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ANALYTICS OF THE HUMAN CAPITAL OF INDUSTRIAL ENTERPRISES IN CONDITIONS OF DIGITALIZATION OF ECONOMICS

The object of research is the development of human capital of machine-building enterprises in the direction of increasing the level of their digital competencies. The links between the indicators of financial and economic activity of the enterprise and the rate of economic growth are studied, since digital technologies allow increasing labour efficiency and creating new added value. It has been found that the economic growth rate of an enterprise that implements digital technologies is higher than the growth rate of an enterprise that does not implement digital technologies. The article proposes a model of economic growth at the enterprise level, based on the concept of human capital, as well as measures that can be implemented by machine-building enterprises to improve their digital competencies. It is established that the cost of human capital at the selected enterprises is characterized by a significant level of underestimation, and it is found that the change in the cost of human capital correlates with the factors selected for analysis, which are to some extent related to the digitalization of processes at the enterprise. Several recommendations have been developed to improve the value and efficiency of human capital, create new added value and ensure economic growth. Those recommendations can be aimed at strengthening fixed assets, increasing demand through assortment changes towards automation and digitalization of processes, production, product, digital reorganization, as well as attracting IT professionals and specialists. Digitalization of products and processes can help to increase labor productivity, increase the number of potential customers and, possibly, investors, thereby strengthening capital equipment. The article notes that digitalization today means competitiveness in the domestic and foreign markets, strengthening of the company's position in the economic environment and transition to a balanced enterprise development strategy where the value of human capital will be higher, and as a result, labor productivity will increase.

Keywords: *human capital, machine-building enterprises, digitalization, correlation-regression analysis, digital competencies, digital technologies.*

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1. Introduction

Digitalization of economic and production activities affects the change of human capital. Digital technologies have a powerful impact on human capital, as they change the way we learn, work, communicate, enable remote work, interact with people around the world, and access information and resources that were previously unavailable. However, digital technologies also have certain risks. For example, they can lead to the loss of jobs due to automation and, accordingly, the replacement of humans by robotic machinery. There is a proven fact in the practice of enterprises that if employees use certain digitalized processes, even related to the simplification of the management system, thanks to the reduction of time for the implementation of operations and the increase in the efficiency of communications between people, the economic results of the enterprise increase.

Human capital is one of the key components of digitalization, which includes knowledge, skills and experience that can be contributed to the development of digital technologies and their use in various spheres of life [1]. Human capital, in turn, is a consequence of digitalization, because after acquiring skills, the employee increases his level of professionalism, starting to apply for a different position and higher remuneration [2]. According to recent studies, in the digital economy, where technology is rapidly changing and developing, human capital is an important success factor [3]. Companies that provide their employees with the knowledge and skills necessary to work with the latest technologies have a greater opportunity to be competitive and effective. On the other hand, if human capital cannot adapt and retrain for new realities, digitalization will proceed more slowly, and as a result, it will slow down the competitiveness of not only individual enterprises but also the country's economy as a whole [4].

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The aim of research is to determine the dependence of the results of the economic activity of machine-building enterprises on the level of human capital, to evaluate human capital in monetary terms.

2. Materials and Methods

Analyzing the influence of human capital on the results of the economic activity of engineering enterprises, it is advisable, using statistical data, to calculate, compare indicators, model and find formal connections related to the development of human capital in the conditions of digitalization of the economy.

It is worth noting that the evaluation of human capital is complicated by the fact that separate official statistics of quantitative indicators of its development under the influence of digitalization are not always conducted at machine-building enterprises, instead, there are a large number of factors that can indirectly determine its impact [5].

The development of human capital has a positive effect on economic growth [6]. Well-educated and skilled human capital is an attractive asset for investors because it provides the basis for innovation and productivity [7]. Highly skilled workers are more likely to contribute to technological progress and learn new ways of doing business, leading to increased competitiveness and economic growth [8]. In addition, human capital development can lead to higher wages and living standards for people because it increases their productivity and employability. To illustrate this argument, consider the example of countries such as South Korea and Singapore, which have made significant investments in education and training [9]. These countries have experienced rapid economic growth and become world leaders in fields such as technology and finance. The availability of highly skilled human capital has attracted multinational corporations and stimulated national entrepreneurship, leading to sustainable economic development [10].

However, it is important to recognize that human capital development may not lead directly to economic growth in all cases. Economic growth is influenced by many factors, including infrastructure, governance and market conditions [11]. Although human capital is a critical component, its impact may be limited in sectors or regions where other factors are more significant [12]. For example, countries rich in natural resources can experience economic growth despite limited investment in human capital. In addition, technological progress can also play a critical role in economic growth, overshadowing the impact of human capital development in certain industries.

The formation of proposals for the development of human capital of machine-building enterprises in the direction of increasing the level of their digital competencies is based, first of all, on the analysis of the existing state of the effectiveness of its use. There are not many methods of calculating human capital in the value equivalent, and there are no such methods that would be related to digitalization at all [13]. Therefore, to implement the objectives of this study, it was assumed that the higher the pace and volume of implementation of digitalization, the higher are the results of the use of human capital, since digitalization leads to an increase in the share of intellectual labor and, accordingly, the created added value. To conduct the analysis, we considered several models of exogenous economic growth of the world's leading scientists.

The first model that deserves attention is the Solow-Swan neoclassical model of exogenous economic growth, as it provided the mathematical basis for further models related to the impact of human capital on the development of a country's economy. This model assumes that technological progress increases labor productivity [14, 15]. Therefore, it can be argued that the level of digitization of the enterprise will increase labor productivity [16]. Human capital, in turn, can act as a factor that affects quality components, and thus, the productivity of the enterprise [17].

The second model that has attracted interest is the Romer model, which is known as the action learning model. P. Romer studied the factors of production and pointed out that there is not only capital and labour, but also technology and claimed that a country with developed human capital and advanced science has a greater probability of economic development and growth [18]. It was Paul Romer who introduced into the scientific field the definition of the «knowledge spillover effect» as being important in increasing productivity. By considering the «knowledge» factor and separating it into a separate important category, his model made it possible to understand what labor productivity depends on.

According to the AK model or the model of R. Lucas, economic growth is achieved due to the marginal productivity of capital, which includes not only physical but also human capital. This model does not consider the rate of growth of technological progress, since they can be explained without isolated technological changes. Decreasing depreciation rates lead to higher rates of economic growth. Under certain conditions, growth rates increase due to technological changes, which lead, in turn, to an increase in the technological parameter A, increasing the average and marginal productivity of capital [19, 20]. Taking into account the above, this particular model was chosen for the given research task.

Based on this model, it is possible to explain the economic growth of the enterprise without involving assumptions about the growth rates of technological progress, which are set exogenously. In the model, net income Y is given by a multiplicative production function describing an economy with constant returns to scale – extensive growth, i. e.: $F(nK, nL)=nY$ for any $n>0$, i. e. by the Cobb-Douglas function $Y=F(K, L)=\bar{A}\cdot K^{\alpha}\cdot L^{1-\alpha}$ (if the sum of the exponents of K and L were greater than one, then the growth would be intense) [21]:

$$Y(t)=\bar{A}\cdot\left(K(t)\right)^{\alpha}\cdot\left(\bar{L}\cdot H(t)\right)^{1-\alpha},\ 0<\alpha<1, \quad (1)$$

where $Y(t)$ is the net income from product sales; $\bar{A}$ – technological parameter, $\bar{A}>0$; $K(t)$ – physical capital (fixed assets); $\bar{L}$ – the number of employees; $H(t)$ is the level of human capital possessed by a typical representative of the workforce.

The use of the model involves several assumptions:
– the size of the labor force is constant, so the total stock of human capital is equal to $\bar{L}\cdot H(t)$. Then labor efficiency is measured by the level of human capital $H(t)$;
– investment $I(t)$ at time t is the sum of investments in physical $I^k(t)$ and human capital $I^h(t)$: $I(t)=I^k(t)+I^h(t)$;
– net income is distributed between consumption C and investment I;
– depreciation rates μ of physical and human capital coincide, therefore:

$$\frac{dK}{dt} = I^k - \mu \cdot K, \quad \frac{dH}{dt} = I^H - \mu \cdot H,$$

where μ is the depreciation rate;

– full interchangeability of capital resources is assumed. Therefore, since the costs of accumulation of physical and human capital coincide, in the equilibrium state their marginal productivity should also be equal, i. e. $MPK = MPH$ [1]:

$$MPK = \frac{dY}{dK} = \alpha \cdot \bar{A} \cdot \left(\frac{L \cdot H(t)}{K(t)}\right)^{1-\alpha} = \left(\frac{L \cdot H(t)}{K(t)}\right) \cdot \left(\frac{L \cdot H(t)}{K(t)}\right)^{-\alpha},$$

$$MPH = \frac{dY}{dH} = (1-\alpha) \cdot \bar{A} \cdot \left(\frac{K(t)}{L \cdot H(t)}\right)^{\alpha} \cdot L =$$

$$= (1-\alpha) \cdot \bar{A} \left(\frac{L \cdot H(t)}{K(t)}\right)^{-\alpha} \cdot L.$$

It follows that human capital can be found using the formula:

$$\frac{H(t)}{K(t)} = \frac{(1-\alpha)}{\alpha}. \quad (2)$$

Then the production function takes the form:

$$Y(t) = \bar{A} \cdot \left(\frac{(1-\alpha)}{\alpha}\right)^{1-\alpha} \cdot L^{1-\alpha} \cdot K(t) = A \cdot K(t),$$

where the constant A:

$$A = \bar{A} \cdot \left(\frac{(1-\alpha)}{\alpha}\right)^{1-\alpha} \cdot L^{1-\alpha}. \quad (3)$$

The main property of the obtained model is the constant marginal productivity of capital. This constant return on capital is made possible by the fact that capital includes both physical and human capital.

3. Results and Discussion

3.1. Results. We selected several machine-building enterprises for the study that can correlate with the Cobb-Douglas function and the fact that the number of personnel has not changed for the observed period. For example, PJSC «Ivano-Frankivsk Plant «Promprylad»'s economic and production activity of the enterprise is concentrated on the production of gas meters, gas filters, diaphragms and pressure transducers, while the growth of the company occurs through the policy of reinvestment, the main share of profit is aimed at investing in the development and modernization of production [22].

JSC «Elmiz» concentrates on the production of equipment for space systems, tests, mining and mine systems, agro-navigation while the company's growth is due to the policy of reinvestment, the main share of profit is aimed at investing in development. Thus, the company focused on the production of charging stations for electric vehicles of the FastCharger class because the demand for this type of goods is high on the market, but, at the same time, it continues the production of the products specified in the catalog. Income from the production of charging stations are invested in conducting scientific analyzes by specialized organizations to preserve the scientific design, engineering-technical, production and personnel potential. There is also the preservation of positive dynamics of development, and involvement of the enterprise in the execution of state orders [23].

PJSC «Kyivpoligrafmash», which focuses on the production of flexographic roll and folding machines, various polygraphic and packaging machines, gilding presses, laminators, printing and cutting lines and equipment for the production of corrugated cardboard containers, as well as spare parts for various printing and packaging equipment, while the company's growth is due to the reinvestment policy. Directly at the enterprise, all types of mechanical processing of parts are carried out, including their heat treatment, galvanic coating and painting [24]. The main share of the profit is aimed at investing in the development of the company's factory laboratory, which carries out quality control of parts, as well as for improving the designs of machines, taking into account the experience of their operation and the wishes of customers [24].

PJSC «Kyiv Radio Plant». The economic and production activity of the enterprise is concentrated on the production of basic serial and non-standard, individual elevators. In its developments, the company uses the latest, progressive world and its own developments, using the best European components [25]. At the same time, the growth of the company is due to the policy of reinvestment, the main share of the profit is directed to investing in the development of the company to create the latest products in the occupied field [25].

The detailed performance indicators of machine-building enterprises, based on which the model for determining the human capital indicator and the application of the Cobb-Douglas production function will be built, are given in Table 1. As it is possible to see, the average number of employees is almost stable at all sample enterprises: PJSC «Ivano-Frankivsk Plant «Promprylad» – 134 people, JSC «Elmiz» – 132 people, PJSC «Kyivpoligrafmash» – 97 people, PJSC «Kyiv Radio Plant» – 168 people.

Let's find regression functions of the dependence of net income on fixed assets using the *MNC* method in the form:

$$\hat{Y} = A \cdot K, \quad (4)$$

where the regress and $\hat{Y}$ – net income from product sales; regressor K – basic means.

Regression functions by enterprises, according to the MNC method, are given in Table 2.

In the future, let's calculate the value of the human capital indicator in the monetary equivalent for PJSC «Ivano-Frankivsk Plant «Promprylad», using the dependence (3), let's find $\bar{A} = 1.24$; $\alpha = 0.7474$.

Then from relation (2) there is:

$$H(t) = \left(\frac{(1-\alpha)}{\alpha}\right) \cdot K(t) = 0.33797 \cdot K(t).$$

Using dependence (3), let's find $\bar{A} = 1.13$; $\alpha = 0.8474$. Then from relation (2) there is:

$$H(t) = \left(\frac{(1-\alpha)}{\alpha}\right) \cdot K(t) = 0.18008 \cdot K(t).$$

For PJSC «Kyivpoligrafmash», using dependence (3), let's find $\bar{A} = 1.0175$; $\alpha = 0.685$. Then from relation (2) there is:

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$$H(t)=\left(\frac{(1-\alpha)}{\alpha}\right)\cdot K(t)=0.45985\cdot K(t).$$

The fourth company in our sample is PJSC «Kyiv Radio Plant». Using dependence (3), let's find $\bar{A}=1$; $\alpha=0.84$. Then from relation (2) there is:

$$H(t)=\left(\frac{(1-\alpha)}{\alpha}\right)\cdot K(t)=0.19\cdot K(t).$$

Thus, according to calculations using the model of R. Lucas, indicators of human capital in monetary equivalent were determined for machine-building enterprises (Table 3).

Table 1

Indicators of financial and economic activity of enterprises

Enterprise	Years	Fixed assets K, USD	Initial cost, USD	Net income from the sale of Y products, USD	Labor costs L, USD	The number of employees $\bar{L}$, people
PJSC «Ivano-Frankivsk Plant «Promprylad»	2018	131.58	526.31	447.36	162.17	151
	2019	118.42	473.68	444.72	200.00	136
	2020	142.2	500.00	368.42	247.37	131
	2021	129.5	449.31	500.00	237.70	134
JSC «Elmiz»	2018	736.8	1263.16	375.00	255.26	132
	2019	657.9	1200.53	578.95	370.37	128
	2020	657.9	1263.16	332.68	421.05	134
	2021	635.47	1286.68	1842.11	382.16	133
PJSC «Kyivpolygrafmash»	2018	228.9	552.63	1379.87	221.05	93
	2019	210.52	552.63	736.84	289.47	100
	2020	187.05	538.79	605.26	306.67	97
	2021	166.26	539.63	644.53	316.39	97
PJSC «Kyiv Radio Plant»	2018	421.05	1710.53	716.76	429.58	188
	2019	526.31	1736.84	974.36	484.89	161
	2020	730.42	2077.24	1132.00	521.47	186
	2021	743.5	2118.32	1352.00	515.34	138

Table 2

Regression functions, built according to the data of the studied enterprises, according to the MNK method

Enterprise	Regression function	Model indicators	Conformity
PJSC «Ivano-Frankivsk Plant «Promprylad»	$\hat{Y}=3.248872\cdot K$, $A=3.248872$	Coefficient of determination: $R^2=0.99$; value of the F-criterion: $F=494$	The regression approximates the empirical data well, and is significant
JSC «Elmiz»	$\hat{Y}=1.8325\cdot K$, $A=1.8325$	Coefficient of determination: $R^2=0.86$; value of the F-criterion: $F=18$	The regression approximates the empirical data well, and is significant
PJSC «Kyivpolygrafmash»	$\hat{Y}=3.3654\cdot K$, $A=3.3654$	Coefficient of determination: $R^2=0.98$; value of the F-criterion: $F=147$	The regression approximates the empirical data well, and is significant
PJSC «Kyiv Radio Plant»	$\hat{Y}=1.741\cdot K$, $A=1.741$	Coefficient of determination: $R^2=0.95$; value of the F-criterion: $F=64$	The regression approximates the empirical data well, and is significant

Table 3

Indicators of economic activity and human capital of machine-building enterprises, calculated based on the R. Lucas model

Years	Fixed assets (K), USD	Average salary, (W), USD/person	Excess Human capital to the average salary, times	Net income calculated according to the model $\hat{Y}$, USD	Human capital, (H), USD/person	Relative deviation of calculated net profit from statistical data
PJSC «Ivano-Frankivsk Plant «Promprylad»						
2018	131.58	1080.53	41.16	427734.2	41317.83	–0.04
2019	118.42	1470.00	27.22	384789.3	40013.4	0.04
2020	142.2	1865.71	25.43	46600.3	47445	–0.08
2021	129.5	1777.64	24.61	41820.32	43747.72	0.13
JSC «Elmiz»						
2018	736.8	2000	67.92	1327618.4	135840.00	1.33
2019	657.9	2850	41.16	1211058.1	117306.00	–0.05
2020	657.9	3121	37.70	1211058.1	117661.7	–0.33
2021	635.47	2837	39.82	1152460.5	112969.3	–0.15
PJSC «Kyivpolygrafmash»						
2018	228.9	2405.26	43.77	764063.2	105266.85	0.05
2019	210.52	2894.74	33.44	705825.3	96800.11	0.17
2020	187.05	3164.47	27.18	624964.2	86010.3	–0.03
2021	166.26	3230.26	23.83	566494.3	76920.9	–0.22
PJSC «Kyiv Radio Plant»						
2018	421.05	2299.2	34.88	731672.2	80196.09	–0.25
2019	526.31	2975.0	33.10	914675.7	98472.5	–0.18
2020	730.42	2780	49.62	1273661.2	137943.6	–0.06
2021	743.5	3729.5	37.93	1298598.8	141459.94	0.36

Based on calculations, the human capital index of the investigated machine-building enterprises in dynamics was determined. As shown in Table 3 at some machine-building enterprises, a decrease in the level of human capital in monetary terms is observed, which indicates a greater orientation of enterprises to the development of fixed assets than human capital. Even with a decrease in their indicator, the decrease in the level of human capital occurred faster.

As wages increase, so does the value of human capital, and vice versa. Therefore, with an increase in wages, the undervaluation of human capital will decrease and, as a result, labor productivity may increase.

According to calculations at PJSC «Ivano-Frankivsk Plant «Promprylad» there is an underestimation of human capital, which can reduce the motivation of employees for their development and reduce labor productivity. Moreover, human capital exceeds the average salary by 25–41 times, and on average by 29.61 times. JSC «Elmiz» also undervalued human capital relative to the average salary, in recent years on average approximately 39.56 times. In recent years, this company has had a direct relationship between human capital and the average salary at the company. At PJSC «Kyivpoligrafmash» there is also an undervaluation of human capital relative to the average salary, which exceeds on average approximately 32.06 times. According to calculated and statistical data, we have an inverse relationship between human capital and the average salary at the enterprise.

At PJSC «Kyiv Radio Plant» there is also an undervaluation of human capital relative to the average salary, which exceeds on average approximately 38.88 times. According to calculated and statistical data, in certain periods there is a direct relationship between human capital and the average salary at the enterprise.

For all considered enterprises, $\alpha > 0.68$, which, within the considered model of R. Lukas, indicates a relatively greater elasticity of net capital income than net labor income. This may indicate wear and tear and possible technological obsolescence of fixed assets.

In the future, it is worth clarifying the relationship between human capital and the net income of machine-building enterprises. This will allow not only to find out the level of human capital but also its use as a factor in ensuring the economic result of enterprises.

First of all, we will determine the correlation coefficient between the indicator of human capital and the net income of enterprises, which will make it possible to determine the density of such a relationship and, accordingly, determine whether the studied economic result depends on the available human capital of the enterprise.

According to the results of calculations for PJSC «Ivano-Frankivsk Plant «Promprylad» the correlation coefficient is 0.886, which indicates a strong connection. This may indicate that the enterprise is focused on the use of human capital in ensuring the results of economic activity.

For PJSC «Kyiv Radio Factory» the value of the correlation coefficient between human capital and net income is average, that is, the company is oriented both on the use of human capital and on the development of fixed assets.

PJSC «Kyivpoligrafmash» demonstrates a low level of interconnection, which indicates other components of obtaining net income than the use of added value provided by human capital.

JSC «Elmiz» has a strong inverse relationship between net income and human capital, which indicates that when the human capital index increases, net income can decrease. This state defines the enterprise as focused on the improvement of technologies, fixed assets, and the introduction of innovations, which it is focused on when creating added value. That is, it can be said that the enterprise needs a balance between the development of fixed assets and human capital for its use in increasing the results of economic activity.

Based on the results obtained by the correlation coefficient, it is possible to determine the company's existing policy regarding human capital (Table 4).

Table 4

Summarized results of the correlation analysis of the impact of human capital on the net income of the studied machine-building enterprises

Name of Enterprise	Undervaluation (exceeding human capital average salary)	Dependencies of net income on the value of human capital (correlation coefficient, r)	Company policy
PJSC «Ivano-Frankivsk Plant «Promprylad»	29.61	$r=0.886$ strong direct relationship	Active policy, existing dependency
PJSC «Kyiv Radio Plant»	38.88	$r=0.380$ average direct relationship	Agreed policy for the use of both human capital and fixed assets
PJSC «Kyivpoligrafmash»	32.06	$r=0.004$ weak direct connection	Orientation to use mostly fixed assets and other factors
JSC «Elmiz»	39.56	$r=-0.820$ strong inverse relationship	Orientation to the use of fixed assets and other factors

Thus, based on the application of the R. Lucas model at the enterprise level, the parameters of the production function, which includes human capital, were found. The calculation of human capital in value form and its comparison with wages at selected enterprises is characterized by a significant level of underestimation of 29.6–39.5 times from the point of view of the average wage, which can affect labor productivity, the cause of which is the wear and tear and technological obsolescence of the main means that were not subject to digitization. The presence and absence of the dependence of the net roof of machine-building enterprises on human capital, determines the policy of focusing on fixed assets in achieving its highest results.

Determining the economic significance of human capital in the activities of machine-building enterprises, we will carry out a detailed analysis of its impact on key economic indicators (Table 5). In this sense, there are such indicators as:

– labor productivity ($Y1$) is a well-known indicator that is used to determine the economic benefits of workers in the production/creation of products;

– gross profit per person ($Y2$), which will determine how much of the total profit per employee;

– income from the use of labour of one employee ($Y3$), which is calculated by dividing the difference between gross income with the volume of the wage fund and investments in human capital by the number of employees [8].

According to the analysis, it should be noted that the human capital index of PJSC «Ivano-Frankivsk Plant «Promprylad» is characterized by a weak connection with gross profit (Table 5). This can be explained by the wear and tear

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of the equipment, the plant is operating at only 10 % of its production capacity.

JSC «Elmiz» has a fairly close inverse relationship according to all indicators, which shows negative trends in this company. The reason for this may be the focus of investing in research projects, and not in human capital.

Table 6 summarizes of the results of analysis and the influence of human capital on the indicators of the efficiency of the economic activity of machine-building enterprises.

Table 5

Economic performance indicators of the economic activity of machine-building enterprises related to human capital in 2018–2021

Name of Enterprise	Years	Productivity, USD, *Y1*	Gross profit, per person, USD, *Y2*	Income from the use of labor of one employee, USD/person, *Y3*
PJSC «Ivano-Frankivsk Plant «Promprylad»	2018	2.96	1080.53	1585.78
	2019	2.68	150.53	886.31
	2020	3.84	363.92	1506.25
	2021	2.38	475.37	611.05
JSC «Elmiz»	2018	4.37	0	2019.43
	2019	9.84	570.53	6410.52
	2020	13.52	1721.05	9746.05
	2021	10.27	3216.05	6881.57
PJSC «Kyiv Radio Plant»	2018	5.15	825.29	2365.78
	2019	6.85	2142.32	3179.47
	2020	7.22	1854.74	3795.26
	2021	6.87	2364.42	2358.15
PJSC «Kyivpoligrafmash»	2018	7.92	1161.61	5063.15
	2019	6.05	1080.53	2571.42
	2020	6.64	1213.16	2855.26
	2021	7.35	1283.44	3506.05

Table 6

Summarized results of the correlation analysis of the influence of human capital on the indicators of the efficiency of the economic activity of machine-building enterprises related to human capital

The name of enterprise	Productivity, USD/person, *Y1*	Gross profit, per person, USD, *Y2*	Income from the use of labour of one employee, USD/person, *Y3*
PJSC «Ivano-Frankivsk Plant «Promprylad»	r=0.761 strong direct relationship	r=0.281 weak direct connection	r=0.600 average direct relationship
JSC «Elmiz»	r=–0.833 strong inverse relationship	r=–0.792 strong inverse relationship	r=–0.814 strong inverse relationship
PJSC «Kyiv Radio Plant»	r=0.820 is a strong direct relationship	r=0.757 strong direct relationship	r=0.337 medium direct connection
PJSC «Kyivpoligrafmash»	r=0.118 weak direct connection	r=–0.763 strong inverse relationship	r=0.484 medium direct connection

PJSC «Kyivpoligrafmash» demonstrates a weak relationship with labor productivity, as well as a negative relationship with gross profit. As we have seen from the previous stages of the analysis, human capital is decreasing, while gross profit is increasing. Taking into account the information from the annual reports, we can assume the fact that the company focused on increasing the specialization of its laboratory and, accordingly, the quality of products, increasing the wages of employees. However, a negative relationship may indicate the inefficiency of this type of investment, it may be appropriate to increase the production volumes of products that were in the greatest demand while increasing revenues to subsequently invest in digitalization.

Weightedness in the influence of human capital on indicators of the efficiency of economic activity is manifested at PJSC «Kyiv Radio Factory», which has quite positive relationships according to three indicators.

3.2. Discussion. *Practical Relevance:* The results of the research can help to analyze the situation with human capital development at the enterprise and to choose the right strategy for improving the results. Correlation analysis also maintains the connection between the increasing of the economic activity. It gives the possibility of changing scenarios of the development of enterprise reducing or increasing the human capital level of development.

Research limitations: However, some limitations were highlighted during the research. This type of evaluation of human capital could be done only when there is no changes in the personnel number because it is the main condition of using the model when the main indicator such as a number of workers is stable. Moreover, used type of analysis is not easy to do for certain enterprise because it can be characterized as complicated. It can be used as an additional instrument to the analysis of financial activity.

The war and its influence increase the value of human capital at the machine building enterprises could be seen clearly. Without professional and motivated workers the economic activity of the enterprise will start to decrease and become unstable. The current research was provided under difficult conditions with online information safety rules from the government when there is no open information databases about human resources development. However, this research was successfully maintained and new possibilities of evaluation of human capital were found.

Prospectives of further research: We continue our research to find out if it is possible to use this type of analysis for another enterprises that do not have stable indicators. Moreover, the creation of strategies for human capital development with the use of the research results will be done.

4. Conclusions

Summing up, it can be noted that we used the conditions for applying the R. Lucas model at the enterprise level, although it is usually used at the macroeconomic level. We tried to apply it, taking into account the fact that few human capital assessment models could be used in these conditions. This model was tested and applied to a selected sample of small enterprises that are industry leaders. Based on the model of R. Lucas, the parameters of the production function, which includes human capital, were found. It is worth noting that the calculation of human capital in the form of value and its comparison with wages at the selected enterprises is characterized by a significant level of underestimation. With the help of the conducted types of analysis, the correlation between the change in the value of human capital and the factors

selected for analysis, which to one degree or another led to associated with the digitalization of processes at the enterprise. Considering the different levels of capital endowment and approaches to investing, it is not possible to unambiguously define a reference approach to the development of human capital at the selected enterprises. For example, an increase in wages increases the value of human capital, but the increase must be balanced, because the increase in wages causes an increase in other indicators, which can negatively affect investment policy, retooling of production, etc. After conducting various types of analysis, several recommendations were developed to improve the value and efficiency of human capital, which involve the development of a set of measures aimed at strengthening fixed assets, increasing demand through assortment changes in the direction of digitalization of the production product, digitalization of the product, digital reorganization, automation and digitization of processes, as well as the involvement of IT professionals and specialists. Digitization of products and processes can help increase labor productivity, raising the number of potential customers and, possibly, investors, thereby strengthening capital armament. Of course, in the current situation, it is necessary to think about the survival of the enterprise, but digitalization today means competitiveness in the domestic and foreign markets, strengthening its position in the industry and transitioning to a balanced strategy of enterprise development, where the value of human capital will be higher, and as a result, will increase productivity.

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Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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Data availability

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