

Problems and Features of the Human Side of Digital Supply Chain Mechanism

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Abstract—Digitization has become the dominant theme in discussions about the future of supply chains. Wherever there is a problem, there is the promise of a technological solution, using some combination of artificial intelligence or machine learning, big data, automation, and the Internet of Things. The article actualizes the problems of the impact of digitalization of supply chain on the formation and transformation of human capital and, above all, the formation of new competencies, knowledge and skills. The main components of human capital in the digital supply chain have been clarified and disclosed - knowledge and skills that bring income to its carriers and value added; features of formal and informal educational process; the necessity of measures to minimize the class of precariat, which does not have a modern level of development of human capital, are proved; The main directions of a qualitative improvement of human capital that are adequate to the challenges of the modern digital supply chain and globalization are identified. Digital supply chain management can transform a company's ability to anticipate and serve customer needs, starting with a focus on world-class demand sensing; controlling product flows; and optimizing customer deliveries.

Keywords— *Human capital, supply chain digitalization, precariat, learning economy.*

1. Introduction

Human capital in the digital supply chain is turning into an important resource for economic development. Economic activity is constantly growing, since in almost all areas of socio-economic activity it has been determined that the role belongs to highly skilled workers with creative potential. Today, in conditions of global intensive technological development, education not only makes it possible to master old, already accumulated knowledge, but also contributes to the acquisition of new knowledge in the labor process, which also provides the conditions for their

production in the future [1].

The concept of human capital covers the totality of human characteristics, which include the ability to learn, mental, physical, intellectual abilities, ability to work, as well as health and psychopathic abilities [2]. In theory, several elements of human capital are distinguished: education capital, labor capital, health capital, and socio-cultural capital. The main components of human capital are education capital and labor capital. The set of human abilities that are included in labor capital are evaluated in terms of the ability to generate income. According to M. Kolosnitsyna's definition, human capital is "the opportunity embodied in a person to generate income", and according to [3] definition, human capital is "a combination of qualities that determine productivity and can become a source of income for a person, family, enterprise and society".

Nobel laureate, American economist [4] gave his definition of the concept of "human capital". According to his theory, education is a form of capital, because it affects production and is important for the economy. In addition, education can be considered as capital for the reason that it allows you to get satisfaction or earnings in the future. G. Becker continued the development of the theory of human capital; he is considered the founder of the modern theory of human capital. Becker highlights knowledge, skills and motivation in human capital. He believes that investments in the education of specialists and skilled workers can bring in the future no less profit than the cost of machinery [5].

At the moment, there is no single true definition of the concept of "human capital", however, all definitions can be divided into two groups. According to the first approach, human capital is a combination of human knowledge and skills acquired during education and participation in the labor process, which can become a source of income. For example, [6] under human capital means "knowledge and skills that people acquire through education, training or practical experience and which allow them to provide other people with valuable productive services".

The second approach to the definition of “human capital” is characterized by a broader view of the term. In this case, the components of human capital include not only human knowledge and skills, but also motivation, ability, values and energy, which contribute to the growth of labor productivity and generate income. For example, R.M. Nureyev (2008). The most controversial issue remains the ability. People with higher motivation and learning abilities are more likely to enter the university, therefore, their income in the future will be higher. Analysis of the potential and determining the directions of its use allows us to make a reasonable forecast of economic development. Human capital is being formed in certain sectors, such as education, healthcare, but it is in demand everywhere, therefore, sectors that form a new quality of human capital should be considered as priority ones. The tasks of realizing the structural changes necessary for the Russian Federation in the economy create an increased need for human capital with desired properties and it is impossible to solve these problems if there is a shortage of it and at the same time there is an excess of human resources that do not meet the needs of economic development [7].

Digital supply chain technologies change a person’s life, all spheres of his activity and, first of all, the forms and content of education. They also significantly change the purpose of human capital and influence its formation, which, in turn, dictates the acquisition of a number of new competencies that allow us to constantly adapt to the new conditions of the “learning economy” [7]. The term “learning economics” was coined by Danish researchers. They called the continuous universal improvement of knowledge and skills a necessary condition for the creation of new products and a key factor in increasing the competitiveness of countries [8].

The leaders in the world today are those countries that form and use the knowledge and competencies of people better than others, as well as their ability to continuous learning and complex interaction. People with high human capital are able to quickly master and introduce new technologies, generate innovative ideas, and, ultimately, create more value added per unit time than low-skilled workers. Scientists confidently argue that the shift in economic emphasis from industry to education and healthcare will be as crucial in the 21st century as the transition from the agrarian to the industrial era in the 19th century [9].

Numerous studies of foreign and domestic scientists indicate that human capital is the main factor in economic growth and improving the welfare of the population.

The concept of “human capital” means not only an awareness of the crucial role of man in the economic system of society, but also the recognition of the need to invest in a person, increases his productive abilities, contributes to the development of him as an employee. The main type of such investments are education expenses, including general and special, formal and non-formal education, on-the-job training, etc. [10]. Thus, according to the evidence of American scientists (Human Capital Trends 2012), 70% of US wealth is created thanks to human capital. Already in the second half of the XX century about 800 thousand dollars were spent on the training of a scientific and technical worker in the USA. USA, which confirms the growing importance of the development of employee education as an important investment form of society.

At the present stage, education is becoming an element of a strategy for economic growth, and promoting it and its forecasting has become part of the practice of state regulation of all developed countries of the world. In Western countries, the economic justification for educational expansion took place in several directions at once. First of all, this is recognition of the role of highly qualified specialists in the process of economic development, both of an individual enterprise and of the country as a whole. Their lack leads to the emergence of “problematic links” in the economy, which negatively affects the growth rate. Therefore, in all developed countries, starting from the 1960s, the role and importance of education and training in the system of national priorities increased, the transfer of this sphere to a qualitatively new level of material and staffing was substantiated. This goal was achieved as a result of a jump in the share of education spending in relation to the national income of these countries.

It is generally recognized that highly qualified personnel are the most dynamic element of the production system: they produce new ideas, contribute to the speedy implementation of scientific discoveries in practice, that is, the pace of scientific and technological progress largely depends on them. One of the most important incentives for the development of education was its interpretation as a producer of human capital and a factor in socio-economic growth. Raising the level of education of workers leads to an increase in their earnings and increases the chances of finding a job.

The solution to the problems of enhancing the

development of human capital must begin with the dissemination in society of the ideas of the theory of human capital and the practice of their implementation. The decisive role in this belongs to the state. Scientists have proven the following areas of active influence on economic growth [11]:

1. Education and training make the work of each individual productive. Proof of this is the close correlation between the level of education of workers and their earnings, which is confirmed by statistical data. Education either increases the productivity of an employee at a given workplace, or makes him capable of such work, the results of which are of the highest value, and which is therefore better paid. Consequently, an increase in the qualifications and education level of the economically active population increases labor productivity in the economy.

2. Education develops in a person business skills and enterprise. In Western literature, this phenomenon is called the "distributive effect of education." Working efficiency is associated with the ability to perform a certain range of tasks, distribution efficiency is associated with the ability to make the right decisions. Education increases people's sensitivity to new scientific ideas and technical developments, and therefore the lag between the discovery and its widespread use is reduced. Reducing the time of the spread of scientific and technological discoveries, education increases social productivity of labor, stimulates economic growth.

3. The third direction is that education increases not only the speed with which discoveries spread, but also the speed with which they are realized. There are three reasons for this: firstly, the further development of science and technology is inconceivable without highly qualified scientists, researchers and engineers who are generators of ideas and on which the practical implementation of perfect discoveries depends. Secondly, a significant part of scientific research is carried out in educational institutions. Thirdly, the ideas of improving technologies and organizing production are often born directly at the workplace. If education and training develop the innovative abilities of an employee, makes him inventive and proactive, then this also contributes to technological progress. Accelerating the pace of scientific and technological progress increases social productivity.

So, the contribution of education to economic growth is carried out in the following areas: it gives

the labor force productive knowledge, helps to build up new knowledge, stimulates the process of producing new ideas. Nowadays, people are considered not as labor resources, but as owners of human capital. Accordingly, it is not the person himself who is present on the labor market, and not even his capital, but the services of human capital. The ability to provide services is derived from the size and quality of human capital. Thus, the theory of human capital makes it possible to measure the effectiveness of education and training at various levels.

At the personal level, the effectiveness of investment in education is determined by an increase in the income of a person as a result of training, at the microeconomic level, by an increase in the marginal product, profit, or (for non-profit organizations) an improvement in the quality of work, an expansion of the scope of activity; at the meso- and macroeconomic level - the growth of national income.

In developed countries, the state proceeds from the fact that the better the educational preparation of the labor force, the higher its role in production, the less social problems associated with unemployment, poverty, crime, etc. Vocational training at enterprises and the acquisition of production experience are also important. This is especially important when looking for a first job to prevent youth unemployment. Lack of work experience greatly reduces the competitiveness of a potential employee; sometimes it becomes a very serious obstacle to employment. Various methods are used to mitigate social tensions among young people and create opportunities for the realization of human capital in developed countries.

For example, in France, the vocational training system is used, in Germany, the apprenticeship system. In the United States, the so-called concept of preparation for working life arose, designed to ensure a painless transition of a student from school to the world of work. This is a multi-stage program that covers all levels of school education: from exploring the world of professions in the lower grades to mastering the basics of two or three specialties - in the older ones. Particular emphasis is placed on acquaintance with the peculiarities of working life, on obtaining skills in the labor market. In Japan, unlike other countries, as part of the general strategy of "lifelong hiring", the main form of professional education is the training of an employee directly at the enterprise.

Education has a positive effect on the labor market, not only because it increases the competitiveness of workers, but because it accumulates potentially unemployed youth. The states of many countries are consciously pursuing policies aimed at continuing the

duration of their studies. Consequently, the development of education and training contributes to the solution of such important tasks of socio-economic development as accelerating economic growth, mitigating inequality in the distribution of personal income, improving the quality of the national labor force (hence the competitiveness of the economy), directly reducing unemployment and preventing it in the future. All this actively contributes to human development.

2. Materials and Methods

The methodology for studying the impact of education on the formation of human capital in the context of supply chain digitalization is based on the concept of innovative development at the stage of formation of the information-digital method of production and consumption.

A systematic approach in the context of digital supply chain transformation allows us to study the development of human capital, taking into account external and internal relations, interdependencies, effects and results [12].

The subject of this study was the socio-economic relations arising from investment processes in human capital based on the division of labor, deepening specialization and cooperation. In the process of preparing the article, the concepts of abstract-logical, causal analysis methods, methods of socio-economic research, etc. were used.

3. Results

By digitizing and collecting data from across the enterprise, supply chain integration creates a single version of a company's performance – sales, efficiency, cost allocations, profit centers and more. Dashboards that process and present this information empower decision-makers to pinpoint production bottlenecks, transform maintenance activities from reactive to preventative and predictive, identify parts redundancies and consolidate sources of supply.

Benefits of Digital Supply Chain Integration

Efficiency rises and costs fall as digital integration automates many inventory, ordering, and scheduling tasks. With fewer manual interventions required, accuracy mounts. Employees can devote more time to strategic and tactical duties rather than duplicating efforts, re-entering data and replicating repetitive tasks. At their best, supply chain integration strategies serve as platforms for buyer-supplier collaborations that allow both partners to optimize:

Inventory; Delivery; Warehousing processes.

To achieve true performance improvement, supply chain integration starts with eliminating time-consuming, redundant, and unnecessary processes that erect artificial obstacles to material procurement, order review and reconciliation. And that starts with clean, consistent information collected, categorized and presented into actionable reports. Reliable data will generate several benefits:

Faster decisions based on accurate representations of usage, costs, and historical performance.

Elimination of effort duplication in which several departments input similar data for different purposes.

Less downtime as machine learning and analytical forecasting helps coordinate maintenance and predict part failure.

Better use of employee time and lower inventory costs as historical data feeds automation that triggers reorders of replacement machine parts and consumables.

Challenges of Digital Supply Chain Integration

Despite digital supply chain integration's obvious benefits, there are a few common challenges that go along with the process:

Many companies remain mired in mismatched legacy and analog – or even pen-and-paper – systems whose history of minor, incremental improvements cannot keep pace with business operations. Employee and supplier aversion to change, institutional knowledge gaps, and unwillingness to turn over supply chain control to perceive “robot masters” is a common hurdle in the early going.

Silo-based procurement, inventory, and maintenance processes create conflicts among departments whose performance is measured (and often their compensation is determined) based on isolated factors such as work order completion, units produced, on-time delivery, or cost per piece. As a result, cooperation between various factions can be challenging.

The transition to a “knowledge economy”, using ideas and innovations as the main source of growth, places high demands on human potential. It is important to note that the steady growth of the economy is increasingly becoming dependent on the intellectual abilities acquired by human capital during lifelong learning [13]. This process largely depends on external conditions, although personal motivation for development is just as important. The main components of human capital are competencies and skills, which are the basis for the formation of value added in the digital supply chain, and education is a key industry that forms human capital.

In the course of his life, a person, for various reasons, is exposed to risks, as a result of which he may lose his source of income, reduce the value of his human capital due to illness, changes in the situation on the labor market, etc. Throughout life, the qualitative characteristics of human capital undergo changes. Its value decreases over time, if there is no recovery at a higher level by acquiring new competencies and skills through permanent education, that is, modernization.

The modernization of human capital can be characterized as a change in the qualitative characteristics of the person himself, contributing to the growth of the well-being of the individual, increase labor productivity and change the parameters of human economic activity [14].

The value of human capital can not only increase, but also change in the other direction, due to slow adaptation to the changes that are caused by the devaluation of a previous education, partial de-qualification, which inevitably occurs during periods of loss of the source of income due to unemployment [15].

Thus, investing in human capital occurs both for conservation, and then it is not only education, but the cost of maintaining health, and for modernization, which involves advanced training, retraining, learning a foreign language, etc., and leads to productivity growth of human capital.

Digitalization of the supply chain accelerates the pace of economic diversification, which in turn entails the diversification of knowledge and competencies. The manifestation of new, more productive industries requires appropriate specialists. A more complex structure of the economy requires a better, specialized education [16].

Analyzing the impact of education on the structure of the economy, it should be noted that a more complex structure correlates with quality education. A high level of education in developed countries provides higher salaries. But it is noteworthy that in the Russian Federation the connection between quality education, incomes of the population and the structure of the economy is not so pronounced, but on the contrary, the high level of education and the complex structure of the economy of a particular region do not lead to a rapid increase in wealth.

Estimates of human capital in international ratings show that Russia lags significantly behind the leading countries in terms of its continuous growth through institutions of professional retraining and

advanced training and the availability of qualified personnel. At the same time, a contradictory fact is noted: with a sufficiently high level of formal quality of human capital, we have low labor productivity and low GDP per capita [17]. Experts explain this contradiction by insufficiently developed institutions for the capitalization of the knowledge and skills of people in our country and underfunding of the educational sphere. This also indicates a flaw in the education system regarding the need for a quick update of knowledge and the formation of digital supply chain, creative, entrepreneurial competencies. The current educational model of such competencies, unfortunately, does not form, while this is the only way to stimulate business to create new high-performance jobs [18].

An analysis of the Russian labor market revealed some contradictions that also do not contribute to the efficient use of human capital. A peculiar reaction to macroeconomic shocks in our labor market is to maintain an overall stable number of people employed in the economy while lowering wages.

We have a huge number of people who are employed in the shadow economy, self-employed, freelancers, etc., who are called representatives of the "new oppressed class" - the precariat. Nomadism, as a special category of employees, as a rule, leads to the individualization of labor, when a person works remotely from home, performing tasks that were previously traditionally solved within the framework of a stationary workplace. This fact is not always explained by the desire for complete freedom and independence, often they are forced to leave the "white sphere of the economy" due to low salaries, uninteresting work, and the inability to realize themselves. If we take all the people employed in the Russian Federation, which is about 72 million people, for 100%, then about 80% have signs of precarious employment (where there are at least one or more signs of belonging to this class). About 18% is informal employment, and 60% are those who work in organizations, but seek work because of dissatisfaction with the existing one, but cannot find it because of their uncompetitiveness, lack of jobs, or for another reason [19].

With the transition to a digital supply chain, there are more and more representatives of this class. Using the objective laws of transition (work, automation, etc.), employers increase qualification requirements, cut salaries for those who, from their point of view, do not correspond to realities, thereby worsening the situation of such workers, on the one hand, and making them more economically dependent, on the other hand, and

ousting them from the white economy to its shadow part [20].

What should be done so as not to increase this class? You can't simply ban it. This is an objective global process. But the first step towards reducing this class has been taken. The Russian Federation adopted the Law on Self-Employed. This is an attempt to legalize and streamline the lives of such workers, including this class. True, this was done late, but the main thing is to keep up with life and take certain steps in time: look for new forms of social protection, social insurance, raise wages to a decent level, apply flexible forms of employment, inform people about their rights. An uninformed person in an unprotected form of employment poses a danger to everyone; he dumps, erodes the matter of public welfare and reinforces an individual-selfish labor model of behavior in society.

Collective representation of workers and employers must be ensured by public policy methods, because the potential of the social partnership system and collective contractual regulation to solve social problems is underestimated [21].

But the most pressing solution to this problem can be implemented through the education system. It is necessary to increase the competitiveness of our people and increase their human potential.

4. Discussion

There's no doubt that technology is set to have a big impact on every part of supply-chain operations, from planning to logistics. By focusing so much attention on digital solutions, however, companies may inadvertently be ensuring their failure. That's because the technology-first approach ignores an inconvenient truth: the intensely human nature of the supply chain.

Technological optimists paint a bold picture of supply chains that are so highly digitized that the function itself disappears. They envision a world in which forecasting, planning, and execution are fully automated and seamlessly integrated, where systems adapt to solve problems and respond to changes in supply or demand without human intervention.

Such supply chains might eventually become a reality, but today's digital solutions must be integrated into today's supply chains. And today's supply chains are wrestling with the same problems they have faced for decades: poor visibility, uncertainty, mistrust among functions and stakeholders, biased behaviors, misaligned

incentives, and slow decision making. Human potential exists as an abstract concept until it receives a tangible form [22].

One of the first who pointed out the inextricable link between formal and non-formal education with the size of human capital was G.S. Becker. He emphasized that the personality is inseparable from its knowledge, skills, value attitudes, in contrast to other forms of capital. That is why the market is not able to determine the price of human capital, but only focus on the price of its rent.

Another feature of human capital, according to G.S. Becker, is a diminishing marginal return on investment. Physical and mental abilities decrease over time during aging, so the marginal product obtained from investing in a particular individual will inevitably decrease. According to G.S. Becker, the maximum investment should be made in the education of children, but as they acquire the necessary competencies, the investment strategy should be changed, switching to investments in other assets. G.S. Becker expands productive human capital with a behavioral component: "The concept of human capital also embraces habits, including addictions such as smoking and drug use. Human capital in the form of positive working habits or addiction to alcohol has a significant positive or negative impact on productivity, both in the market sector and outside it" [23].

T.U. Schultz and G.S. Becker explained the differences in the level of wages of highly skilled workers (doctors, lawyers, engineers, etc., who, having received education, invested in professional development) as income from investments that were carried out to improve their professional level. Salary, therefore, reflects the different quality of work of workers. Salary includes not only remuneration for the work performed, but also investment income from education.

Modern researchers add innate, biological, and social capital to the educational component of human capital. Moreover, the last two can also be formed by investment. But knowledge and skills are necessary components of any kind of human capital.

The uniqueness of the moment we are experiencing lies in the global changes taking place in real time. This creates previously unbelievable opportunities and challenges.

Now the world is undergoing major metaphysical, epistemological, social, anthropological changes that have penetrated the economy, education, medicine, etc. Digital supply chain technologies at one time provided mankind with unprecedented tools for realizing the fatal desire for economic, cultural and other integration

and unification.

However, this process has both positive and negative sides. Globalization averages the personality, leads to the dominance of mass culture, turning humanity "into an amorphous, colorless mass" [24].

The development of information and communication technologies in the process of globalization exacerbates the problem of redistribution of human capital. Digitalization gives this process a totality.

Humanity has entered a new phase of its virtualized existence. One of the founders of the national school of virtualistics, [25-30], calls virtualistics a new worldview system. He believes that "in the foreseeable future, the world as a whole and every fragment of it will be more and more virtualized." For example, education that moves to distance learning. The big problem that has been discovered in our time in connection with the rapid change in the relevance of knowledge aggravates the problem of breeding the knowledge necessary for basic education. Meanings still relevant today become irrelevant tomorrow. According to experts, 65% of those who are currently studying at school or university will have professions that are not yet available, many will work in the virtual space and for him. According to another opinion, in the near future, most graduates will not have a job at all [31, 32].

But still, first of all, the usefulness of digital supply chain technologies for the formation of human capital is manifested in the possibility of an open space of communications, professional interaction, and expanding the horizons of our imagination and creativity.

5. Conclusion

The processes of supply chain globalization and digitalization, which in the 21st century become strategic directions of social development, increasingly determine the need to consolidate the leading role and role of the locomotive in the processes of formation, development and use of human capital. It is education that has a leading role in ensuring technological and socio-economic breakthrough.

Thanks to universal continuing education that constantly adapts to changes in global trends, it will be possible to provide a solution to key socio-economic problems: social stability and sustainability, equal access to various development resources, capitalization of skills and knowledge, etc.

Experts studying the problem of the development of human capital, offer concrete measures to improve its quality. These are projects related to supporting the early development of children. They believe that investing in early child development has a greater delayed effect than spending on vocational education; talent development and support; digital educational schools and the development of material school infrastructure; creating an environment of equal educational opportunities and success for everyone and the continuing education system; new technological education; the formation of regional innovation centers on the basis of leading universities in the region; projects for the further development of fundamental research and applied research in higher education institutions, research centers, research institutes; education export; the creation of modern training systems, professional retraining and advanced training for the development of the national education system.

The implementation of the above projects will ensure qualitative changes in human capital, adequate to the challenges of the modern digital supply chain and globalization. One technology company, for example, created consensus estimates of demand twice a month using a mix of historical data, sales-team estimates, and long-term revenue predictions. The process worked well, but fear of capacity shortages meant the company routinely inflated its own demand forecasts. The result was significant oversupply, low asset utilization, and high costs.

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