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The role of functionality and quality of service of Internet services in improving the business efficiency of pharmaceutical companies

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Abstract

With the continued growth of business-to-busines (B2B) and business-to-consumer (B2C) Internet services, online providers offer an increasing range of services that support and improve their core products or services. In this article, we will explore Internet services in the pharmaceutical market in E-Pharma.

The results of the field study confirm that the functionality and quality of the services provided by Internet services are important predictors of customer beliefs and behaviour, and have a significant impact on indicators of pharmaceutical company development as sales and advertising revenue. The constructed econometric model confirms that the monthly traffic of the Internet service is primarily sensitiveto the speed of order processing, i.e. a change in the speed of order processing will be reflected in the growth of traffic after a shorter period of time compared to other factors. The functional value is also confirmed, reflecting the usefulness of the Internet service in a practical aspect due to the influence of selected factors in the multiple regression model studied.

The study allowed us to identify the most effective ways to develop Internet services in the E-Pharma market. These include: promotion of Internet services through social networks, which will ensure an increase in both the social and emotional value of the Internet values studied; implementation of other measures to increase public awareness of Internet services operating in the Russian pharmaceutical market; development of a loyalty programme for customers of a pharmacy organisation who purchase medicines through an Internet service, thereby contributing to an increase in their functional, social, and emotional value.

Keywords: e-commerce, customer satisfaction, functionality, quality of service, consumer behavior.

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功能性和服务质量在提升制药公司业务效率中的作用

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简介

随着互联网服务在商业和消费者领域不断增长，在线供应商提供越来越广泛的服务范围，以支持和改进其核心产品或服务。在本文中，我们将探讨电子制药领域中的互联网服务。

田野调查结果证实，互联网服务的功能性和服务质量是客户信念和行为的重要预测因素，并且在很大程度上影响着制药公司的营收和广告收入等发展指标。建立的计量模型证实，互联网服务的月度流量主要受订单处理速度的影响，即订单处理速度的变化将更快地反映在流量增长上，相对于其他因素。功能价值也得到了确认，反映了互联网服务在实践中的实用性，这是通过所选因素在研究的多元回归模型中的影响来确认的。

因此，对互联网服务的工作满意度对其工作效率产生重要影响，而这又直接影响到公司的发展。该研究还揭示了在电子制药市场发展互联网服务的最有效方法：推广互联网服务通过社交媒体，将提升所研究的互联网价值的社会和情感价值；采取其他措施扩大俄罗斯制药市场上的互联网服务的宣传信息；制定客户忠诚计划，针对通过互联网服务购买药品的药店客户，从而提升它们的功能性、社会性和情感价值。

关键词: 电子商务、消费者满意度、功能性、服务质量、消费者行为。

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Introduction

Currently, the issues of implementing Internet services and their impact on business activities are becoming increasingly relevant. Research shows that Internet services play an important role in business and can influence the results of a company's activities. Electronic business to customer (B2C) has shifted the focus of the use of Internet technologies (IT) from internal management tools to customer-oriented Internet services and has stimulated a sharp increase in the use of IT in the provision of all types of customer services [Straub, Watson, 2001].

Research on Internet services examines the characteristics that determine their value to consumers and businesses. These include various economic, social and psychological aspects. Thus, according to F. Kotler, value is the combination of three components: quality, service and price (QSP), and value itself is a key concept in marketing [Kotler, 2011]. The first works in the field of service value research were the works of V.A. Zeithaml, A. Parasuraman [Zeithaml, Parasuraman, 2004] and others. In particular, Zeithaml's theory of service value states that 'the value of services is determined by the relationship between the quality of customer service and the perceived quality of service and the associated payment' [Zeithaml, 2000]. This statement formed the foundation for the development of the Service Quality Gap Model, which posits that consumer dissatisfaction (low value) is attributable to two gaps: the first gap (Gap1) between the service provider's and consumer's understanding of quality, and the second gap (Gap2) between the design and actual implementation of service quality.

In the study conducted by Huth and Allee (2002), the following characteristics of the value of Internet services for customers were identified: economic value, knowledge value, and intangible value. In [Krizanova et al., 2019], the authors introduce the concept of 'relative value', which is understood as 'the value of acquiring a certain product (service) by using an Internet service, taking into account the cost of purchasing (acquiring) this product (service)'. [Spohrer et al., 2007] state that the Internet service is produced by the service provider and the customer at the same time (simultaneously) and that the value is determined in the process of interaction that meets the needs of both parties (supply and demand). Thus, the main goal of an Internet service as a 'co-production' is to create value for both parties - demand and supply.

In addition to value creation, many studies have examined the service quality of B2C Internet services

(e.g. [Devaraj et al., 2002; Gefen, 2002; Zeithaml et al., 2002; DeLone, McLean, 2003; Đurašković, 2017]). At the same time, the question remains unanswered: what services should Internet services provide, what functionality should Internet services have?

The purpose of this study is to determine how the functionality and quality of services provided by Internet services affect the performance indicators of the companies that develop them.

1. Literature review

1.1. Concept of functionality and quality of support services

Internet services/web applications are increasingly being used around the world to create customer-centric solutions and are having a significant impact on the overall efficiency of businesses. The study [Cenfetelli et al., 2008] identifies four categories that reflect the degree of influence of Internet services on a company's efficiency: quality of service, satisfaction, usefulness and users' ongoing intentions.

The satisfaction category allows us to evaluate the relationship between the results obtained and the customer's expectations, and to identify the result of positive and negative deviations that indicate customer satisfaction or dissatisfaction [Cenfetelli et al., 2008].

The service quality category assesses interaction with process participants and the degree to which customer needs are met [Parasuraman et al., 1985; 1988; Dabholkar et al., 2000]. The SERVQUAL concept is widely used to assess the quality of service, which reflects the customer's perception of the supplier's activities, reliability, trust, loyalty to the supplier, physical aspects of the infrastructure and the appearance of the Internet service [Parasuraman et al., 1985; 1988; Dabholkar et al., 2000; Cenfetelli et al., 2008].

The utility category determines the degree of user satisfaction with the product received. The evaluation of the utility level of different products determines consumer preferences.

The reasons why a user makes a search query are reflected in the persistent user intent category.

The study [Cenfetelli et al., 2008] introduces the concept of Supporting Services Functionality (SSF), which reflects the benefits of using IT to provide services that support a product. There are three models of such services: additional services [Lovelock, 1994; Lovelock, Yip, 1996], extended services [Levitt 1980; Kotler, 1997], and customer service life cycle (CSLC) models [Ives, Learmonth, 1984]. These models are based on the idea that sellers who offer additional services alongside their core product or service can differentiate that product or service, making it more attractive.

The use of support service functionality is our guarantee of high quality. This is firstly because related services are a source of customer support and service quality is the value created for customers [Lovelock, 1994; Lovelock, Yip, 1996; Parasuraman, Grewal, 2000; Piccoli et al., 2004]. Secondly, full customer satisfaction is one of the key factors of service quality and related services contribute to it [Zeithaml et al., 2002; Piccoli et al., 2004; Cenfetelli et al., 2008]. The functionality of supporting services provides the basis for interaction between suppliers and customers in B2C, which is the basis for assessing the quality of service of B2C websites [Parasuraman et al., 1985; Parasuraman, Grewal, 2000; Cenfetelli et al., 2008]. The use of support service functionality allows the creation of a wide range of related services, which ensures a higher level of customer satisfaction compared to traditional offline retailing [Cenfetelli et al., 2008]. At the same time, the use of related services creates value for consumers [Zeithaml, 1988; Bolton, James, 1991; Oliver, 1996; Cronin et al., 2000; Parasuraman, Grewal, 2000; Homburg et al., 2002]. The idea behind this assertion is that a core product or service offered with ancillary services is more valuable than offering the core product or service alone [Levitt, 1980; Lovelock, 1994; Kotler, 1997]. Using a website also helps to increase customer satisfaction. Customers who are more satisfied with a website are more likely to continue using the site because their satisfaction is higher [Bagozzi et al., 1999; Dabholkar et al., 2000; Devaraj et al., 2002; Cenfetelli et al., 2008].

1.2. The impact of Internet services on the efficiency of a company at the different stages of the value creation chain

In the work [Pham, Ahammad, 2017], the main aspects of the influence of Internet services on the overall performance of companies were identified (Table 1).

Thus, each stage of the value creation process of Internet services should be aimed at increasing customer satisfaction and creating a positive image not only of the product but also of the company as a whole, which will ensure high efficiency of the company.

In light of the above, we formulated a research question, 'How does the functionality and quality of services provided by Internet services affect the performance of companies that develop these services?'.

2. Research methodology

The research question posed suggests the use of an inductive approach, combining the description of reality and the interpretation of the results obtained. In this respect, the case study method was chosen, which allows a comparative analysis of cases to be used to obtain results.

The empirical analysis is based on three Russian pharmaceutical companies, each of which has been using

Table 1
The impact of Internet services on the company's performance at different stages of the Internet services value chain

Stages of value creation for Internet services	Characteristics of the impact of Internet services on efficiency
Pre-sale stage	At this stage, customers typically engage in a number of activities: searching for information about the product, comparing different alternatives, reading customer reviews. A high level of quality and functionality of online services has a positive impact on customer satisfaction with e-retailers and the company as a whole. [Srinivasan et al., 2002; Liu et al., 2008; Rose et al., 2012; Pham, Ahammad, 2017]
Search for product information	Information provided by online services helps shoppers make purchasing decisions [Wang, Strong, 1996; Wolfinbarger, Gilly, 2003; Pham, Ahammad, 2017]. E-retailers with detailed product information increase customer satisfaction compared to those without detailed product information [Jiang, Rosenbloom, 2005; Pham, Ahammad, 2017]
Ease of use	A user-friendly website makes it easier to find the information you need about the product and increases customer satisfaction. [Srinivasan et al., 2002; Rose et al., 2012; Pham, Ahammad, 2017]
Website look and feel	The appearance of the site (aesthetics) has an impact on the formation of positive impressions in the minds of consumers and an increase in their level of satisfaction. [Kotler, 1973; McKinney, 2004; Rose et al., 2012; Pham, Ahammad, 2017]
Product customisation	Customisation (the degree to which products are adapted to customer needs) increases customer satisfaction by improving product quality, providing services to help customers make quick decisions about purchasing a product, etc. [Shapiro, Varian, 1999; Haubl, Trifts, 2000; Srinivasan et al., 2002; Rose et al., 2012; Pham, Ahammad, 2017]
Purchase stage	This aspect includes the following activities for shoppers: choosing a payment and delivery method, filling in payment details, confirming the order at checkout. [Pham, Ahammad, 2017]
Easy to order	The faster and easier it is to place an order and complete a transaction, the higher the customer satisfaction. [Pham, Ahammad, 2017]
Ensuring safety	The higher the cybersecurity of ordering and transacting, the higher the customer satisfaction.
After sales service	Post-purchase product evaluation influences future customer behaviour [Kotler, 1997]
Fulfilling an order	The higher the quality of order fulfilment, the higher the level of customer satisfaction. [Coyle et al., 1992; Stank et al., 1999; Stock, Lambert, 2001; Stank et al., 2003; Davis-Sremeck et al., 2008; Rao et al., 2011; Pham, Ahammad, 2017]
Speed of customer service	Research shows that there is a strong link between customer satisfaction and service quality, an important aspect of which is efficiency. [Devaraj et al., 2002; Gounaris et al., 2010; Pham, Ahammad, 2017]
Ease of return	Research shows that more than 60% of shoppers read the return policy carefully before making a purchase[a]. Ease of return is therefore also an important component of customer satisfaction. [Pham, Ahammad, 2017]
Repurchase option	Customer satisfaction is expressed in the desire to make repeat purchases. [Srinivasan et al., 2002]

[a] Online shopping customer experience study commissioned by UPS (2012). https://thenewlogistics.ups.com/cdn/enus/whitepapers/Online_Shopping_Cust_Experience_Study.pdf.
Source: compiled by the authors.

Internet services for more than 5 years. The Internet services of these companies operate in the territory of the Russian Federation and allow the purchase of medicines. The cases were selected from a wider database of pharmaceutical companies, including eleven Russian pharmaceutical companies that participated in this study. The remaining eight were not selected because the online service did not allow online purchases (it only worked as a showcase) or had been in operation for less than 5 years.

Data collection. Data collection was carried out between March and May 2023 using semi-structured interviews with employees and management of companies during personal visits. The interview questions concerned the strategy for promoting Internet services, defining the functionality of support services, assessing the customer's perception and satisfaction with the Internet service, creating and assessing the quality of the service provided by the Internet service and its usefulness.

Data analysis: Four key questions were identified regarding the role of Internet services in the development of a pharmaceutical company:

1) why Internet services are important for the development of the pharmaceutical business;
2) how the quality and functionality of the Internet service as perceived by the customer influences the further development of the pharmaceutical company;
3) how the customer's satisfaction with the Internet service influences the development of the pharmaceutical company;
4) how the efficiency of the Internet service affects the overall performance of the pharmaceutical company.

The data analysis was carried out in four stages. The first stage collected key characteristics of the business model of Internet services. The second stage analysed the efficiency of the Internet services under study. The third stage conducted a consumer survey and identified assessments of the functionality and quality of service of Internet services. The fourth stage assessed the relationship between the level of perception of functionality, quality of service and satisfaction with the Internet service by the consumer and the efficiency of the pharmaceutical company.

Evaluating the effectiveness of Internet services. The effectiveness of the use of Internet services can be determined using various methods and tools [Mutigullin, Prasolova, 2018]:

- Return on investment (ROI) methodologies to determine the effectiveness of funds invested in the development and deployment of Internet services;
- Methods for assessing the impact of an Internet service on the achievement of business objectives (COBIT), which involves comparing the cost of developing and implementing Internet services with the performance indicators and development of the business as a whole;
- Methods for analysing the costs and risks associated with the use of Internet services, the benefit of which is the ability to fully quantify the costs of developing and deploying these services over their entire lifecycle;
- Expert methods using tabular data. The method of expert evaluation consists in obtaining the opinions of experts and, based on them, forming the necessary information, the analysis of which is carried out using logical and mathematical-statistical methods. Currently, there are different classifications of expert judgement methods (e.g. weighting coefficient methods, sequential comparisons, paired comparisons, etc.);
- ALE methodology, which involves the assessment of potential financial losses (damages) that make up the total amount resulting from the implementation of information security threats;
- Methods of usability evaluation based on users - these are subjective methods of evaluation of Internet services, the results of which cannot be interpreted by means of monetary instruments, but their use is advisable for the purpose of determining, for example, a company's image and the influence of Internet services on it, etc;
- Usability evaluation methods based on evaluators. These methods belong to the group of expert evaluation methods. Their essence is to determine the usability and efficiency of Internet services by such subjects as experts in the field of functioning of the services under study. The most common method in this category is heuristic evaluation, where, for example, each evaluator individually walks through the system interface at least twice. The result of such an assessment is a list of problems with the Internet service, with reference to the broken heuristics, etc. In fact, the participants in the evaluation methods are people who are specialists in the field of creating Internet services, so they can not only present a report with problems, but also name the cost of the Internet service being evaluated;
- Web evaluation methods - involve studying the Internet as a holistic phenomenon and the place of Internet services within it, calculating statistics on the detailed use of an Internet service and providing data on web traffic, visibility, connectivity, ranking and the overall impact of an Internet service on business performance.
- Web rating methods work by comparing a particular Internet service with other similar services and with the Internet as a whole;
- Link analysis methods. Link analysis studies the topology of Internet services, assuming that the

quality of a Web page depends on its links. There are two main methods that use link analysis: PageRank and Webometrics. The PageRank tool was invented together with the Google search engine by its creators L. Page and S. Brin. Google PageRank is a link analysis algorithm, named after Page, that assigns a numerical weight to each hyperlink, and each page has a calculated PageRank based on the number and quality of links pointing to it. [Мутигуллин, Прасолова, 2018, с. 43]. It is worth noting that Google takes more than 100 factors into account when analysing links, but PageRank is the most important one when ranking search results. This tool is a reliable source of information about popular and long-established Internet services.

Speaking about the methods of determining the efficiency of the use of Internet services, which include identifying the place of these services in the web space, which implies, for example, an assessment of the degree of their coverage of the audience, consumers, etc., it should be noted that such tools for determining the efficiency of use of Internet services as automatic evaluation of Internet services and web analytics play an important role in the implementation of these methods.

Tools for automatically evaluating web services include W3C validators and link popularity checkers, software that automates the collection of interface usage data and identifies potential web problems. Their data can be used indirectly as some basis for monetary valuation. However, for evaluation purposes, only automated tools for evaluating internet services cannot be used, as they cannot be considered effective [Perell, 2018].

The most popular web analytics tools are Google Analytics and Alexa. Alexa is a metric system for internet services and websites that calculates traffic rank by analysing web page usage by Alexa toolbar users over three or more months as a combined measure of page views and number of visitors to the internet service.

O.V. Lebedev and L.Kh. Gabidullina identify the following web analytics tools that can be used to collect data to determine the effectiveness of using internet services, which are presented in Table 2 [Lebedev, Gabidullina, 2017].

In this case, the efficiency of the use of Internet services should be considered from two points of view:

– in terms of the financial benefit, in monetary terms, of using the services in question;
– from the point of view of creating a positive image of the organisation, which in turn will contribute to increasing its efficiency in the Russian market.

The efficiency of the use of Internet services can therefore be measured using different methods and tools. The research carried out enables us to distinguish among these methods, such as methods of cash flow assessment (ROI), which allow us to determine the efficiency of

Table 2
A number of web analytics tools that can be used to collect data in order to determine the effectiveness of the use of Internet services

Group of tools	Tools
Counters	LiveInternet, «Рейтинг@Mail.ru», OpenStat, HotLog и др.
Log analysers	Webalizer, AWStats и др.
Internet statistics systems (counter trackers)	GoogleAnalytics, «Яндекс.Метрика» и др.
Marketing tools	Cy-pr, Linkpad, Pr-cy и др.

Source: compiled by the authors based on: [Lebedev, Gabidullina, 2017, p. 100].

investing funds in the development and implementation of Internet services; a method of analysing the costs and risks associated with the use of Internet services; expert methods using tabular data; web assessment methods, which involve identifying the place of internet services in the web space, etc.

In order to assess the value of Internet services for pharmaceutical market participants in e-Pharma, this study uses methods for assessing cash flow (ROI), assessing the impact of Internet services on the achievability of business goals (COBIT) and expert methods.

Such tools for determining the efficiency of the use of Internet services, such as Google Analytics, Alexa, etc., play an important role in the implementation of methods that involve identifying the place of Internet services in the web space.

When determining the efficiency of using Internet services, it is advisable to evaluate the cost of their development, creation and implementation into operation, as well as subsequent maintenance, taking into account the human and software resources involved, covering the databases, network equipment, etc. It is also necessary to identify potential information security risks, the likelihood of which is significantly increased by the use of the Internet (e.g. using the ALE method of expected losses).

3. Case analysis

3.1. Brief description of pharmaceutical companies and their internet services

All three selected pharmaceutical companies and their Internet services Apteka.ru, Zdravcity.ru, Evalar have been operating in the e-Pharma market for more than 5 years and are in demand by consumers.

Apteka.ru - a domestic internet service that allows customers to order the medicines and cosmetics they need

Table 3
Indicators of web-based evaluation of the effectiveness Internet services under study in the Russian pharmaceutical market

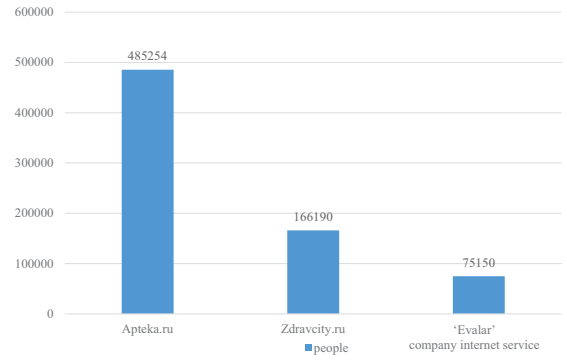
Web evaluation metrics	Apteka.ru	Zdravcity.ru	'Evalar' company internet service
Monthly visits (people)	485254	166190	75150
Annual visits (people)	6001880	2055525	929500
Monthly views (number)	1941007	664750	300615
Annual views (number)	24007390	8221974	3718169
Estimated value (USD)	3262606	189352	22975
Quality score (out of 100)	51	37	44
Monthly ad revenue (USD)	5823	1994	901
Annual advertising revenue (USD)	72022	24665	11154

Source: compiled by the authors based on https://parsesite.ru/.

without leaving home, with the customer choosing the point of sale where they want to collect their order.

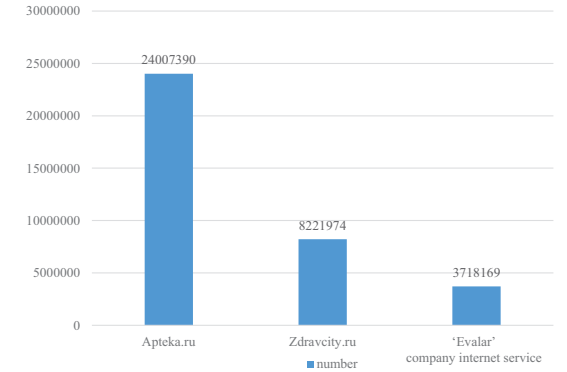
Apteka.ru offers a wide range of pharmaceutical products at the best price. The service also offers a policy of discounts on certain goods and for regular customers. For example, a customer receives a 10% discount on their first order and can use the loyalty programme for subsequent purchases.

Fig. 1. Monthly visits to the Internet services studied (people)



Source: compiled by the authors based on https://parsesite.ru/.

Fig. 2. Yearly views of the Internet services studied (number)



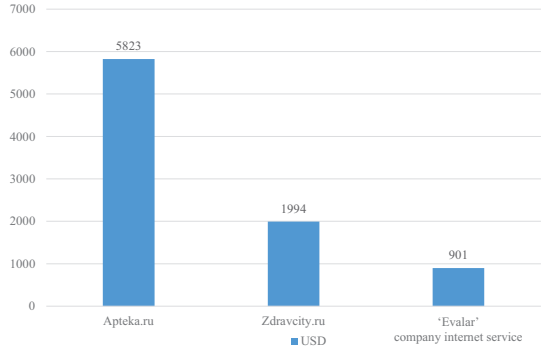
Source: compiled by the authors based on https://parsesite.ru/.

At the same time, the service allows you to search the database for the medicines you need by name or by category, including: cosmetics, basic care, vitamins and supplements, joint disorders, vision, etc. To familiarise themselves with the product, consumers can go to the relevant page on the site. Here they can select the quantity of the product to be ordered, its form factor and specify the price. The site also provides detailed information about the product: composition, indications and contra-indications, method of use, storage conditions, etc. The consumer can also compare the drug with its analogues and leave a review about the product. The consumer can also compare the drug with its analogues and leave a review about the product.

Zdravcity.ru. Just like Apteka.ru, Zdravcity.ru is an online service that allows the client to order delivery of medicines, medical products, hygiene products, dietary supplements, cosmetics and other health and beauty products. The service offers more than 46.000 certified products.

The difference with this Internet service is that you can place an order for delivery by courier. At the same time, it allows you to search for the products you need and classifies them into categories: medicines, dietary supplements, medical devices, medical equipment,

Fig. 3. Monthly income from advertising of the Internet services studied (USD)



Source: compiled by the authors based on https://parsesite.ru/.

Table 4
Findings from an expert evaluation of the effectiveness of Internet services for pharmaceutical market participants

Evaluation criteria	Apteka.ru	Zdravcity.ru	'Evalar' company internet service
Lowest costs	–	–	–
Highly qualified staff	+	–	+
Order execution control	+	–	–
Timely execution	+	–	+
Assessment of the problem	+	–	–

Source: compiled by the authors.

hygiene, mother and baby, cosmetics and healthy food. Like Apteka.ru, Zdravcity.ru allows you to view detailed information about a product, place an order in the 'shopping cart', and also participate in the loyalty programme. The 'ZdravsitiPlus' loyalty programme allows customers to accumulate bonuses for purchases of 100 roubles or more and spend them on up to 70% of their next purchase. Thus, Zdravcity.ru is an Internet service similar to Apteka.ru, the difference being the possibility of courier delivery of the order to the customer's address, which makes the purchase of pharmaceutical products even easier.

'Evalar' - this Internet service offers the same possibilities as those mentioned above, including the possibility of familiarising oneself with the characteristics of the product, placing an order with delivery to the customer and a discount policy. In addition, the site hosts and regularly updates the 'Fitodoctor' blog of the 'Evalar' company, which publishes articles on health and beauty, further attracting consumers.

In order to assess the demand and efficiency of the specified Internet services for pharmaceutical market participants, E-Pharma used web evaluation methods that allowed the determination of service traffic, number of hits, estimated costs, advertising revenue, etc. (Table 3).

The analysis of web evaluation indicators of the studied internet services on the Russian pharmaceutical market shows that the Internet service Apteka.ru has the

Table 5
Findings from an expert evaluation of the effectiveness of Internet services for pharmaceutical market participants

Answers	Number of respondents (people)	Percentage of responses as a proportion of the total number of respondents (%)
Which online pharmaceutical service do you use?		
Apteka.ru	1768	33.4
Zdravcity.ru	1527	22.9
'Evalar' company internet service	598	17.3
Other internet service	1009	17.8
I don't use internet services	192	8.4
What features of online pharmaceutical services attract you?		
Ease of search	1614	70.4
Speed of service	1480	67.8
Ability to receive products without leaving home	1727	75.3
Availability of product information	1368	59.6
I find it difficult to answer	49	2.1
Other	13	0.6
What do you think about the quality of service provided by online services that offer pharmaceutical products?		
Products and services meet my expectations	1324	57.7
Products and services partly meet my expectations	728	31.7
Products and services do not meet my expectations at all	242	10.5
Are you satisfied with the work of online services offering pharmaceutical products?		
Yes, in full	1991	86.8
Not at all	206	8.9
I find it difficult to answer	97	4.3

Source: compiled by the authors on the basis of the survey results.

Table 6
Statistical sample from June 2021 to May 2023

Period (t)	Traffic (y) (million users)	Order processing speed (x_1)	User friendly interface (x_2)
June 2021	9.3	3.2	2.5
July 2021	9.4	3.5	2.6
August 2021	9.3	3.6	2.6
September 2021	11.5	3.4	2.8
October 2021	11.4	3.8	2.3
November 2021	11.1	3.5	2.5
December 2021	11	3.4	3.1
January 2022	9	3.3	3.5
February 2022	10.8	3.7	3.4
March 2022	9.3	3.7	3.5
April 2022	9.2	3.7	3.7
May 2022	9.5	3.5	3.4
June 2022	5.2	3.8	3.8
July 2022	9.7	3.8	3.4
August 2022	9.7	3.8	3.6
September 2022	9.9	4	3.3
October 2022	10.7	4	3.2
November 2022	10.9	4.2	3.7
December 2022	11.7	4.5	4.4
January 2023	8.2	4.6	4.2
February 2023	11.2	4.5	3.3
March 2023	12.4	4.7	3.8
April 2023	12.6	4.8	4.2
01.05.2023 - control sample	12.6	4.9	4

Source: compiled by the authors on the basis of the survey results.

highest value among them, which is demonstrated by monthly and annual traffic, number of views, estimated costs, advertising revenues, etc.

For example, monthly visits and annual views of the Apteka.ru internet service exceed similar indicators of the Zdravcity.ru Internet service by 34.2%, and the Internet service of the 'Evalar' company by 15.5% (Figs. 1, 2). The monthly advertising revenue of Apteka.ru also exceeds the similar indicator of Zdravcity.ru and 'Evalar' (Fig. 3.).

In order to assess the effectiveness of the specified Internet services for pharmaceutical market participants, E-Pharma also used the expert assessment method. For this purpose, a survey was conducted among experts (professional participants in the pharmaceutical market, including pharmacy managers - 10 people) on such evaluation criteria as the cost of maintaining the Internet resource, the availability of qualified staff, etc. These criteria allow us to determine the value of internet services from the point of view of companies offering

Table 7
Estimated least squares model using the LINEST function

R26C2 =ЛИНЕЙН(R[-24]C:R[-2]C;R[-24]C[1]:R[-2]C[2];ИСТИНА;ИСТИНА)

	1	2	3	4
1	Period (t)	Traffic (y) (million users)	Order processing speed (x_1)	User friendly interface (x_2)
2	June 2021	9.3	3.2	2.5
3	July 2021	9.4	3.5	2.6
4	August 2021	9.3	3.6	2.6
5	September 2021	11.5	3.4	2.8
6	October 2021	11.4	3.8	2.3
7	November 2021	11.1	3.5	2.5
8	December 2021	11	3.4	3.1
9	January 2022	9	3.3	3.5
10	February 2022	10.8	3.7	3.4
11	March 2022	9.3	3.7	3.5
12	April 2022	9.2	3.7	3.7
13	May 2022	9.5	3.5	3.4
14	June 2022	5.2	3.8	3.8
15	July 2022	9.7	3.8	3.4
16	August 2022	9.7	3.8	3.6
17	September 2022	9.9	4	3.3
18	October 2022	10.7	4	3.2
19	November 2022	10.9	4.2	3.7
20	December 2022	11.7	4.5	4.4
21	January 2023	8.2	4.6	4.2
22	February 2023	11.2	4.5	3.3
23	March 2023	12.4	4.7	3.8
24	April 2023	12.6	4.8	4.2
25	01.05.2023 - control sample	12.6	4.9	4
26		-1.466806707	2.42661415	5.638351991
27		0.708682624	0.875813186	2.497805721

Source: compiled by the authors.

pharmaceutical products through them. The results of the expert evaluation are shown in Table 4.

The survey of experts also showed that the Apteka.ru service is the most valuable of the Internet services mentioned for pharmaceutical market participants in the e-Pharma sector.

In order to assess the quality of service, usefulness and satisfaction of consumers with Internet services offering pharmaceutical products, a sociological survey was carried out through social networks, where respondents were asked to answer a series of questions. 2294 people participated in the survey, the results of which are presented in Table 5.

The sociological survey showed that the majority of respondents (75.6%) use the internet service Apteka.ru to purchase pharmaceutical products. 55.8% of consumers who took part in the survey use Zdravcity.ru, and only 17.3% use 'Evalar'. At the same time, 8.4% of respondents do not use online services to purchase pharmaceutical products.

The most important functionality that determines the attractiveness of the internet services studied for consumers is the possibility of obtaining medicines without leaving home (75.3%). At the same time, consumers are also attracted by the ease of finding a product (70.4%) and the speed of service (67.8%).

The vast majority of respondents (86.8%) are satisfied with the work of internet services offering pharmaceutical products, while 4.3% found it difficult to answer this question as they do not use Internet services to purchase pharmaceutical products.

Table 8
The 2nd Gauss - Markov assumption. The Goldfeld - Quandt test

				The Goldfeld - Quandt test		
June 2021	9.3	3.2	2.5	–2.358901	4.9479107	–0.364968517
July 2021	9.4	3.3	2.6	1.07042109	2.80653955	7.418202454
August 2021	9.3	3.4	2.6	0.37958265	0.89705602	#Н/Д
September 2021	11.5	3.4	2.8	2.44727297	8	#Н/Д
October 2021	11.4	3.5	2.3	3.93868762	6.43767602	#Н/Д
November 2021	11.1	3.5	2.5			
December 2021	11	3.6	3.1			
January 2022	9	3.7	3.5	GQ	0.29196757	Random residuals are homoscedastic
February 2022	10.8	3.7	3.4	GQ^{-1}	3.42503791	
March 2022	9.3	3.7	3.5	Fkr	3.43810123	
April 2022	9.2	3.8	3.7			
May 2022	9.5	3.8	3.4			
June 2022	5.2	3.8	3.8	–1.8917539	4.53231808	–2.007865363
July 2022	9.7	3.8	3.4	1.51494508	1.60836901	6.13492392
August 2022	9.7	3.8	3.6	0.50092158	1.66016883	#Н/Д
September 2022	9.9	4	3.3	4.01477257	8	#Н/Д
October 2022	10.7	4	3.2	22.1307156	22.0492844	#Н/Д
November 2022	10.9	4.2	3.7			
December 2022	11.7	4.5	4.4			
January 2023	8.2	4.5	4.2			
February 2023	11.2	4.6	3.3			
March 2023	12.4	4.7	3.8			
April 2023	12.6	4.8	4.2			

The analysis of the web evaluation indicators of the studied Internet services on the Russian pharmaceutical market shows that the internet service Apteka.ru has the highest value among them, which is demonstrated by the monthly and annual traffic, number of hits, estimated costs, advertising revenues, etc. These results were confirmed by a survey of experts and a sociological survey of consumers.

3.2. Assessment of the relationship between satisfaction level, service quality and functionality of an internet service and its performance

In order to analyse the impact of service quality, functionality and consumer satisfaction with internet services on the efficiency of their work, correlation and regression analysis was used, which allowed us to construct an econometric model.

It is necessary to build a specification of the model of dependence of monthly traffic on order processing speed and user-friendly interface and to test the econometric model for adequacy. As an endogenous variable in the model, we use the monthly traffic of the internet service, and the remaining variables are explanatory or exogenous: x_1 is the order processing speed and x_2 is the convenience of the interface.

Let us present the statistical information required for the next stage[1]. We will take a monthly statistical sample from June 2021 to May 2023, with a volume of 24 units. May 2023 has been chosen as the control sample (y) (Table 6).

For the analysis we use a linear econometric model with multiple regression (with several regressors - exogenous variables).

Let us denote y_t as the monthly traffic of the internet service, x_{1t} as the order processing speed, x_{2t} as the convenience of the interface, and create a linear dependency :

$$\begin{cases} y_t = a_0 + a_1 x_{1t} + a_2 x_{2t} + u_t \\ a_0 > 0 \\ E\left(\frac{t}{u^{X1t,X2t,X3t}}\right) = 0 \\ E\left(\frac{2t}{u^{X1t,X2t,X3t}}\right) = \sigma^{2u} \end{cases} \quad (1)$$

The model estimated by the least squares method using the linear function in Excel is as follows (Table 7):

$$\begin{cases} y_t = 5{,}638 + 2{,}427 x_{1t} - 1{,}467 x_{2t} + u_t \\ (S_{\tilde{a}0} = 2{,}498), \\ (S_{\tilde{a}1} = 0{,}876), (S_{\tilde{a}2} = 0{,}709) \\ (\sigma_{\tilde{u}t} = 1{,}408) \end{cases} \quad (2)$$

The free regression term $a_0 = 5.638$ reflects the value of the dependent variable when the independent variable is zero. The sign of the coefficient a_1 indicates the direction of the relationship between the variables x_t and y_t. In our case a_1 is approximately equal to $2.427 > 0$, which means that a 1% increase in the speed of order processing for the

[1] Megaindex. Premium Analytics. Competitor visibility history. https://ru.megaindex.com/visibility/apteka.ru?ser_id=1,5693,2846&group=url&url=apteka.ru.

period t leads to a 2.427% increase in the monthly traffic of the Internet service.

There are several indicators that characterise the quality of the regression model, i.e. the degree of agreement between the constructed model and the original data. In this paper, the F-test is used to assess the quality of the model[2].

For the model studied in the work F_{fact}=3.869, F_{crit}=3.493 (calculated using the function $F_{INV.RT}$ (with probability 0.95 and degrees of freedom 2 and 20), $F_{crit} < F_{fact}$, therefore the hypothesis of insignificance of the regression equation is rejected and the quality of the compiled model is confirmed.

For an ordinary least squares regression analysis to produce the best possible results, the random term must satisfy the three Gauss-Markov conditions. If these conditions are not met, it is worth returning to the model specification from the beginning.

The first Gauss-Markov condition: $E_{(\varepsilon i)} = 0$ for all observations. To check this assumption, it is sufficient to find the mathematical expectation of the residuals and make sure that it is close to 0. Using Excel, the mathematical expectation of the random residuals calculated earlier is found as their mean value. The mean value u_t is 0.000000000000001429, i.e. it tends to zero. The first condition is fulfilled.

The second Gauss-Markov condition: the random term variance must be constant for all observations.. Sometimes the random term will be larger, sometimes smaller, but there should be no reason why it should cause a larger error in some observations than in others. When we write the model $y_t = a_0 + a_1x_{1t} + a_2x_{2t} + u_t$, the first two Gauss-Markov conditions indicate that the random terms in n observations come from probability distributions with zero mean and equal variance. The probability of ε taking any positive (or negative) value is the same for all observations. This condition is called homoscedasticity.

To check the second condition, the Golfeld-Quandt test is used: it is necessary to rank the observation equations in ascending order of the sum of the absolute values of the model regressors (in our case, we select the regressor x_1 in ascending order), then to evaluate two samples (in our case, the first 11 and the last 11 values: n' = 1/2; n = 23/2 = 11.5) and finally to use the linear function to calculate ESS_1 and ESS_2.

The next step is to determine the statistics GQ = ESS_1/ESS_2 and GQ^{-1} = ESS_2/ESS_1 = 1/GQ. According to our model GQ = 0.292; GQ^{-1} = 3.425

To conclude that the second condition of the Gauss-Markov theorem is fulfilled, it is necessary to check the fulfilment of the system of inequalities: GQ < F_{crit}, GQ^{-1} < F_{crit}.

F_{crit} is calculated in Excel using the formula: $F_{обр.пх}$ (0.05; 11; 11).

F_{crit} = 3.438, so both inequalities are true and the second condition of the Gauss-Markov theorem is satisfied. Thus, the random residuals are homoscedastic (Table 8).

The third condition of the Gauss-Markov theorem: the random deviations u_i and u_j are independent of each other for $i \neq j$. Fulfilment of this assumption requires that there is no systematic relationship between any random deviations. The magnitude and specific sign of one random deviation should not be the cause of the magnitude and sign of any other deviation. The test is performed using the Durbin-Watson test.

Criterion algorithm: (1) find the estimated u_t according to our model, then find u_t^2 and compute $(u_t - u_{(t-1)})^2$; (2) compute DW = $(\sum(u_t - u_{(t-1)})^2) / (\sum u_t^2)$; DW = 1.9598; (3) for k = 2, n = 23 (find the intersection in the Durbin-Watson table) intervals for d_l° and d_u: d_l° = 1.17; d_u° = 1.54; (4) construct intervals M1 - M5 (Table 9) and see which one contains the DW value.

Table 9
The Darbin - Watson criterion

M1	M2	M3	M4	M5
0-1.17	1.17-1.54	1.54-2.46	2.46-2.83	2.83-4

Source: compiled by the authors based on the results of calculations.

DW ϵ M3, i.e. Cov $(u_t; u_{(t-1)}) = 0$ - there is no autocorrelation of the random residuals. Therefore, the third condition of the theorem is also satisfied.

Thus, all the conditions of the Gauss-Markov theorem are fulfilled with respect to random remainders. In the econometric dependency model, the monthly traffic of the Internet service depends on the speed of order processing and the convenience of the interface.

In order for the forecast for which the econometric model is created to be the most accurate, it is necessary for the model to be recognised as adequate. We have divided the statistics into training and control samples. (See Table 10). The second sample included the May 2023 values according to the statistics presented in Table 6.

Using the least squares method through the linear function, we estimate the training sample and use the resulting coefficients (formulae (1-2)) to find confidence intervals for the control period (May 2023).

The confidence interval for the control sample is calculated using the following formula:

$$y_i(-) = y_i' - t_{crit.} \times S(y_i'), \quad (3)$$
$$y_i(+) = y_i' + t_{crit.} \times S(y_i'),$$

where y_i'–y_i rated, $S(y_i') = \partial_u' \times (q_i + 1)0.5$, $q_i = 1/n + (x_i - x_{mean.})^2 / \sum(x_n - x_{mean.})^2$, n = 1, …, 23; $t_{crit.}$ = 2.086 - is the same for all intervals and is calculated in Excel using the STUDENT.INV2X function (0.05; 20); q_{24} = 0.103; $S(y_{24}$ rated) = 1.479; $y_{24}(-)$ = 12.26; $y_{24}(+)$ = 18.43.

The actual value y_{24} = 12.6 belongs to the confidence interval (Table 10).

[2] Byvshev V.A. (2008). Econometrics: a tutorial. M., Finance and Statistics.

Table 10
Econometric model adequacy assessment

x_{mean}	$(x - x_{mean})^2$	q_0	u_t	$(u_t - u_{(t-1)})^2$	u^2
3.33913043	0.70413989	0.10270015	–0.436500502		0.19053269
	0.5463138		–0.917804076	0.23165313	0.84236432
	0.5463138		–1.260465491	0.11741685	1.58877325
	0.29066163		1.71821868	8.87255939	2.95227543
	1.07979206		–0.085830333	3.25459284	0.00736685
	0.70413989		0.635515253	0.52033946	0.40387964
	0.05718336		1.658260692	1.04600823	2.74982852
	0.02587902		0.48764479	1.37034159	0.23779744
	0.0037051		1.17031846	0.46604334	1.3696453
	0.02587902		–0.183000869	1.83147321	0.03348932
	0.13022684		0.010360472	0.03738861	0.00010734
	0.0037051		0.35564129	0.11921884	0.12648073
	0.21240076		–4.085620272	19.7248043	16.692293
	0.0037051		–0.172342955	15.3137394	0.02970209
	0.06805293		0.121018386	0.08606088	0.01464545
	0.00153119		–0.604346456	0.52615415	0.36523464
	0.01935728		0.048972873	0.42682615	0.00239834
	0.13022684		0.497053397	0.20077616	0.24706208
	1.12544423		1.595833847	1.20731848	2.54668567
	0.74109641		–2.440188909	16.2894797	5.95452191
	0.00153119		–0.517653531	3.69614228	0.26796518
	0.21240076		0.930426993	2.0969372	0.86569439
	0.74109641		1.474488261	0.29600266	2.17411563
	7.37478261		0.000000000000001429	77.7312768	39.6628592

Point forecast	
s_0	15.3448086
q_0	0.10270015
sy_{24}	1.47878736
t_{kr}	2.08596345
$y–$	12.2601122
$y+$	18.429505

Source: calculated by the authors.

Thus, the multiple regression model under study is considered adequate, since the y_t control sample fell within the confidence interval.

When analysing the impact of order processing speed and interface convenience on the monthly traffic of an Internet service, the following conclusions can be drawn:

1. The constructed econometric model confirms that the monthly traffic of the Internet service is primarily sensitive to the order processing speed, i.e. a change in the order processing speed will be reflected in the traffic growth after a shorter period of time compared to other factors.
2. The functional value is confirmed, reflecting the usefulness of the Internet service in a practical aspect, due to the influence of the selected factors in the multiple regression model studied.

4. Discussion of the results of the case analysis

4.1. The impact of functionality on business efficiency

In the e-Pharma market we are considering, Russian legislation does not provide for a separate licence to secure the right to sell medicines via the Internet, so despite the online format of such interaction with the customer, this process is recognised as a pharmaceutical service. This means that in order to sell pharmaceutical products via Internet services, an entrepreneur must have a licence to sell goods through retail trade, which in turn

requires the presence of premises and equipment, in effect a bricks-and-mortar pharmacy. Thus, the operation of an Internet service related to the sale of pharmaceutical products without the need for material support of an offline pharmacy seems impossible, and the delivery of medicines itself is illegal, with some exceptions provided by the legislation of the Russian Federation, if the client is a representative of a privileged category of citizens.

Under these conditions, the functional value of Internet services offering products on the pharmaceutical market is reduced, since this problem creates difficulties in their use. The problem here is specifically related to the delivery of medicines to the customer, since throughout the world only pharmacists are allowed to dispense them, while the courier is not in a position to ensure the proper provision of pharmaceutical services. For example, the delivery of medicines would have to be carried out by specialists, which seems impossible due to the high costs and the human and administrative difficulties of providing pharmacies with this process.

At the same time, pharmaceutical companies are trying to solve this problem. As the manager of JSC RPC 'Katren', which owns the Apteka.ru service, notes, they process customer orders via an online service and deliver to a pharmacy convenient for the customer under a standard supply agreement. An important role is played by partnership relations between JSC RPC 'Katren' and pharmacy organisations, on the basis of which the latter undertake to fulfil orders via the Apteka.ru website at special prices indicated on the website. In this case, Apteka.ru only collects information about the customer's intention to buy a certain product, while the sale itself takes place directly at the point of sale of the medicines.

Thus, RPC 'Katren' managed to maintain the functionality of its Internet service, which probably influenced the indicators of its successful development: maximum user traffic, highest advertising revenues, etc.

4.2. The impact of Internet service quality

The quality of service affects customer loyalty and is a function of their emotional attachment to the organisation, regardless of the conditions under which the purchase is made and the efforts competitors make to attract customers to their service. In the cases we studied, managers noted that emotional attachment was strongly influenced by the promotion of internet services through social networks, which created the conditions for informing a large number of consumers about the services themselves, the medicines presented on them, etc. A representative of the company 'Evalar' notes the need to carry out various campaigns to provide information on which social networks, etc. can be used.

The representative of the company 'Protek' (Internet service Zdravcity.ru) notes that the possibility for consumers to leave feedback on the most interesting Internet services influences the improvement of the quality of Internet services for participants of the pharmaceutical market, which in turn creates conditions for conducting market research and determining the directions of further development of pharmacy organisations. It is also necessary to distribute information materials (including thematic booklets and brochures) in printed form through banking institutions, agency groups, consumer advice centres, and to develop a customer loyalty programme for the pharmacy organisation for certain categories of citizens who purchase medicines through an online service.

It is therefore safe to say that the functionality and quality of the services provided by Internet services influence consumer satisfaction and, consequently, the development indicators of a pharmaceutical company.

Заключение

The purpose of this study is to determine how the functionality and quality of services provided by Internet services affect the performance indicators of the companies that develop them.

Our research confirms that the functionality and quality of service provided by internet services has a significant impact on the perception of customer satisfaction and, consequently, on the company's performance indicators.

The value of Internet services to consumers is determined by their functionality, which allows them to better meet the needs of buyers and also encourages them to choose these services. The value structure of Internet services can include components such as traffic and number of views, which in turn affect revenue indicators, advertising revenues and allow companies to expand their activities.

The analysis of web evaluation indicators of the studied Internet services shows that the Internet service Apteka.ru has the highest value among them, which is confirmed by monthly and annual traffic, number of views, estimated costs, advertising revenues, etc. Thus, monthly and annual traffic of Apteka.ru exceeds similar indicators of Zdravcity.ru by 34.2%, Internet service of 'Evalar' - by 15.5%; monthly advertising revenue of Apteka.ru is also higher. The higher value of the Apteka.ru Internet service was confirmed by an expert survey and a sociological survey of consumers. This is explained by the highest functionality of this service and the perceived quality of customer service - ease of finding a product, speed of service.

The most important events for the development of Internet services in e-Pharma are:

- promoting them through social networks, which will increase their social and emotional value;
- increasing public awareness of them;
- developing a loyalty programme that will help increase their functional, social and emotional value.

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