shehab, E., Braganza A., Tiwari, A., Alcock, J., Angus, J., Bastl, M., Cousens, A., Irving, P., Johnson, M., Kingstone, J., Lockett, H., Martinz, V., Michele, P., Tranfield, D., Walton, I., Wilson, H. (2007). State-of-the-art in product-service systems. *Journal of Engineering Manufacture*, 221 (10), 1543–1552.
- Boothroyd, G., Dewhurst, P., Knight, W.A. (2011). *Product Design for Manufacture and Assembly*. Boca Raton: CRS Press.
- Borowski, P.F., Gaworski, M. (2009). *Organizacja i zarządzanie procesami produkcyjnymi*. Warszawa: Wydawnictwo WEMA.
- Flejterski, S., Panasiuk, A., Perenc, J., Rosa, G. (2005). *Współczesna ekonomika usług*. Warszawa: Wydawnictwo Naukowe PWN.
- Goedkoop, M.J., van Halen, C.J.G., te Riele, H.R.M., Rommens, P.J.M. (1999). *Product service systems, ecological and economic basis*. PricewaterhouseCoopers N. V./Pi!MC, Storm C.S., Pre consultants. Retrieved from: <https://teclim.ufba.br/jsf/indicadores/holan%20Product%20Service%20Systems%20main%20report.pdf>.
- Hollins, B., Shinkins, S. (2009). *Zarządzanie usługami. Projektowanie i wdrażanie*. Warszawa: PWE.
- Jaakkola, E., Orava, M., Varjonen, V. (2007). *Competitiveness through Productisation – A Guide to Companies*. Helsinki: The Finnish Agency for Technology and Innovation.
- Kotler, Ph. (1994). *Marketing Management. Analysis. Planning, Implementation and Control*. New Jersey: Prentice Hall.
- Lange, O. (1959). *Ekonomia polityczna. Tom I*. Warszawa: Wydawnictwo Naukowe PWN.
- Lim, C., Kim, K., Hong, Y., Park, K. (2012). PSS Board: a structured tool for product-service system process visualization. *Journal of Cleaner Production*, 37, 42–53.
- Malcolm, M., Hugh, W. (2013). *Plany marketingowe*. Warszawa: Wolters Kluwer.
- Manzini E., Vezzoli, C. (2003). A strategic design approach to develop sustainable product service systems: examples taken from the 'environmentally friendly innovation' Italian prize. *Journal of Cleaner Production*, 11 (8), 851–857.
- Michalski, E. (2009). *Marketing. Podręcznik akademicki*. Warszawa: Wydawnictwo Naukowe PWN.
- Mont, O. (2002). Clarifying the concept of product-service system. *Journal of Cleaner Production* 10 (3), 237–245.
- Mruk, B., Pilarczyk, H. Szulce (2005). *Marketing – uwarunkowania i instrumenty*. Poznań: Wydawnictwo Akademii Ekonomicznej w Poznaniu.
- Sakao, T., Sandstrom, G.O., Matzen, D. (2009). Framing research for service orientation through PSS approaches, *Journal of Manufacturing Technology Management*, 20 (5), 754–778.
- Sakao, T., Shimomura, Y. (2007). Service engineering: a novel engineering discipline for producers to increase value combining service and product. *Journal of Cleaner Production*, 15 (6), 590–604.
- Tischner, U. Verkuilj, M. Tukker, A. (2002). *First Draft PSS Review, SusProNet Report*. Cologne, Germany: TNO-STB, Delft.
- Tukker, A. (2003). The potential of CO₂-reduction from household consumption by product-service systems – a reflection from SusProNet. *The Journal of Sustainable Product Design*, 3 (3), 109–118.
- Valminen, K., Toivonen, M. (2012). Seeking efficiency through productisation: a case study of small KIBS participating in a productisation project. *The Service Industries Journal*, 32 (2), 273–289.

Yang, X., Moore, P., Pu, J., Wong, C. (2009). A practical methodology for realizing product service systems for consumer products. *Computers & Industrial Engineering*, 56 (1), 224–235.

Systemy produktowo-usługowe jako szansa dla przedsiębiorstwa produkującego formy wtryskowe

Słowa kluczowe: system produktowo-usługowy, produkt, usługa, serwicyzacja

Streszczenie. Celem artykułu jest przedstawienie wyników analizy literaturowej dotyczącej produktów, usług i systemów produkowo-usługowych. Na podstawie przeprowadzonej analizy przedstawiono różnice między produktem i usługami oraz najważniejsze cechy systemów PSS. Dzięki wykorzystaniu analizy literatury stworzono i omówiono koncepcyjny model systemu produktowo-usługowego dla przedsiębiorstwa produkcyjnego.

Citation

Salwin, M., Lipiak, J., Pręcicka, M. (2018). Product-Service Systems as an Opportunity for the Enterprise Producing Injection Molds. *Marketing i Zarządzanie*, 4 (54), 75–87. DOI: 10.18276/miz.2018.54-06.