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DEVELOPMENT OF BUSINESS MODELS OF SERVICE COMPANIES: THEORETICAL AND METHODOLOGICAL ASPECTS

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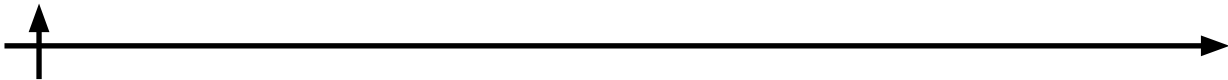
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Abstract. This article discusses the theoretical and methodological aspects of the development of business models of service companies. In the course of the research, a terminological analysis of the concept of "business model" was carried out, two main approaches to the definition of a business model were identified: the first involves focusing on the value that the company creates for its external customers, and the second directs the focus of attention inside the company, on the flow of its business processes. As a result of the study, various options for the application of business models are considered, the main stages of their life cycle are illustrated. Based on the consideration of various theoretical and methodological concepts of building business models, an example of how a strategic canvas could look like in the service market is presented. As a result of the study, it was revealed that currently the most optimal for service companies are component approaches to the development of business models, which suggest considering the company as a set of interacting and complementary elements, since for successful business in modern conditions, the company must have the ability to see and recognize what is happening outside its own market, in particular including its closest competitors.

Keywords: business model, business concept, component approach, consumer value, business architecture, operating model, revenue model

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РАЗРАБОТКА БИЗНЕС-МОДЕЛЕЙ СЕРВИСНЫХ КОМПАНИЙ: ТЕОРЕТИЧЕСКИЕ И МЕТОДОЛОГИЧЕСКИЕ АСПЕКТЫ

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Аннотация. В данной статье рассмотрены теоретико-методологические аспекты разработки бизнес-моделей сервисных компаний. В процессе исследования проведен терминологический анализ понятия «бизнес-модель», выявлено два основных подхода к определению бизнес-модели: первый предполагает ориентацию на ценность, которую компания создает для своих внешних клиентов, а второй направляет фокус внимания внутрь компании, на протекание ее бизнес-процессов. В результате исследования рассмотрены различные варианты применения бизнес-моделей, проиллюстрированы основные этапы их жизненного цикла. На основе рассмотрения разнообразных теоретических и методических концепций построения моделей бизнеса представлен пример того, как могла бы выглядеть стратегическая канва на рынке сервисного обслуживания. В результате исследования выявлено, что в настоящее время наиболее оптимальными для сервисных компаний являются компонентные подходы к разработке бизнес-моделей, которые предлагают рассматривать компанию как совокупность взаимодействующих и взаимодополняющих элементов, поскольку для успешного ведения бизнеса в современных условиях, компания должна обладать умением видеть и распознавать то, что происходит за пределами собственного рынка, в том числе своих ближайших конкурентов.

Ключевые слова: бизнес-модель, бизнес-концепция, компонентный подход, потребительская ценность, бизнес-архитектура, операционная модель, модель дохода

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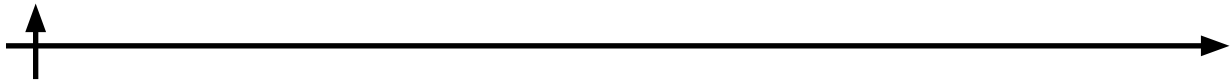
Introduction

The high level of competition, the growing needs and expectations of customers, the rapid development of the IT infrastructure, the sharp aggravation of the economic and political instability of the country force the company to continuously update and improve its activities in order to instantly adapt to changes in the external environment and improve the effectiveness of its activities.

Today, it is becoming increasingly difficult for most organizations to maintain a competitive advantage. A wide range of products and services offered, the use of advanced technologies, high quality of service and other factors of maintaining competitiveness have long been transformed into minimal conditions of presence on the market. To date, the solution of issues of improving the efficiency of the functioning of economic entities is not possible without the formation of their effective business model.

In this context, the company's competitiveness is higher the better it is able to take into account not only the changing market conditions, but also analyze and adjust its internal business environment to market requirements, represented by various elements that are aimed at creating value and turning this value into profit.

In order to develop a unified understanding of the mechanism of operation of a particular business



unit, it is necessary to understand what actions and in what sequence are performed in the company on the way to creating a useful product for consumers and achieving the desired results of activity. This helps the company to identify and analyze the business processes that form the basis of its business model.

It is the description of the processes taking place in the organization that allows you to see a holistic picture of its work, identify the reasons that hinder the achievement of the goals set, and develop recommendations for their elimination to improve the financial and economic performance of the company as a whole.

The modern theory and practice of business management has a large number of different approaches, methodologies and methods that allow organizing the company's activities in the most effective way. One of the most effective tools for describing the basic principles of the creation, development and successful functioning of an organization is the business model. It not only allows you to visualize and analyze the complex mechanism of the company's work, but also to identify its strengths and current problems, to find opportunities for optimization and improvement of activities.

Despite the fact that the real interest in this approach in scientific circles appeared in the mid-1990s, to date, scientists have not yet come to a single and generally accepted definition of the concept of "business model". Table 1 provides examples of interpretations of this term.

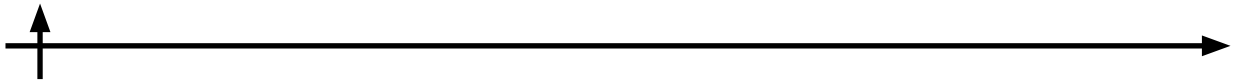
Table 1. Terminological analysis of the definition of "Business model"

Author	Definition
V. Jang Kim, Mauborn Rene (2005)	A business model built in the following sequence – exceptional utility, strategic pricing and target cost (profit) – leads to value innovation (Kim Chan, 2017).
Henry Chesbroke (2006)	A business model is a way that a company uses to create value and generate profit.
Kotelnikov V.Yu. (2007)	The business model of an enterprise is a representation of a business (enterprise) that actually exists or is planned in the future in a form that can clearly demonstrate all the significant properties and features of the company associated with its ability to make a profit and be competitive.
Hamel G. (2007)	A business concept and a business model are made of the same test: a business model is just a business concept put into practice (Hamel, 2007).
Markides K. (2010)	The business model is the sum of the answers to three main questions. Who is my target audience? What products or services will be my value proposition and what will be its competitive advantage? How can I do this effectively (Markides, 2008).
A.Osterwalder, I. Pinier (2010)	A business model –is a representation of how an organization makes (or intends to make) money. It describes the value that the company offers to various clients, reflects the capabilities of the organization, the list of partners, the capital relations necessary to obtain sustainable income streams (Osterwalder, Pinye, 2013).
Shubin A. (2016)	The business model is a comprehensive view of how a company chooses its customers, how it differentiates its offer and through which channels it brings it to target customers, which business processes are key for the company, how resources are used, and finally, how it makes a profit for owners (Shubin, 2016).

Summarizing the definitions presented in the table, it should be noted that they are all distributed according to two approaches: the first involves focusing on the value that the company creates for its external customers, and the second directs the focus of attention inside the company, on the flow of its business processes.

The optimal interpretation is one that combines two visions and may sound like this: "A business model is a visual and logical description of how a company builds its processes in order to create value for customers and profit from it."

Despite the fact that the number and composition of the elements of the business model allocated by the authors vary, four key components can be identified that determine the content of the model of any



organization:

1. the value for external customers that the company offers based on its products and services;
2. a system for creating this value, including suppliers and target customers, as well as value chains;
3. assets used by the company to create value;
4. the financial model of the company, which determines both the structure of its costs and the ways of making a profit (Barjaev, 2020).

Materials and Methods

In this study, analytical methods were used, such as description, grouping of data, causal analysis, evaluation. The use of these methods allowed us to link disparate facts about the current situation in the development and evaluation of the success of business models of service companies in modern economic conditions. The methodological base of the study contains theoretical provisions of public sector economics and management, data from official sources of state authorities and includes methods of critical analysis, theoretical modeling and formalization.

Results and Discussion

There are many options for applying business models. Someone uses them to analyze the effectiveness of their business in comparison with competitors, some companies use this approach to assess their potential and investment attractiveness in the future. For operating firms, the business model is the most important tool of strategic management, which is used to find new growth points, analyze the external environment, develop value propositions and determine the best practices for business development.

Like any product put on the market, a business model has its own life cycle (Tleuba, Seken, Eshenkulova, 2019). If the turning points of the cycles are not identified in time and changes are not implemented in accordance with strategic, tactical and organizational requirements, the company may lose its value. In general, the lifecycle of a business model is illustrated in Figure 1.

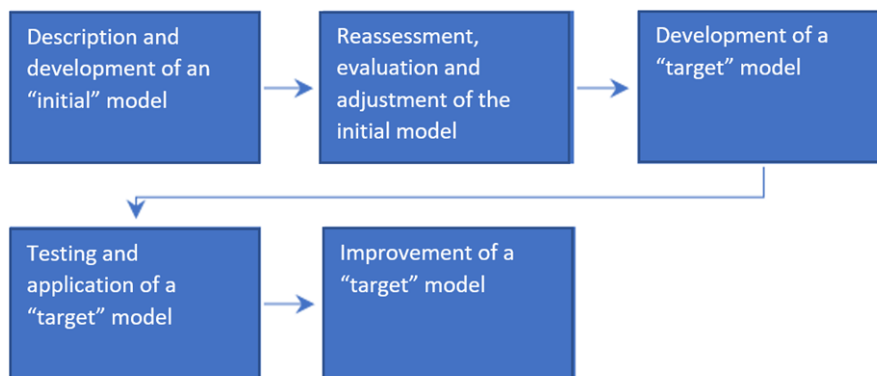
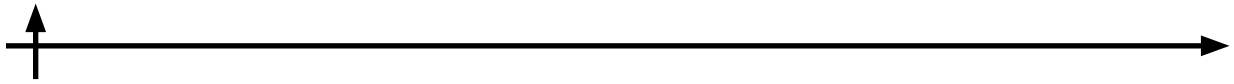


Fig. 1. Business model lifecycle

The construction of any business model is preceded by a thorough analysis of the company's activities, the industry and the industry business system. This is necessary to describe each component of the model with which the company creates consumer value and receives income from it.

If any shortcomings are identified in the course of the company's work, the business model is reviewed and clarified. Taking into account the identified weaknesses, the management develops the "as it should be" model, describing the desired state of the business in the future, and implements it into work.

Back in the 1950s, the pioneers of business modeling - Toyota and McDonalds - proved that continuous improvement of the business model ensures stable profits and cost growth (Slywotzky, 2006). A



model developed once is not the end point on the way to success. In order to maintain its competitiveness and keep up with the times, the company must constantly adapt to the changes taking place in the external environment, revising, updating and improving the components of the business model.

There are many different ways to present a business in the form of a simplified scheme. The tool that management chooses for modeling will affect not only the understanding of the mechanism of the company's functioning, but also the quality of decisions made in the future (Kostin, Shildt, 2020.).

In the management literature, you can find a large number of the most diverse theoretical and methodological concepts of building business models. One of the first approaches, which appeared at the beginning of the XXI century, was proposed by Chang Kim and Rene Mobarn in the book "The Strategy of the Blue Ocean" published in 2005.

The main idea promoted by the authors is that the business world can be conditionally divided into two market spaces – scarlet and blue oceans. To become truly successful, a company should not focus on competitors operating in the scarlet waters and offering similar services and goods. It should look at the market more broadly, go beyond the existing demand and form a strategy that offers value innovation.

At the same time, it should be understood that in order to turn value innovation into a working strategy, the company needs to apply a systematic approach that combines the unity of utility, benefit and human factor (strategic coherence) with a focus on differentiation and cost reduction (without compromise between them) (Dashkov, Chernikova, 2021).

In this concept, the company's business model is presented in the form of a value curve. It forms the basis of such a tool as the "strategic outline", the essence of which is to graphically display the comparative effectiveness of the company, taking into account various factors of competition (Markides, 2010).

Figure 2 shows a conditional example of what a strategic outline in the service market could look like.

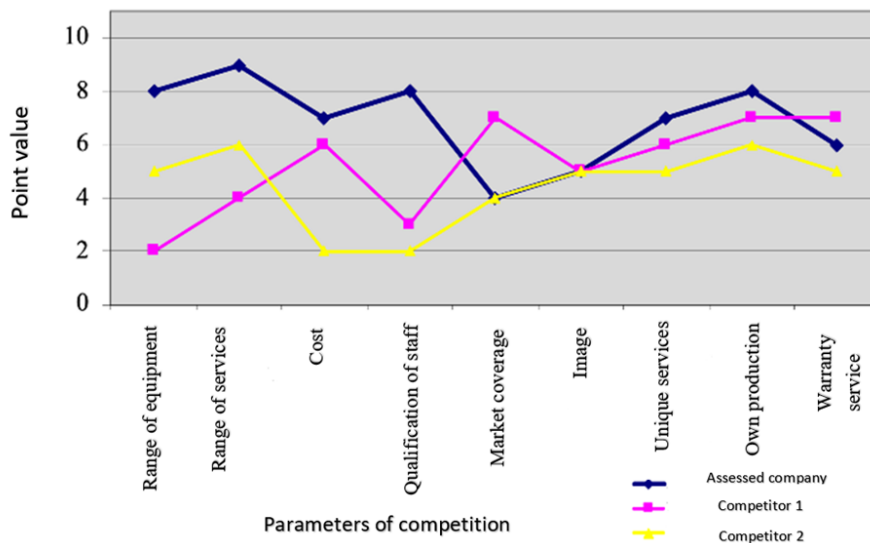
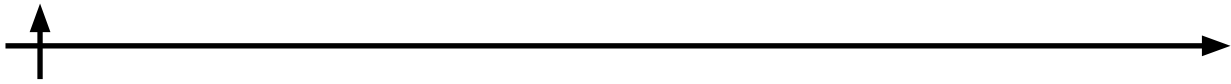


Fig. 2. Strategic outline of the industry

The construction of this model allows the company to see its weaknesses in relation to competitors, which it must overcome in order to improve the value proposition and increase the efficiency of its activities.

Conclusions

In order to create an updated, more competitive value curve, the firm must decide which elements of value for the buyer it should reconstruct. To do this, the four-action model helps, which offers the owners of the company to answer four fundamental questions concerning the strategic logic inherent in



this industry and the principles of doing business:

1. What factors need to be reduced compared to existing industry standards?
2. What factors that the industry takes for granted should be taken out of the spotlight?
3. What factors need to be significantly improved compared to existing industry standards?
4. What factors can be created from those that have never been offered on the market before (Dukki, 2012)

To date, the component approaches to the development of a business model have received the greatest support among researchers and consultants, which suggest considering the company as a set of interacting and complementary elements.

For example, in his work M. Johnson, K. Christensen and X. Kagermann identified four components of the business model:

1. The value offered to consumers (customer value proposition). It includes analysis of key consumers and needs that need to be met, as well as the development of a company's offer based on the desired value.

2. Profit formula. It consists of a revenue generation model, cost structure, marginal profit model and resource circulation rate.

3. Key resources, namely: personnel, products, applied technologies, equipment, information, partnerships, supply channels, etc.

4. Key processes. It includes indicator systems, company rules and established norms (Voronova, Ilyin, 2019.).

The developed offer and the profit formula determine, respectively, the value for consumers and the company, and the key resources and processes indicate how this value will be delivered both to external customers and to the company itself.

The strength of this concept is due to the fact that all the elements of the model are closely interrelated with each other: that is, drastic changes in any of the four components will undoubtedly affect the other three and the entire mechanism of the company as a whole (Charikov, 2021.).

An American management consultant, Gary Hamel, highlighted in his book "At the Head of the Revolution" the following elements of the business model:

client interface;

– key strategy (i.e. choosing the way to compete);

– strategic resources (the company's competitive advantages are based on them);

– value network (what surrounds the company complements and reinforces its resources) (Vostroknu-tov, Loyko, 2018).

At the same time, all components are connected by three intermediaries, or connecting elements, and the factors that determine the profitability potential of the company act as the basis of the business model (see Fig. 3).

According to the author, the only way for the company to get away from the high pressure of competition is to create a business model completely different from everything that was before and exists to this day. For real success, one cannot limit oneself to smooth growth, it is necessary to grow faster than the market by creating a completely new business concept. And each of the components of the model can be used as a lever for these breakthrough changes (Kusakina, 2018).

Despite the wide variety of business modeling concepts, the most optimal and understandable for perception today is the approach proposed by A. Osterwalder and I. Pinier in the book "Building Business Models".

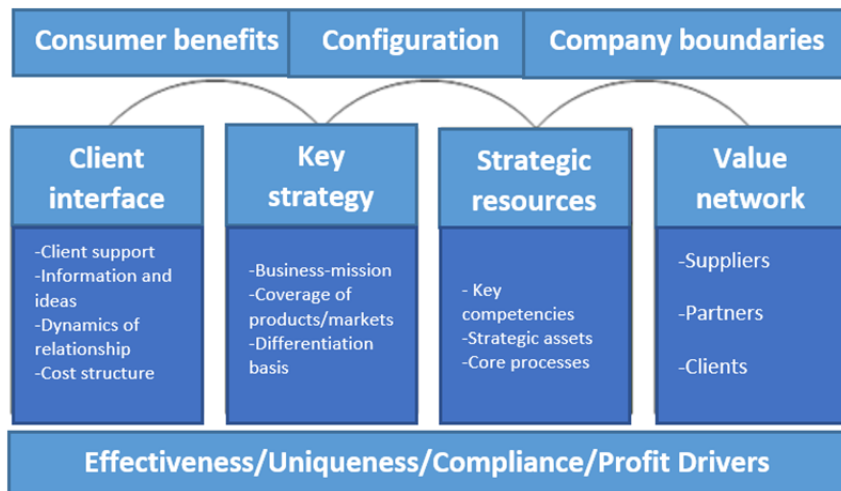
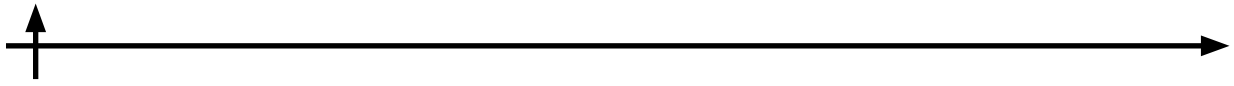


Fig. 3. Elements of G. Hamel's business model

In their work, the authors propose to decompose the company's business model into separate components - structural blocks – reflecting the logic of the organization's actions aimed at meeting the needs of customers, making a profit and ensuring competitiveness in the market with the help of the proposed competitive advantages.

To construct a business model, it is proposed to use a template - a universal language for describing the mechanism of the company's work (Voronova, Orlova, Sheleyko, 2022; Digital economy of Russia, 2024). This template consists of nine blocks reflecting the four main areas of business: customer interaction, supply, infrastructure and finance (see Figure 4).

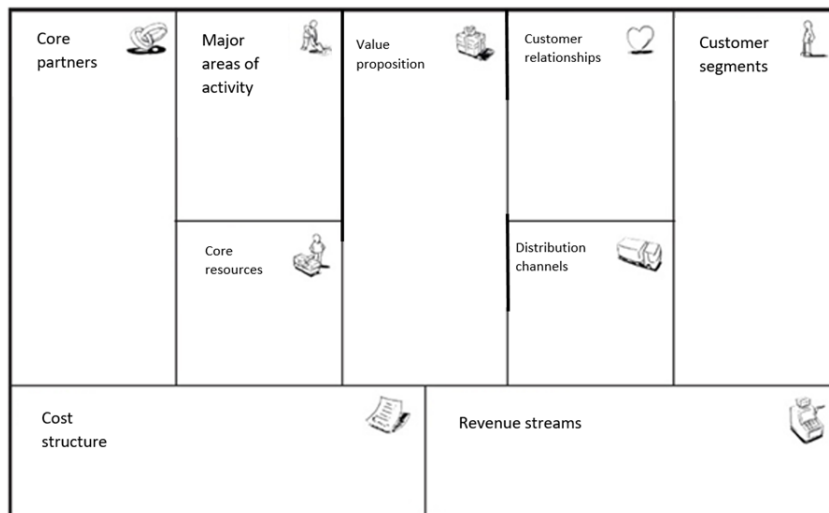


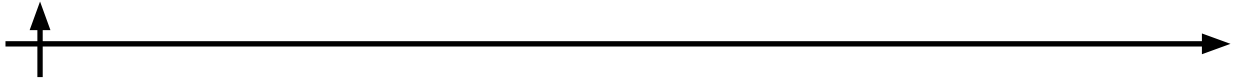
Fig. 4. Business model template by A. Osterwalder and I. Pinier

1. Consumer segments. This block decides which customer segments the company expects to attract and serve. It makes sense to divide customers into different groups if differences in their needs lead to differences in offers.

2. Value propositions. The block includes a description of products and services, as well as distinctive features (competitive advantages) that determine their value to the consumer.

3. Sales channels. This is a block about how a company delivers its value propositions to customers (information channels, delivery, sales channels, after-sales service, etc.).

4. Customer relationships. This block describes the principle by which the company builds relation-



ships with consumer segments.

5. Revenue streams. This block includes all sources of profit from all segments of consumers (taking into account various pricing mechanisms).

6. Key resources. The block is devoted to the description of the most important assets of the company necessary for the successful functioning of the business model (material and intellectual resources, personnel, finance).

7. Key activities. This block contains the main directions of the company's work, without which its effective existence is impossible.

8. Key partners. The block includes the main suppliers and partners involved in the development of the company.

9. Cost structure. This block allows you to describe the main focus of the company's business model. This can be either a focus on maximizing consumer value, or maintaining a minimum cost structure, or a combination of the two listed directions.

It is worth remembering that a one-time analysis and description of the business model is not enough for the successful functioning of the company. It is also necessary to regularly evaluate and update it in order to objectively assess its position in the market and adapt accordingly.

The undoubted advantage of this model over others is its simplicity and visibility. Special knowledge and skills in the field of strategic planning are not required for its construction. Each block can be analyzed separately from the other, and also see how changes to one of the elements will affect the rest. And the information summarized in the scheme gives the management a clear understanding of where there are "bottlenecks" in the company, what is unprofitable to work with, and what, on the contrary, can be improved or radically changed in order to increase customer satisfaction and improve the company's position in the market (Johnson, Christensen, Kagermann, 2009).

If A. Osterwalder and I. Pinier proposed a general concept suitable for all organizations, then A. Shubin adapted the classic outline of the authors' business model for medium-sized and niche retail companies.

According to Shubin, if we present the business model of a retail company at the conceptual level, then it will be based on three interrelated elements:

– interface with suppliers (joint creation of added value: logistics, inventory, personal relationships, shared resources, etc.);

– customer interface (value proposition as a result of correlating the desires of target customers and the company's capabilities);

– an operational model (a system of business processes through which suppliers' goods reach customers and additional value is created) (Denisov, Velinov, Viter, Busalova, 2019.).

To become successful, a company must have the ability to see and recognize what is happening outside its own market, including its closest competitors. A clear understanding of her business model and its constant adaptation to ensure future success will help her in this.

REFERENCES

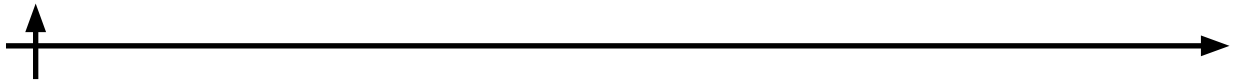
Barjaev R.R. 2020. Transformation of Business Models of Russian Banks. *Economics and Entrepreneurship* 5, 729-734. doi:10.34925/EIP.2020.118.5.148

Charikov A.A. 2021. Changes of a Business Model under Covid-19 Pandemic. *Relevant Research* 18, 49-51.

Dashkov A.A., Chernikova E.S. 2021. Research on the impact of digital platforms on the business model of an organization. *E-Management* vol. 4, 48–57. doi: 10.26425/2658-3445-2021-4-1-48-57

Denisov I.V., Velinov E., Viter K.A., Busalova A.D. 2019. Business model: the history of the concept in foreign and domestic scientific publications. *Leadership and Management* 6, 385-396. doi: 10.18334/lim.6.4.41241

Dukki A.S. 2012. Assessment of Criteria for Formation of Business Models in IT. *Innovative Science*



5, 106-108.

Hamel G. 2007. Leading the revolution. St. Petersburg: BestBusinessBooks, 350-368.

Johnson M., Christensen K., Kagermann H. 2009. Updating the business model. Harvard Business Review 3, 50-63.

Kim Chan V. 2017. Blue ocean strategy. How to Create Uncontested Market Space and Make the Competition Irrelevant. M.: Mann, Ivanov and Ferber, 224-336.

Kostin K.B., Shildt M.S. 2020. The transformation of business models of modern TNCs on the example of X5 Retail Group. Journal of Economics, Entrepreneurship and Law 6, 1649-1676. doi: 10.18334/epp.10.6.110391

Kusakina A.V. 2018. Methodological Analysis of Correlation between a Strategy and a Business Model of Organization. Scientific Analytical Journal 2, 5-10

Markides Constantinos C. 2008. Game-Changing Strategies: How to Create New Market Space in Established Industries by Breaking the Rules, 205-210.

Markides K.A. 2010. New business model: Strategies for painless innovation. M.: Alpina Publisher: Yurayt, 290-304.

Osterwalder A, Pinye I. 2013. Business Model. Generation A Handbook for Visionaries, Game Changers, and Challengers. M.: Alpina Publisher. Skolkovo series, 280-288.

Slywotzky A. 2006. Value migration: How to think several moves ahead of the competition. M: "Mann, Ivanov and Ferber", 428-432.

Shubin A. 2016. Business models of retail companies. How to compete with the "giants". M.: One-book.ru, 256-275.

Tleuba Ye.A.T.Y., Seken A., Eshenkulova G.I. 2019. Development of Entrepreneurship and Successful Business Model in Rural Tourism of Kazakhstan (on the example of the Eco-village "Toksumak"). Regional Issues of Economic Improvement № 6, 83-93.

Voronova O.V., Pyin I.V. 2019. Improving the Business Model of Network FMCG Retail based on a Process Approach. Proceedings of the St. Petersburg State University of Economics № 2, 74-82.

Voronova O.V., Orlova V.I., Sheleyko V.A. 2022. Development of the Company's Business Model for the Maintenance of Radio Navigation Equipment based on the Assessment of the Service Market in the Arctic zone. Proceedings of the St. Petersburg State University of Economics № 3, 100-106.

Vostroknutov A.E., Loyko V.I. 2018 Methodological Aspects of Formation and Strategic Development of a Business Model of Small Business Organization. New Technologies 3, 92-100.

National program "Digital economy of Russia 2024". URL: <http://government.ru/info/35568/> (accessed 10.07.2022).

СПИСОК ИСТОЧНИКОВ

Баржаев Р.Р. 2020. Трансформация бизнес-моделей российских банков. Экономика и предпринимательство 5, 729-734. doi:10.34925/EIP.2020.118.5.148. 4

Чариков А.А. 2021. Изменение бизнес-модели в условиях пандемии COVID-19. Актуальные исследования 18, 49-51.

Дашков А.А., Черникова Е.С. 2021. Исследование влияния цифровых платформ на бизнес-модель организации Research on the impact of digital platforms on the business model of an organization. E-Management 4, 48-57. doi: 10.26425/2658-3445-2021-4-1-48-57

Денисов И.В., Велинов Э., Витер К.А., Бусалова А.Д. 2019. Бизнес-модель: история развития понятия в зарубежных и отечественных научных публикациях. Лидерство и менеджмент 6, 385-396. doi: 10.18334/lim.6.4.41241

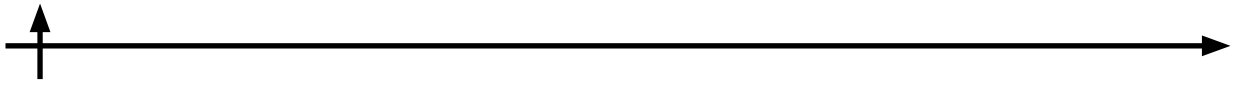
Dukki A.S. Assessment of Criteria for Formation of Business Models in IT. Innovative Science 5, 106-108.

Hamel G. 2007. Leading the revolution. St. Petersburg: BestBusinessBooks, 350-368.

Johnson M., Christensen K., Kagermann H. 2009. Updating the business model. Harvard Business Review 3, 50-63.

Kim Chan V. 2017. Blue ocean strategy. How to Create Uncontested Market Space and Make the Competition Irrelevant. M.: Mann, Ivanov and Ferber, 224-336.

Костин К.Б., Шильдт М.С. 2020. Трансформация бизнес-моделей современных ТНК на примере X5 Retail Group. Экономика, предпринимательство и право 6, 1649-1676. doi: 10.18334/



еpp.10.6.110391

Кусакина А.В. 2018. Методика анализа соответствия стратегии и бизнес-модели организации. Научно-аналитический экономический журнал. 2, 5-10.

Markides Constantinos С. 2008. Game-Changing Strategies: How to Create New Market Space in Established Industries by Breaking the Rules, 205-210.

Markides К.А. 2010. New business model: Strategies for painless innovation. М.: Alpina Publisher: Yurayt, 290-304.

Osterwalder А, Piney I. 2013. Business Model. Generation A Handbook for Visionaries, Game Changers, and Challengers. М.: Alpina Publisher. Skolkovo series, 280-288.

Slywotzky А. 2006. Value migration: How to think several moves ahead of the competition. М: "Mann, Ivanov and Ferber", 428-432.

Шубин А. 2016. Бизнес-модели розничных компаний. Как конкурировать с «гигантами». М.: Onebook.ru, 256-275.

Tleuba Ye.A.T.Y., Seken А., Eshenkulova G.I. 2019. Development of Entrepreneurship and Successful Business Model in Rural Tourism of Kazakhstan (on the example of the Eco-village "Toksumak"). Regional Issues of Economic Improvement № 6, 83-93.

Воронова О.В., Ильин И.В. 2019. Совершенствование бизнес-модели сетевого FM-CG-ритейла на основе процессного подхода. Известия Санкт-Петербургского государственного экономического университета 2, 74-82.

Воронова О.В., Орлова В.И., Шелейко В.А. 2022. Разработка бизнес-модели компании по обслуживанию радионавигационного оборудования на основе оценки рынка сервисного обслуживания в Арктической зоне. Известия Санкт-Петербургского государственного экономического университета 3, 100-106.

Вострокнутов А.Е., Лойко В.И. 2018. Методологические аспекты формирования и стратегического развития бизнес-модели организаций малого бизнеса. Новые технологии 3, 92-100.

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