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The Impact of Digitalization on the Financial Performance of Russian Companies

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ABSTRACT

Digitalization is one of the most urgent problems for Russia; companies need to gain a competitive advantage, increase their efficiency and improve business performance. The aim of the study is to identify the relationship between the financial performance of Russian companies and the degree of digitalization of their business processes. Operating profit was chosen as the main financial indicator reflecting the results of the current core activities of the companies. To calculate the digitalization index, McKinsey information data was taken on six parameters: digital marketing, digital product experience, e-commerce, electronic customer relationship management (E-CRM), social networks. The authors used regression analysis of data from 482 companies from 20 industries for the period 2017–2019 as a research method for testing the hypotheses. The findings of the study revealed that the digitalization index has a positive effect on the operational efficiency of companies, but the degree of influence differs depending on the industry, age, and size of the enterprise. The authors concluded that the greatest effect from digitalization is observed among companies with traditionally high digital maturity. These are companies from the financial, technology, or communications industry, where business digitalization is vital and where a slowdown in digital transformation processes can push such enterprises far back in the ranking. Assessing the impact of digitalization of Russian companies on their operational activities will allow the management of companies to choose the right strategy in matters of digital transformation, which will ensure the company's competitiveness, increase its efficiency and contribute to its development. On a national scale, the results of this study can help decide which industries should be subsidized for digital innovation.

Keywords: digitalization; digitalization index; operational efficiency; operating profit; performance; company age; company size; new technologies

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INTRODUCTION

Digitalization is traditionally understood as the transformation of existing processes into digital form and thereby gaining benefits in terms of financial and operational efficiency [1]. This process is a key business trend today: more and more industries are launching a strategy of actively introducing digital tools (digital transformations) into their business processes.

Digital transformation means more than the introduction of new technologies. Digitalization is a restructuring of business models, a change in the approach to conducting internal and external processes. In addition to new technologies, companies need completely new skills, corporate culture, organizational and operating models.

Digitalization has enormous potential in terms of increasing efficiency, speed, and quality of work, reducing costs, increasing equipment productivity, efficiency in the use of raw materials, labor, and other aspects of business efficiency. L. Fuentelsaz et al. argue that the introduction of new technologies directly affects the productivity of the company through qualitative changes in operational processes [2]. In addition, in developing countries, digitalization is seen as a driver of economic growth by increasing capital and labor productivity, reducing transaction costs, and facilitating access to global markets [3].

Currently, Russian enterprises are at an extremely low level of digitalization [4]. Thus, according to the results of the research "Index of readiness of Russian companies for digital transformation", 91% of manufacturing enterprises in Russia use an outdated business model. However, 78% of respondents said they intend to use digital technology to improve production processes in the next 3–5 years. At the same time, only 4% of companies have a high level of digitalization of the production process, and only the same 4% of companies widely use digital solutions in various corporate functions. Additionally, M. Galimova [4] conducted a study, based on the results of which it was concluded that most Russian companies are not ready for digitalization for some fundamental reasons: the lack of an appropriate corporate culture within the organization, knowledge, and skills to implement and use technologies, outdated business models. In the course of the same study, it was revealed that Russian enterprises do not see global opportunities for digital transformation and are not ready to join the digitalization race. Thus, Russian companies face the question of the need to accelerate such processes and assess the benefits of such transformation.

The aim of the study is to assess whether business digitalization affects the main (operational) efficiency of Russian companies, and also to determine whether this impact depends on the size and age of the company.

Despite the fact that the topic of digitalization of enterprises is currently underdeveloped by the academic community, over the past few years, a number of scientific studies have appeared that are significant for the start of its development. Thus, the methodological basis of this study will be the work of J. Manyika et al. and J. Wroblewski et al., who deeply considered the concept of digitalization [5, 6]. Unlike previous studies in this field, the article assesses the impact of the degree of digitalization of an enterprise on operational efficiency, depending on the economic sector, the size of the company, and also its age. All of these factors affect the speed at which digital change is introduced and the benefits of such transformations.

This paper looks at the impact of digitalization from a new perspective and with a new level of detail that can help guide better governance decisions for digital transformation. The article uses data on not yet studied Russian companies, which will be useful for studying the specifics of the impact of digitalization within the country. Exclusive data includes an enterprise-specific digitalization index and relevance (end of 2019) as companies have seen their peak in digitalization strategies in recent years.

THEORETICAL OVERVIEW

While digital transformation has only become a particularly popular topic of discussion in the past decade, the importance and inevitability of digitalization have been debated as far back as the 1990s and 2000s.[1] However, there are few scientific studies on the digitalization of business processes these days, and most of them are devoted to the concept of digitalization, and not to modeling specific dependencies and effects, at least to a deeper level than the country one. In addition, it should be noted that Russian business still rarely focuses on the level of digital technologies. The current level of digitalization of business in Russia is not high, so there is practically no research based on the data of Russian companies, with the exception of massive surveys of business leaders about their digitalization practices. Nevertheless, there are still a number of works closely related to the topic of this study.

One of the objectives of the study is to determine if the degree of digitalization of a company affects its performance indicators in comparison with other companies, and if so, how exactly. Digital maturity has become a defining element of corporate competition [5].

A. McAfee and E. Brynjolfsson argue that industry competition becomes more dynamic due to successfully implemented digital systems, while companies that cannot adapt properly and in a timely manner risk falling behind and becoming uncompetitive [7]. Ignoring new technological innovations these days can have long-term consequences for the future competitive environment of the company [8]. For example, technology has changed traditional competition, and the gap between leaders and laggards has widened.

J. Manyika et al. and Y. Yoo claim that digitalization opens up new opportunities for companies, increases operational efficiency, expands innovative boundaries, and allows better allocation of resources [5, 9]. This is confirmed by L. Fuentelsaz et al., who believe that the introduction of new technologies directly affects the company's productivity through changes in the production process itself [2]. Back in the 1980s, M. Lieberman and D. Montgomery clearly stated that technology leadership is one of the main drivers of first-mover advantage, which often leads to increased profitability in the future [10].

H. Bouwman, M. de Reuver, S. Nikou based on interviews with companies from 11 countries showed that companies with a higher degree of digitalization have more efficient and innovative business models in general [11]. One of the most striking examples of how digitalization directly affects efficiency was shown by M. Barret and G. Walsham, who described how technology allows brokers and underwriters to operate in an e-commerce environment, which can dramatically increase both profitability and efficiency (speed, percentage of errors, volumes) [12].

Also, by the example of the banking industry S. Scott et al., based on data from SWIFT, a global data security provider, has provided strong evidence that technology investments have a positive and significant impact on long-term profitability and productivity [13].

K. Hayes, using the example of the US company Walmart, showed that the corporation is a leader in its segment because it uses advanced digital tools for collecting and analyzing data on their consumers' buying habits. [14]. Digital retail giant Amazon uses advanced algorithms that show shoppers products based on the consumers' record and predictably adjust prices to increase sales and profits. Also, retail banks are using automated digital systems such as mobile channels and web presence to increase paperless workflows and reduce costs [15].

Another example of how digitalization can improve efficiency is in the case of the automaker Tesla Inc. The company can update

[1] Auriga. Digital Transformation: History, Present, and Future Trends. 2016. URL: https://auriga.com/blog/digital-transformation-history-present-and-future-trends/ (accessed on 17.02.2021).

the software of its electric vehicles without the help of the car owner [16].

E. Van Bommel et al. found that virtual environments, ubiquitous big data, and digital channels are increasing companies' knowledge about customers. At the same time, technology is changing the way the consumer makes decisions, and in the context of digitalization, consumers know more about the product and its alternatives [17]. Also, E. Van Bommel et al. note that companies must not only collect data but also use sophisticated analytics to interpret it.

In general, according to a study by R. Dobbs et al., the profits of firms in sectors that are more dynamically transitioning to digital technologies are growing, and companies with a higher level of digital maturity have higher profitability [18]. A study by J. Bughin and N. van Zeebroeck proves that companies that try to unleash their full digital potential get the most benefits, and their revenues are higher than that of the average company [19]. Also, J. Manyika et al. argue that it is important to understand that digitalization is not limited to the introduction of new technologies that automate processes and lead to significant cost savings [5]. Additional information such as analytics helps companies better understand their customers, adapt to their dynamically changing preferences, and align strategy with consumer trends. Also, J. Manyika et al. proved economic growth driven by the changes brought about by the ongoing digitalization process [5]. Specifically, the authors explore in detail two topics that they believe will impact future growth, namely capital efficiency and multi-factor productivity driven by digital activity.

At the moment, there are a number of works and expert opinions proving an undoubted positive relationship between business digitalization and the characteristics of its effectiveness. For example, some studies have specifically shown that digital technology increases profits, value, and positively affects productivity [20].

It is important to understand what approaches have been used to model the relationship between digitalization and business efficiency. I. Kaufman et al. using a sample of more than one and a half thousand industrial enterprises in Germany conducted a study of how the introduction of digital technologies affects the efficiency of their production [21]. Various performance indicators (productivity, income per employee, etc.) were taken as dependent variables, and various indicators of the level of digitalization (the degree of automation, the range of digital products used, etc.) were taken as independent variables. The findings of the study showed the obvious and positive impact of digitalization on productivity.

A similar study was conducted by M. Agboola et al., which analyzed the impact of digitalization on the efficiency of commercial banks in Nigeria [22]. The study used direct statistics and a sample of 370 employees of commercial banks. The survey was used as the main data collection tool. It was found that there is a moderately significant and positive relationship between the digitalization process and the efficiency of a commercial bank.

B. Hildebrandt, A. Handelt, S. Firk, and L. Kolbe, using data from the world's largest car manufacturers from 2000 to 2013, found empirical evidence of the positive impact of mergers and acquisitions with digital companies on the efficiency of a business model. [23]. Besides, the authors found signs of a positive impact of digital innovation on the expected future performance of car manufacturing companies, which confirms the importance of digital transformation.

J. Wroblewski conducted a study in which he explored the impact of digitalization on the company's performance, namely: whether companies with digital maturity outperform their less mature competitors. The paper analyzed data from Swedish enterprises and showed that digital maturity increased the operational efficiency of companies and the

return on their shares [6]. But the results of the study did not lead to a conclusion about the benefits of more digitalized companies.

In general, there is currently a limited number of studies examining the impact of digitalization through data-driven modelling. First of all, this is due to the limited volume of such data and limited access to them due to corporate confidentiality and the lack of a clear procedure for collecting and aggregating such data (digitalization), as well as the lack of a formulated and general approach to such research. At the same time, the findings of the studies differ because they are not obvious, which gives value to the results of this paper.

HYPOTHESES

The main logic of the study is based on the assertion that there is a relationship between the degree of digitalization of an enterprise and its efficiency (operational, financial). Due to the fact that in most of the existing literature an unconditional positive effect of digitalization is asserted, we can test the following hypothesis [2, 5, 9, 15, 18].

H1: In general, there is a positive dependence of efficiency on the degree of business digitalization.

However, different industries have different specifics, in particular, some industries are more dependent on digital tools. Thus, it is assumed that the effects will be different depending on the industry, and the degree of digitalization is likely to differ depending on the industry. According to the study "Digitalization of business in Russia and abroad" conducted by the Institute for Statistical Studies and Economics of Knowledge of the Higher School of Economics (2019),[2] as well as the work of J. Wroblewski, companies working in the field of technology, information and communications traditionally are more mature in terms of digitalization. [6]. We propose to check whether this fact is explained by the increased effect of digitalization.

H2: The greatest effect of digitalization is observed among companies in the field of finance, technology or communications.

We assume that the effect of digitalization depends on the size of the company. Larger companies may have a smaller effect on the level of digitalization, for example, due to the large volume of fixed costs that do not depend on the level of digital presence in business processes (office maintenance, salaries, etc.) [24]. Or, conversely, smaller companies benefit less from using less advanced technologies due to the lack of a large amount of free capital [9].

Since opinions differ on this, we will assume that the effect will not be different or will be slightly different as the main hypothesis.

H3: The magnitude of the digitalization effect does not depend on the size of the company.

There are a number of studies that show that more mature companies are less flexible about structural change, including digital transformation. This is due to the fact that the transformation of an old business requires extremely significant capital expenditures [25–29]. At the same time, the digitalization of a mature business may bring less effect than the launch of a new one using new technologies. This is primarily due to the fact that the effective functioning of the digital environment requires restructuring, including the corporate culture itself [5].

H4: More mature companies benefit less from digitalization.

METHODOLOGY

Dependent variable. Business digitalization affects all performance indicators of companies. In this study, the operating profit margin is taken as the dependent variable because it is used most often and best reflects the efficiency of the company's core activities. Operating profit margin is a measure of income received after deducting expenses incurred in the course of operating income-related activities. This parameter was used in similar models by J. Wroblewski, H. Lam,

[2] URL: https://issek.hse.ru/data/2019/10/03/1542994758/NTI_N_146_03102019.pdf (accessed on 18.03.21).

A. Yeung and E. Cheng, to reflect the company's efficiency [8, 30]. The operating profit margin will be calculated using the following formula:

$$Operation\ profit\ margin = \frac{operating\ profit}{revenue} \times 100\%, \quad (1)$$

where *Operating profit = operating income — operating expenses*.

Explanatory variables. To assess the level of digital maturity of a company, a metric will be used in which the degree of digital maturity is measured in six dimensions, namely: digital marketing, experience with digital products, e-commerce, electronic customer relationship management (E-CRM), social media.

Digital marketing measures a company's ability to use search engine marketing and advertising to attract customers. Experience with digital products makes it possible to assess the web presence of a company. E-commerce reflects a company's ability to sell goods digitally. E-CRM includes a company's ability to improve customer relationships through digital channels (e.g. unique personalization). Social media measures a company's engagement with social media such as Facebook or Twitter.

The formula for calculating the metric is as follows:

$$Digitalization\ Index = \frac{\sum_{i=1}^{n} X_i}{n}, \quad (2)$$

where n is the number of metrics (6), i is the metric's number, X_i is the value of the number of the metric i, which can take values from 0 to 100. This metric was used in studies of the Russian market by ISSEK HSE (2019), KPMG (2019), McKinsey & Company (2019), and Bank Otkritie with NAFI (2019).

To improve the representativeness of the research results, it is necessary to include structural explanatory variables in the model. The main fundamental indicator that can show the profitability of a company is belonging to a particular industry since the rate of return and profitability differ for different industries due to different scales of production, class of products and services, capital intensity, and other factors [31]. Thus, a binary variable will be added to the model, equal to 1 for companies operating in the field of finance, technology, or communications, and 0 otherwise. According to J. Wroblewski, digitalization has the most significant impact on these industries [6].

The profitability of an enterprise is also significantly influenced by its size, which is expressed in the value of its total assets, so this variable will be included in the model [32, 33].

In addition, the age of the company should be taken into account, as there is a number of studies proving that more mature companies are less efficient, because, first of all, there are high capital costs of transformation (including digital transformation) to change activities and thereby increase profitability. Thus, new players gain an advantage in profitability due to the initial access to new approaches and technologies [25–28]. According to a study by J. Bughin and N. van Zeebroeck, often new market players with a high degree of digitalization occupy up to 20% of the market in the first 5 years of operation [19].

To make the model's results more representative, we include an additional variable: the debt-to-equity ratio. This variable is often used by researchers when analyzing the profitability of a company, for example, in the works of H. Song, C. Zhao, J. Zeng; W. Ruiqi, F. Wang, L. Xu, C. Yuan [34, 35]. According to the pecking order theory, companies have priorities in terms of sources of funding. From the point of view of this theory, the most preferred source of financing for current activities or individual projects is its own funds. Other sources should be used when, firstly, the net present value of the project is positive and, secondly, there are not enough own funds to finance it. Consequently, more efficient firms try to increase the share of equity in the capital structure, which affects profitability.

As a result, the following model will be tested in this study:

$$OPMi,t = \beta_0 + \beta_{DI}\, DI_{i,t} + \beta_{sector2} Sector_{it} + \\ + \beta_{assets5} \ln(Assets_{it}) + \beta_{age} \ln(Age_{it}) + \\ + \beta_{\frac{D}{E}} \frac{D}{E}_{i,t} + \beta_{OPM} OPM_{i,t-1} + \varepsilon_{it}, \quad (3)$$

where: $OPMi,t$ — Operating Profit Margin, current term;

$DI_{i,t}$ — Digitalization Index (0–100);

$Sector_{it}$ refers to an industry more or less dependent on digital instruments; a dummy variable that takes the value 1 for industries that are more dependent on digitalization (in the field of finance, technology or communications), and 0 for industries that are less dependent on digital technologies;

$Assets_{it}$ — the natural logarithm of the company's assets (a proxy variable reflecting the size of the company);

Age_{it} — the natural logarithm of the company's age (proxy variable reflecting the number of years since the company was founded);

$\frac{D}{E}_{i,t}$ — the ratio of equity to the company's borrowed funds;

$OPM_{i,t-1}$ — an operating profit margin of the previous period;

I — company number (1–500);

t — the number of the year (2017–2019);

ε_{it} — a random error, distributed according to the normal law;

β — coefficients reflecting the influence of the digitalization index, size and age of the company on the indicator of operating profit.

DATA DESCRIPTION

Data of the annual ranking of the 500 largest companies in Russia in terms of revenue RBK-500 for 2017–2019 were taken for the study. The 2019 ranking includes 401 private companies and 81 state-owned companies. The sample included representatives from more than 20 different industries. The data were taken to calculate the operating profit margin, determine the sector of the economy, total asset value and capital structure to calculate the debt-to-equity ratio. Information on the age of companies was collected manually from the Federal Tax Service database.

The digitalization index is a parameter with a numerical value from 0 to 100, where 0 is no digitalization, 100 is the maximum digitalization. The index data was taken from the corresponding annual survey of digitalization of Russian business, which McKinsey & Company has been conducting since 2017. However, it was not possible to determine the digitalization index for all companies from the RBC-500 list. A number of companies were not included in the rating for all three years and were excluded from the sample.

Table 1 shows descriptive statistics for the data. As a result, the sample size consists of observations of 402 Russian companies over 3 years. Total observations in the sample — 1206.

Before building the model, it is required to make sure that the regressors are not correlated with each other. *Table 2* shows the correlation coefficients of the parameters.

As can be seen, none of the pairs of parameters is significantly correlated. The highest correlation (45%) is observed between the value of the profit rate of the current and the previous period, which is consistent with the logic of the model.

Below is the distribution of companies by industry (*Table 3*). The largest part of the sample consisted of manufacturing and consumer goods companies, the smallest — construction, electricity, and other smaller industrie.

ANALYSIS OF RESULTS

According to the test results, the model with random effects showed the best results, so it will be used in the analysis (*Table 4*).

Four of the six parameters of the model were found to be significant at different levels of significance. Thus, the natural logarithm of the company's age and the debt-to-equity ratio do not affect the company's operating

Table 1

Descriptive statistics

Variables	Average	Standard deviation	Min	Max
OPM current	0.05	0.18	–3.31	0.80
Age	33.66	32.41	1.00	241.00
Sector	0.17	0.38	0	1.00
DI	31.65	6.28	15.25	59.10
Assets	443.19	1 996.32	0.01	31197.50
DE	1.19	25.95	–799.44	322.27
OPM previous	0.06	0.17	–3.31	0.80

Source: authors' calculations.

Table 2

Correlation matrix

	OPM current	Age	Sector	DI	Assets	DE	OPM previous
OPM current	1.00						
Age	0.01	1.00					
Sector	–0.03	–0.02	1.00				
DI	0.27	–0.14	–0.01	1.00			
Assets	0.05	0.14	0.19	0.04	1.00		
DE	0.01	–0.01	–0.01	–0.00	–0.00	1.00	
OPM previous	0.45	–0.01	–0.06	0.24	0.03	0.01	1.00

Source: authors' calculations.

Table 3

Distribution of companies by industry

Industry	Number of companies
Development and construction	20
Manufacturing	96
Information technology and communication	18
Defense and mechanical engineering	51
Consumer goods	66
Trade	43
Transport	29
Finance	47
Power engineering	22
Others	10
Total	402

Source: authors' calculations.

Table 4

Model result

Variables	Coefficients	Standard deviation	Z	P-value	95% confidence intervals	
Ln(age)	0.01	0.01	1.45	0.15	0.00	0.02
DI	0.00***	0.00	6.53	0.00	0.00	0.01
Ln(assets)	0.00***	0.00	1.73	0.01	0.00	0.01
DE	0.00	0.00	0.36	0.72	0.00	0.00
OPM previous	0.43***	0.03	15.37	0.00	0.37	0.48
Sector	–0.01**	0.01	–0.76	0.04	–0.04	0.02
Constant	–0.17***	0.03	–5.24	0.00	–0.24	–0.11

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

Table 5

The result of the model for companies in finance, technology, or communications

Variables	Coefficients	Standard deviation	Z	P- value	95% confidence intervals	
Ln(age)	0.00	0.00	0.64	0.52	0.00	0.01
DI	0.04***	0.00	2.86	0.00	0.00	0.00
Ln(assets)	0.00**	0.00	0.47	0.04	0.00	0.00
DE	0.00	0.00	0.40	0.69	0.00	0.00
OPM previous	0.83***	0.02	33.72	0.00	0.78	0.88
Sector	–0.04**	0.02	–2.30	0.02	–0.08	–0.01
Constant	0.00	0.00	0.64	0.52	0.00	0.01

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

profit margin at any level of significance. But at the 1% significance level, the company's profitability is positively influenced by the digitalization index, company size, and profitability of the previous period. In addition, at the 5% significance level, participation in the financial, technology, or communications sector has a weak negative effect. The key observation is that the digitalization of the enterprise does affect its profitability.

To test the hypotheses put forward, it is necessary to divide the sample into several different groups: by company age, size and industry. To test hypothesis H2, we split the sample into companies from the financial, technology, or communications sector and other companies. The results of building models for two groups of industries are presented in *Tables 5, 6*.

In general, the same results are observed as in the general sample: only the coefficients

Table 6

The result of a model for companies in other industries

Variables	Coefficients	Standard deviation	Z	P–value	95% confidence intervals	
Ln(age)	0.04	0.04	1.03	0.30	–0.04	0.12
DI	0.01***	0.00	4.56	0.01	0.01	0.02
Ln(assets)	–0.01**	0.01	–0.63	0.03	–0.03	0.02
DE	0.01	0.01	0.77	0.44	–0.02	0.03
OPM previous	0.15**	0.07	2.21	0.03	0.02	0.29
Sector	–0.60***	0.20	–3.04	0.00	–0.98	–0.21
Constant	0.04	0.04	1.03	0.30	–0.04	0.12

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

with the parameters were significant: digitalization index, asset value, and profit of the previous period. It should be noted that for the main investigated variable (digitalization index) there is a different order of influence and significance. For companies in the sector of finance, technology, and communications, this coefficient is significant at any reasonable level of significance and has a value of 0.04. And for the rest of the sectors, the same parameter is significant precisely at the level of 1% and higher with a coefficient value of 0.01, which indicates a lower level of dependence and influence on the dependent variable.

We evaluate the models for larger and smaller companies (since our sample consists only of large companies, it would be wrong to divide companies into large and small). According to statistical tests, the most acceptable was the division of companies into companies with assets of more than 50 billion rubles and less. The model results are presented in *Tables 7, 8*.

As a result, for larger companies belonging to a particular industry does not affect profitability, while for smaller companies this parameter remains significant at the 5% significance level with a weak positive relationship. The influence and the level of significance of the degree of digitalization for both samples are practically the same: the parameter is significant at any reasonable level of significance with a weak positive effect.

To test the hypothesis about the difference in the significance of the digitalization degree for younger and more mature companies, we will also divide the sample into two parts and build two models with random effects for comparison. Likewisw, through statistical tests it is considered appropriate to divide companies into groups over 25 and younger. This division does not violate the stability of the sample and is logically correct since the largest gap in technology has occurred in the last 25 years (UNCTAD Secretariat, 2018). The model results are presented in *Tables 9, 10*.

In this case, the "degree of digitalization" parameter is significant only at the 10% level of significance for younger companies, while for more mature companies — at any. Thus, more mature companies are more dependent on the introduction of new technologies.

To sum up the model:

H1: In general, there is a positive dependence of efficiency indicators on the degree of business digitalization.

Table 7

The result of a model for larger companies

Variables	Coefficients	Standard deviation	Z	P–value	95% confidence intervals	
Ln(age)	0.02	0.01	1.62	0.11	0.00	0.05
DI	0.00***	0.00	6.19	0.00	0.01	0.01
Ln(assets)	0.00**	0.01	0.01	0.03	–0.01	0.01
DE	0.00	0.00	0.10	0.92	0.00	0.00
OPM previous	0.36***	0.04	8.90	0.00	0.28	0.44
Sector	–0.02	0.02	–0.74	0.16	–0.06	0.03
Constant	–0.29***	0.08	–3.88	0.00	–0.44	–0.14

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

Table 8

The result of a model for smaller companies

Variables	Coefficients	Standard deviation	Z	P–value	95% confidence intervals	
Ln(age)	0.00	0.00	0.08	0.93	0.00	0.00
DI	0.01***	0.00	5.57	0.00	0.00	0.00
Ln(assets)	0.00**	0.00	1.11	0.02	0.00	0.01
DE	0.00	0.00	0.78	0.44	0.00	0.00
OPM previous	0.86***	0.02	37.25	0.00	0.81	0.90
Sector	0.00**	0.01	–0.08	0.04	–0.01	0.01
Constant	–0.01**	0.01	–0.50	0.02	–0.03	0.02

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

The first hypothesis was confirmed, the coefficient with a variable degree of digitalization in the general sample is significant, having a positive effect on the operating profit margin.

H2: The greatest impact of digitalization is observed among companies in the field of technology, finance, or communications.

This hypothesis was also confirmed since the variable in the model responsible for digitalization turned out to be more significant and has a greater influence on the dependent variable in a sample of companies belonging to the financial, technology, or communications sectors.

H3: The magnitude of the digitalization effect does not depend on the size of the company.

The third hypothesis was also confirmed since there were no considerable differences in the impact and significance of the digitalization variable.

Table 9

The result of a model for old companies

Variables	Coefficients	Standard deviation	Z	P–value	95% confidence intervals	
Ln(age)	0.01	0.01	0.54	0.59	–0.02	0.04
DI	0.02***	0.00	5.71	0.00	0.01	0.01
Ln(assets)	0.01**	0.00	1.56	0.02	0.00	0.02
DE	0.00	0.00	–1.10	0.27	–0.01	0.00
OPM previous	0.29***	0.04	7.66	0.00	0.22	0.37
Sector	–0.03**	0.02	–1.48	0.04	–0.07	0.01
Constant	–0.25***	0.08	–3.15	0.00	–0.40	–0.09

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

Table 10

The result of a model for young companies

Variables	Coefficients	Standard deviation	Z	P–value	95% confidence intervals	
Ln(age)	0.00	0.01	0.27	0.78	0.02	0.02
DI	0.00*	0.00	1.66	0.09	0.00	0.00
Ln(assets)	0.00***	0.00	–0.57	0.01	0.01	0.00
DE	0.00	0.00	0.44	0.66	0.00	0.00
OPM previous	0.89***	0.04	22.19	0.00	0.81	0.97
Sector	0.00***	0.01	0.04	0.01	0.03	0.03
Constant	–0.04	0.03	–1.05	0.29	0.10	0.03

Note: P-value — significance level; Z — (z-score) — measure of the relative spread of the observed value; */**/*** — significance levels: 10/5/1% respectively.

Source: authors' calculations.

H4: More mature companies benefit less from digitalization.

This hypothesis is not confirmed by the results of the model, since for younger enterprises it turned out that the parameter of the degree of digitalization is significant only at the level of 10% significance with a weak coefficient of influence, while for more mature companies the coefficient is much more significant and has a greater impact on profitability.

CONCLUSIONS

This study complements the topic of business digitalization with new findings since a new digitalization index of a company was used. Despite the fact that this study has some limitations and areas for development, its results can be used for practical purposes. Thus, the results of the analysis provide a general understanding of the importance of digitalization in relation to its impact on profitability, as well as an understanding of

which companies, which industries, what scale and age, this relationship has the strongest impact on. Different areas require different levels of digital implementation and adjustment over time. The research results will allow companies to better understand and evaluate the specifics of changes in business processes as a result of the formation of a digital company. Today, the cost of digitalization is high, so the results obtained will allow us to appreciate the benefits of the company's digital maturity level.

From the point of view of not only an individual company, but the whole country, the results of this study can help decide which industries should be subsidized for digital innovation. As has been illustrated by the study, digitalization increases profitability, which means that the rate of economic growth should increase.

The study has a number of limitations.

First, the sample consists only of large Russian companies and excludes small and medium-sized enterprises. A sample of smaller companies may show different results from the results obtained in this study.

Second, the study used the operating profit margin as the dependent variable and did not have any other metrics. There is a possibility that digitalization will have a greater impact on other performance indicators not directly related to the company's profitability.

Third, the digitalization index is detailed for specific companies, but not detailed for its constituent parts. Since different aspects of digitalization may be less or more relevant to different industries, different criteria can have different impacts depending on the profile of the company.

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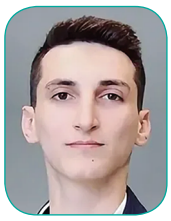

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