RELATIONSHIP BETWEEN HUMAN CAPITAL DEVELOPMENT AND INNOVATIVE DEVELOPMENT: RUSSIAN CASE

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Abstract

The aim of the research is to study the interrelation between the level of human capital and innovation development in different countries in the context of transition to sixth technological level. The author formulates the hypothesis of considerable difference in sensitivity and influence of innovations on the level of human capital in that respect for groups of different countries. In order to analyze the influence of human capital on innovation development of different countries we used correlation – regression method of analysis based on spatial and temporal lines. Database for correlation – regression analysis was take from World Bank statistic data for 2017 – 2018. In order to test this hypothesis the author used analytical, statistic and correlation and regression analysis methods. Combination of these methods allowed for identifying different degree of relation between human capital level and GDP, human capital and innovations, innovations and GDP. According to such analysis there is a close connection between human capital level and GDP, less intense interrelation between innovations and human capital and weak relation between innovations and GDP. The author suggested taking certain measures in six directions to support innovation development of developing countries.

Key words: human capital, innovation development, academic and technological development

JEL Code: O15, O31

Introduction

According to the results of the study by Zeebaree, M., Ismael, G. Y., A. Nakshabandi, O., Saleh, S. S., & Aqel, M., the development of human capital ensures the development of innovative progress (Zeebaree et al.).

Innovation is one of the most important factors in enhancing the economic development of countries. New products and processes, as well as organizational and marketing practices, are essential to the operation of firms and the prosperity of the country (Mariev, Davidson N. & Nagieva, 2020; Yang, 2021; Arocena, 2017).

At present international economy is undergoing crisis period related to transition to the sixths technological order which formulates new requirements to human capital. Transition to

new technological order is always accompanied by reconstruction of educational system, labor market transformation and changes in economic system as a whole. Professional skills, knowledge and competencies accumulated earlier in many specializations undergo significant changes. Certain professions and specialization can disappear entirely because they do not fit into new technological order and are replaced by new ones. This process was observed in different periods of development of modern civilization. For example, not that long time ago there were such professions as postman, typewriter, telephone operator, etc. Academic and technological development decreased the need to deliver letters to the doors of recipient, loo for typewriting services (everyone can type the text) or use manual connection to make a phone call.

Industrial revolutions, followed by modernizations, introduction of innovation technologies in companies created the demand for new specialists, which facilitated mastering new knowledge, skills and competencies. Therefore nowadays in the context of transition to new technological order we can expect transformation and significant changes in education system and labor market which will continue forming new knowledge accumulation cycle of human capital for the next 10-20 years.

Education system if a crucial component of human capital aimed at meeting the demand of the labor market and economy. Educational system might not be act fast enough to meet these requirements as it has time lag related to training and "supplying" necessary specialists to labor market. As a result there is a serious gap between actual and necessary human capital reserves. This gap becomes particularly severe during the periods of economic shock or crisis, which might demonstrate the change in technological orders and the need for reconstructing educational system in such a way that would make it capable of meeting labor market requirements. In such context participants take active measures aimed at filling this gap or optimizing existing human capital reserves.

Such situation developed in the modern history of Russia in 1990s after socialist development was replaced by capitalist one and educational system and specialists required by Soviet economy, were no longer able to meet the needs of the Russian current reality. As a result a huge number of people with high level of human capital was set free: some of them went abroad others had to master new skills required at the labor market.

Production forces accumulated during Soviet times were no longer adequate to production relations in capitalist environment. Construction of a new system and creating some sort of macroecomic balance in the county required significant costs in terms of time and other resources. However new economic model in Russia existed for a relatively short period of time and by now has completely outlived itself. This trend is typical not only of Russia, but of majority of countries in the world.

To answer the stated question the authors studied existing relations between human capital level and it's economic, academic and technological development as well as identified which groups of countries have the best starting grounds for transition to the new technological order. The aims of this research are:

1. To define the level of interrelation between basic indicators of academic and technological development: human capital>innovations>GDP for different groups of countries in the world;

2. To understand the conditions of developing countries' (particularly Russia) transition into the group of developed countries with the aim of further long-terms successful economic development.

1. Theoretical review

Economic science sees "human capital" as a relatively new notion despite the fact that in XVII century W. Petty identified the relation between labor skills and population's input into the creation of national wealth. Modern human capital theory was formed in 1960s by Nobel laureates T. Schultz and G. Becker.

Representatives of institutional approach were interested in the aspect of economic impact of human capital in the context of social institutions influence on its level (Stiglitz, 2009). Researchers believed in and provided solid proofs of the importance of social institutions for forming human capital as they were capable of influencing its qualitative and quantitative characteristics. In other words, authors of institutional approach theory thought that interaction between people in a certain social environment leads to the improvement of qualitative component of human capital. It facilitates strengthening of connection between generations, creating community, building continuous process of professional skills and competencies transfer which helps not only accumulate human capital but also improve its level and importance in the economic system.

Certain input into the development of methodology and understanding of human capital was made by UN experts. In its guidelines on measuring human capital UN provides definition of human capital as knowledge, skills, competencies and other qualities of people that have "overall influence" on social and economic welfare. UN calculation method is based on integral qualities and certain component indicators of human capital such as average lifespan of generation, duration of active labor period, pure work power balance, family life cycles, etc.

Return on human capital increases and turns into huge benefits for those countries where human capital is detained and accumulated. In this case we see not only continuous process of human capital reproduction, but also how it interacts with academic, technological and physical capital

and is complemented by it. As a result of this interaction human capital is transformed into the most important resource for technical progress and long-term economic development.

According to various estimates process of effective interaction between human and physical capital accounts for 10-30% gap between countries in terms of per-capita GDP. The size of the gap is influenced primarily by quality of education, as well as by interaction between workers with different level of qualification. Our analysis also demonstrates strong interconnection. Comparative analysis of different countries showed that gap in per-capita GDP between countries can truly be explained by the differences in human capital level.

It should be mentioned that majority of investments into human capital in advanced countries was made by state institutions which is particularly typical of EC countries (Campbell, 2020).

The growth of the role of state institutions is particularly noticeable in innovation economy as innovations are always related to risks which business is not always ready to take. At the same time innovations need significant investments in tangible and intangible innovation system components (technoparks, technopolices, innovation centers, clusters, Hi-Tech territories, venture business, specialist training, etc.).

At present developed countries are in transition to the sixths technological order based on digital technologies where the main source is presented not by financial or physical capital, but by human one. In new digital economy intellectual labor involved in hi-tech technology allows countries with high level of human capital to form prerequisites for successful transition to the sixths technological order by mastering the new round of technological development.

The authors see the main task of this research not only in studying interrelation between human capital and innovation development in the most successful countries, but also in understanding the context of transition to the sixths technological order with the aim of forming long-term trends of sustainable economic development of Russia.

2. Metadata

In order to analyze the influence of human capital on innovation development of different countries we used correlation – regression method of analysis based on spatial and temporal lines. Database for correlation – regression analysis was take from World Bank statistic data for 2017 – 2018. This period was chosen as statistical information concerning human capital was available only for these years.

At present World Bank human capital study covers only 157 territories. Several countries during the research were divided into parts, e.g. China is subdivided into China, Hong-Kong and

Macao. Research database includes the following indicators: human capital index (HCI), GDP per-capita (PC GDP)[1] and innovation development index of chosen territories.

In order to give objective presentation of the situation in the international economy presented by different groups of countries the studied pool was subdivided into 4 quadrants with their own characteristics. Such pool division allowed for demonstrating the connection between performance indicators under analysis for different categories of countries defining their place in the international economy.

1. The first quadrant is characterized by high level of human capital (0,5-0,9) and high level of per-capita GDP (> 25000USD), as well as innovation development index.

2. The second quadrant is characterized by medium level of HCI (0,4-0,5), medium and high level of per-capita GDP (> 21000USD), medium and high innovation development index.

3. The third quadrant is characterized by low level of human capital (0,22-0,5), low level of per-capita GDP (700$ to 17,900 USD) and low innovation development index.

4. The fourth quadrant is characterized by medium and high level of HCI (0,5-0,8) and medium and high level of per-capita GDP (from 18000 USD to 25000 USD) and medium innovation development index.

The closest index to HCI is the human development index (HDI) calculated by UN experts which is also subdivided into 4 categories. According to the most recent classification by UN experts countries are divided into 4 categories with the following characteristics: very high level HDI H (0,8-0,99); high HDI 0,7 – 0,799; medium HDI level 0,55 – 0,699 and low level – less than 5 (Consesao, 2019).

As we can see from Fig.1 on the first quadrant trend line divides countries. Authors believe that countries above the trend line are those that managed to move from the second quadrant to the first one. In international classification these countries possess high level of HCI though still lower than those with very high HCI but in favorable external environment resource – rich countries can achieve qualitative changes and enter the group of countries with high chances of transition to the sixths technological order.

Therefore approach suggested by authors allowed not only for placing countries into quadrants bu also for analyzing countries' chances for moving from one quadrant to another. It also facilitated formulating prerequisites for such transition that allows countries to improve their position in all three indicators. For example if the transition from the fourth quadrant to the second

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1 Further per-capita GDP

or the third the institutes in this country should follow state politics aimed at improving human capital components (e.g. broad access to healthcare and education).

Besides that, authors formulated hypotheses for country groups according to quadrants. Authors believe that in the context of transition to the sixths technological order countries from the first quadrant and possessing the highest level of human capital have the best starting grounds for implementing this transition. The countries from the third quadrant have the worst starting ground and will not be able not only move to the next technological order in the context of international economic crisis, but also will face the broadening gap with other countries, which will significantly complicate the transition from the third quadrant to the second and the fourth.

Results obtained by authors differ from existing research as obtained estimates are more qualitative as compared to simple country ratings and country ranks they provide the opportunity to evaluate country potential and understand which group it fits into even with lower ratings compiled by international institutions.

3. Research results

Analysis of the division of countries under research into quadrants shows that 157 territories fill three quadrants: the first, the third and the fourth. The first quadrant includes 52 territories, which is 32% of the pool; the third quadrant includes the largest number of countries – 59 or 38% of the overall pool; the fourth quadrant has 46 countries or 30% of the pool. The countries basically fall under the following categories according to the quadrants: developed weakly developed and developing respectively.

Placing countries by category is conditional, as developed countries' group includes some countries, which international organizations do not consider as developed ones. For example this group includes oil-producing countries with high level of income per-capita and high level of life, which actually placed them into the first quadrant, such as Saudi Arabia, UAE, Kuwait etc. Authors believe that countries rich in hydrocarbon resource could earlier be positioned in the second quadrant characterized by medium level of HCI, medium and high level of per-capita GDP.

Favorable external environment of the last decade allowed oil – producing countries to improve not only quality of life of their population but also to significantly upgrade human capital accumulation as advanced technologies were introduced for effective mining and use of resources. This implies mastering new skills and need for additional training which form the basis for upgrading human capital level.

Correlation – regression analysis for the studied countries and territories demonstrated significant non-linear connection between per-capita GDP and HCI (Fig. 1). Influence of human capital on GDP can be different for different categories of countries.

Whereas the degree of human capital influence on GDP of developing and developed countries is the same, weakly developed countries from the third quadrant demonstrate noticeably steeper tilt angle which reflects higher sensitivity between these indicators.

On the one hand it demonstrates that even small increase of income level in the country according to per-capita GDP will have positive influence on human capital level in the country. On the other hand it shows that existing potential of these countries, most of which are resource – rich ones, remains dormant.

Fig. 1. Interrelation between per-capita GDP and human capital in world countries on average in 2017-2018.
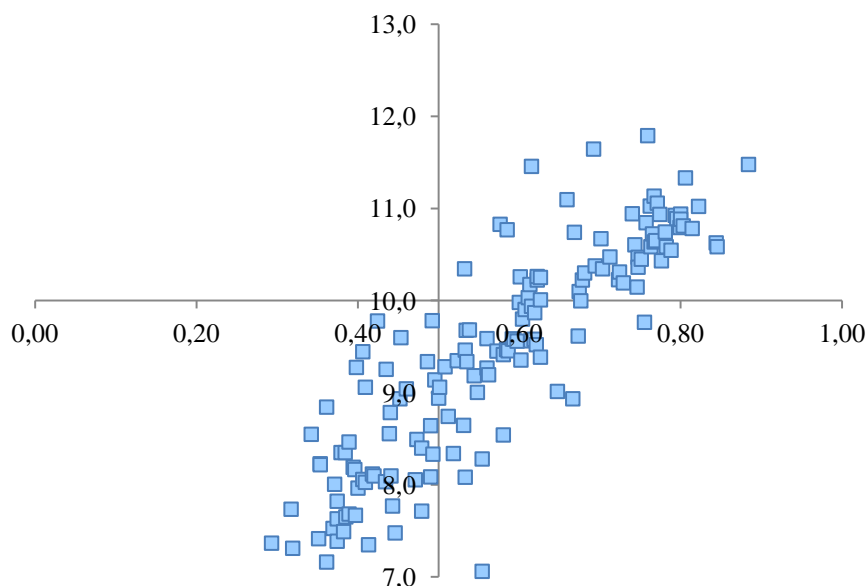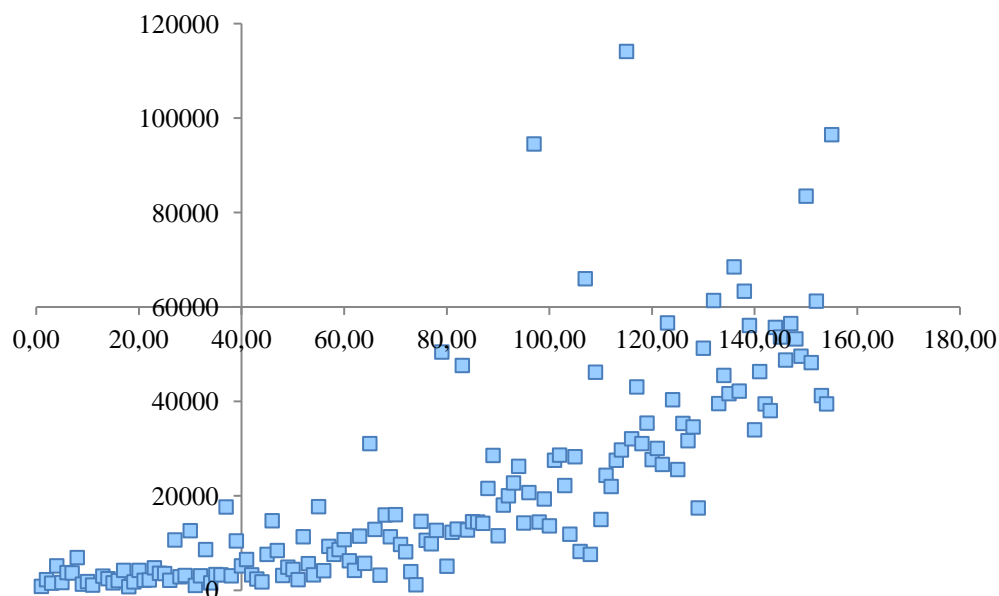

Source: based on World Bank data

However at present majority of weakly developed countries is placed in the third quadrant which demonstrates not only low level of human capital but also absence of opportunities for technological breakthrough. This will only deepen the gap even between weakly developed and developing countries in the new sixths technological order.

Analysis of interconnection between innovations and economic development according to per-capita GDP criteria demonstrated that at present only a small number of developed countries is mastering a new technological order (Fig. 2). Countries that demonstrate successful transition to the sixths technological order are the countries of so-called "capitalist core" - USA, Switzerland, UK, Sweden, etc. It is interesting to mention that Hong-Kong has already joined this group whereas China on average is in the fourth quadrant among catching-up countries.

Fig. 2. Interrelation between GDP per capita and innovation in 2018.

Source: compiled on the basis of World Bank data and global innovation index

Developed and developing countries in Europe are largely placed in the fourth quadrant and some move into the first quadrant. Most countries in the world are in the third quadrant and have less pronounced sensitivity to GDP which demonstrates not only the lagging of these countries but also difficulties in transition to new technological order because of discrepancy between accumulated human capital level an new digital economy environment.

Russia is in the third quadrant and is not yet in the group of catching-up countries, which implies that the climate for innovations is not altogether favorable. Negative tendencies for Russia can be explained by long period of innovation implementation at Russian companies as well as innovation imbalance3 in some branches and absence of modernization in other branches no less important for the economy. This affects the situation in the country as a whole.

Conclusion

As it was already mentioned at present developed countries are moving to the sixths technological order where state institutions play an important role in forming new environment for accumulating human capital. Russia with its high level of human potential is significantly lagging behind in terms of innovation development, which might indicate a weak role of state institutions in managing this process.

Analysis of interrelation between innovations and human capital level showed less close correlation for several countries, including Russia (4th quadrant with high level of human capital and medium level of innovations in economy). Authors believe that less close correlation between these indicators reflects a longer period on innovation introduction in the companies as compared to other developed countries. We also believe that less sensitivity between innovations an human capital in case of Russia can be explained by uneven implementation of innovations in different branches of economy.

For example in export-oriented branches the process of innovation introduction and implementation goes much faster than in other sectors of economy. Such uneven spread can significantly decrease overall sensitivity of human capital as related to innovations. However we must say that Russia has good prerequisites for moving into the 1st quadrant which is characterized by higher returns on human capital for innovations.

At the same time the analysis of interconnection between GDP and innovations in the economy demonstrated that Russia is in the third quadrant together with the group of weakly developed countries with the opportunity for moving into the fourth quadrant. This situation can also indicate weak mechanism of broad introduction of innovations into the economy.

Creation of above – mentioned terms will create prerequisites for strengthening interrelation between human capital level and innovations, which in turn will strengthen the link between GDP and innovations. Without forming this important environment for innovation development Russia's transition to higher positions seems unlikely.

Acknowledgment

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