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Y. Sansyzbay, PhD student¹
G. Rakhimzhanova*, PhD¹
A. Kocherbaeva, d.e.s., professor²
Alikhan Bokeikhan University,
Semey, Kazakhstan¹
Kyrgyz-Russian Slavic University
by the named B.N. Eltcin, Bishkek, Kyrgyzstan²
* – main author (author for correspondence)
e-mail: gulmira.72-78@mail.ru

IMPACT OF DIGITALIZATION ON SMEs LABOR PRODUCTIVITY IN EAST KAZAKHSTAN

The article presents a quantitative analysis of digitalization processes in the entrepreneurial sector of the East Kazakhstan Region. The effects of digitalization on the labor productivity of enterprises in the region are identified.

An analysis of the digital environment in the East Kazakhstan Region was conducted. The over time increasing contribution of SMEs to Kazakhstan' GDP are shown. The increasing number of organizations with automated internal business processes and Internet resources are showed. The reduction of the number of personnel with digital competencies in the region has been observed amid an increase in enterprise expenditures on the development of information and communication innovations.

A positive correlation has been identified between the number of organizations with automated internal business processes and the labor productivity of SMEs. A positive correlation has been identified between the increasing of expenditures on information and communication technologies and the labor productivity. A positive correlation has been identified between the increasing of specialists in information and communication technologies and the labor productivity.

The practical significance of the study lies in the development of measures aimed at the systematic advancement of digitalization processes in the entrepreneurial sector of the East Kazakhstan Region. These measures include stimulating digital modernization, developing regional digital infrastructure, and enhancing the digital competencies of the region's human capital.

The study employs methods of quantitative assessment of digitalization effects, an econometric model of multiple regression, as well as methods of observation, measurement, and comparison, and logical methods of induction and deduction, analysis and synthesis. The analysis and assessment conducted are based on data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, international sources, and open publications available on the Internet.

Keywords: digitalization, impact of digitalization, entrepreneurship, region, digital infrastructure, information and communication technologies, human capital, labor productivity.

Кілт сөздер: цифрландыру, цифрландырудың әсері, кәсіпкерлік, өңір, цифрлық инфрақұрылым, ақпараттық-коммуникациялық технологиялар, адами капитал, еңбек өнімділігі.

Ключевые слова: цифровизация, влияние цифровизации, предпринимательство, регион, цифровая инфраструктура, информационно-коммуникационные технологии, человеческий капитал, производительность труда.

JEL Classification: L26, O11, O18, O47, R15.

Introduction. Digitalization in the East Kazakhstan Region is intended to act as a key driver of entrepreneurial development in the region. The successful digitalization development leads to ensure the growth of enterprise revenues and increase their labor productivity in order to improve the accessibility of services and the quality of life of the population. The established basic institutional conditions, market environment, economic policy, and organizational readiness of businesses are oriented toward the digital transformation of business models and the support of entrepreneurial activity in the region.

Within the context of strategic priorities and government initiatives aimed at implementing the mechanisms of the “Digital Kazakhstan” program and regional roadmaps, the issue of further implementation of “smart” technologies, transformation of digital infrastructure, business models, services, and management systems becomes particularly relevant.

However, the decrease in the number of ICT specialists observed on the region in recent years may indicate to limited digital skills of human capital hindering growth of labor productivity and the effective development of entrepreneurship.

In this regard, becomes necessary the analyze and assess the impact of digitalization on the entrepreneurship labor productivity in the East Kazakhstan Region for identify vulnerabilities and develop further measures for the implementation of digitalization mechanisms in the region, which was the purpose of the present study.

The methodological framework of the study is based on a quantitative assessment of the impact of digitalization using an econometric model of multiple regression, as well as methods of analysis, synthesis, observation, measurement, and data grouping to describe economic processes and explain the causes and mechanisms of development.

The information base of the study consists of statistical data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, international sources, and publicly available information from Internet resources.

Literature review. Approaches to studying the impact of digitalization on entrepreneurship are comprehensively examined in the works of many foreign and domestic researchers, covering institutional foundations, infrastructure conditions, economic instruments, and implementation mechanisms. In particular, the impact of digitalization on entrepreneurial development within the institutional paradigm support of digital projects in the context of disruptive and turbulent changes [1], [2], but without the human factors, which influencing on the business initiatives development. In the regional aspects using the example of large developing countries [3], as well as major cities characterized by significant financial resources and economic and technological diversity [4], digitalization and its effects are studied in isolation from the organizational and systemic factors involved in shaping this process.

In addition, the effects of digital entrepreneurship are studied in relation to the formation and development of entrepreneurial ecosystems [5], as well as innovative tools that contribute to their development [6], [7], excluding digital investments in business process automation, distorted the creation of multi-level conceptual frameworks with key digital solutions aimed at improving the understanding of digital entrepreneurship and stimulating its growth [8], as well as the mechanisms of its functioning [9].

Another research on the effects of digital entrepreneurship are associated with the use of artificial intelligence and digital platforms [10], as well as digital technologies and digital startups [11], do not take the entrepreneurial processes mechanisms without which digital transformations cannot translate into output growth for a specific business owner

The extensive body of scientific research devoted to the impact of digitalization on entrepreneurship is of significant importance for both methodological and theoretical understanding of this issue. It also provides a foundation for a deeper examination and identification of the effects of digitalization on domestic entrepreneurship in an applied context, which is the focus of the present study.

Main part. The entrepreneurship in East Kazakhstan Oblast is characterized by an increasing contribution of SMEs to Kazakhstani GDP until to 25,9% in 2025 from 16,9% in 2016 (a 9 percentage-point increase) amid a 1,6-fold decrease in the number of active SMEs during the analyzed period (from 98,9 thousand in 2016 until 62,5 thousand in 2025) (Figure 1).

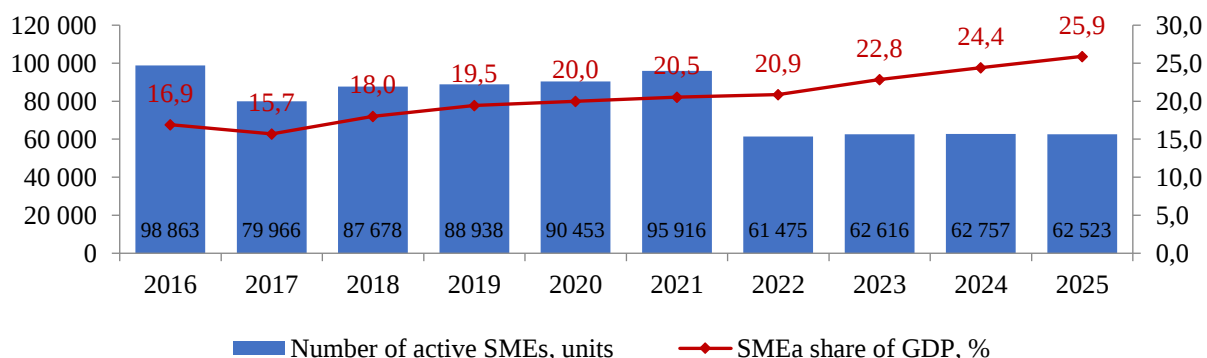


Figure – 1. **Number of active SMEs in East Kazakhstan Oblast and its share of GDP, units/%**

**compiled by the authors based on sources [12]*

In addition, the number of enterprises with internet-resources is increasing during the analyzed period in 1,6-fold (from 996 units in 2016 until 1583 units in 2025). The number of enterprises, having automated business processes, to increase in 2,7-fold (from 374 units in 2016 until 1023 units in 2025). The number of enterprises, having specialists in ICT against is decrease in 1,7-fold (from 508 units in 2016 until 306 units in 2025) as well as to decrease the number of ICT specialists on 6,8% (from 1495 people in 2016 until 1393 people in 2025) (Figure 2).

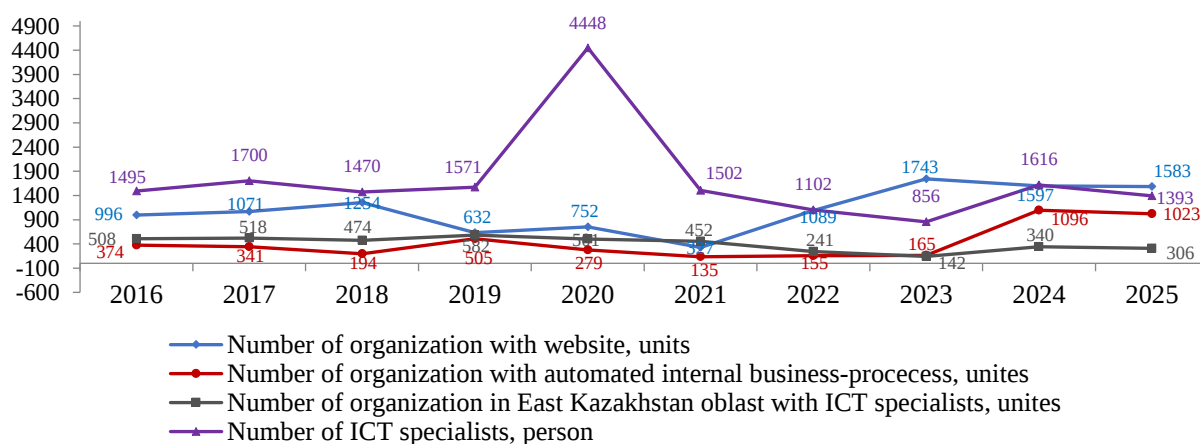


Figure – 2. **Dynamics of ICT and digitalization usage in organization of East Kazakhstan Oblast**

**compiled by the authors based on sources [13].*

The one of the significant factors of digital modernization in the region enhancing the scale and pace of digital transformation is high cost of implementing digital solution. So, innovation costs on the information and communication technology in the region for last ten years up almost in two fold in nominal (from 12,9 billion tenge in 2016 to 23,3 billion tenge in 2025) (Figure 3).

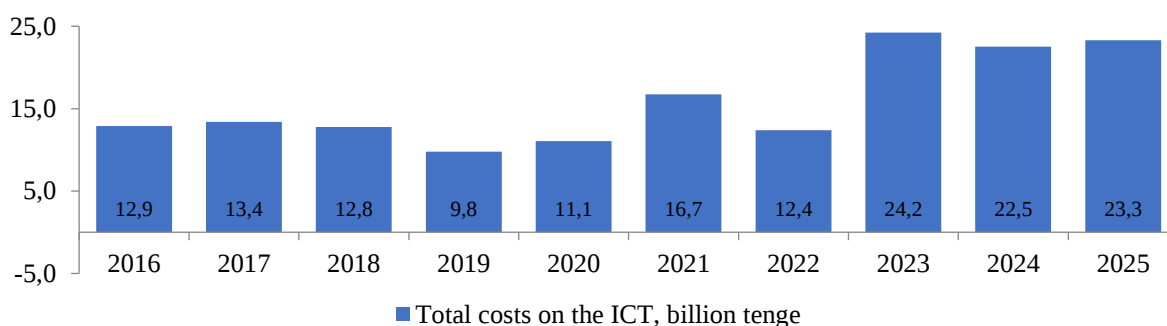


Figure – 3. **Total costs on the information and communication technology, billion tenge**

**compiled by the authors based on sources [14].*

The current situation demonstrates that digital processes in the region is accompanied predominantly by the expansion of the material and technical base of East Kazakhstan oblast enterprises. Expansion driven by rising costs amidst a contraction ICT specialists in complex positively impacts the labor productivity growth in such enterprises throw workforce optimization and the substitution of manual functions with highly scalable digital capital.

In this regard, in order to assess the effects of digitalization implementation, a correlation analysis was conducted to identify the statistical relationship between the diffusion of digital technologies in entrepreneurship and labor productivity.

The calculations were performed based on a logarithmic multiple regression model (Formula 1):

$$\ln(Y_t) = \beta_0 + \beta_1 Org_{ICT} + \beta_2 ICT_{exp} + \beta_3 ICT \quad (1)$$

where:

Y_t - SME labor productivity, %;

β_0 – regression intercept (constant);

$\beta_1, \beta_2, \beta_3$ – regression coefficients representing the marginal effects of the factors;

Org_{ICT} – organizations with automated business processes, units;

ICT_{exp} – expenditures on information and communication technologies, billion KZT;

ICT – specialists in information and communication technologies, units.

As a result of the regression analysis a positive relationship between the labor productivity in East Kazakhstan oblast firms and factors determining the level of digitalization of enterprises in the region was founded. Multiple R (0,988) indicates a very strong linier relation between the labor productivity in East Kazakhstan oblast firms and the factors included in the model. Coefficient of determination ($R^2 = 0,976$) shows that 97% of the variation in the dependent variable is explained by the factor model, the remaining 3% are attributable to other factors. Adjusted R-squared (0,961) confirms the high accuracy of the number of variables and implies that 96,1% appropriately adjusted for the number of variables. The model is statistical significant ($F = 4,92E-05 = 0,00005 < 0,05$), which confirms the adequacy of the constructed regression (Figure 4).

Regression Statistics								
Multiple R	0,988322							
R-Square	0,976781							
Adjusted R Square	0,961302							
Standard Error	793,7066							
Observation	44							
ANOVA								
	df	SS	MS	F	Significant F			
Regression	4	1,59E+08	39752419	63,10207	4,92E-05			
Residual	6	3779821	629970,1					
Total	10	1,63E+08						
	Coefficients	Standard Error	t-Stat	P-Value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95,0%
Intercept	3455,517	2368,47	1,458966	0,194857	-2339,92	9250,953	-2339,92	9250,953
X Variable 1	4,560203	0,880797	5,177358	0,00206	2,404969	6,715436	2,404969	6,715436
X Variable 2	14,03046	0,893789	4,848476	0,002856	2,111308	6,949617	2,111308	6,949617
X Variable 3	4,168197	0,972671	4,28531	0,005175	1,788157	6,548238	1,788157	6,548238

Figure – 4. Regression Results

*authors' calculations.

The obtained results indicate the growth of the number of organizations with automated business processes by the 1 units the labor productivity of the East Kazakhstan Oblast enterprises increases by 4,56%, ceteris paribus. With a P-value of 0,002 ($< 0,05$), the model is statistically significant.

At the same time, with rising expenditures on information and communication technologies by 1 billion KZT the labor productivity of the enterprises in East Kazakhstan oblast increases by average 14,03%, ceteris paribus. The model is statistically significant ($P\text{-Value} = 0,003 < 0,05$).

With rising the number of specialists in information and communication technologies in the region by 1 units the labor productivity increases by 4,17%, ceteris paribus. The model is statistically significant ($P\text{-Value} = 0,005 < 0,05$).

The obtained results of the regression analysis of the effects of digitalization on enterprises development indicate a direct positive relationship between the number of organizations with automated internal business processes, rising expenditures on information and communication technologies, the number of specialists in information and communication technologies and the labor productivity of enterprises.

Conclusion. Digitalization processes in the East Kazakhstan Oblast are accompanied by an increase to digital material and technical infrastructure of the enterprises and expenditures of enterprises on information and communication technologies. At the same time, the number of specialists in information and communication technologies are decreasing. In complex this has an impact on labor productivity of the enterprises, which to achieved throw optimization of human resources and replacing manual labor with scalable digital solutions.

The results of the regression analysis demonstrated a positive relationship between the use of digital automated processes and the economic efficiency of enterprises, reflected in the growth of labor productivity.

For future digital development in entrepreneurship in the East Kazakhstan Oblast it is essential to stimulate platforms for interaction between business and IT companies. This facilitated a broader access to the Internet and accelerated the diffusion of digital solutions among enterprises.

A key factor is the improvement of digital competencies among entrepreneurs, as well as the training of specialists in the new educational interdisciplinary digital fields.

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Сансызбай Е.С., Рахимжанова Г.А., Кочербаева А.А.

ШҚО-ғы ШОБ-тың ЕҢБЕК ӨНІМДІЛІГІНЕ ЦИФРЛАНДЫРУДЫҢ ӘСЕР ЕТУ ЭФФЕКТІСІ

Аңдатпа

Мақалада Шығыс Қазақстан облысы кәсіпкерлік секторындағы цифрландыру үдерістеріне сандық талдау жүргізіліп, цифрландырудың өңір кәсіпорындарының еңбек өнімділігіне әсер ету нәтижелері анықталды.

ШҚО-дағы цифрлық ортаның жағдайына талдау жүргізілді. ШОБ-тың ел ІҮӨ-не қосып отырған үлесінің серпінді өсіп келе жатқаны көрсетілген. Өңірде автоматтандырылған бизнес-процестері бар және интернетке қол жетімді ұйымдарының саны өсуі анықталған. Ақпараттық-коммуникациялық инновацияларды дамытуға кәсіпорындардың шығындары артқанына қарамастан, өңірде цифрлық құзыреттері бар қызметкерлер санының қысқару үрдісі байқалды.

Ішкі автоматтандырылған бизнес-процестері бар ұйымдар саны және оның еңбек өнімділігі арасында оң корреляциялық байланыс анықталды. Сонымен қатар ақпараттық-коммуникациялық технологияларға жұмсалатын шығындардың артуы кәсіпорын еңбек өнімділігінің өсуімен оң корреляциялық байланыста екені анықталды. Және цифрлық дағдылары бар мамандарының саны өсуімен кәсіпорын еңбек өнімділігінің артуымен оң корреляциялық байланыс анықталды.

Зерттеудің практикалық маңыздылығы ШҚО кәсіпкерлік секторындағы цифрландыру үдерістерін жүйелі дамытуға бағытталған шараларды әзірлеуде көрінеді. Бұл шаралар цифрлық модернизацияны ынталандыруды, өңірлік цифрлық инфрақұрылымды дамытуды және өңірдің адами капиталының цифрлық құзыреттерін арттыруды қамтиды.

Зерттеу барысында цифрландыру әсерлерін сандық бағалау әдісі, көпфакторлы сызықтық регрессияның эконометриялық моделі, бақылау, өлшеу және салыстыру әдістері, сондай-ақ индукция мен дедукцияның логикалық әдістері, талдау және синтез тәсілдері қолданылды. Жүргізілген талдау мен бағалау Қазақстан Республикасы Стратегиялық жоспарлау және реформалар агенттігінің Ұлттық статистика бюросы деректеріне, халықаралық дереккөздерге және интернет желісіндегі ашық жарияланымдарға негізделді.

Сансызбай Е.С., Рахимжанова Г.А., Кочербаева А.А.

ЭФФЕКТ ВЛИЯНИЯ ЦИФРОВИЗАЦИИ НА ПРОИЗВОДИТЕЛЬНОСТЬ ТРУДА МСП В ВКО

Аннотация

В статье проведен количественный анализ процессов цифровизации в предпринимательском секторе ВКО, выявлены эффекты влияния цифровизации на производительность труда предприятий региона.

Проведен анализ цифровой среды в ВКО. Показан в динамике растущий вклад МСП в ВВП страны. Выявлен рост количества организаций с автоматизированными внутренними бизнес-процессами и с доступом в Интернет. Выявлена тенденция сокращения персонала в регионе с цифровыми компетенциями на фоне роста затрат предприятий на развитие информационно-коммуникационных инноваций.

Выявлена положительная корреляционная взаимосвязь между количеством организаций, имеющих автоматизированные внутренние бизнес-процессы и производительностью труда на предприятии. Определена положительная корреляционная взаимосвязь роста затрат на информационно-коммуникационные технологии и роста производительности труда на предприятии. Выявлена положительная корреляционная взаимосвязь между ростом количества специалистов с цифровыми навыками и ростом производительности труда на предприятиях региона.

Практическая значимость исследования заключается в разработке мер по системному развитию процессов цифровизации в предпринимательском секторе ВКО, охватывающих стимулирование цифровой модернизации, развитие региональной цифровой инфраструктуры и повышение цифровых компетенций человеческого капитала региона.

В работе применены метод количественной оценки эффектов цифровизации, эконометрическая модель множественной линейной регрессии, методы наблюдения, измерения и сравнения, логические методы индукции и дедукции, анализа и синтеза. Проведенный анализ и оценка основаны на данных Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан, международных источников, а также открытых публикаций сети интернет.