

Management of intellectual personnel in the era of Industry 4.0

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Annotation. *New technologies of Industry 4.0, their measurement and research tools are named; the consequences and risks for society, the state and people are defined. Peculiarities of modern management of intellectual personnel are studied. The motivation of the work of the intellectual staff is substantiated. The importance of the involvement of intellectual personnel in the company has been proven.*

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1. Introduction

The era of Industry 4.0 began at the beginning of the XXI century in developed countries (Germany, USA, and Japan) [1]. Today, its key dimensions and means of research have already been determined (Table 1).

Table 1 Key dimensions of Industry 4.0

Dimension	Means, research
Autonomy of control	Self-driving vehicles, drones, space exploration, blockchain
Hyper-interrelatedness of integration	Internet of things, social media, remote electronics technologies (jobs)
Adaptability of reconfiguration	Big data computing, virtual augmented reality, 3D printing
Scale on demand	Cloud computing, end-to-end mobile search, streaming media
System stability due to renewable resources	Clean energy, smart cities & homes, e-commerce

It is worth mentioning the new technologies that have already been implemented or will become a reality by 2030:

- high-speed Internet due to high frequencies, bandwidth (up to terabits per second), flexible network technologies;
- internet sensations, virtualization of physical objects, digital twins;
- artificial intelligence, a new era of creativity (in robotics, cinema, music);
- large-scale use of drones.

Examples of digital twin projects are:

- the digital twin project was created by Ericsson in the terminal of the Italian seaport in Livorno;
- audi plant in Germany based on 5G.

The era of Industry 4.0 today already has consequences and risks that must be taken into account not only in the organization of the management of intellectual personnel, but also for society and the state as a whole, namely:

1) for society:

- although a person will be freed from hard and routine work, the complete independence of production from people will lead to a massive loss of jobs, which can already be observed in countries where automation is widely practiced in plants and factories;
- technological development can also cause an increase in the gap between capital income and labor income and, as a result, growth of inequality. Demand for workers with a low level of education and lower qualifications, on the contrary, will decrease. Therefore, the experts insist that the states deal with this issue today and prepare for a new industrial revolution. Countries with low-wage labor can lose this advantage over developed countries and fall even further behind them;

2) for a person:

- the new world based on digital technologies will change a person's personality, as Industry 4.0 will establish new principles in ethics and aesthetics;

- a person can customize goods and services for himself, as well as create "continuation" of the world that he specifically likes;

- as a person immerses himself in the digital environment, his individual behavior will become more digital and will cause him to alienate his inner world, cause the lack of freedom to form his own identity; will cause segregation of people based on their identity and, as a result, polarization of society;

3) for the state:

- the more closely the physical world will intersect with the digital world, the more opportunities will appear to control and monitor unwanted events around the world by means of digital networks;

- new technologies will enable citizens to influence the political life of their state, but the security problem will worsen. Wars in the future will have a completely different nature. Future military conflicts will have a hybrid nature and combine direct actions on the battlefield with non-state phenomena and elements;

- the lines between war, peace and soldiering and even violence and non-violence (cyber-terrorism) will be blurred. With the development of military technologies, the emergence of biological and autonomous weapons, non-state associations of people will reach the same level of lethality as states;

- the deterioration of the position of the middle class can lead to the imbalance of political systems that rely on the middle class. There will be a strengthening of the ideas of populism, radicalism, fundamentalism and militarism, which we can already observe.

2. Features of modern management of intellectual personnel of the corporation

In the economic theory of modern society, the category "intellectual activity" is meant to play a key role, similar to the one played by the category "commodity - labor power" for the creation of K. Marx's economic science. Therefore, creative work in the form of intellectual activity is the main source of creating added value and a special factor of production in a post-industrial society [2]. Intellectual activity is the final stage of human evolution in economic life. The main stages of the formation of the concept of intellectual activity are given in the table 2.

The evolution of the formation of the knowledge economy and the science of management demonstrates how the perception of those human qualities that are used in production processes changes over time [3]. Self-realization, the desire to acquire knowledge, and the search for new opportunities for creativity become the main motive of the employee's activity. In the post-industrial society, the very nature of work, which was traditionally aimed at creating material values, is being transformed. Its place is occupied by the intellectual activity of a person, which is based on a set of scientific knowledge, spiritual and cultural values and is not subject to the regulation that is usually applied to the work in the traditional sense.

Table 2 Stages of formation of the concept of intellectual activity

Period	Category	Ideas about the role and place of man in economic	Concept of management
XIX century - 60s of the XX century	Workforce	A person as a carrier of abilities and features that can be productively used in the work process	Human labour management
30 years of the XX century - the present day	Personnel	A person as a passive object of external management, a planning and accounting unit	Personnel management
70-80s of the XX century - the present day	Human resources	A person as a non-renewable resource is an element of social organization, a factor in increasing production efficiency	Human resource management
The beginning of the 90s of the XX century - the present day	Human capital	A person is an object of effective investments and a subject that transforms them into productive abilities for implementation	Social management
The end of the 90s of the XX century - the present day	Intellectual staff	A person with his creative abilities is the main source of innovation and creation of profitability potential	Knowledge management

The World Economic Forum in Davos defines the key competencies that have become necessary in the 21st century, in the labor market, and according to which modern education should develop (Table 3). In 2025, many new competencies were added to the ten future competencies, which requires their development and inclusion in educational programs.

Table 3 Key competencies of intellectual staff [4]

№	2020	2025
1	Comprehensive problem solving	Analytical thinking and innovativeness
2	Critical thinking	Active learning
3	Creativity	Solving complex problems
4	People management	Critical thinking and analysis
5	Coordination with others	Creativity, originality, initiative
6	Emotional intelligence	Leadership and social influence
7	The ability to assess the situation and make decisions	Use of technologies
8	Orientation to providing services to others	Creation of technologies and programming
9	Ability to negotiate	Cognitive flexibility, resistance to stress
10	Cognitive flexibility	Formation of ideas

The company's internal personnel management system should include a section for managing intellectual labor resources, which will adequately reflect the professional and personal characteristics of employees engaged in creative activities. The substantive specificity of the indicated section of personnel management of the

corporation is determined, first of all, by the degree of intellectualization of production processes, the role of intellectual resources in the overall effect of scale [5]. The section should include: recruitment of intellectual personnel, evaluation of their contribution to the efficiency of the company, methods of motivation for intellectual activity.

The company's intellectual staff are highly educated employees engaged in creative activities and absolutely adequate to the company's business technologies, the result of which is an intellectual product in the form of a technological or management solution. The source of replenishment of this personnel for the company is not the labor market, but investments in its training and development. Thus, recruitment of intellectual personnel is, firstly, the result of the organization of their internal corporate movement; secondly, the important strategic direction of the corporation's management as a whole.

We can talk about the effectiveness of personnel policy and its impact on the general state of the corporation if the following aspects of it are present in the organization:

- motivation system (certification, personalization of rewards for work, monitoring of the level of payment in the labor market);
- resource planning (an assessment of available labor resources is carried out; the future need for personnel and methods of finding candidates for vacant positions are determined; the results of past recruitment are evaluated);
- personnel selection and adaptation (assessment of the effectiveness of selection procedures and adaptation measures);
- personnel rotation (system of personnel monitoring, favorable social and psychological climate, internal communications, evaluation of the effectiveness of career planning methods).

3. Motivation of intellectual staff

In the scientific literature, a number of factors are cited under the influence of which work motivation is formed:

1. Internal factors, related and generated by labor activity. These include: the content of work, awareness of one's achievements, recognition of them by others, the desire for promotion and a sense of responsibility, self-realization in work.

2. External factors that are outside the scope of work. In particular, the policy and management methods of the higher organization, leadership style, working conditions, psychological climate, competence of the manager, social and monetary rewards, social and professional status.

When creating conditions and an appropriate environment for effective motivation of intellectual staff, managers of organizations should pay attention to the following components:

1. *Diagnostic of the problem.* It is necessary to make sure whether the unsatisfactory performance of the organization is really related to the problem of motivation. Such a problem exists when there is a discrepancy between expected and achieved results and when this discrepancy is caused by insufficient effort rather than low ability or capability.

2. *Understanding the nature of motivation.* First, it is necessary to understand the nature of the process of motivation of intellectual activity. For this, it is necessary to:

- set organizational goals that need to be achieved;
- understand the needs of knowledge specialists;
- identify organizational needs and the needs of the specialist, his expectations;
- choose the motivators that will be used. Satisfying the same need in two people may require completely different motivators.

In general, as practice shows, the biggest source of tension and frustration for creative specialists who possess knowledge is that the routine methods and policies of organizational management do not reflect an adequate understanding of their needs and expectations as professionals. Today, the most significant needs for the motivation of creative specialists are:

A *wide range of powers* that do not fit into formal rules, a high level of trust and freedom in making many decisions give

creative specialists the opportunity to use the results of their work through the implementation of innovations.

Responsibility. Research shows that work itself is a very powerful motivator. Creative workers need such work, which is considered "their own", where they make decisions, define criteria and bear responsibility for possible successes and failures.

Recognition. Achievement without recognition leads to disappointment. Recognition and reward should be both material and moral.

Success. To be well motivated, a creative professional must feel that his work is both important and meaningful, and that his contribution to the overall cause has real value. Success can be achieved even if there is no formal recognition. What is essential is success for the sake of success - pride in one's work and awareness of the significance of one's contribution to the common cause.

The listed needs are very important components of the motivational system and it is on them that managers should focus their attention. That is, the motivation system should stimulate creativity, professionalism, freedom of action more than just discipline and action.

3. *Selection of incentives for intellectual staff.* The effectiveness of incentives depends on such factors as the content of work; career stage; the type of stimulus used; salary level; formation and support of a creative environment open to new ideas; working with talented staff, etc. The main incentives include:

Increase in material reward. Creative specialists to a greater extent than other specialists evaluate a specific material reward. Salary is even more important than money itself. It is material evidence of how employees of mental labor are evaluated in the organization.

Participation in value creation. Earnings should directly depend on the value created by employees, that is, there should be individualization of wages. One of the most widespread systems for stimulating long-term results in global practice is the system of options, which provides for the provision of the right to purchase a corresponding number of shares in the future as a reward.

Learning. In a world of high technology, where people understand what it is like to master new knowledge or use it in new areas, learning is a strong incentive for creative specialists.

Reputation. Reputation is also a key driver in a professional career and any chance to improve it is a very strong motivation for a professional.

Promotion. Previously, career planning consisted mainly of planning an employee's promotion up the hierarchical ladder. The basis of the strategic planning of the career of employees is the optimization of the ratio of professional and hierarchical growth, in particular:

- provision of individual development of a specialist's career strategy;
- achieving the relationship between the goals of the organization and the needs and interests of an individual employee;
- formation of clear and unambiguous receptive criteria for official growth;
- studying the "career potential" of employees for a reasonable assessment and reduction of unrealistic expectations;
- determination of ways of professional growth of employees.

4. *Formation of a creative climate.* Effective management of creative people requires:

- hire people with creative potential;
- hire leaders who stimulate creativity;
- create a creative climate in the team with reasonable freedom, flexibility and autonomy;
- show trust in employees;
- ensure a high level of professionalism.

5. *Expansion of managerial competence of creative workers.* Development of management skills in intellectual staff due to a change in the current educational orientation.

6. *Creation of a positive motivational climate.* Motivational potential can be engaged directly through the setting of a task, where work should be seen as a challenge, and thus, worth the efforts of a creative individual.

4. *Involvement of intellectual personnel in the company*

Any manager should think about the level of involvement of his staff in the management of the corporation and its internal life. Engagement leads to the fact that employees talk about the company and recommend it as a good place to work (67%), advertise the company's products and services (78%) and rarely leave the company because they are offered higher pay elsewhere (4%) (according to research in Great Britain).

If we talk about the advantages for the company, which are provided by a high level of staff involvement, then the following can be noted:

- a higher level of customer loyalty to the company's products and services;
- 5-10% higher level of customer satisfaction;
- 10-20% higher profitability from working with clients;
- 3,800 USD per year more income per employee;
- lower costs for attracting and retaining talented employees;
- twice as many qualified applications for an open vacancy;
- as well as many other advantages compared to competitors.

The cost of lack of interest in involvement is also impressive. According to the Gallup company, based on an analysis of American companies, it costs the US economy 270-343 billion dollars in losses due to the low productivity of indifferent employees.

Research conducted by Hewitt Associates shows that among companies that show more than 10% growth in turnover, there are many more companies that pay the closest attention to the issue of employee engagement than among companies whose growth does not exceed the level of 10%. The level of staff involvement in growth leader companies is 20% higher on average.

Creating the conditions in which engagement can flourish requires five components:

- inspiring leadership;
- strong corporate culture;
- focusing on issues of talent development;
- a strong sense of responsibility;
- availability and implementation of HR policies and procedures corresponding to the company's goals.

Inspirational leadership. In companies characterized by a high level of employee involvement, senior managers are an example of commitment to their company and their people, not in words, but in deed. They devote a lot of their personal time, attention and energy to issues of communication with the company's employees. They hold meetings and interviews, personally welcome new hires, discuss the company's goals and objectives with employees.

Strong corporate culture. The development and strengthening of corporate culture is implemented through employees. Companies with a high level of employee engagement more carefully match the candidate's competency model with the company's competency model, thus obtaining a clearer fit of the hired employee with the values of the company's corporate culture.

Focusing on talent development issues. If the corporate culture helps to solve the issue of engagement, then the issue of revealing and developing the employee's talents depends on how effectively the relevant HR procedures are implemented, how attentively the managers, from the direct manager to the CEO, pay attention to it.

A strong sense of responsibility. A high level of involvement is characteristic of companies that do a lot to make employees feel their personal contribution, their personal responsibility for achieving success both personally and for the company as a whole.

Availability and implementation of HR policies and procedures appropriate to the company's goals. The fact that consultants have developed a model of competencies for the company, written provisions on the personnel reserve or calculated the return on investment in the training of sales representatives or personnel reserve, in fact, nothing changes in the company. Changes happen when the company understands why it is doing all this.

5. Conclusions

Studying the preliminary results of Industry 4.0, which is spreading around the world, allowed us to draw certain conclusions:

1. This revolution is unique in terms of pace, dimension and systematic transformations.
2. It was driven by digitization and the creation of networks.
3. Today, the limitations of science are more legal and ethical than engineering.
4. Thanks to the effect of the information platform, values can be concentrated in a small number of people.
5. Automation forces people to change professions, increases inequality and can even create tension in society.
6. Lethal technologies will become more accessible.

However, optimists believe that humanity can influence the course of this revolution so that everyone benefits.

Therefore, the difference between traditional work and intellectual activity requires a full theoretical study and a detailed consideration of the essence and content of the latter, an analysis of its structure. Of particular interest is the consideration of the category of intellectual activity in the light of an interdisciplinary approach.

The main elements of the personnel policy of intellectual personnel management are: selection and hiring, motivation and organization of work, career growth planning.

6. References

1. Schwab K. (2017). *The Fourth industrial revolution*: K. Schwab. M.: Publishing House "E". 208 p.
2. Aaker David A. (2010). *Strategic Market Management: Global Perspectives* / David A. Aaker, Damien Mc. Loughlin. New York: John Wiley and Sons, Ltd, 368 p.
3. Zhavoronkova G. (2018) a. *Design methodology management systems knowledge of business processes in manufacturing* / G. Zhavoronkova, L. Melnyk. "Innovations" Vol. 3. P. 98-101.
4. World Bank. *The Future of Jobs, Employment, Skills and Workforce Strategy for the Fourth of Industrial Revolution*, 2018. URL: http://www.3weforum.org/docs/WEF_FOJ_Executive
5. Zhavoronkova G. (2021). *Innovative business development and the startup ecosystem in the era of the fourth industrial revolution* / G. Zhavoronkova, V. Zhavoronkov, V. Nagieva. "Science. Business. Society". Vol.1 P. 31-34.