Scientific Analysis of the Happiness Index in Regard to the Human Capital Development

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Abstract--- A regression analysis of the impact of various global Predictor Indices – Index of Economic Freedom (IEF), World Governance Indicators (WGI), Ease of Doing Business (EDB), Mean Years of Schooling (MYS), Global Competitiveness Index (GCI), and GDP per capita – on the World Happiness Index (WHI) as an indicator of the conditions for the efficient development of human capital has been carried out. It has been demonstrated that such Predictors as the WGI, IEF, and GDP per capita are described by the greatest pair correlation with the WHI. It has been revealed that no Predictor provides a satisfactory pair correlation with the Happiness Index (the determination coefficient R2 does not exceed 0.63 for a sample of 24 countries with the highest GDP). The dependence of the Happiness Index on the number of Predictors has two lows with a trend of the fifth-degree polynomial. The dependence of the WHI on comprehensive Predictors, which are a linear combination of the studied indices, has been determined. C-Predictor, which consists of 40 % of the WGI, 22 % of GDP per capita, 16 % of the IEF, 14 % of the MYS, and 8 % of the GCI, provides the best correlation with the Happiness Index. It provides a high coefficient of determination – 0.84 – for a sample of the 24 largest countries by GDP, and 0.90 for 12 countries. The deviation of happiness from the WHI data estimated using the regression model for Russia, China, the USA, and Germany does not exceed 4 %.

Keywords--- Happiness Economy, Happiness Index, Human Capital, Regression Analysis, Correlation, Progress, Modeling, Forecasting, Global Index, GDP Per Capita.

I. Introduction

GDP per capita had been used as an indicator of the well-being of the population in industrial society. The situation changed fundamentally in the 21st century, when human capital based on the intellectual abilities of workers (Schultz, 1962; Becker, 1962; Brooking, 1996; Albert and Bradley, 1996) made up about 80 % of the national wealth of developed countries (Korchagin, 2005). The concept of human capital is an assessment of the ability of workers to perform socially beneficial work on the basis of their high qualifications and to create public wealth (Koritsky, 2013; Prichina at al., 2019; Orekhov, 2019). Therefore, it is very important to increase human capital and thereby grow the potential of the socioeconomic development of society (Barro, 2004; Suvorov et al., 2014; Kryukova et al., 2016; Fomicheva et al., 2018; Nakhratova et al., 2018; Fomicheva et al., 2018).

It is important to have the conditions for comprehensive training of workers, as well as to maintain their health and ability to work productively, in order to develop human capital. The following relevant conditions can be noted: a high level of well-being, possibility of long-term training, maintaining health, emotional comfort, possibility to apply the acquired skills in work, and motivation for education and work (Makeeva et al., 2013; Fomicheva et al., 2017; Zaernjuku et al., 2014; Kryukova & Makeeva, 2013). It is common to describe the complex of socioeconomic conditions that are close to the described state in a generalized way with the term “happiness” today (Easterlin, 1974; Veenhoven, 1991; Shmatova and Morev, 2015).

At the same time, GDP is not directly aimed at improving the welfare of the population and therefore is insufficient as an indicator of improving living standards for people, including for the growth of human capital. It does not reflect the negative impact of production activities on the environment (Shmatova and Morev, 2015). GDP includes expenditures on weapons, illegal and hidden activities, including drug production and prostitution. Developers of the latest version of the 2008 System of National Accounts (SNA) argue that “GDP has never been intended to measure well-being” (Peter van de Ven, 2014).

An economic concept of happiness was proposed in response to the challenge of time. The resolution titled “Happiness: towards a holistic approach to development” was adopted at the 65th UN session in 2011, according to

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which international indices of happiness were key parameters for the successful development of states. The goal of social development is to create the greatest happiness for people, rather than the growth of wealth (Resolutions of the 65th session, 2011).

Since the key goal and the mission of the society development are changing, the strategy for achieving them must also change at the level of regions, countries, and the whole world. The development indicators are also changing accordingly. However, the transition to a new social goal-setting is now at the beginning of its path, and the indicators of happiness vary significantly across countries and depend on the value systems characteristic of these countries. As a rule, the concept of happiness in relation to society is considered as a goal of public administration and a criterion for evaluating its performance. However, increasing the level of happiness helps improve the conditions for the growth of human capital at the same time. The indicators of happiness will be considered in this study from this very standpoint.

As such, it seems that the indicator of happiness better describes conditions favorable for the development of human capital than GDP per capita. It is convenient to use one of the global Happiness Indices to use the capabilities of cross-country comparison as a digital characteristic of happiness. The WHI (Helliwell at al., 2019), developed as part of the research project of the United Nations Sustainable Development Solutions Network international program, is the most credible of them.

This Index considers for the following components: forecast of healthy life expectancy, GDP per capita, freedom of life choice, social aid and support by other people, low level of corruption, as well as people's feeling of positive or negative emotions.

The WHI will also be considered as a result (function) of economic activities similar to GDP. However, it is important to understand what arguments (Predictors) this result depends on. It is convenient to select a limited number of the most famous aggregated global Indices as Predictors because such a result depends on a large number of parameters in reality.

II. Methods

The goal of the study is to develop a regression model of the relationship between the WHI as an indicator of the conditions for the human capital development and aggregated global Indices.

The methods of regression and correlation analysis serve as the methodological basis of the study. The WHI was used as an indicator of the effectiveness (function) of the society activities. According to (Big Encyclopedic Dictionary, 1998), happiness is “a state of a human corresponding to inner satisfaction with one’s being, fullness, and meaningfulness of life”. Two meanings of this word are provided in the Ozhegov dictionary (Ozhegov, 1984): “Feeling and state of complete, higher satisfaction” and “Success, luck”. As such, the generally accepted meaning of this word refers to the highest level of satisfaction with life, and its designation of a continuum of satisfaction levels is an extension of the well-known concept. Therefore, the authors will further refer to this word as a socioeconomic term that has certain specifics – in particular, the representation on the continuum of digital values 0 – 1. Moreover, the authors will be primarily interested in not the highest levels of “happiness”.

The indices from among the most well-known ones, presented in Table 1, were selected as Predictors (factors, arguments) describing the socioeconomic and legal structure of countries.

Table 1: Indices Selected as Predictors

Abbreviation	**Full name**
IEF	Index of Economic Freedom
EDB	Ease of Doing Business Ranking
WGI	Worldwide Governance Indicators
GCI	Global Competitiveness Index
MYS	Mean Years of Schooling
GDP/C	GDP per capita, PPP

The number of years of schooling (MYS) is the only Predictor considered in this study which is not a global Index. This parameter is a subindex of the Human Development Index (Human Development, 2018), compiled by the United Nations Development Program (UNDP). Its use is due to the fact that it is quite accurately determined by direct measurement of mean years of schooling for the population, in contrast to other Indices in Table 1. For the convenience of comparison with other Indices, the MYS value is presented in relative terms by referring to the conditional duration of tertiary education, which is taken equal to 16 years. The full Human Development Index is

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not used in this study because it includes GDP/C and is more a result of the country's socioeconomic development, rather than a Predictor (Shmatova and Morev, 2015). The Indices in question are usually presented in a 100- or 10-point format in their original form, but they are reduced to a single format in the study – fractions of a unit.

The advantages of the Indices (Ratings, Indicators) under consideration include aggregation, global coverage, regular updating, and wide public discussion. The methods of regression and correlation analysis determined the dependence of the Happiness Index on these Predictor Indices further in the study. The optimal comprehensive Index was also sought for, which would allow to approximate the dependence of the Happiness Index on Predictors with the least error.

Since countries vary greatly in terms of population and GDP, the task of comparing and identifying statistical patterns is ambiguous and requires the use of corrective methods – in particular, limiting the diversity of the correlation field. Small countries are easily susceptible to various influences, and therefore the corresponding point spread may be more random, and the correlation with the function (WHI) may be low. In this regard, samples were used in the study, which included relatively large countries in terms of GDP. At the same time, the share of the global GDP covered by regression dependence is quite high. Four samples of countries ranked by GDP at PPP were used in the study, which are presented in Table 2.

Table 2: Main Country Samples Used

Notation	Number of countries in the sample	Share of the global GDP at PPP, %	Minimum size of the GDP at PPP, bln USD
G6	6	51.7	4,000
G12	12	64.9	2,500
G24	24	78.1	1,000
G48	48	88.6	~400

Since the volume of the GDP per country varies significantly (~ 50 times) across the samples, finding a single regression dependence for them does not make sense. The regression dependences and the coefficients of determination (R2) for the sequence of samples from Table 2 were found in this study, and the arithmetic mean values (mid) of these parameters were also determined. The parameters of the countries included in smaller samples contribute to larger number of obtained dependencies when averaging, and therefore their weight is greater than the weight of the countries included in large samples only. As such, the average value of trends and the coefficients of determination are adjusted towards the adequate contribution of large economies. In order to visually represent the regression and correlation characteristics, the countries of the G6 sample were indicated with special icons on the charts (△ for China, ○ for the USA, ◇ for India, × for Japan, + for Germany, and □ for Russia).

The regression equation, the coefficient of determination (R2) for the samples from Table 2, as well as the arithmetic mean value of R2 for four samples (R2m) were found while creating a mathematical model of the dependence of the Happiness Index on various Predictors. The model development was aimed at finding a comprehensive Predictor that would highly correlate with the WHI. The coefficient of determination was used as an indicator of the correlation level, the target value of which was 0.9. The Predictor was considered optimal if the arithmetic mean value of R2 was the largest for four samples (R2m).

Comprehensive Predictors are a linear composition of the Predictors presented in Table 1 according to formula (1), where ki is the coefficients whose values are in the range 0 – 1, and the sum of these coefficients is equal to unity.

$$\mathbf{CI = k_1 \cdot IEF + k_2 \cdot EDB + k_3 \cdot WGI + k_4 \cdot GCI + k_5 \cdot MYS + k_6 \cdot GDP/C} \quad (1)$$

The regression dependence of the Happiness Index on CI was determined for different ki, and the value of the average error of the regression model (ΔR m2) was found for four samples. After this, the optimal Predictor was sought for (with the lowest ΔRm2) by the coordinate descent method with a cyclic change in ki.

III. Results

A. Analysis of the WHI Paired Regressions with Global Indices

1. The IEF (Miller at al., 2019) is one of the most well-known ratings. The IEF subindex system contains indicators of freedom: trade, business, money, finance, investment, taxes, labor relations, as well as protection of property rights from government redundancy and corruption. It is believed that economic freedom is favorable for economic growth. However, it is stated in the paper (Economic development, 2018, p. 54) that the Index "is

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subjective to scoring." "In fact, this index measures not economic freedom but the degree to which countries are close to the ideal of a liberal economy" (Gurvich, 2012, p. 42).

The analysis of the dependence of the Happiness Index on the IEF indicates the presence of their statistical relationship, as shown in Figure 1 by the example of the 24 largest economies by GDP.

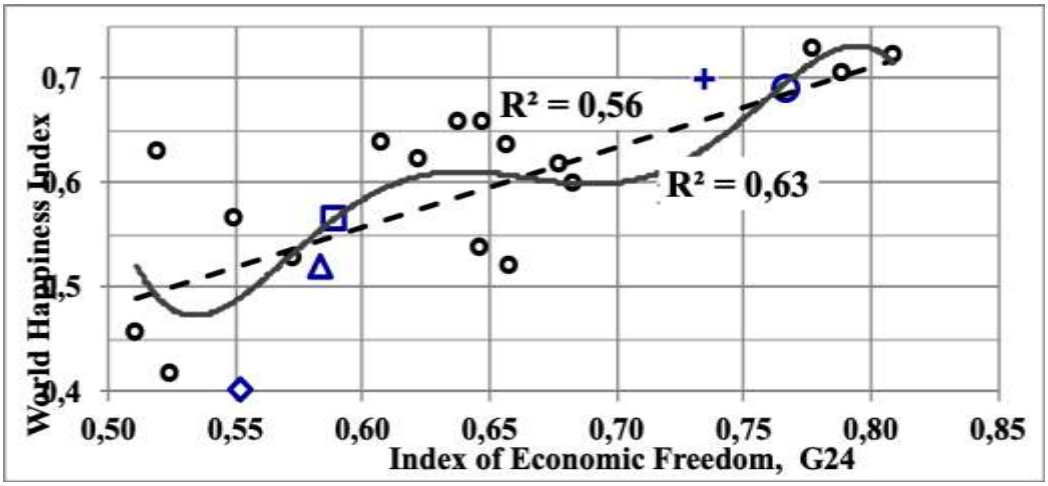

Figure 1: Dependence of the WHI on the IEF, G24

There are two lows on the trend chart. The best approximation was provided by a polynomial trend of the fifth degree. In this case, the coefficient of determination $R^2 = 0.63$; therefore, the approximation could not be considered satisfactory. With a linear trend, $R^2 = 0.56$. For the G12 sample, for the fifth-degree power trend, $R^2 = 0.81$, and for the G48 sample, $R^2 = 0.63$. The points of the six largest economies, representing 52 % of the global GDP at PPP, are highlighted on Figure 1. It can be seen that the largest deviation from the trend is characteristic of India as a minus and Germany as a plus for the G24 sample. The point corresponding to Russia is close to the trend line. As can be seen from Figure 2, the trend shape changes significantly with increasing sample size to G48.

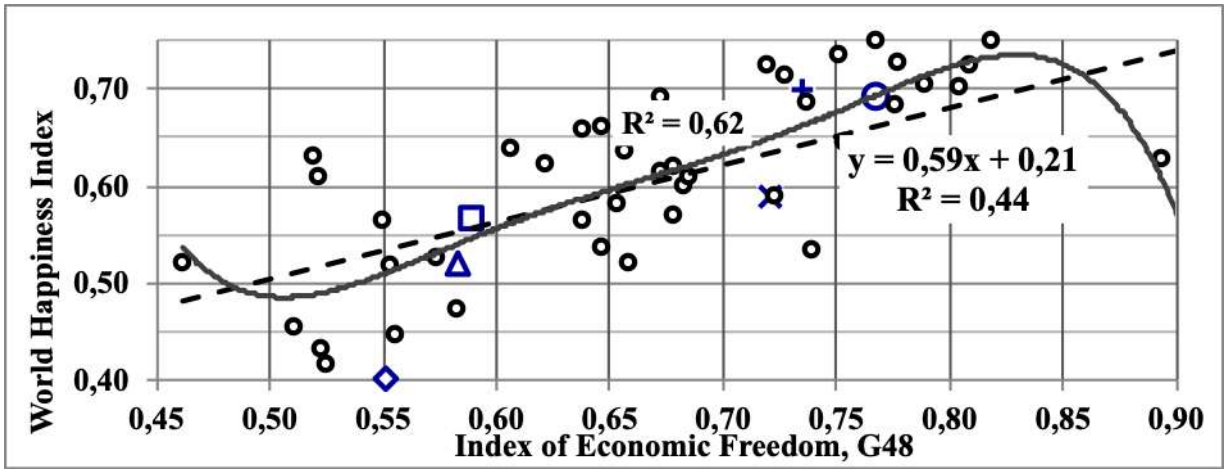

Figure 2: Dependence of the WHI on the IEF, G48

2. The EDB ranking (or Doing Business, 2020) is an index designed to determine the convenience of launching and running a business in the country. It includes ten indicators that measure the ease of launching a business, building, and access to electricity, property registration, obtaining a loan, protecting investments, taxation, and international trade, managing contracts, and ceasing a business. In accordance with the Doing Business 2020 ranking, which was prepared by the World Bank Group in 2019, Russia ranked 28th, beating China, Japan, and Spain. V.V. Putin set a goal in his decrees in 2012 to enter the Top 20 of Doing Business by 2018. However, its achievement was postponed to 2024 in 2018 (Galcheva, 2019). Figure 3 shows the dependence of the Happiness Index on Doing Business for the G24 sample.

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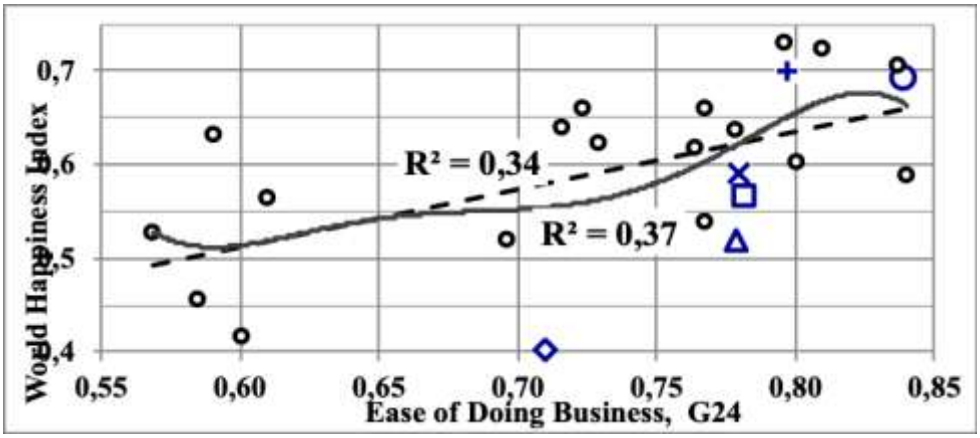

Figure 3: Dependence of the WHI on the EDB

It can be seen that the coefficient of determination is less than that for the IEF and amounts to 0.37 for the polynomial trend, and $R^2 = 0.34$ for the linear trend. The low level of correlation is probably due to the specifics of the EDB Index, which is aimed at specific business problems, and not at the level of happiness.

3. The WGI (Kaufmann and Kraay, 2019) includes six subindices: freedom of speech, accountability of authorities, level of violence and stability, effective management, rule of laws and their quality, and level of corruption. The dependence of the Happiness Index on the WGI for the G24 sample is shown in Figure 4. It can be seen that the coefficient of determination for the fourth-degree power trend is approximately the same as for the IEF: $R^2 = 0.62$, and for the linear one: $R^2 = 0.59$.

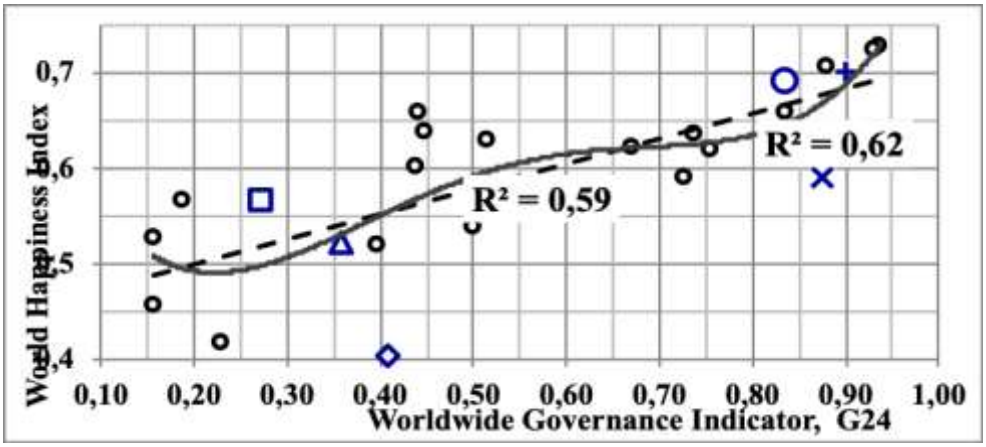

Figure 4: Dependence of the WHI on the WGI, G24

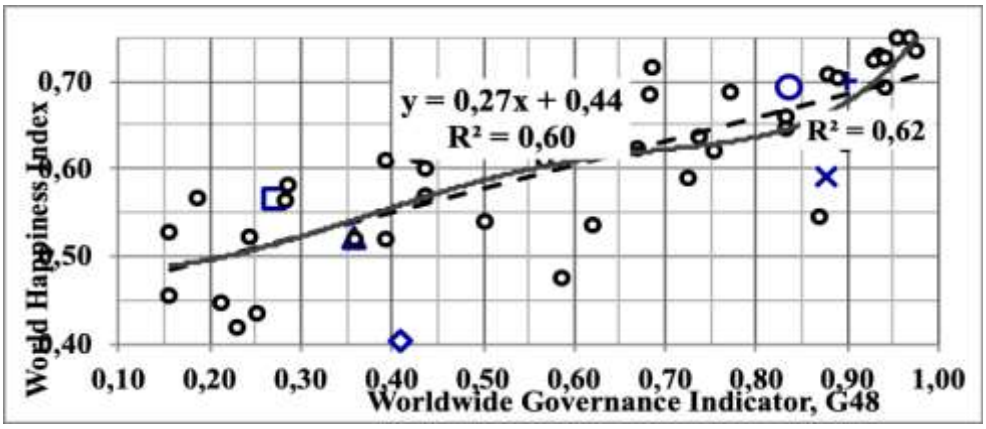

Figure 5: Dependence of the WHI on the WGI, G48

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This ranking differentiates large developed and developing countries more significantly. The index of developing countries is less than half as much as for the previously considered Indices, while it is normally larger for developed ones. For example, the WGI for Russia is 0.27, and the EDB is 0.78, while both are 0.84 for the USA. As the sample size increases to G48, the trend becomes more monotonous (Figure 5).

4. The GCI (Schwab, 2019) describes the competitiveness of countries in 12 fields, including macroeconomics, infrastructure, markets for goods and services, finance and labor, institutions, health, education, innovative potential, business competitiveness, and technological development. The dependence of the Happiness Index on the GCI for G24 and the fourth-degree power trend is provided in Figure 6.

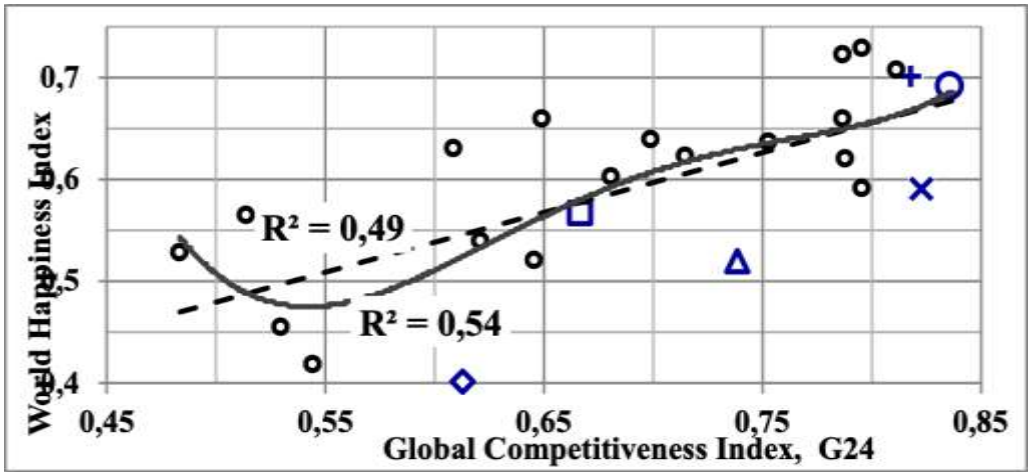

Figure 6: Dependence of the WHI on the GCI

The approximation error in this case is $R^2 = 0.54$, which is less than for the IEF and the WGI, but more than for the EDB. For the linear trend, $R^2 = 0.49$. The points of India and China are much lower than the trend for this index, and Russia is close to the trend.

5. The MYS is a subindex of the Human Development Index (Human Development, 2018). It is formed by the UN Development Program (UNDP). Duration of schooling is one of the most important indicators of human capital in various countries. For ease of comparison with other indicators, the MYS value is expressed as a percentage by referring to the conditional duration of higher education, which is considered to be equal to 16 years. The full Human Development Index is not used in the study because it plays the role of the result of the economic development of countries, rather than a predictor.

The dependence of the Happiness Index on the MYS for G24 is shown in Figure 7. For the fifth-degree power trend, the determination coefficient is $R^2 = 0.59$, which is slightly less than for the IEF and the WGI. For the linear trend, $R^2 = 0.46$. The presence of two lows is pronounced for this trend. If the sample size is increased to G48 (Figure 8), these lows are retained.

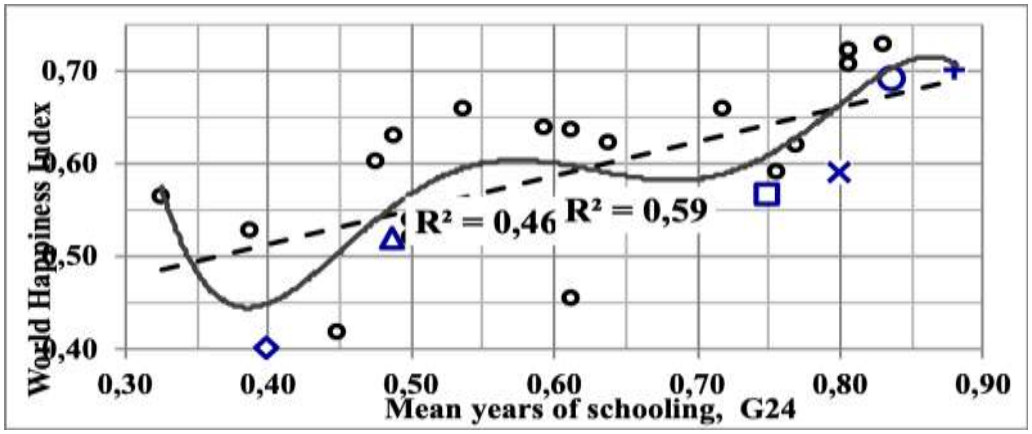

Figure 7: Dependence of the WHI on the MYS, G24

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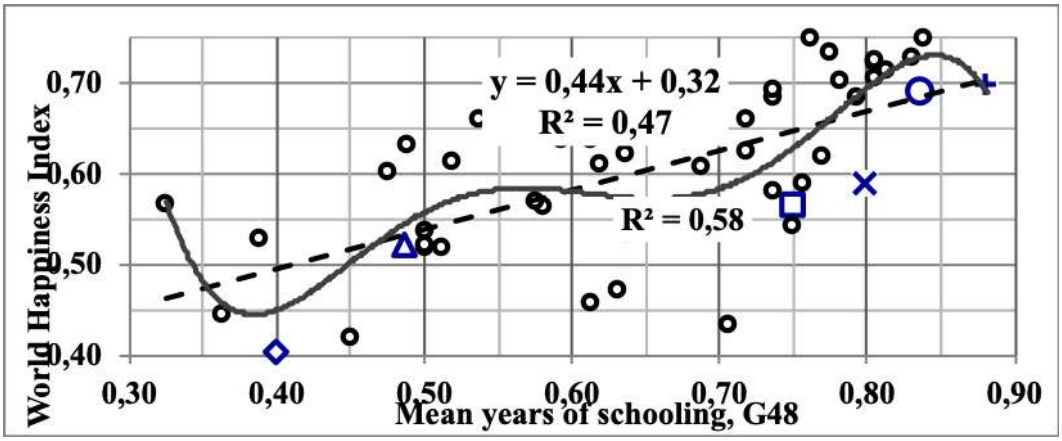

Figure 8: Dependence of the WHI on the MYS, G48

6. GDP per capita at PPP (abbreviated GDP/C) is one of the most important predictors of the Happiness Index. The values of GDP/C in hundreds of thousands of international dollars in 2018 according to the World Bank were used in this study. For almost half a century, economists have been debating about the paradox (Easterlin, 1974; Diener, 2013), according to which the growth of per capita income leads to an increase in happiness only to a certain level. Further, the needs of people grow along with their incomes. An alternative view is that the level of happiness depends on the logarithm of per capita income according to a linear trend (Diener, 2013; Shmatova and Morev, 2015).

Let us consider the dependence of the WHI on GDP/C, PPP in the same form as other predictors. The corresponding chart is provided in Figure 9 for the G24 sample with power and linear trends, for which the coefficients of determination are quite close and amount to 0.6 approximately. The shapes of trends that do not have pronounced lows are also close. The exponential trend is minimally different from the linear in this range of GDP/C values.

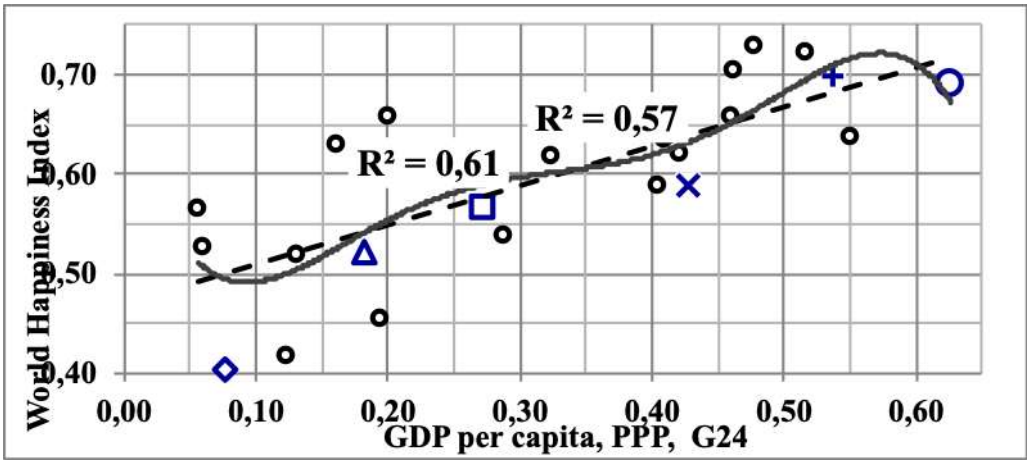

Figure 9: Dependence of the WHI on the GDP/C, PPP

Summing up the analysis of the dependence of the Happiness Index on various Predictors Indices, it can be noted that the largest coefficient of determination for the G24 sample is provided by the IEF, WGI, and GDP/C Indices, and the smallest coefficient is provided by the EDB, as shown in Figure 10. However, no Predictor provides a satisfactory pair correlation with the WHI.

The fact that the trends for some Predictors are not substantially monotonous and have two pronounced lows probably reflects the well-known paradox that "huge historical shifts in the average income level did not cause an increase in the degree of satisfaction and happiness. Probably, this fact is caused by the growth of demands: people dreamed about their own bike before, but now they already need two cars" (Argyle, 2003, p. 177). According to R. Layard, the basic needs of people are met at the GDP level of about $20,000. After that, not the absolute, but the

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relative level of income becomes important for the state of happiness (Layard, 2011). However, as shown above, this phenomenon is observed only in the largest countries by GDP, but not when considering large samples.

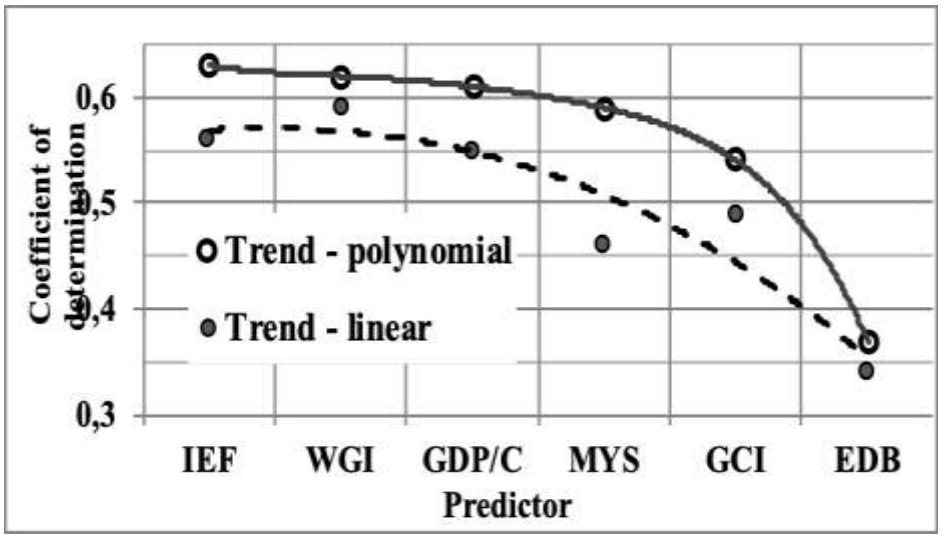

Figure 10: Coefficients of Determination for Various Predictors, G24

B. Dependence of the WHI on the Comprehensive Predictors

Since each of the Indices under study describes its own special field of the socioeconomic development, it is reasoned to try to create a comprehensive predictor for the Happiness Index (hereinafter – C-Predictor), which will be better correlated with the WHI than its components. This will help understand which predictors have the greatest impact on the Happiness Index.

A linear composition of the Predictors studied above according to formula (1) is used to determine the C-Predictor values for each country, where k_i is coefficients whose values are in the range 0 – 1, and the sum of these coefficients is $\Sigma k_i = 1$. The results of calculating the determination coefficients for the WHI dependence on various comprehensive Predictors CI_j are provided in Table 3.

Table 3: R2 Values for the WHI Dependence on Comprehensive Predictors

	R^2: trend – polynomial					**IEF**	**EDB**	**WGI**	**GCI**	**MYS**	**GDP/C**
	G6	G12	G24	G48	mid	k_1	k_2	k_3	k_4	k_5	k_6
CI_1	0.99	0.55	0.74	0.61	0.72	0.2	0.2	0.2	0.2	0.2	
CI_2	0.99	0.74	0.81	0.68	0.81	0.2		0.2	0.2	0.2	0.2
CI_3	0.92	0.80	0.84	0.68	0.81	0.18		0.37	0.08	0.37	
CI_4	0.93	0.84	0.83	0.67	0.82	0.18	0.03	0.40	0.14	0.25	
CI_5	1.00	0.90	0.84	0.68	0.86	0.16		0.4	0.08	0.14	0.22

Five Indices excluding GDP/C are evenly distributed in Predictor CI_1. It can be seen that it provides higher determination coefficient $R^2 = 0.74$ for the G24 sample than the best options of individual predictors ($R^2 = 0.63$). Option CI_2 also contains five uniformly distributed Indices, but it includes GDP/C and excludes the EDB. It provides an even higher coefficient of determination – $R^2 = 0.811$ for G24 and $R_m^2 = 0.805$ for the fifth-degree polynomial trend. The option demonstrates that, despite the highest individual determination coefficient, the IEF predictor in the C-Predictor is less in demand than the WGI and the MYS, and the contribution of the EDB predictor can be close to zero. For the G24 sample, $R^2 = 0.840$ and $R_m^2 = 0.809$ for CI_3.

Option CI_4 is optimal without using GDP/C and provides $R_m^2 = 0.817$. The coefficient of determination is $R^2 = 0.83$ for the G24 sample and $R^2 = 0.84$ for G12 (with a fifth-degree polynomial trend). The regression of the Happiness Index from C-Predictor CI_4 is shown in Figure 11. It can be seen that the trend is not substantially monotonous and has two lows, similar to some initial predictors. The position of the points corresponding to India (◇) and Japan (×) plays an essential role in this multimodality, since the points deviate to the greatest extent from the linear trend and influence its shape.

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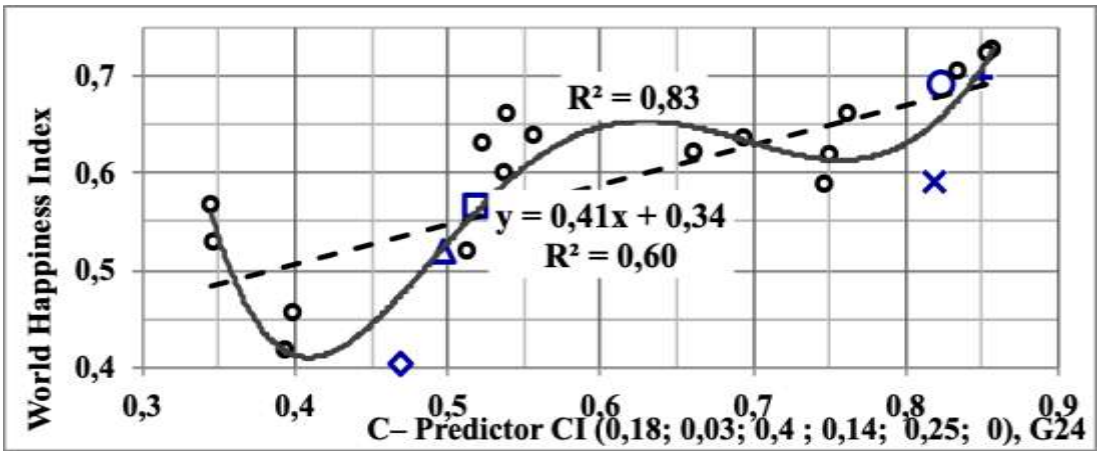

Figure 11: Dependence of the WHI on C-Predictor IC4, G24 Sample

Option CI_5 is optimal with using GDP/C and provides a high coefficient of determination $R^2 = 0.84$ for the G24 sample and $R^2 = 0.90$ for G12 (trend is a fifth-degree polynomial). The regression of the Happiness Index from C-Predictor CI_5 is shown in Figure 12. The approximation function has a multimodal form similar to that shown in Figure 11, but with slightly lower C-Predictor values.

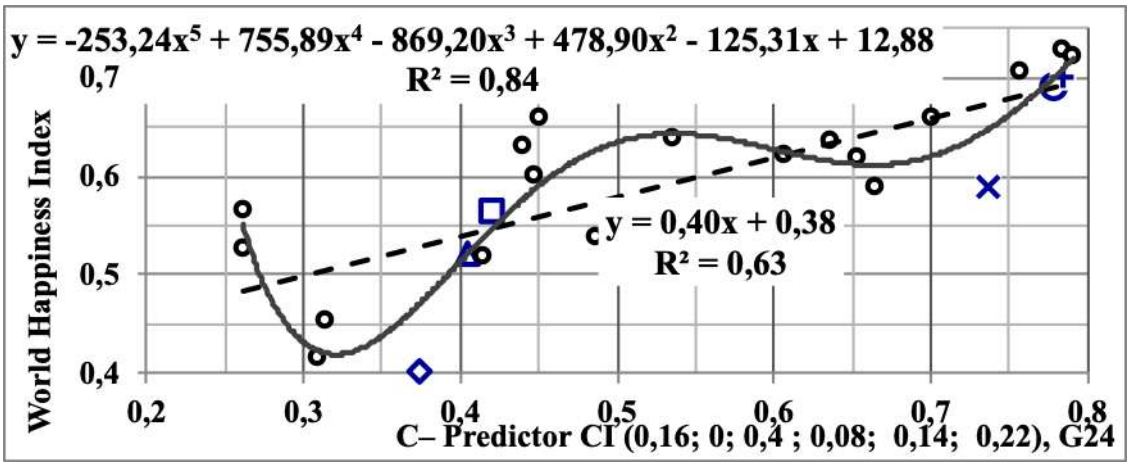

Figure 12: Dependence of the WHI on C-Predictor CI5, G24 Sample

As such, C-Predictor CI_5 provides significantly better correlation with the Happiness Index ($R^2 = 0.86$) than other Predictors. However, the coefficient of determination is significantly lower ($R^2 = 0.68$) in larger samples (G48, Figure 13), although the nonmonotonicity is partially preserved. It can be seen from Table 3 that they almost do not differ for options $CI_2 – CI_5$ for the G48 sample and are slightly larger than for the original Predictors (Figure 10).

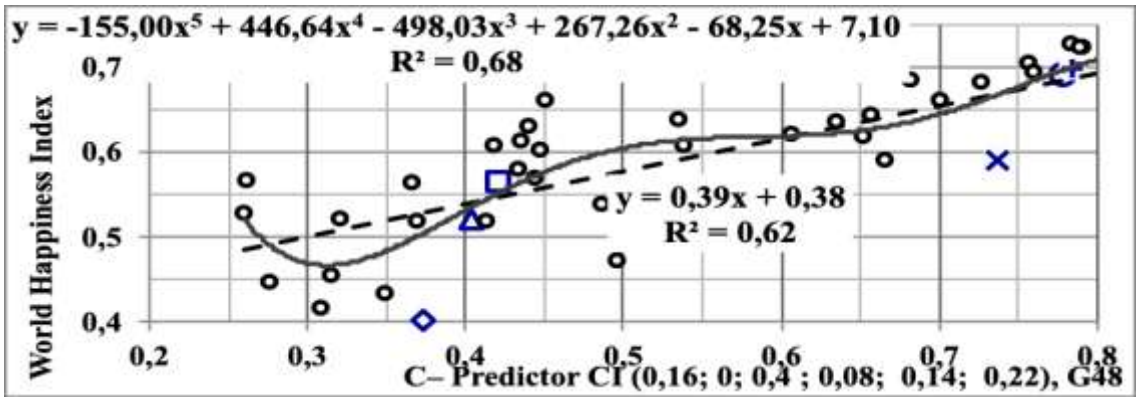

Figure 13: Dependence of the WHI on C-Predictor CI5, G48 Sample

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The regression model of the WHI based on the comprehensive predictor CI_5 is expressed as follows (2), where y = WHI, x = CI_5, and the values of constant coefficients are given in Table 4.

$$Y = a + bx + cx^2 + dx^3 + ex^4 + fx^5 \quad (2)$$

Table 4: Coefficients of the Approximation Dependence of C-Predictor

Coefficients	a	b	c	d	e	f
Values	12.88	–125.31	478.9	–869.2	755.89	–253.24

The regression model (2) can be used to predict the level of happiness for 24 large economies and to analyze the reasons for the deviation of the level of happiness in specific countries from the trend. In particular, it is interesting to understand the reasons for the downward deviation for Japan and India (10 % and 16 %, respectively). It is also important that the regression model for the largest countries in terms of GDP (Russia, China, the USA, and Germany) gives values close to the WHI (deviation of no more than 4 %) for G24 and allows to understand the prospects of increasing the level of happiness by improving the situation for various Predictors. This model can also be used as a guide for the countries not included in the G24 sample, since a low level of coefficient of determination is most likely a consequence of the susceptibility of small economies to various random influences, although the predictive ability of model (2) for these countries is low.

It is important that the WGI makes the largest contribution (40 %) to the formula for the optimal C-Predictor (1). It must be noted that the content of the WGI components indicates that it is primarily focused on the interests of investors, and not the population. However, it most closely correlates with the WHI as part of the studied set of global Indices. The second largest contribution (22 %) is made by GDP/C. The level of education of workers (MYS) makes rather small contribution – 14 %.

The Doing Business Predictor is included in the optimal Predictor with a weight close to zero. This means that it has almost no effect on the WHI, which is in disagreement with the statement of Russia as an important goal of joining the top 20 Doing Business (its correlation with GDP/C is also low).

IV. Discussion

The study has allowed to determine whether the magnitude of the WHI could be managed and with what factors. After this, it can be evaluated what parameters are influenced by the Happiness Index — in particular, how it is related to human capital, which can be estimated using well-known Human Capital Indices. However, the difficulty lies in the fact that most factors are interdependent. In particular, GDP/C is a component of the Happiness Index and is included in the optimal C-Predictor. The workers education level (MYS), which is included in the C-Predictor, is also an important part of human capital. Accordingly, it is important to build such relationships properly, which can be hard to do.

Another difficulty is that the used global indices carry errors. Therefore, it is important to understand the level of these errors and whether they can be adjusted.

Various trends (linear, logarithmic, and exponential) were analyzed in this study when analyzing the dependence of the WHI on GDP/C, and no increase in the coefficient of determination was found in comparison with the polynomial trend, which was not consistent with the works of previous authors who had noted the preference for the representation of GDP/C in the logarithmic form. This difference requires a more detailed study.

The samples in the study were formed on the basis of the country ranking by GDP at PPP, which did not fully correspond to the withdrawal of GDP as the main indicator of the welfare of the population. The possibility of sampling based on ranking by population of countries should be considered in the future.

V. Conclusion

Three main interdependent conclusions can be drawn from this study.

Firstly, endogenous factors that influence the Happiness Index have been identified, and any analysis of the Happiness Index should take this into account. It is shown that the main Predictors for the WHI are the WGI, GDP/C, and the IEF. This has laid the foundation for further research on the impact of the WHI on the human capital indices in various countries. A research is also required to identify the reasons for these particular indicators to have the greatest impact on the Happiness Index.

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Secondly, the obtained regression model of the WHI dependence on the optimal comprehensive Predictor allows finding the deviation of the WHI values from the trend and identifying the countries with the largest deviation. The causes of these deviations using the WHI subcomponents should be studied further to outline ways to improve the Happiness Index forecasting model.

Thirdly, it has been shown that the dependence of the WHI on a number of Predictors has a nonmonotonic form with two lows, which makes some features of the growth in the level of happiness evident as welfare improves.

However, the authors realize that most of the parameters in the study are endogenous, therefore, they are very cautious about the results of the analysis. The authors of the study need to study the systemic trends in the WHI trend, taking both endogenous and exogenous factors of a causal relationship into account in the future, in order to establish whether the identified relationship between the predictors and the index exists in economic reality and to fill out the practical content of the WHI scientific analysis.

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