

# Specificity of Forming Human Capital at IT - Enterprises in Conditions of Concept Lifelong Learning

Kateryna Teteruk, Nadiia Datsii, Evgen Kartashov, Ljudmyla Ivashova, Ganna Ortina

**Abstract:** *The article substantiates the relevance of a scientific insight of those changes in the activities of companies that are observed in the formation of human capital in enterprises of the IT industry. The article highlights the position of digital transformation in accordance with which the conditions for the use of human capital, which is perceived as a combination of knowledge, skills, experience, motivation, health, creative and entrepreneurial abilities of a person, contributing to the increase of his income. During introducing the concept of lifelong learning, it becomes possible to use human capital effectively in terms of both technology and income. As a result of research conducted by domestic and foreign scientists, it was proposed to expand the concept of "human capital" by adding the "entrepreneurial ability" component. Only the introduction of employee abilities, using, and the application of innovations in their work have a decisive impact on the performance of both an individual enterprise and society as a whole, the development of an innovative economy, the acceleration of the pace of scientific and technological progress and the implementation of the concept of sustainable development of an enterprise. For in-depth analysis, it was proposed two initial linear models, the first includes quantitative and qualitative variables. Based on the available statistical data, empirical profiles of the dependence of wages on the level of education are formed, which will give some idea of the demand for labor with a certain level of education in the labor market.*

**Keywords :** digital transformation, IT companies, soft, hard, skills, consumption product

## I. INTRODUCTION

Nowadays the human capital is often considered as a set of knowledge, skills, experience, motivation, health, creative and entrepreneurial abilities, contributing to the increase of his or her income. However, another

component of human capital must also be taken into account — the individual's ability to learn throughout life, meaning lifelong learning. The individual's ability to learn throughout life shows his or her tendency to create and implement something new in order to optimize costs, expand production and increase profits. They differ from creative abilities by practical importance, and from entrepreneurial lack of direct increase of their own income. Thus, the individual's ability to learn throughout life can be considered an independent component of human capital. A sign of the formation and development of human capital's effectiveness in the enterprise is the existence of a system. The system of formation and development of human capital is a complex of organizational and financial measures, the implementation of which will increase the value of human capital and create a reserve for its effective usage.

It is obvious that it is human capital taken as the ability of a person (social group) to create added value to an employer and provide an appropriate income to a person, reflects the effectiveness of a person in the labor process. The most common category of labor economics at the modern stage is the category of "human capital".

The researchers of the theory of human capital consider it as an additional source of income, depending on the knowledge, skills and abilities of a person. In one of their works, the authors [14] made the greatest contribution to the development of the categorical apparatus of the new theory of human capital. By human capital the scientist understands the set of abilities, knowledge, skills and motivations embodied in a person. Its formation requires the diversion of funds from current consumption in order to obtain additional income in the future.

In the memorandum on lifelong learning, the European Commission (now Union) defines the person's aspirations for professional development as "universal educational activity carried out on an ongoing basis with the aim of improving knowledge, skills and competence". The European Commission believes that such training promotes both market demand is difficult, quick employment, and expresses an active citizenship [17].

Many governments are developing and implementing programs related to motivating the population and employees of companies for constantly improving their skills based on the concept of "lifelong learning", for example:

- in OECD countries, the population aged 25-64 years of formal (higher) and additional (courses, training) education is 51%, among the countries of the European

Union it is lower by 40.3%, - the countries that influenced the decrease are: new members of the state

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association: Bulgaria (26.0%), Poland (24.2%), Romania (8%), and Greece (11.7%) [18];

- number of activities that have been developed and now are actively applied include: a wide range of incentives for government support for lifelong learning; liberal education system [5]; direct financing of advanced training of the employed population through certificates for training and / or study of accounts; a complex system of assessment and recognition of qualifications, including informal ones; large-scale entrepreneurship and self-employment courses; various digital resources related to the development of skills that help employees acquire professional competencies and choose effective educational paths;

- The European New Skills Program was adopted by the European Commission in June 2016 [9]. It was developed to improve the quality of skills and determine their role in the labor market; • In Germany, a training voucher has become a successful practice. Employers can receive up to 20 vouchers annually, which cover 50% of the cost of staff training. There are special student bonuses for employees that are distributed among employees with low annual income. In addition, legislation guarantees those who attend continuing education courses during working hours to fully preserve their earnings [7].

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Denmark has successfully introduced a specialized regulatory framework for the recognition of prior education. A law has been passed that gives adult citizens the right to evaluate the results of non-formal and informal learning and receive a detailed certificate registered on the special portal "Map of my competencies" [18].

## II. LITERATURE SURVEY

In 21st century the abilities to continue studying and learning are crucial, and the main task of the governments is the formation of a political, institutional, economic and social climate for ensuring that every citizen of the country has the right to education, whether formal or informal. The concept of lifelong learning that leads to a "learning society" has also been visualized for several decades, an example of which is a report (UNESCO Institute for Lifelong Learning, 2015). In 2009, researchers first noticed the relationship between per capita GDP and labor force participation in education and training in OECD countries (UNESCO Institute for Lifelong Learning, 2009).

Enterprises that own high-quality human capital and are able to use it efficiently have become significantly more successful in terms of both technology and revenues. Large

companies such as Google or Intel cost more than regular manufacturers of goods, including giant corporations engaged in high-tech mining of raw materials.

Professional trainings and retrainings in the workplace, and beyond, are an important source of development and reproduction of human capital [11]. Educational programs related to the formation of professional skills serve as a direct factor in the growth of labor productivity [6]. In addition, recent Studies in the Ukrainian labor market show that employees who receive advanced training have a salary of about 8% [4].

The theory of human capital suggests that education is not the end final product, but a means of further production of added value and, therefore, an important factor in national and global macroeconomic growth, as well as in the growth of income of individuals and legal entities. The price of education is considered as a function of future income growth provided by previously incurred expenses for relevant educational services [13].

Eric A. Hanushek and Ludger Wessmann identify at least three mechanisms by which education can influence economic growth. First of all, education increases the total human capital of the workforce, which leads to an increase in labor productivity. Secondly, education can improve the innovative potential of an enterprise. Thirdly, it can facilitate the dissemination and transfer (transfer) of knowledge, which is necessary for understanding and processing new information, as well as for the successful implementation of new technologies developed by others, which, again, contributes to the economic growth of the company [12].

The policy of the company's employers in the field of education depends on political factors, which include:

- cost-benefit ratio,
- national perception of education and training,
- market aspects of interaction among major competitors[15].

Companies usually organize trainings for their employees when introducing new technologies or equipment [16], as the requirements for knowledge and skills are thus increasing. Demand for highly qualified human resources can be difficult to meet on the external labor market, which also lacks advanced specialists or they are quite expensive, because the training and development of existing personnel becomes the most profitable strategy of the enterprise.

Investment processes also include extensive staff training, especially when new factories of large Ukrainian and foreign multinational corporations open [10]. Business expenses for investment in fixed assets, including innovative equipment, as a rule, exceed the costs of technological innovation in essence. Models are defined as key players interacting among themselves in the labor market. Skills are not static - they mutate and develop depending on the historical moment, economic crises and shocks, as well as the political context [8]. The organization of continuing professional education at an enterprise becomes not only an economical, but also a powerful social instrument, and in

three ways affects the provision and improvement of the quality of the work performed and the satisfaction of one's business.

### III. METHODS

As a result of the assessment of the studies, domestic and foreign scientists should state the need to expand the concepts of “human capital”, adding a component of

“entrepreneurial ability”. Introducing an innovative economy, accelerating the pace of scientific and technological progress and implementing the concepts of enterprise development (Figure1).



Fig 1. The main components of human capital

This way, under human capital one may consider the package of professional knowledge and skills, natural skills and abilities, and received (entrepreneurial) skills, motivation, energy and health, that the person is using during his activities of creating products and services.

For making the proper analysis we have checked various data and factors that lead to salary differences through

years. We have come up to the logarithm model of the salary in IT business depending on the factors that will be mentioned further. The first, and at the same time one of the most important factors is education. To be more specific, we took into consideration the approximate amount of years that people spend on learning. (Figure2)

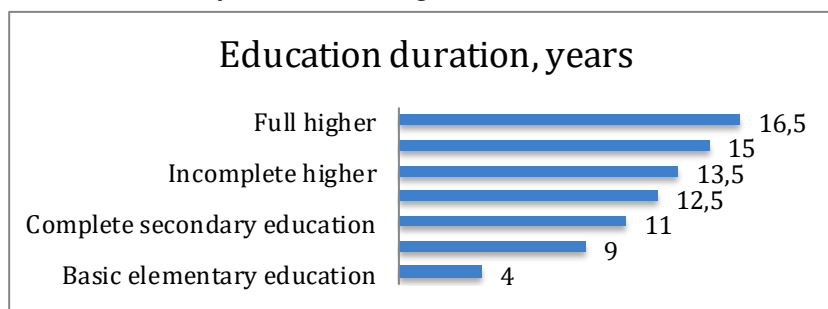


Fig. 2. The average monthly salary of workers with various levels of education in 2018 (in thousands of hryvnias)

Though the time frames gap between higher level of education do not dramatically differ, he further analysis

shows that the time spent on education influences the salary rate in IT field (Figure3).

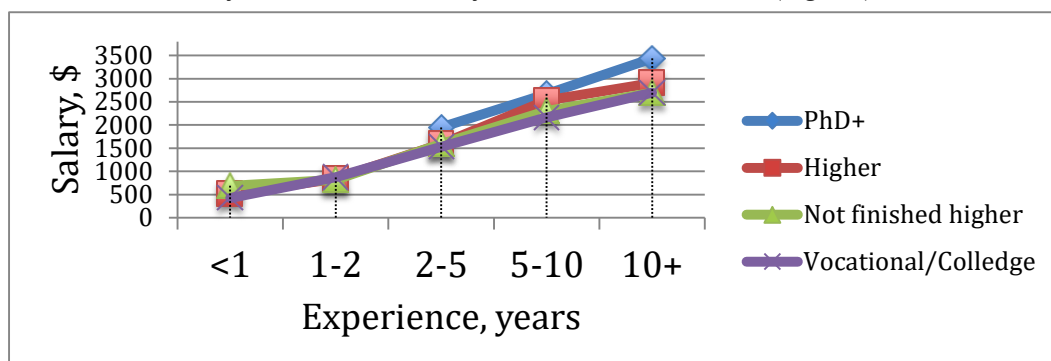


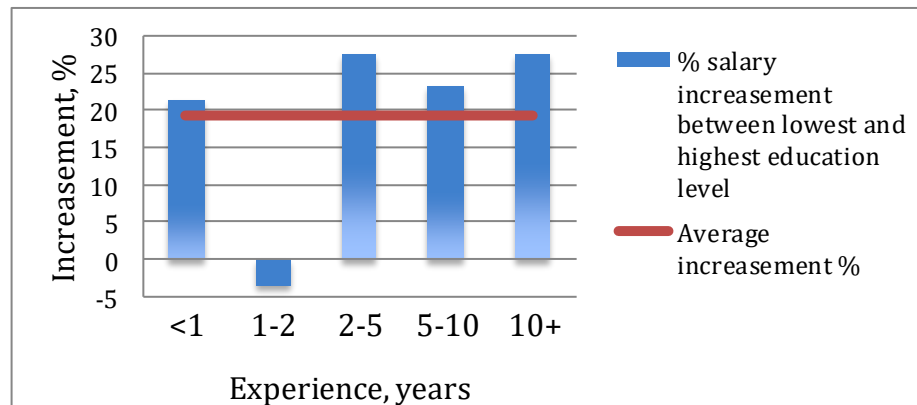
Fig. 3. The dependence of salary of working experience (2012 years)

As we can see, the education level has bigger influence with the incensement of professional experience. Though, at the very beginning of professional career, the years spent on education do not play significant role in salary rate. This can be explained in a following way: at the beginnig of an IT careed professionalism and ‘hard’ skills, though with each

year the importance of broad vision given at universities, which result in ‘soft skills’ level increases [6]. The main proof is the major leap of the Phd+ workers with bigger experience is comparison even with workers with higher education. On the picture below, we can

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check the approximate percentage of the salary incensement (Figure 4, Table 1.).  
on different experience levels depending on education.



**Fig. 4. Salary growth depending on experience, %**

**Table 1. Salary difference ratio, depending on education an experience**

| Experience, years | Salary difference ratio        |                              |                        | General difference |
|-------------------|--------------------------------|------------------------------|------------------------|--------------------|
|                   | Secondary and Higher education | Incomplete higher and Higher | Higher and PhD+ Degree |                    |
| >1                | 61.88                          | -25                          |                        | 21.41              |
| 1-2               | -6.3                           | 2.93                         |                        | -3.5               |
| 2-5               | 3.98                           | 0.25                         | 22.27                  | 27.46              |
| 5-10              | 6.41                           | 9.76                         | 5.49                   | 23.22              |
| 10+               | 0                              | 7.82                         | 18.19                  | 27.44              |

The dramatic fall of the difference of 1-2 year experienced specialists can be explained in the following way: young specialists without fundamental knowledge given by higher education level are more tended to be motivated, hardworking and to obtain ‘survival’ skills, as they experience the highly competitive labor market given that their education level does not give them an extra advantage. This factor does not influence for the starters (<1 year of experience) as employees cannot obviously estimate the candidate by his experience and professional skills. As well, this does not correspond to workers with years of experience, as educational level gives candidates additional advantages.

For the proper analysis we are offering the following linear model:

$$\text{LnS} = \beta_1 + \beta_2 \text{Ln(Ed)} + \beta_3 \text{Ln(Exp)} + \beta_4 \text{LangPt} + \beta_7 \text{LangJS} + \beta_8 \text{LangPHP} + \beta_9 \text{LangAndr} + \beta_{10} \text{LangJ} + \beta_{11} \text{LangN} + \beta_{12} \text{LangSw} + \beta_{13} \text{LangC} + \beta_{14} \text{LangR} + \beta_{15} \text{LangO} + \beta_{16} \text{Pos(J...A)}$$

Where:

LnS - Natural logarithm of salary in IT sector;

$\beta$  – regression equation coefficients

Ln(Ed) – logarithm of quantitative variable, reflecting the years spent on education;

Ln(Exp) – logarithm of quantitative variable, reflecting the years of experience;

LangPt - qualitative variable, reflecting the programming language (mentioned in analisys above)(used language = 1);

LangJS - qualitative binary variable, reflecting Python programming language

LangPHP – qualitative binary variable, reflecting JavaScript programming language

LangAndr - qualitative binary variable, reflecting PHP programming language

LangJ - qualitative binary variable, reflecting Java Android programming language

LangN - qualitative binary variable, reflecting Java programming language

LangSw - qualitative binary variable, reflecting C#, .NET programming languages

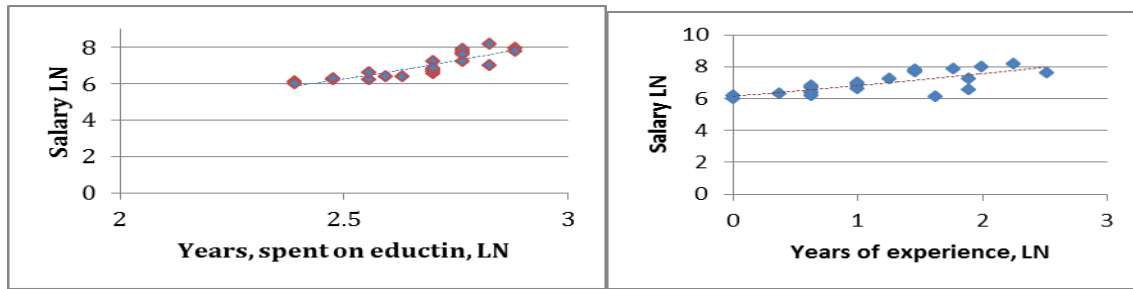
LangC - qualitative binary variable, reflecting Swift programming language

LangR - qualitative binary variable, reflecting C++ programming language

LangO qualitative binary variable, reflecting Ruby/Rails programming language

Pos(J...A)– qualitative variable, reflecting the professional level (Junior=1;Middle=1,Senior=1,Lead=1, Architect=1).

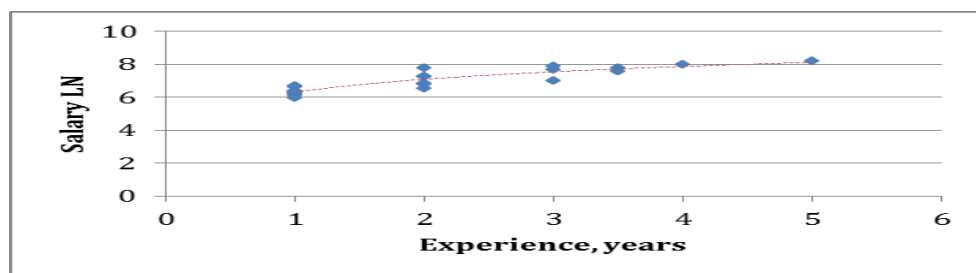
As a result of all the calculations, we have come up to three graphs showing the dependency between salary logarithm and factors such logarithm of years, spent on education and logarithm of years of experience as well as proficiency level. We have built these graphs of these three factors, since the calculations proved they are the most significant factors ( $\beta$  coefficients are the following: 0.9, 0.9, 0.8). This can be seen on graphs shown (Figure 5)



**Fig. 5 Dependency between salary logarithm and years spent on education and salary logarithm and years of experience accordingly**

As we can see both dependencies on the graphs go up, though the education factor sees a stronger bend on top, other than the graph with experience years. This is one more proof of the long-term perspective of salary incensement, depending on education level and years, spent on it.

The third graph shows the dependency between the third major factor, proficiency level (from junior to system architect) and salary logarithm (Figure 5)



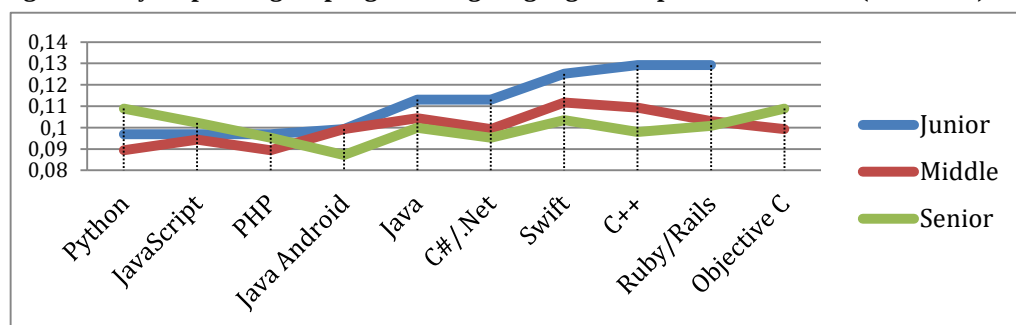
**Fig. 6. The dependency between salary logarithm and proficiency level of the worker in IT field according to the regression model**

The graph shows the biggest bend for the period of 1 till 2 years of experience. Then the graph goes evenly. We can draw a conclusion that specifically for IT field the biggest difference in salary occurs at the very beginning of the career.

analyzed the data provided by IT resources and calculated the coefficient of salary difference among usage of different programming languages depending on professional level, which is shown on diagram and graph (Figure 7,8).

Another major factor that has an influence on the salary is the programming language the worker uses. We have

**Fig. 7. Salary, depending on programming languages and professional level (dol., USA)**



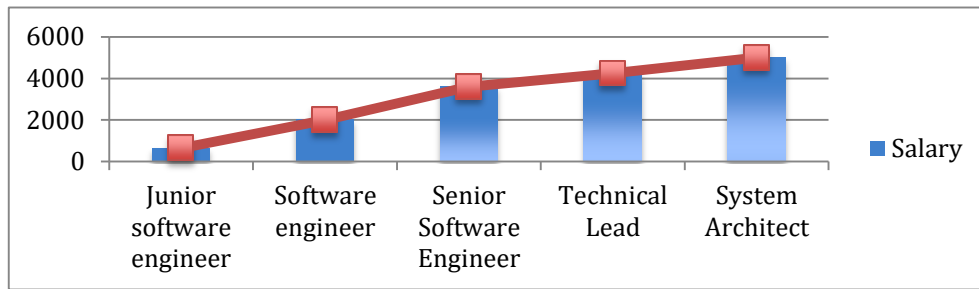
**Fig. 8. Salary, difference coefficient, depending on programming languages and professional level (%)**

Due to the diagram and graph, the salaries obviously tend to grow proportionally depending on the professional level. Though, the difference between the languages depends on both: the difficulty of the language itself, together with time, needed to learn it well to obtain the mentioned professional level.

The most common and obvious way of evaluating the worker's salary is his professional level and his or her position as a result. Even though this factor depends on some factors listed above, we consider it a separate one (Figure 9). Once a worker is estimated to a higher level, the salary reacts immediately. Most probably, the worker will be intended to use the newly achieved professional level when identifying himself as a whole.

For example, some of Ukrainian IT schools offer 16 weeks split into two levels of PHP course. At the same time, the same IT school offers you three-level course of Python for 24 weeks full program duration.

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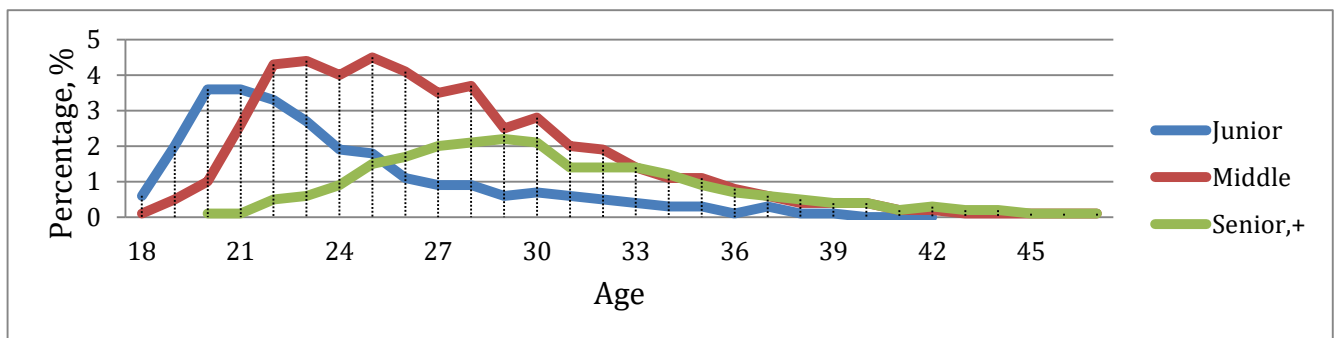


**Fig. 9. The dependence of salary of the professional employee development (dol., USA)**

As we can see, in most of the cases, the biggest salary difference is between junior and middle-level specialists (software engineer), but not higher level ones. Meaning that the main difference between junior and senior specialist is most commonly the professional knowledge. Though, senior specialists obtain bigger experience that results in internal feeling of right solutions, motivation, leadership skills, team player skills and some other skills considered to be 'soft' ones.

The IT field can be considered as one of the brightest examples for analyzing lifelong learning concept: this is a relatively new sector, which is why most individuals older than 33-35 on all professional levels, have gathered professional knowledge by their own, by constantly studying and learning. age distribution between IT workers can be seen on Figure 10.

The general statistics of average age, experience and professional level is shown on Table 2.



**Fig. 10. Salary growth depending on age and professional level (%)**

**Table 2. Average age, experience and salary corresponding to professional position**

| Position                 | Age | Experience | Salary |
|--------------------------|-----|------------|--------|
| Junior software engineer | 23  | 1          | 650    |
| Software engineer        | 26  | 3          | 2000   |
| Senior Software Engineer | 30  | 6          | 3600   |
| Technical Lead           | 30  | 7          | 4250   |
| System Architect         | 32  | 7          | 5000   |

According to the data, provided in Figure 8, the midpoint of junior specialists is 23 years old; for middle specialists it is 26 years old and for senior+ specialists it is 30 years old.

The analysis of the diagram shows that the amount of junior-level specialists extremely goes down after the point of 21-22 years till 30 years; after that it stays on approximately same low level. Obviously, most of the young specialists improve their hard and soft skills and turn to middle-level workers, through this tendency shows us that most of the individuals are not intended to start a new profession after

30+ years old, even considering the fact that this economic sector is considered to be one of the most successful and perspective in Ukraine. This also speaks of a low tendency of lifelong learning between individuals.

The IT human capital analysis shows that most of the workers (51%) are 23-29 years old Figure 11 and the Salary graph line reaches its peak for 32+ year old workers.

Unlike most regular sectors, the salary incensement is stable and increases depending on the age. Though, the percentage of the oldest workers with highest salaries does not reach 30%.

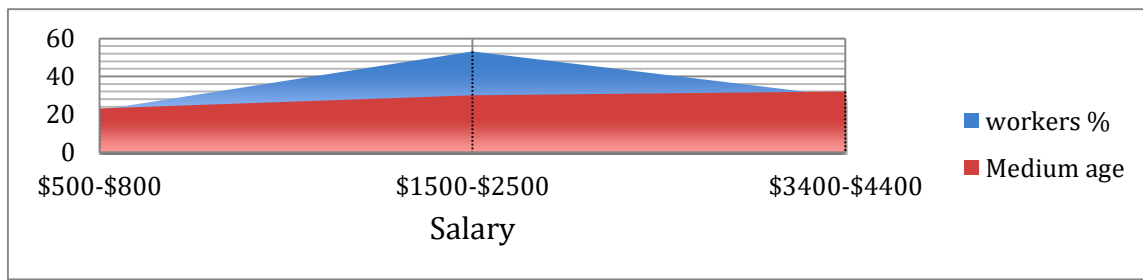


Fig. 11. IT workers age and salary distribution

An important remark is the fact that the number of older workers has slightly increased.

All these analysis bring us to a point that even though the salary in IT sector palpably increases with the growth of experience and accumulated years of learning and studying, and as a result age, the peak of workers quantity is moved to left side of the graphs which represent younger age. This may also speak of diverse activities needed to be done to encourage professionals stay at their work places.

#### IV. RESULTS

The trends' determination in the human capital formation is a complex analytical task and lots of research. The state of human capital on national level is defined by population's education level, healthcare system development level and changes done at education system at various levels. According to the goals of this research, under human capital formation we mean the number of processes, such as: abilities of primary reproduction of knowledge, skills and abilities used on labor market; gaining basic and specific human capital; obsolescence of human capital and skills; some human capital elements' depreciation due to external changes. This results as well as in the case of decreasing amount of professional workers with higher age, the dependency of educational level and years spent on learning on different professional stages and experience levels in IT field. [2].

The so-called human development index has received the significantly important status for the comparative intercountry and interregional analysis of human development state through last decade. Due to the simplicity of the mathematical tools used in the calculations and the minimal set of data needed for analysis, it has found widespread use both - in classical form (included in the UN annual reports, also used in Ukraine to analyze the state of the

regions) and in modified states (for example , in the study) [3].

This index, however, cannot be used to assess the state of human capital, since it includes an incomplete set of data regarding the state of the educational system, limited by the literacy level of the population, and the direct effects of the impact of investments in human capital on earnings and labor productivity are not taken into account. The HDI index of some countries can be checked in Table 3.

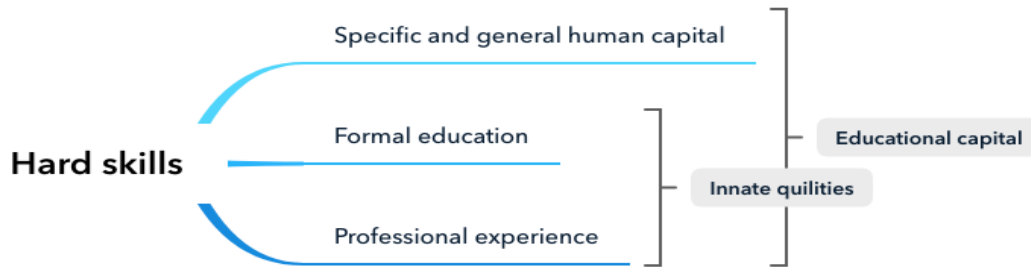
At the level of national economies, parametric analysis of wages has greater importance, which as well reveals the influence of individual factors on trends in wage changes. As the analysis has shown, such factors primarily include the level of education and the level of accumulation of production experience. More complex models may include gender parameters [1], segmentation of the labor market by occupation, skill level, occupation, etc. The basic model proposed by J. Mintzer has been used to analyze the processes of reproduction of human capital for the past forty years, in recent years there has been a tendency to increase the set of indicators included in the regression model. The advantages of the Mintzer equation include the possibility of calculating returns to various levels of education and indirectly determining the demand on the labor market for workers with a certain level of education, experience, etc.

The disadvantage of using this approach is the inability to take into account a number of factors, such as health capital or social capital, due to the difficulty of formalizing the latter for inclusion in the regression model [12].

We are offering to structure the control object, as can be seen from Figure 12-13, human capital differs from human resources, as it includes only the received human characteristics that are forming the core competencies as a result

Table 3. Human development index (HDI) in different countries comparison in 2019

| Country        | HDI   | Population, 2019 |
|----------------|-------|------------------|
| Norway         | 0.953 | 5 378 857        |
| United States  | 0.924 | 329 064 917      |
| United Kingdom | 0.922 | 67 530 172       |
| Bulgaria       | 0.813 | 7 000 119        |
| Ukraine        | 0.751 | 43 993 638       |
| Colombia       | 0.747 | 50 339 443       |
| Samoa          | 0.713 | 197 097          |



**Fig. 12. Hard skills syructure scheme**



**Fig. 13. Soft skills structure scheme**

Competencies are formed through activities of separate elements of human capital. Such, professional competencies are mostly formed because of educational capital, which includes formal education as well as accumulated production experience.

The past few year works on human capital formation analysis shows they drawn into deep philosophical, ethical problems of economic growth. They are reflecting the humanistic ideas that arose at the turning point of Russian history, and generally preserve the peculiarities and peculiar traditions of national social and economic thought.

In addition, an important feature of most reviewed works is the lack of complex elements of econometric modeling, which allows us to conclude that economic analysis in domestic studies of human capital is carried out mainly in line with the institutional tradition.

## VI. CONCLUSIONS

According to our research, it becomes clear that education, as an integral element in human capital, is not a final consumption product, but it acts as a means of further production of added value. It is becoming an important factor in national and global macroeconomic growth, as well as ensuring the individuals' and organizations' growth of incomes. The education cost is considered as a future income increase function, which is received as a result of costs, previously spent on the relevant educational services.

By stimulating the educational activity of company's employees, the employer/government activates everyone's personal resources, increases person's activity, forms a mood for action, but not for contemplation. The company develops a culture of industriousness, goals achievement, business focus, as well as cooperation and communication skills. As a result, it leads to getting (turning into) a proactive person, the one who is ready to respond to external challenges. Being flexible, he successfully masters new professional qualifications and implements existing ones, ensuring himself a reliable position in the company. Such employee turns out to be very productive both – in the company and in the whole country, since and easy-learning individual may be useful in dozens of places and companies.

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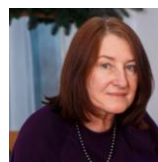
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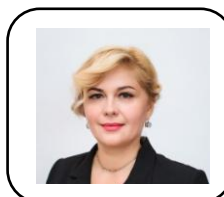


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