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DIGITAL BUSINESS STRATEGIES IN THE PANDEMIC ERA

The strategic priorities of digital business in the COVID-19 context are analyzed based on the results of analytical and empirical digital business researches. The importance of adjusting the strategic guidelines for digital business reformatting due to the pandemic is determined. It is defined that the online store is a driver of digital business. The metrics of online store performance are substantiated. Monitoring of the metrics allows to change the strategic priorities of digital business in terms of increasing traffic. The methodical tool for diagnosing the stages of online store operation (matrix of gradation-conversion shifts) is developed. This allows to choose a relevant digital business strategy in the pandemic era, as well as a correct comprehensive system of measures to increase the online store efficiency. Approbation of methodical tool proves its expediency for systematic use.
Keywords: digital business, business strategy, retail, online store, development and optimization priorities.

Statement of the problem in general form and it's connection with important scientific or practical tasks. In today's realities, which are determined by radical changes in market trends in the digital transformation context and globalization, as well as characterized by permanent changes and bifurcations in the external environment, the implementation of a proactive decision-making mechanism for effective strategic development management becomes a priority.

Analysis of the latest research and publications, which initiated the solution of this problem and on which the author relies. Theoretical and practical aspects of digital business are covered in the thorough scientific works of domestic and foreign scientists and economists, among whom: Bavyko O., Boiko O., Bondarchuk M., Hellstrom D., Hjort K., Shams P., Vakulenko Yu., Vasiutkina N., Yermak S. Detailed analysis of scientific works of well-known leading foreign and Ukrainian scientists and economists, in particular: Dasgupta S., Gupta B., Iskandar M., Ivanova N., Jung J., Kenney M., Komara D., Nambisan S., Siegel D., as well as reports of foreign and Ukrainian institutions – Gartner, IBM, Kantar Ukraine, Retail systems research, YOTTAA), allowed to establish the key role of optimizing the work of online store in the framework of achieving the desired level of market competitiveness and building positive relationships with customers.

Highlighting the previously unresolved parts of the general problem to which the article is devoted. Without diminishing the importance of scientific developments and achievements on this issue, and given the fragmentary nature of studies, it is necessary to justify the scientific and methodological approach and develop relevant tool in the context of proactive decision-making mechanisms to effectively chose digital business strategy in the pandemic era.

Formulation of the purpose of the article (statement of the problem). The purpose of the article – to substantiate the metrics of the online store to adjust the strategic benchmarks of digital business reformatting, as well as develop methodological tool for diagnosing the stages of the online store operation (matrix of gradation-conversion shifts), which allows business to choose a relevant digital business strategy in the pandemic era.

Statement of the main material of the research with full justification of the scientific results obtained. On the example of Ukrainian retailers, as a continuation of analytical and empirical researches [13–14], identified the 21 largest retail chain in six segments (food retail, drogerie, DIY-retail, home appliances and electronics retail), developing digital business simultaneously with the traditional offline format in Ukraine. The strategic priorities of digital business in the COVID-19 context are analyzed. The strategic guidelines for reformatting the digital business of retailers, in particular their online stores, as a result of the pandemic are determined.

The key role of online stores in the context of progressive digital business development is identified. It is established that the performance of online stores, its basic metrics, which is fundamentally important for online buyers when ordering, can be researched and analyzed by retailers for special online services. Based on the results of monitoring the practical activities of Ukrainian retailers and a comprehensive analysis of their online stores, it was found that the most common tool for determining the performance of websites is the online service "Page Speed Insights" [15] of Google. It is a comprehensive tool for determining an integral score of the page load speed of a website and choosing effective ways to optimize it based on the analysis of the effectiveness of the dynamics of loading and playback of site pages in a web browser [15].

The mechanism for calculating an integral score of the page load speed of a website is based on the "Lighthouse" metrics, which reflect the speed of the website when interacting with a real audience (online buyers), by emulation in 3G conditions. "Lighthouse" [11] is a tool (web browser extension) for monitoring the performance of a website, as well as open source applications, the main purpose of which is to assess the performance, quality and correctness of their operation and generate a report with recommendations and suggestions for tactical steps for SEO-optimization. *"Page Speed Insights" metrics* [15]:

1. *"First contentful paint" (FCP)* displays the time from the start of loading a web page to the moment when at least one of its content elements appears on the screen. The importance of FCP is due to the fact that at the moment of loading the web page, given its performance, the online buyer determines the appropriateness of being on the website and the potential of its use in the future. An online buyer is less likely to leave a resource if the FCP is within the normal range.

2. *The download time of sufficient content ("First meaningful paint", FMP)* indicates the time from the start of loading the web page to the time of the main content of the page, namely: rendering of the first (initial) screen seen by the online buyer – the upper half of the visible part of the site on the first screen (above the fold) and download fonts.

3. *"The speed index" (SI)* provides information on how quickly the content of a web page becomes available for viewing. Defined by frame-by-frame comparison of web pages - as the moment when the page stops changing visually.

4. *The CPU idle time (“First CPU idle”, CPU)* is the period of time until the main flow of the web page is released so that it can respond to the actions of the online buyer. It is assumed that most elements of the web page, but not all, are interactive, and the web page responds to the actions of the online buyer.

5. *“Time to interactive” (Int)* shows the time it takes for the web page to fully load and be ready to interact with the online buyer. The Lighthouse extension uses event handlers for most visible elements, and the response time to an online buyer's action is no more than 50 milliseconds. JavaScript optimization plays a key role for Int, because it is the performance of scripts that is very important for the readiness of a web page to interact with an online buyer.

6. *“Estimated input latency” (EIL)* reflects the average response time of a web page to an online buyer's actions in its busiest 5 seconds. If this value exceeds 50 milliseconds, then online buyers may have difficulty loading the site. The metric is directly affected by the rendering of the web page, which depends on the rational organization of the structure of CSS-files and the unloading of the main stream.

The above metrics allow digital business to comprehensively assess the actual performance of a web page, its ability and speed to respond to a certain interaction with the online buyer (interactivity of the page).

Metrics are defined using the “Page Speed Insights” on a logarithmic distribution by obtaining the 75th and 95th percentiles for website pages from the “HTTP Archive” service [5], which generates reports *that allow business to systematically analyze and track the online store efficiency:*

− *the state of the Internet*, namely: 1) the duration of browsing sites on the Internet; 2) the effectiveness of the Internet, including web standards;

− *JavaScript status*: 1) use of JavaScript on the Internet; 2) the level of perception of JavaScript by mobile devices and personal computers; 3) trends in the peculiarities of the use and perception of JavaScript by mobile devices and personal computers;

− *analysis of the use of images on the Internet*;

− *speed of loading of sites*: 1) influence of productivity of sites on their conversion; 2) the impact of website performance on the level of satisfaction of online buyers; 3) analysis of the dynamics of website loading speed during the life cycle of their web pages, taking into account the trends of implementation of modern progressive web applications;

− *availability of web pages (only for mobile devices)*;

− *level of SEO-optimization*: 1) methods and algorithms of website development; 2) ranking of websites in search results; 3) basic methods and tools of SEO-optimization;

− *the weight of the web page on the Internet*: 1) the size of the resources of web pages; 2) the availability and number of popular web page resources; 3) the level of popularity of web page resources;

− *experience of Chrome users*: 1) speed and frequency of loading web pages of sites by Chrome users, taking into account the state of the Internet and the type of user software; 2) the degree of interactivity of Chrome users;

− *PWA features* (“Progressive web applications”) – progressive web applications that allow applications to support independent network downloads, receive push notifications and synchronize data in the background, and, like web applications, allow users to install PWA on their devices).

The main purpose of PWA is to increase the conversion of the website, the number of users and increase the usability of web applications on certain devices. PWA should be considered as a website developed using web technologies, but which interacts with the user as a native application. A distinctive feature of PWA is that they use a stack of web

technologies (JS, HTML, CSS) and allow business to combine the ease of use of the website with specific to native applications of the UX operating system and technical capabilities. An integral score of the page load speed of the website is in the range [0; 100] and is calculated as a weighted average, based on five metrics, namely – FCP, FMP, SI, CPU, Int, including the weight of the metrics and the median (Table 1).

Table 1 – Metrics for calculating the integral score of the online store page loading speed *(built by the author according to [11])*

Metric	Weight	Median (milliseconds)
Int	5	7 300
SI	4	5 800
FCP	3	4 000
CPU	2	6 500
FMP	1	4 000

Ranges of integral score [90; 100], [50; 89], [0; 49] characterize the high, medium and low download speed of the web page, respectively. According to the Table, the weight of the metrics indicates the degree of their impact on the online buyer in the process of his interaction with the website page. Based on this, we can conclude that the greatest influence on the final evaluation of the website has the metric Int. Therefore, to improve the integral score of the page load speed of the website and to ensure the best interaction with the online buyer, it is advisable to systematically update and implement a set of measures aimed at reducing the full load time of the web page. *Stages of calculating the integral score of the online store page loading speed:*

1. *comparison of metrics with similar indicators of sites from the database of the service "HTTP Archive";*

2. *standardization of metric scores using a 100-point scale based on the logarithmic distribution (the higher the percentage of pages of websites in which the score is compared below, the better the metrics of the analyzed page);*

3. *averaging metric scores.*

In particular, according to the algorithm of the "HTTP Archive" the Int metric is calculated, in the case when the page became interactive and convenient for interaction with the online buyer within 2,180 milliseconds, the value of Int is 0.926 (Fig. 1).
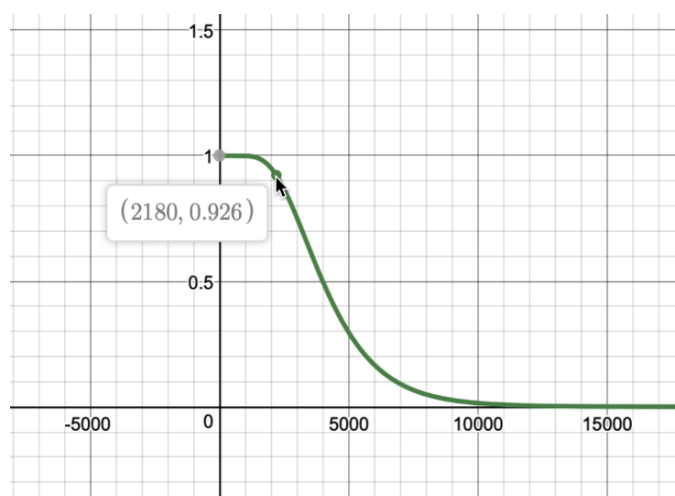

Figure 1 – Lognormal distribution Int *(constructed by the author with [4])*

Based on the results of metrics diagnostics FCP, FMP, SI, CPU, Int, EIL, the online service "Page Speed Insights" generates a report on the results of *the performance audit of the site's web page* and includes three sections:

1. *test data* – no problems were identified on the website on these points;
2. *opportunities* – audit of a recommendatory nature;
3. *diagnosis* – statement of facts.

It is important to note that the data presented in these sections do not have a direct impact on the calculation of an integral score of website page load speed, and following these optimization tips is likely to improve page load speed, given that web page load time is reduced. in seconds / kilobytes is calculated in "Page Speed Insights" based on emulation. Thus, the use of the online service "Page Speed Insights" for SEO-analysis of a web page guarantees the security of landing for a potential lead, however, the implementation of all recommendations cannot provide an instant increase in page rank in search results.

As part of determining the integral score of the speed of online stores web pages loading on computers (PSc) and mobile devices (PSm), *the diagnosis of their typical web pages is carried out, including:*

1. main web page;
2. web page with information about the activity and / or history of the trade network;
3. web page with promotional offers;
4. web page with information about the features of payment and delivery of goods;
5. web page with contacts and / or locations of offline stores.

Taking into account the results of the research, the average values of the "Page Speed Insights" metrics were identified and their comparative analysis was performed. Graphic interpretation of metrics is shown in Fig. 2-8.

According to the Fig. 2, the FCPm of all Ukrainian retailers in different segments is much longer than FCPc, the average download time of the first content of online shopping web pages on mobile devices is much longer than the time spent by the user when using a computer. Low metric values indicate the availability of resources on the web pages of online stores, which significantly inhibit rendering. This may also be explained by the lack of adaptive design of the retailer's website due to the existence of a special application for online buyers that is more convenient for them to use. It is recommended for retailers to optimize the download time of the first content by using JavaScript and CSS. In addition, it is advisable to implement resource caching and compression in GZip format. It is important to note the significant differences between FCPm in DIY and home appliances and electronics retailers, in contrast to retailers in other segments, given the breadth and depth of their product range.

Also it was found that the low values of FMPm compared to FMPc in most cases due to differences in the settings of the correct sequence of loading the required resources (Fig. 3). The largest gap in the download speed of a sufficient part of the content ΔFMP=FMPc-FMPm is observed in DIY5 (12,500 milliseconds), DIY6 (7,600 milliseconds), HA5 (6,200 milliseconds), HA6 (5,700 milliseconds); FR6, DIY3 (4,400 milliseconds) and DIY1 (3,300 milliseconds).
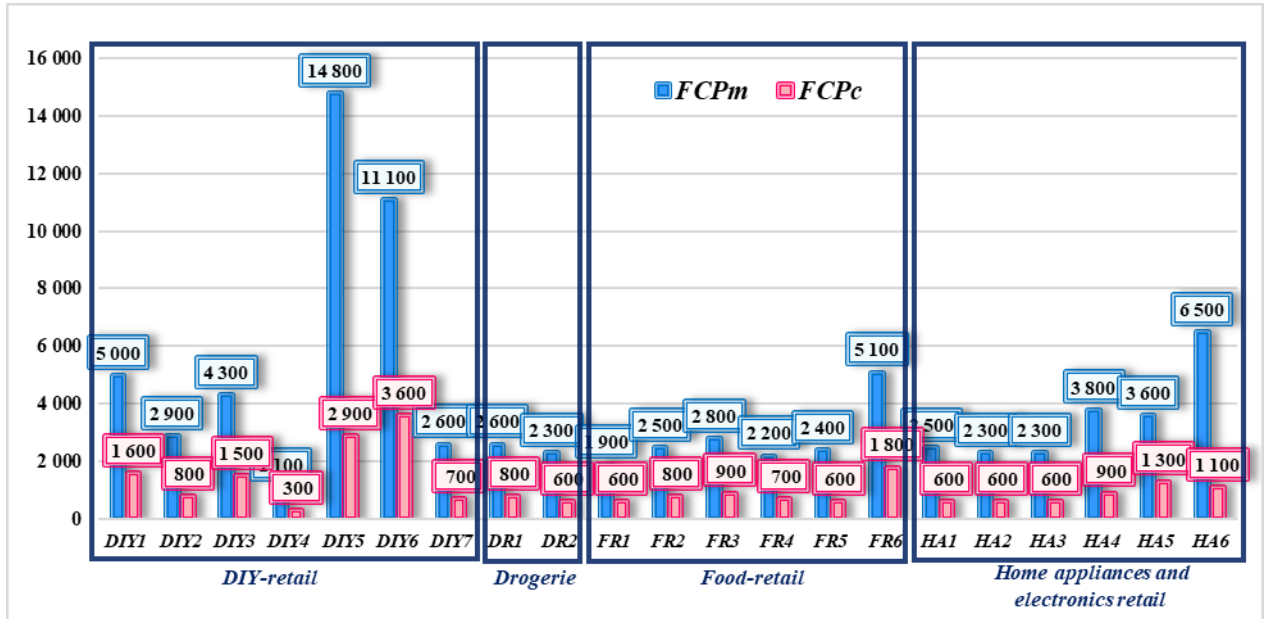
Notes:

DIY1 – BRV Kyiv, DIY2 – Nova Linia, DIY3 – Budmax, DIY4 – Epicentr K, DIY5 – Leroy Merlin Ukraine, DIY6 – Mebelna Kompaniia Ukrainy, DIY7 – JYSK Ukraine; DR1 – Yves Rocher Ukraine, DR2 – RUSH; FR1 – Auchan Ukraine, FR2 – Metro Cash and Carry Ukraine, FR3 – NASH KRAI, FR4 – NOVUS Ukraine, FR5 – Tavria V, FR6 – Fozzy Food; HA1 – ALLO, HA2 – Foxtrot, HA3 – DIESA, HA4 – Comfy-Trade, HA5 – Harazh Mobail Hrup, HA6 – Citrus Discount; m – mobile devices; c – computers.

Figure 2 – Average values of FCPm and FCPc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*
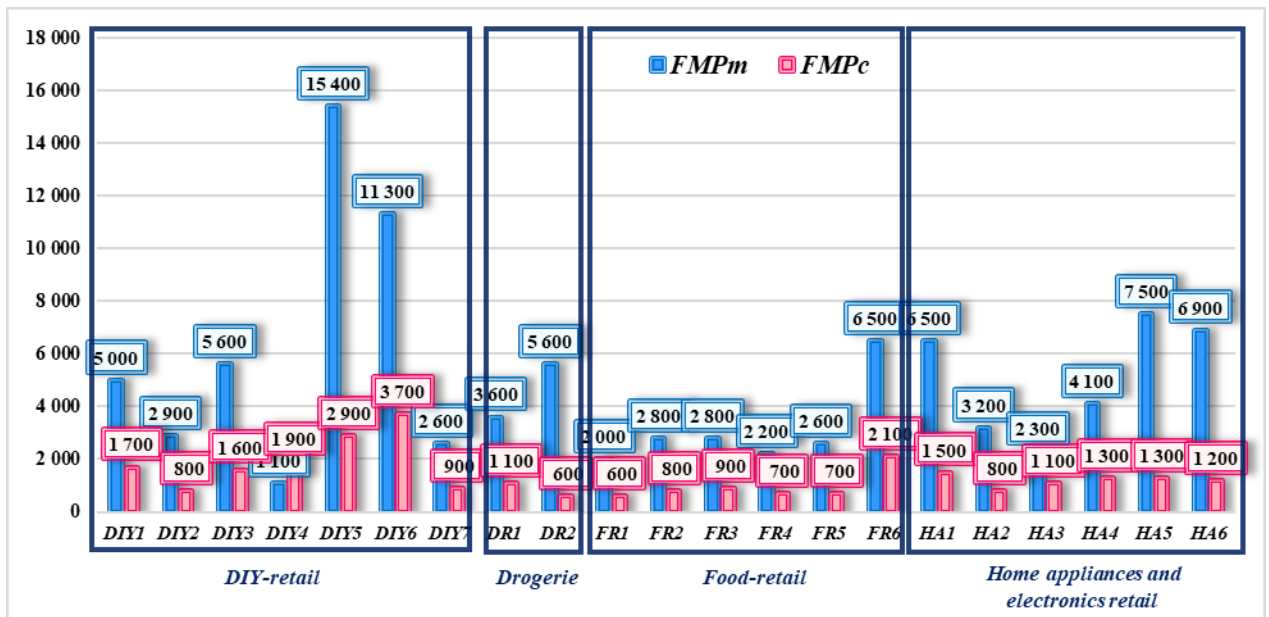

Figure 3 – Average values of FMPm and FMPc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*

The value of ΔFMP is due to the specifics of the online business of retailers, their wide range and focus on consumer preferences for choosing a device for online ordering. DIY4 (800 milliseconds) has the lowest value of ΔFMP among the entire pool of FMPc online retailers surveyed, which indicates its active permanent wall work on SEO-optimization of the website and the implementation of measures aimed at achieving the minimum metric. Online buyers are clearly aware of their needs, so they strive to place an order, pay for it and receive it in a convenient way in a short time, given that FMP is an important metric when analyzing the functioning of an online store.

It should be noted that retailers need to pay equal attention to FMPm and FMPc during their optimization. According to the "YOTTAA" report [19], published as a result of a study by "Retail Systems Research" [16], which reflects the assessments of online buyers and international experts on the effectiveness of the websites of 80 retailers' online stores, a primary role for online FMP buyers. Thus, among the 1,300 online buyers surveyed, 90% said they leave online stores if their web pages do not load within 15 seconds. Also, according to large-scale international studies [3; 6; 16] found that only a small proportion of online buyers (12% of the total of 1,300 respondents) reported to retailers a negative experience of interacting with the website. This percentage is critical for retailers' online business, as it makes it impossible to quickly and flexibly change the settings of their online stores according to the requirements of online buyers and can lead to huge losses of existing target audience, and, consequently, reduce revenue and increase costs.

The results of diagnostics of SIm and SIc values of typical web pages of online stores of Ukrainian retailers (Fig. 4) allow business to state the fact that the download speed of content on a mobile device is 2.5-5.3 times lower than on a computer, which causes urgent the need to resize resources (image compression, HTML minimization, JS and CSS), as well as to adjust the sequence of their loading, which, in turn, helps retailers achieve the planned metric SI.
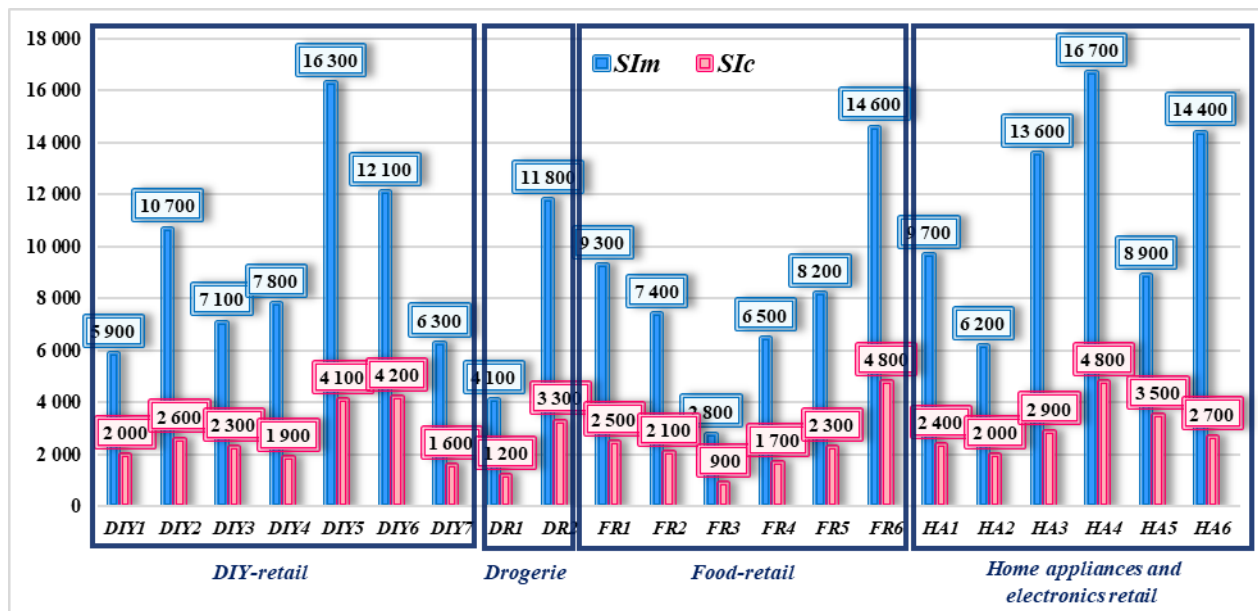

Figure 4 – Average values of SIm and SIc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*

Research and diagnostics of the average values of CPUm and CPUc of typical web pages of online stores of retailers (Fig. 5) allowed to identify the main factors influencing the CPU, namely: the sequence of file downloads, their size. Optimizing and customizing an online store's web pages with the ability to respond quickly to online buyers' actions will help retailers achieve the desired CPU value. Analysis of the international experience of functioning of online stores of Ukrainian retailers [3; 10; 19] allowed to establish that in case of unsatisfactory CPU for online buyers, more than 50% leave websites and make purchases from priority competitors. It should be noted that the CPU reduction of websites is cyclical (up to 10 times a year), so retailers should monitor and implement a system of innovations to reduce the value of this metric.
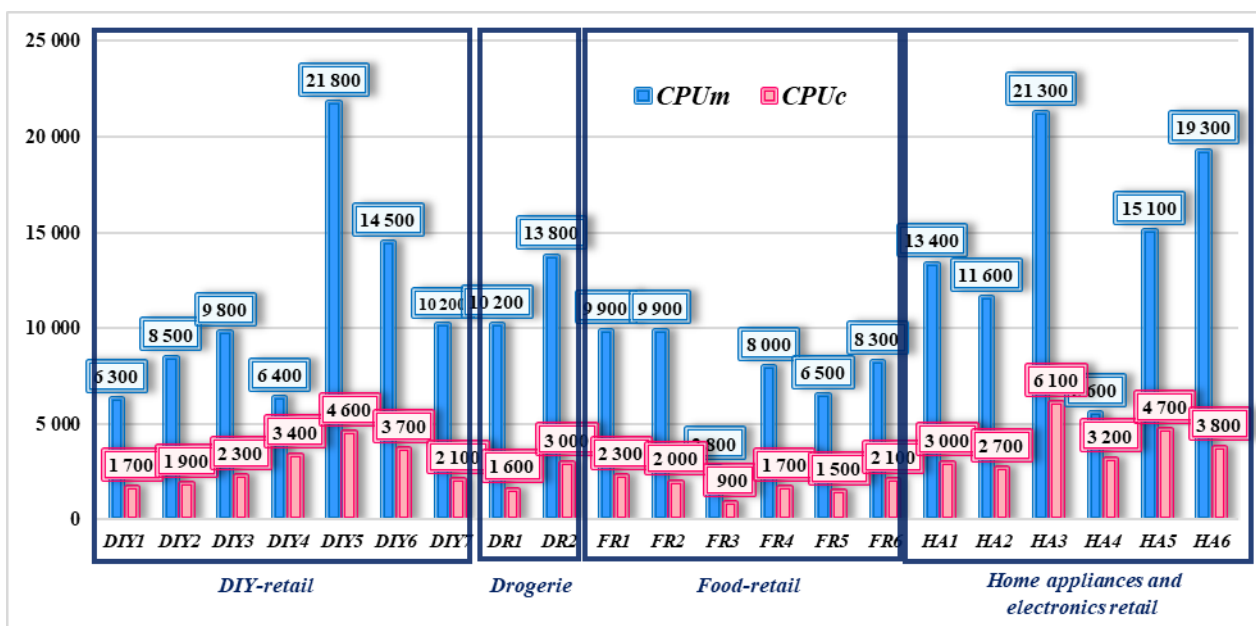

Figure 5 – Average values of CPUm and CPUc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*

Comparative analysis of Intm and Intc (Fig. 6) represents the high speed of loading web pages of online stores of retailers and their willingness to interact with online buyers when using computers. Much lower is Intm. Given that the majority of online buyers use mobile devices that have access channels and internal software to perform in the online store, which is less productive than computers, the development and implementation of a set of strategic and operational measures to improve download speeds The web pages of the online store should be viewed by retailers from different angles, for which it is recommended to use differentiated tools and relevant ways to optimize speed. However, despite the fact that the key role for Int is played by efficient JavaScript, because it is the performance of scripts is important for the readiness of the website to interact with the online buyer, the prevailing fact is that delays in data processing by servers allow business to reduce peak loads on the site.
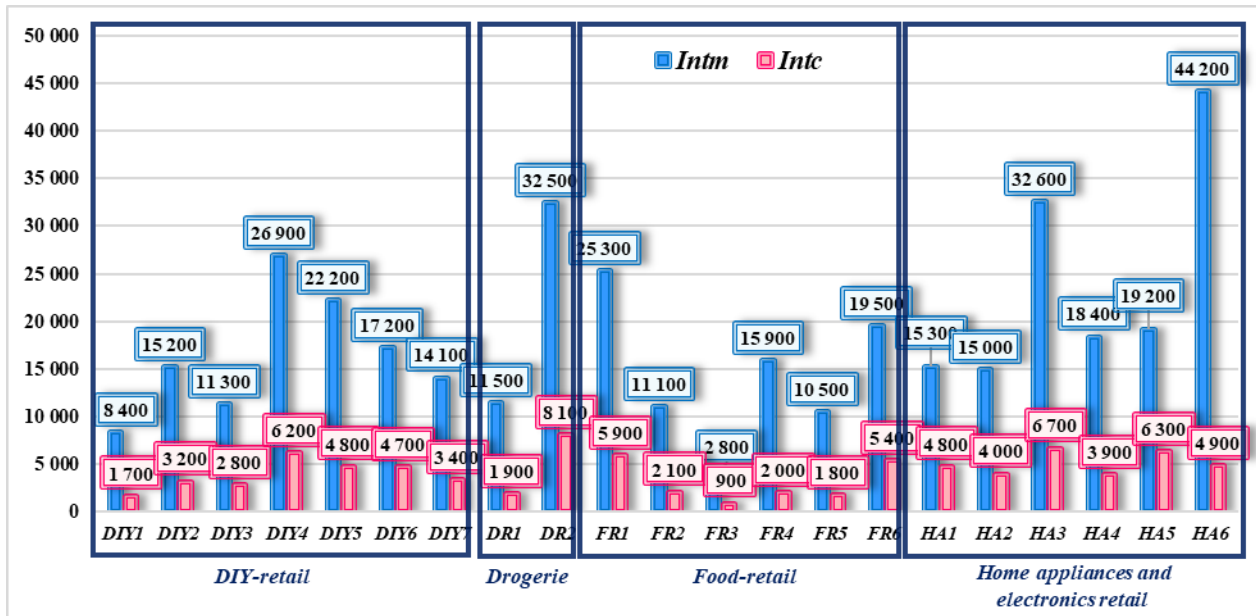
Figure 6 – Average values of Intm and Intc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*

Based on the diagnostics of the approximate delay time when entering typical web pages of online stores, the minimum and maximum gap limits EILm and EILc are determined (Fig. 7). However, given that the value of EILc is optimal for all online stores of Ukrainian retailers, in general, the EILm metric is sufficient and acceptable for online buyers, compared to other market players operating in the online space and implement similar or related activities in this direction through an online store. In addition, with an 3G connection, the pages of the online store may run slower, but if online buyers moved to the site from a computer or mobile device using WI-FI, they will not find problems with download speeds.
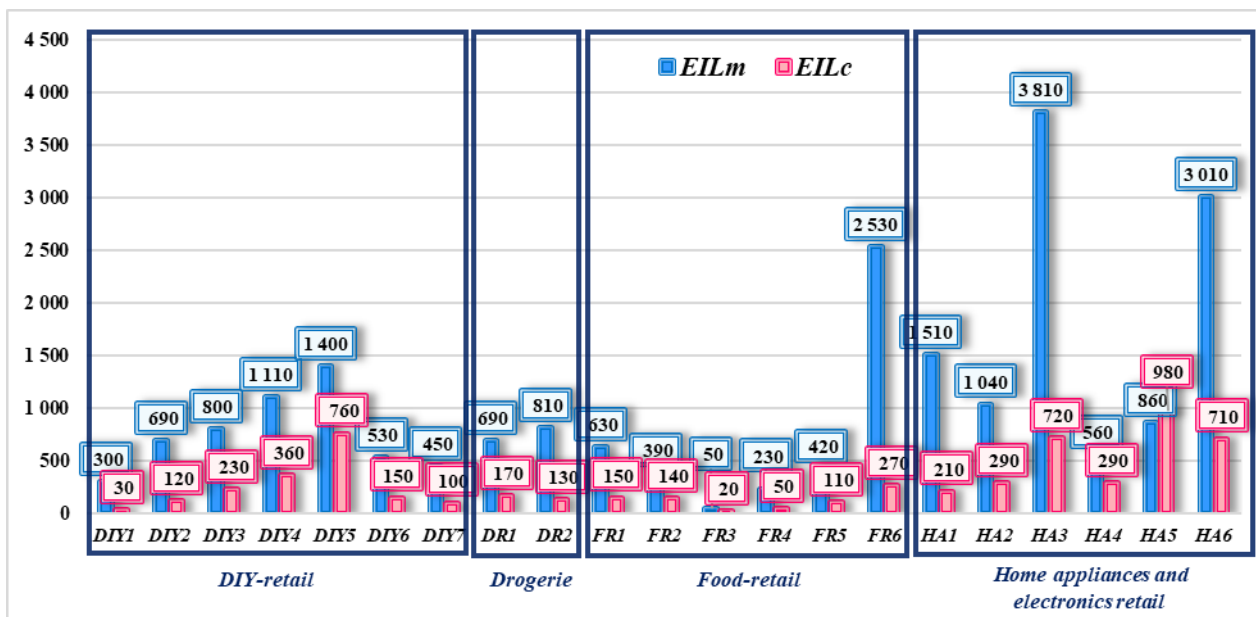

Figure 7 – Average values of EILm and EILc of typical online stores web pages of retailers, milliseconds *(built by the author with [15])*

Graphic interpretation of the generalized results of determining the Integral scores of the loading speed of online stores web pages of retailers is shown in Fig. 8.
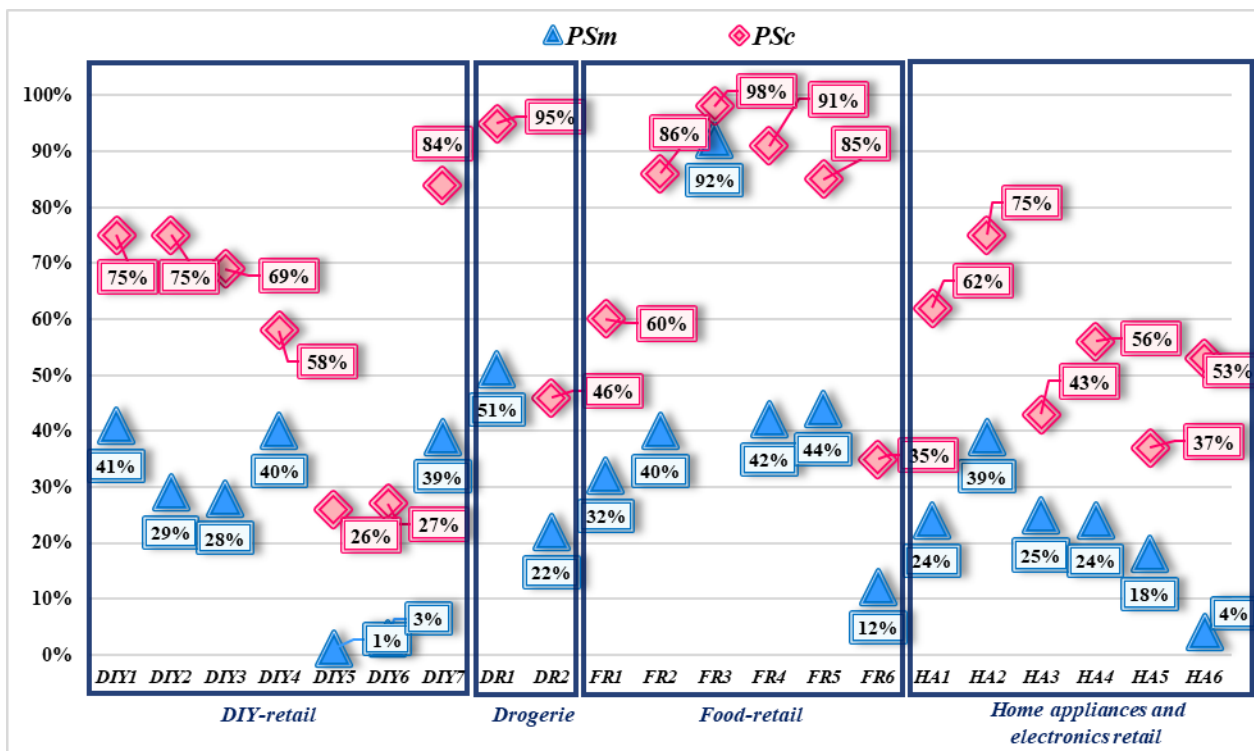

Figure 8 – Integral scores of the loading speed of online stores web pages of retailers
(built by the author using [15])

According to the Fig. 8, in the online stores of DIY-retailers PSm is in the range from 1% to 41%, which indicates a low speed of loading web pages on mobile devices and requires efforts to optimize it. Thus, when interacting with online buyers, the minimum website speed among the studied DIY-retailers is DIY5 (1%), and the maximum – DIY1 (41%). Among drugstores, DR1 has an average download speed of online store web pages on mobile devices (51%), which is 29% higher than DR2. As part of the increase in the value of PSm DR1 and DR2, it is recommended to use modern software that is able to identify fragments of web pages of the online store that inhibit their download on mobile devices. In the food retail segment, only FR3 determined PSm, which is 92% and indicates a high speed of loading online store pages. The other 5 Ukrainian retailers in this segment have low PSm, among which in FR6 this indicator is minimal (12%), and in FR5 – maximum (44%).

The analysis shows the importance for Ukrainian food retailers of using Google tools to optimize the download speed of web pages of online stores on mobile devices, which directly affects the depth of viewing and the number of failures. Also PSm online stores of Ukrainian home appliances and electronics retailers, as well as DIY-retailers, found a low speed of loading web pages. Among the six online stores PSM in HA2, equal to 39%, is the highest. Such low PSm values necessitate the revision by Ukrainian home appliances and electronics retailers of strategy to increase the speed of response of online store web pages to the actions of potential online buyers who use mobile devices.

As the Fig. 8 shows, in the DIY-retail segment, 71.4% of online stores of Ukrainian retailers have an average speed of loading web pages on computers. In online stores DIY5 and DIY6 PSc is in the range [0; 49] and indicates a slow download speed of web pages from your computer. DR1 (95%) has a high speed of downloading web pages of the online store, in

contrast to DR2 (46%), for which PSc is insufficient for instant response of web pages to the actions of visitors. In the food retail segment, only FR6 PSc=35% shows a low download speed of online store web pages. 33.3% of Ukrainian food retailers optimized their own site for effective interaction with online buyers, as evidenced by the PSc in the range [90; 100]. In 50% of food retailers, the download speed of online store web pages is average. In general, in the food retail segment, you can see better customization of online shopping pages for customers who perform certain actions from a computer, rather than on mobile devices.

The defining of PSc online stores of retailers in of home appliances and electronics retail revealed that 66.7% of the average download speed of web pages of online stores (HA1, HA2, HA4, HA6), which is an advantage in the market given their rich product range. However, among the studied population there are retailers for whom PSc indicates a low download speed of web pages, namely – HA3, HA5 with PSc at 43 5 and 37%, respectively. With this in mind, HA3 and HA5 should adjust the settings of online store web pages in order to improve the interactive interaction with online buyers who place orders from a computer.

Based on the results of diagnostics of loading speed of web pages of online stores of retailers by using the online service [15], taking into account the comparative analysis of its components on mobile devices and computers, given the key role of optimizing websites of online stores of retailers in achieving the desired level of market competitiveness and building positive relationships with online buyers, which determine the usability, substantiated and tested analytical and synthetic tools for diagnosing the stages of the online store – *a matrix of gradation-conversion shifts. Additionally, it is developed a comprehensive system of relevant measures* to increase the online store efficiency (Fig. 9).
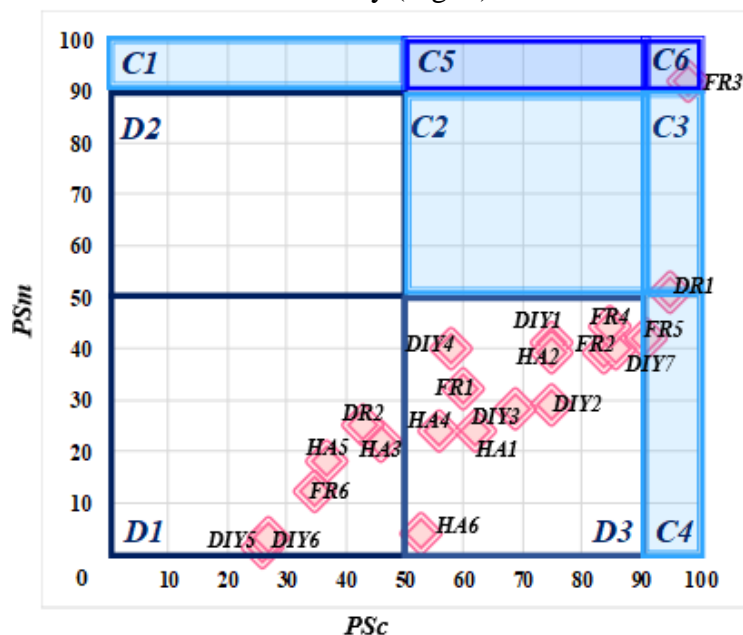
Notes.

Discrete stage. D1: m_1 – cost analysis of third-party dynamic libraries; m_2 – implementation of the approach to optimizing the website performance, which involves the breakdown of large JavaScript-applications into sets of small bundles that are loaded automatically as needed; m_3 – reduce the time of parsing, compiling and running JavaScript scripts. **D2:** m_4 – implementation of a system for monitoring site performance metrics on mobile devices and computers; m_5 – correct choice of image size in order to save traffic and minimize download time; m_6 – efficient image encoding. **D3:** m_7 – reduction of server response time; m_8 – provide visibility of the web font; m_9 – provide a small number of requests and transmission volumes, given the size of resources.

Continuous stage. C1: m_1' – analysis of used polyphiles and rejection of those that are no longer needed by the target audience; m_2' – minimization of the main data flow – reducing the time of parsing, compiling and running JavaScript scripts; m_3' – testing of possible ways and speed of fonts loading. C2: m_4' – use of off-screen and hidden images after downloading all the necessary resources in order to speed up interaction with online buyers; m_5' – remove unused CSS content – remove unused rules from style sheets and defer unloading CSS that do not apply to "above the fold" content to reduce byte loading during online buyers' activities; m_6' – avoid excessive size of the document object model. C3: m_7' – avoid large amounts of data in the network; m_8' – download third-party code after download; m_9' – elimination of unused JavaScript-code. C4: m_1'' – removal of old polyphiles / replacement of third-party libraries with compact and alternative ones; m_2'' – use of service workers that cache the bytecode obtained by parsing and compiling scripts. C5: m_3'' – use of modern and up-to-date images to optimize download speed; m_4'' – display static objects using effective caching rules. C6: m_5'' – preload basic requests; m_6'' – minimize the depth of important requests from online buyers – speed up downloads by reducing downloads or canceling downloads of unnecessary resources.

Figure 9 – Matrix of gradation-conversion shifts of the stages of the online store functioning *(developed by the author)*

As the Fig. 9 represents, the matrix consists of 9 quadrants, each of which characterizes the PSm and PSc of the online store. Depending on the intersection of which quadrant, in which zone of the matrix, retailers are located, the necessary measures (m, m′, m″) are determined in discrete and continuous stages. The results of calculations show that most of the studied retailers are located in the lower quadrants of the matrix, the distinguishing feature of which is the discrete stage of operation of the online store and only digital business of DR1, FR3, FR4 is in continuous stage. That is why, retailers are encouraged to adjust their strategic priorities and implement an appropriate set of relevant measures.

Conclusions from this research and prospects for further developments in this area. Based on the results of analytical and empirical researches of digital business, the strategic priorities of digital business in the COVID-19 context are analyzed. Strategic guidelines for digital business reformatting due to the pandemic are determined. Given that the online store is a driver of digital business, it is substantiated and identified on the example of Ukrainian retailers, the metrics of online store performance. Monitoring these metrics allows business to adjust the strategic priorities of the digital business in terms of increasing traffic. Methodical tool for diagnosing the stages of online store operation (matrix of gradation-conversion shifts) is developed. This allows to choose a relevant digital business strategy in the pandemic era, as well as a correct comprehensive system of measures to increase the online store efficiency. Approbation of methodical tool proves its expediency for systematic use.

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Стратегії цифрового бізнесу в епоху пандемії.

Проаналізовано стратегічні пріоритети цифрового бізнесу в умовах COVID-19 базуючись на результатах аналітичного та емпіричного досліджень цифрового бізнесу. Детерміновано важливість коригування стратегічних орієнтирів переформатування цифрового бізнесу внаслідок пандемії. Визначено, що інтернет-магазин виступає драйвером цифрового бізнесу. Обґрунтовано метрики продуктивності інтернет-магазину, моніторинг яких дозволяє змінити стратегічні пріоритети цифрового бізнесу у частині збільшення трафіку. Розроблено методичний інструментарій діагностики етапів функціонування інтернет-магазину.

Ключові слова: цифровий бізнес, бізнес-стратегія, ритейл, інтернет-магазин, пріоритети розвитку й оптимізації.