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TRANSNATIONAL COMPANIES` PRODUCT DEVELOPMENT IN INDUSTRY 4.0

РОЗРОБКА ПРОДУКТУ ТРАНСНАЦІОНАЛЬНИМИ КОМПАНІЯМИ В УМОВАХ ІНДУСТРІЇ 4.0

The article deals with the features of product development of transnational companies in the conditions of the Fourth Industrial Revolution. The main trends of changes in the product life cycle in conditions of uncertainty and risks are highlighted. The need for new scientific approaches to determining the product development strategy of transnational companies in the context of Industry 4.0 is emphasised. The process of product development based on the needs, wants, and wishes of customers has gained attention since the shift of the main focus from direct production to the causes of consumption, the manifestation of utility, and the marginal utility of the product. This process is important for determining the ways of increasing the efficiency of TNCs` activity in the conditions of Industry 4.0. The main fields of product development in the conditions of Industry 4.0 are highlighted in the article. The existing scientific approaches to the evaluation of the changes of product life cycle are analysed. The important task to assess these opportunities using the examples of transnational companies is interpreted in this research. The phenomenon of transnational companies increasing the length of product life cycle when using the capital expansion on the markets of other countries is described in the article. The advantages of cooperation between startup companies and transnational corporations are identified. It is noted that the speed of product scaling is increasing under the conditions of the Fourth Industrial Revolution; this statement is especially true for new products in the field of information and communication technologies. The key performance indicators and preferences of the transnational companies in product development are presented. The digital transformation of companies combines numerous initiatives for advanced analysis, cyber security, digitalization, automation, and communication in the development of Industry 4.0 elements is discussed. New principles of transnational companies` product development in the conditions of Industry 4.0 are reflected.

Keywords: product, product development, transnational company, Industry 4.0, product life cycle, Fourth Industrial Revolution; needs, wants, and wishes of customer

У статті розглядаються особливості розробки продукту транснаціональними компаніями в умовах Четвертої промислової революції. Висвітлено основні тенденції змін у життєвому циклі товару в умовах невизначеності та ризиків. Підкреслюється необхідність нових наукових підходів до визначення стратегії розробки продукту транснаціональними компаніями в контексті Індустрії 4.0. Процес розробки товару, заснований на нуждах, потребах і побажаннях споживачів, привертає увагу після зміщення основного акценту досліджень від безпосередньо виробництва до причин споживання, прояву корисності та особливостей граничної корисності товару. Цей процес важливий для визначення шляхів підвищення ефективності діяльності транснаціональних компаній в умовах Індустрії 4.0. У статті висвітлено основні характеристики розробки продукту в умовах Індустрії 4.0. Проаналізовано існуючі наукові підходи до оцінки у змінах життєвого циклу продукту. Важливим завданням є оцінювання цих можливостей на прикладах транснаціональних компаній. У статті описано явище, коли транснаціональні компанії збільшують тривалість життєвого циклу продукції при експансії капіталу на ринки інших країн. Визначено переваги

співпраці між стартап-компаніями та транснаціональними корпораціями. Відзначається, що швидкість масштабування продукту зростає в умовах Четвертої промислової революції; це твердження особливо справедливо для нових продуктів у галузі інформаційно-комунікаційних технологій. Представлені ключові показники ефективності та переваги транснаціональних компаній у розробці продукту. Цифрова трансформація компаній поєднує в собі численні ініціативи щодо вдосконаленого аналізу, кібербезпеки, цифровізації, автоматизації та комунікації при розробці елементів Індустрії 4.0. У статті відображено нові принципи розробки продукту транснаціональними компаніями в умовах Індустрії 4.0.

Ключові слова: продукт, розробка продукту, транснаціональна компанія, Індустрія 4.0, життєвий цикл продукту, Четверта промислова революція; нужди, потреби та побажання замовника

Introduction. Many scientists and entrepreneurs have been involved in the study of these issues. In particular, a generalized scheme of types and methods of marketing research in accordance with the stages of the innovative process of product development is given in [1] by Baz` and Zozul`ov. The main postulates of Industry 4.0 are described in [2; 3; 4]. The concept of a dynamic product life cycle having five characteristic zones is discussed in [5]. The concept of the international product life cycle is firstly found in the scientific research of Vernon [6] and then discussed by Haberler in [7] and is further developed in the papers of Kyreev, for example [8]. Product development features for startups are highlighted in [9; 5; 10]. Integrated product development and dynamic product development are articulated in [11].

Setting objectives. The goal of this research is to identify the main fields of product development in the conditions of Industry 4.0. The existing scientific approaches to the evaluation of the changes of the product life cycle are analysed in this article. It is also an important task to assess these opportunities using the examples of transnational companies. This should be reflected in the creation of new principles of product development in the conditions of Industry 4.0.

Methodology. An information base for the conducted research is scientific articles, materials of periodicals, official data of national and international statistics. The methods used are: analysis and synthesis methods based on a historical-logical approach, dialectical method of cognition; logical and formal-logic methods for evaluating the above theoretical foundations for defining the new features of product development processes. Comparison, generalization, synthesis, and graphical description methods were used to systematize the data.

Research results. The main concepts of the product life cycle were created not so long ago. Particular attention was paid to product life cycle theory in the mid-20th century when transnational entrepreneurial structures entered the phase of capital expansion. This process causes the product life cycle to increase its duration due to the appearance of its international stages. But with the development of technology, the economic cycles of production gradually reduced in length. This situation stipulates the decrease in the duration of the international product life cycle.

On an international scale, goods in their life development go through several stages. The concept of an international product life cycle is originally found in the paper of Vernon [6]. As a result of the study of transnational companies' activities in the early second half of the 20th century, the scientist noted that during the product

life cycle its suppliers to the international market may change. In this case, the product also undergoes these four standard stages, but the individual phases can be repeated within one cycle depending on the forms of foreign economic activity of the transnational structure and the type of market of the host country.

Figure 1 demonstrates the functioning of the product life cycle depends on the country's type. Transnational companies can increase the length of the product life cycle when it uses the expansion on markets of other countries.

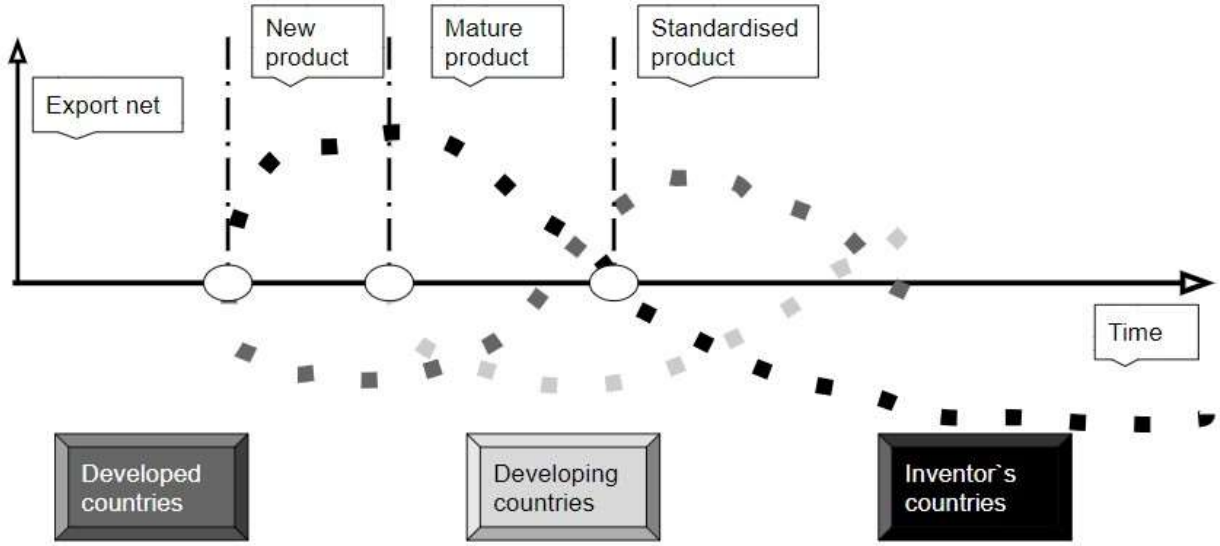

Figure 1 – A product life cycle for inventor`s countries, developed countries, and developing countries.

Source: formed by the author based on [6; 7].

As noted in [12] by Solntsev and Zozyl`ov, there are two types of commodity growth classification by criteria “In the direction of increasing market share”: for a brand-new product / service - release on the market of goods of world / national novelty and for the new product / service for the company - expansion of the product range within the market. So, the international product life cycle has the following structural logic (Fig. 2).

In each specific case, the strategy of building an international product life cycle (synchronous, gradual, proactive) is based on the choice of certain methods of testing (different commodity, marketing, and information and communication policy of a transnational company) [13].

The process of trade based on differences in tastes and preferences of consumers in the context of the 4th Industrial Revolution is influenced by a number of factors. Internal factors include cybersecurity, augmented and virtual reality, cloud computing, and Big Data usage, national production robots, historical territory development factors, language features, religion, education level, family traditions, work and leisure attitudes, social development level. In the context of rapid scientific and technological progress, there is a shortening of the life cycle of goods in domestic markets. Transnational companies have the ability to artificially extend the phase of the cycle by exporting capital to countries with less advanced technology and,

conversely, shortening the product life cycle to encourage consumers to buy new variations of goods.

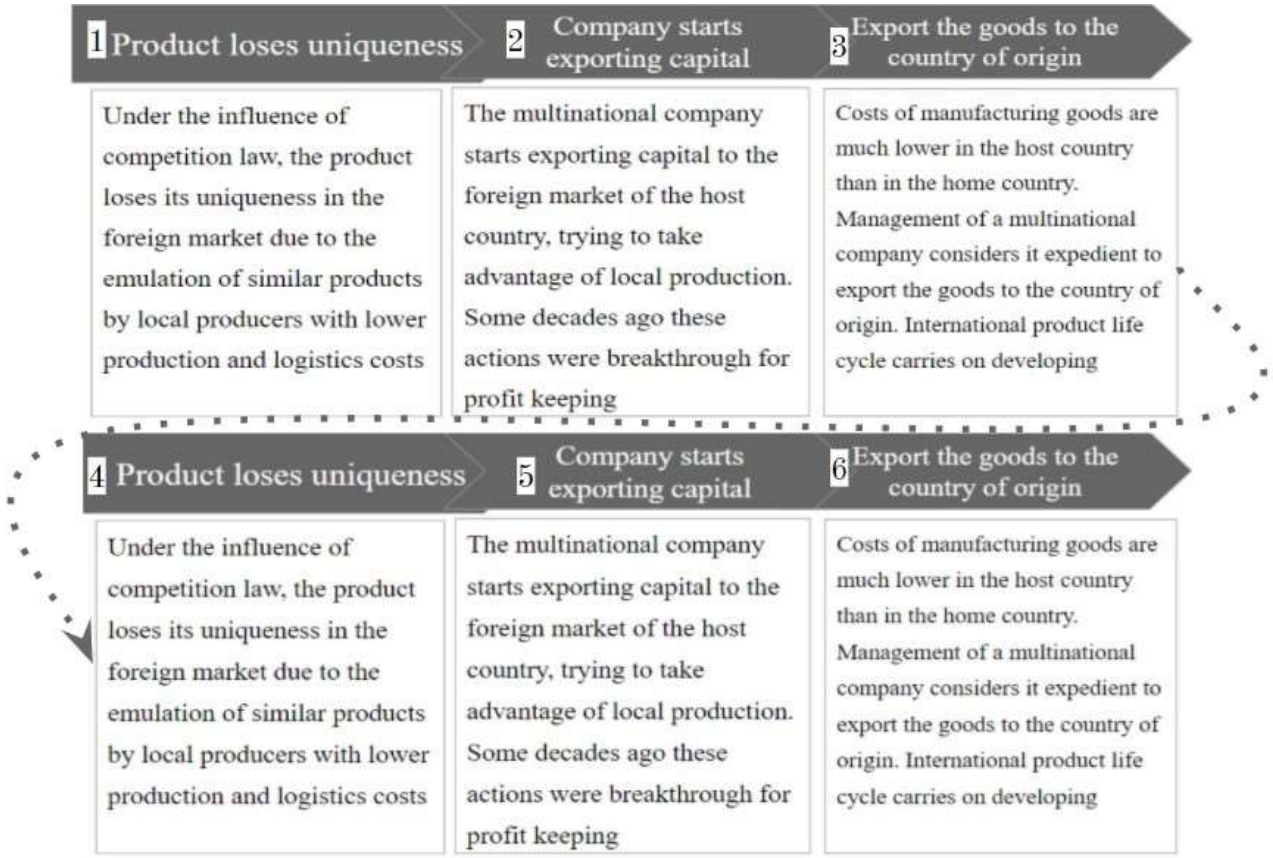

Figure 2 – International product life cycle (6 stages)
Source: formed by the author on the basis of [6; 7; 8; 13].

Industry 4.0 is a type of production focused on the combination of production processes and individual stages of the product life cycle with the Internet-based on the Internet of Things technology, as noted by Voitko [3]. Today there is an increasing share of industries where the beginning of the product life cycle is a need, that is, a customer (see Fig. 3) Unlike the traditional product development model, where novelties and marketing activities are parallel processes, leading companies today use models that consider the features of product development and marketing as one element.

In the process of exploring new trends in product development by transnational companies, product development methods are of interest (Fig. 4). One of the product development methods [11] is integrated product development, which focuses on cross-functional teams working together to fulfill a need-driven solution. The first step is to find out the (customer`s) needs, then to find solutions - e.g. with the help of benchmarking existing solutions in the market. The next step is to find the pros and cons of different solutions to develop a solution that will be the concept for the new product development process. Typically, integrated product development focuses on multifunctional teams that work together to meet demand-driven needs [11].

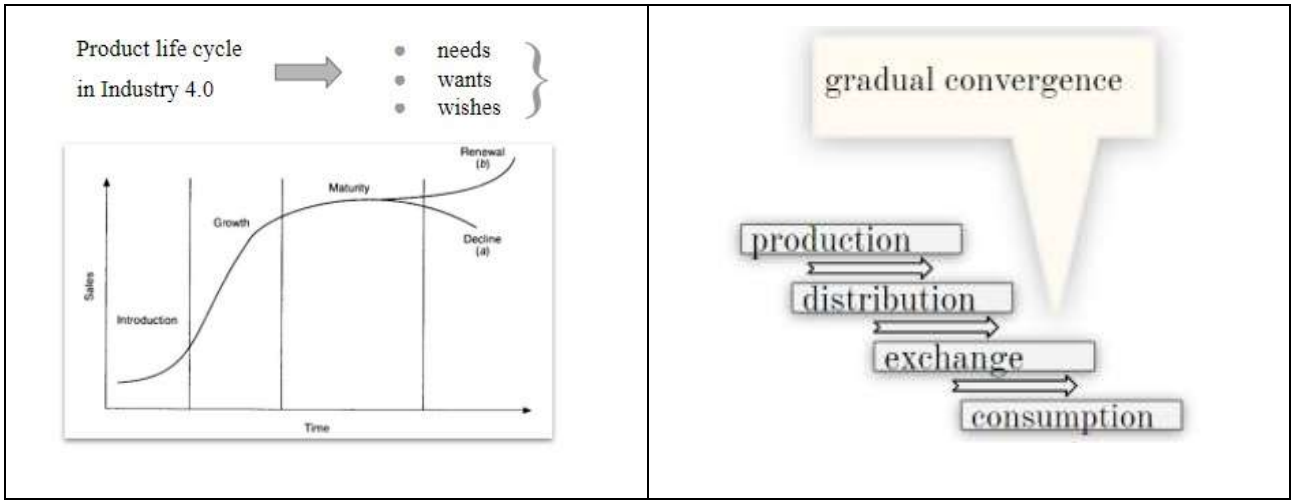

Figure 3 – A product life cycle in Industry 4.0 considering needs, wants, and wishes of a customer.

Source: formed by the author based on [3; 6; 7; 14].

Thus, the process of product development from determining the customer's need to selling the product goes through several stages, each within a specific functional field [11; 14]:

-for design (product alternative study, product principles, preliminary product design, changes for production, final design);

-for production (evaluation of process type, establishment of production methods, establishment of production requirements, preparation for production, proper production);

-for marketing, it is a requirement study, user survey, market study, preparation for sales, proper sales [11; 14].

Dynamic product development has been developed to be used for all kinds of product development starting conditions, to fulfill “needs”, “wants”, and “wishes” [11]. Impacts associated with a product during its life cycle can be classified as embodied and active impacts, as noted in [15]. Embodied impacts are caused during the realization (manufacturing) of a product, while active impacts occur during the use and post-use phases of a product life cycle [16].

And the next method of product development based on the conception of Lean production development [17] which deals with the complete process from gathering and generating ideas, through assessing potential success, to developing concepts, evaluating them to create the best concept, detailing the product, testing/developing it and handing over to manufacture. With the beginning of the Fourth Industrial Revolution and the rising efforts to realize a smart factory environment, also product development has to perform a substantial transformation [17; 18; 19]

The concept of smart manufacturing is closely connected to knowledge-driven decision-making to meet customers’ needs, wants, and wishes for new products. Smart production development is based on new technologies which refer to the combination of advanced manufacturing capabilities and digital technologies to improve the effectiveness of communication between manufacturer and consumer [17;

18; 19].

Product development methods are:

- ★ integrated product development;
- ★ dynamic product development;
- ★ lean product development;
- ★ smart product development;
- ★ etc.

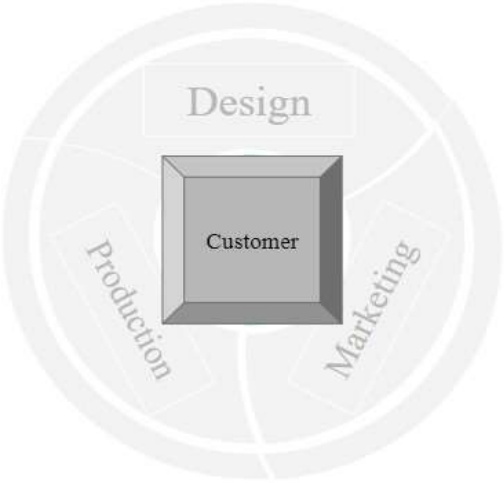

Figure 4 – Beginning of the product life cycle is a need, that is, a customer
Source: formed by the author based on [16-19].

It is of interest to define the influence of global problems of Humanity (such as COVID-19) which changes the approach to the definition of needs, wants, and wishes of customers. As noted in World Bank site [20], the coronavirus (COVID-19) pandemic has impacted both demand for and supply of commodities: direct effects from shutdowns and disruptions to supply chains, indirect effects as economic growth stalls. Effects have already been dramatic, particularly for commodities related to transportation.

But we have another side of this situation. With the onset of quarantine, most companies in industrial markets quickly entered a mode of adaptation to the crisis. The revision of budgets and capital investment programs, with the process of suspending large new and long-term contracts, ending current ones, and focusing on the most priority changes, is a general and already common trend. Manufacturers and distributors are adapting to these changes, trying to understand new needs and respond to them quickly. COVID-19 has introduced additional incentives and requirements to accelerate the overall digitalization of enterprises, as well as a better focus on a range of technologies that provide social distancing, remote monitoring, and control of management.

So, product development in Industry 4.0 has some features:

- small-scale production using 3D-printing allows adaptation of any product feature to the specific needs of a particular consumer;
- the focus on flexibility and cost reduction in the manufacturing process;
- generation and choice of the idea that is offered by the customer;
- the product does not actually lose its competitive advantage by meeting the specific individual needs of the consumer.

Customization in product development, manufacturing, and promotion enable companies to adapt their product life cycle model. This is especially important for startups. The role of startups is growing [10]. Startups are identified as a catalyst for innovative development in Industry 4.0, as startups are able to quickly develop new

ideas and technologies in new technology areas. The use of Industry 4.0 tools already allows leading global market leaders to uncover a wider range of potential business opportunities. These factors will contribute to the implementation of effective management activities in transnational companies, which will ensure long-term dynamic development of enterprises, encouraging them to innovate in product development.

Conclusions. The article substantiates the need to form the product development basis for the opportunities for transnational companies` development at the present stage of implementation of the achievements of the 4th Industrial Revolution. Elements of scientific novelty are closely related to the constructive understanding of conceptual provisions on the development of different parts of the product life cycle. The application of Industry 4.0 tools will allow businesses to unlock a wider range of potential business opportunities. Future studies can further transform the issues into determining factors that will contribute to the implementation of effective management activities that will ensure the long-term dynamic development of enterprises, encouraging them to innovate and enhance international competitiveness. Further studies should aim to reach the latest methods of product development and integration by transnational companies in cooperation with startup structures. These directions of research will be developed by the author in the further creative process of scientific search.

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