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**Development of Criteria for Personnel Assessment in High-Tech Production Accounting
for The Development of Digital Technology**

Desarrollo de criterios para la evaluación de personal en la contabilidad de producción de alta tecnología para el desarrollo de tecnología digital

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Resumen

Las industrias de alta tecnología, que están reemplazando cada vez más las tecnologías tradicionales en la producción moderna, se centran en una alta proporción de nuevos conocimientos en el producto final. Recientemente, la terminología Industria 4.0 se ha utilizado cada vez con más frecuencia. Su característica distintiva radica en la interconexión de los sistemas ciberfísicos y su interacción en un solo espacio de información para garantizar la eficiencia de la producción, siendo su vínculo clave los modelos matemáticos de objetos capaces de interactuar entre sí en el espacio de la red. El artículo describe los enfoques implementados en el desarrollo de criterios para la evaluación del personal en el campo de la producción de alta tecnología necesarios para lograr resultados altamente efectivos en esta área.

Palabras clave: Producción de alta tecnología, Criterios de evaluación, Tecnología digital, Personal.

Abstract

High-tech industries, which are increasingly replacing traditional technologies in modern production, are focused on a high proportion of new knowledge in the final product. Recently, the terminology Industry 4.0 has been used increasingly often. Its distinctive feature lies in the networking of cyber-physical systems and their interaction in a single information space to ensure production efficiency, with their key link being mathematical models of objects capable of interacting with each other in the network space. The article outlines the approaches implemented in the development of criteria for personnel assessment in the field of high-tech production necessary to achieve highly effective results in this area.

Keywords: High-Tech Production, Evaluation Criteria, Digital Technology, Personnel.

Introduction

New technological processes are inextricably linked with the quality of technological preparation of production and the requirements to it stemming from the general policy and objectives of the customer, developer, and manufacturer in the sphere of ensuring the quality of products during their development and production, considering the requirements of ISO 9000. The aforementioned is unattainable without altering the content of labor and changing the structure and, most importantly, requirements for production personnel (Shkliaruk, Garkusha, 2020; Zaitsev et al., 2018; GOST R 50995.3.1-96, July 7, 1997).

In a general sense, these changes are associated with the quite intense implementation of rapidly changing knowledge, the involvement of an individual's intelligence and creative abilities in routine tasks.

In this regard, special importance is attributed to training in the sphere of digital technology, which is being intensively embedded in the modern production and economic sphere as a whole. The digital transformation of the economy and public administration of the Russian Federation is an urgent challenge and an ambitious task, which requires attracting, developing, and retaining professionals in the public sector of the economy. At the same time, in the era of digitalization, competition for highly qualified personnel is intensifying, which is most noticeable in such areas as the development of high-tech solutions, the creation of digital services, data-based management, etc. As part of the implementation of Presidential Decree № 204 of May 7, 2018 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024", including to ensure accelerated implementation of digital technology in the economy and the social sphere, based on the program "Digital Economy of the Russian Federation" the Government of the Russian Federation has developed the national program "Digital Economy of the Russian Federation" approved by the protocol of the meeting of the Presidium of the Presidential Council for Strategic Development and National Projects № 7 (June 4, 2019).

High-tech industries focus on a high share of new knowledge in the final product. This is impossible without changing the content of labor and altering the structure and requirements for the workforce. Undoubtedly, modern personnel must understand the specifics of high-tech production and have the knowledge and skills necessary to ensure its effective functioning.

Several laws and documents on the prospects for the development of the Russian education system have been approved, in particular, the “Strategy for the Development of the National Qualifications System of the Russian Federation until 2030”, which notes that Russia’s accession to the group of the world’s largest economies, the creation of high-tech enterprises in the fundamental industries, the digitalization of the national economy, and the need for mass implementation of technological innovations place new demands on the country’s human resource potential. It is impossible to increase labor productivity and ensure high rates of economic growth without changing the quality of personnel in accordance with the modern demands of high-tech production (National Council for Professional Qualifications under the President of the Russian Federation (protocol № 51), March 12, 2021).

In the system of the modern economy, the personnel becomes not just the main productive force, but a source for ensuring the priority development of high technology. The transition from an industrial society to an “innovation” society is due to several qualitative changes in the development of society itself (Machavariani, 2012; Eskindarova, Silvestrova, 2017; Korchagin, 2020; Mindeli, Chernykh, 2016; Svirina, 2012; Rutkauskas, 2018). In brief, the results of this process can be summarized as follows:

- the population is characterized by a high quality of life;
- the “labor” factor is transformed into human capital – these are professionals with high competence and creative and scientific potential;
- the economy is dominated by the innovation sector with a highly productive industry, the industry of knowledge, and a high share of high quality and innovative services in GDP;
- the economy is gradually reducing its growth rate and enhancing qualitative, innovative changes;

- competition pervades all economic and other activities;
- global crises, being cyclical, are exacerbated.

The problem of the quality of training workers for high-tech production in contemporary Russia is acute and requires urgent measures to resolve it. Highly qualified specialists are in demand by employers in all sectors of the economy. The training of professional staff, especially in the field of production, is one of the key elements of economic growth in the near future.

Materials and Methods

Approaches to personnel assessment in the process of work

The goal set for the developed program for the assessment of enterprise employees is to identify the degree of compliance of an employee's personal qualities and the quantitative and qualitative results of their activity with certain requirements imposed by job duties, the nature and content of work, as well as the requirements stemming from the effective organization of production and the use of the most rational methods of work and technical means (Zainetdinova, 2016).

We distinguish the following levels of business assessment of personnel:

- continuous assessment – in the form of management control;
- periodic assessment – in the form of attestation or certification;
- strategic assessment – in the form of monitoring of production behavior and organizational culture. Strategic assessment allows predicting the state of human resources and scenarios for the development of the company.

Next, we have developed personnel assessment criteria. By personnel assessment criteria we refer to the key parameters (business, behavioral, and personal indicators and characteristics) by which the performance of an employee is evaluated.

The assessment criteria allow us to determine how each function and each action should be performed to meet the company and customer requirements.

The developed criteria are analyzed for compliance with certain requirements. We proceed from the assumption that the criteria should:

- a) be attainable, which is necessary for the work to be performed;
- b) be objective and reasonable and not depend on who is meeting them (that is, they need to be developed for a specific position and not a specific person);
- c) inform the employee about the specific actions and results that are expected from them;
- d) correspond to the content of work;
- e) motivate the employee to achieve better results;
- f) correspond to the organization's goals;
- g) be understandable and linked with the key characteristics of working behavior and/or the most important results of work;
- h) be dynamic, i.e. they need to develop and adapt to the changes occurring in the organization.

The assessment criteria can be developed by the supervisor and HR specialist or in collaboration with the employees who perform the job in question. Collaborative development of criteria by the immediate supervisor together with the employees has certain advantages:

- the criteria will be understandable for both the supervisor and the employees,
- the criteria will better correspond to the peculiarities of the given work,
- the criteria will account for the conditions and content of work and be accepted by the personnel.

However, it needs to be considered that the final decision is made by the supervisor after a discussion of the developed criteria with senior management and human resources specialists. Shared recognition and awareness of the evaluation criteria are crucial, which is why before the meeting each participant should be explained what the evaluation criteria

are, why they are important, and how they will be used in the employee performance assessment process.

Result and discussion

To determine the assessment criteria, an analysis of the regulatory and legal framework for evaluating the professional performance of staff is conducted (Table 1) (Presidium of the Presidential Council of the Russian Federation for Strategic Development and National Projects № 7, June 4, 2019; Order of the Ministry of Labor and Social Protection of the Russian Federation № 691, October 6, 2015; Order of the Ministry of Labor and Social Protection of the Russian Federation № 635n, September 22, 2020; GOST P ISO 9004-2019, 2019; GOST R ISO 9001-2015, 2015; GOST R 56937-2016, May 31, 2016; ISO 10015:2019, 2019; ISO 10018:2020, 2020).

(Table 1): Personnel requirements and recommendations

Normative documents	Requirements for personnel
National Program “Digital Economy of the Russian Federation”, approved by the Presidium of the Presidential Council of the Russian Federation for Strategic Development and National Projects on June 4, 2019, № 7.	The National Program “Digital Economy of the Russian Federation” includes the following federal projects approved by the protocol of the meeting of the Presidium of the Government Commission on digital development and the use of information technology to improve the quality of life and the business environment of May 28, 2019, № 9: “Normative regulation of the digital environment”; “Human Resources for the Digital Economy”; “Information Infrastructure”; “Information Security”.
Professional Standard № 559 “Human Resources Specialist”, approved by Order of the Ministry of	The Standard contains eight generalized labor functions, each of which is associated with a specific area of practice: 3.1 – documentation of work with personnel; 3.2 – activities to provide the employer with personnel;

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<p>Labor and Social Protection of the Russian Federation of October 6, 2015. № 691</p>	<p>3.3 – personnel assessment and certification; 3.4 – personnel development activities; 3.5 – organization of labor and personnel remuneration; 3.6 – organization of corporate social policy; 3.7 – operational management of personnel and the organization’s subdivision; 3.8 – strategic management of the organization’s personnel.</p>
<p>Professional Standard № 1367 “Specialist in the standardization of innovative products of nanoindustry”, approved by Order of the Ministry of Labor and Social Protection of the Russian Federation of September 22, 2020, № 635n.</p>	<p>The Standard establishes regulatory support for the production, introduction, and marketing of innovative products of the nanotechnology industry and the related high-tech industries. It describes the labor functions of specialists in the standardization of innovative nanoindustry products. The Standard also determines the purpose of the type of professional activity, normative support for the production, introduction, and marketing of innovative products of the nanoindustry and the related high-tech industries.</p>
<p>GOST R ISO 9004-2019 “Management for the sustainable success of an organization. The quality management approach”</p>	<p>In paragraph 6.3, the standard defines: - requirements for personnel assessment; - the processes enabling the growth and development of personnel at the enterprise; - the level of professional and personal competence of the employees, the maintenance of the achieved level; - personnel motivation, constant analysis of the level of satisfaction and the needs and expectations of personnel.</p>
<p>GOST R ISO 9001-2015 “Quality management systems. Requirements.”</p>	<p>Paragraph 7.1.6 states: “The organization must identify the knowledge necessary for the operation of its processes and for achieving product and service conformity.” In paragraph 7.2, the standard defines and ensures the necessary competence of personnel and requires that this information is documented.</p>

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	<p>In paragraph 7.3, the standard requires ensuring that the organization employees are aware of:</p> <ul style="list-style-type: none"> a) the quality policy; b) objectives in the sphere of quality; c) their contribution to the effectiveness of the quality management system, including the benefits of improved performance; d) the consequences of non-compliance with the quality management system.
<p>GOST R 56937-2016 “Conformity assessment. Rules for voluntary certification of personnel”</p>	<p>Certification allows candidates to:</p> <ul style="list-style-type: none"> - establish the existing degree of qualification; - confirm compliance with the provisions of a highly specialized standard; - compete more effectively in the labor market; - stimulate their employability and increase wage demands; - ensure their emotional and psychological comfort; - increase their self-confidence and self-esteem; - determine the near-term strategy and the paths of professional development; - conclude an employment contract on more favorable terms; - protect themselves from unscrupulous employers.
<p>ISO 10015:2019 Quality management. Guidelines for competency management and personnel development.</p>	<p>The standard provides practical guidelines for managers and supervisors to follow as well as implement and monitor.</p> <p>This document provides recommendations for organizations on establishing, implementing, maintaining, and improving competency management and staff development systems to positively impact the outcomes related to product and service compliance and the needs and expectations of relevant stakeholders.</p> <p>This document applies to organizations of any type or size.</p>

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<p>ISO 10018:2020 Quality management. A guide to employee engagement.</p>	<p>The standard specifies the basis for increasing the involvement and competence of people in the organization and helps them feel part of the whole, as well as provides information about the difficulties of attracting staff to implement a quality management system and understanding how it is relevant to the daily work. Focusing on better integration of interaction strategies, the standard provides a framework for increasing the engagement and competencies of employees in the organization, helping them feel part of a single whole.</p> <p>The document applies to any organization, regardless of its size, type, or type of activity. Being aimed at explaining the principles of quality management and communicating them to personnel, the standard is intended to be referred to regularly.</p>
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Considering the specific features of high-tech production, competencies and groups of requirements for personnel in this area are developed (Table 2).

(Table 2): Requirements for personnel in high-tech production

Group of personnel requirements	Requirements for personnel in high-tech production
<p>Professional competencies</p>	<p>1) Having a level of basic education of the staff, its correspondence to the tasks at hand.</p>
	<p>2) Provision of training as part of the corporate education system.</p>
	<p>3) Having knowledge in the subject area of innovative technologies.</p>
	<p>4) Having knowledge in the areas related to innovative technologies.</p>
	<p>5) Having mastery of the modern regulatory and methodological base in the field of high-tech production.</p>
	<p>6) Improving professional knowledge (systematically improving qualifications based on updating professional knowledge).</p>

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	7) Being aware of the quality policy, the requirements of the organization's quality management system, and the consequences of non-compliance with these requirements.
Digital competencies	1) Having the skills of working with personal computer equipment, with the file system, and applied programs.
	2) Having the skills of working with graphic and spreadsheet editors for viewing and archiving design and technological documentation.
	3) Being able to do a quick search on the Internet, work with different browsers.
	4) Knowing how to create design and technological documentation using computer-aided design systems.
	5) Mastery of the methods of constructing mathematical and computer models of technical objects, making the necessary calculations.
Business competencies	1) Having management and organization skills.
	2) Having teamwork skills.
	3) Being able to solve challenging tasks.
	4) Being creative
	5) Increasing the volume and quality of the work performed.
	6) Being disciplined.
Personal competencies	1) Being communicative.
	2) Being responsible.

To ensure the stable and effective functioning of high-tech production, the criteria for evaluation of personnel for high-tech production are developed based on the regulatory framework with the personnel requirements and considering the specifics of high-tech production, as well as the specific requirements to the personnel of high-tech production (Table 3).

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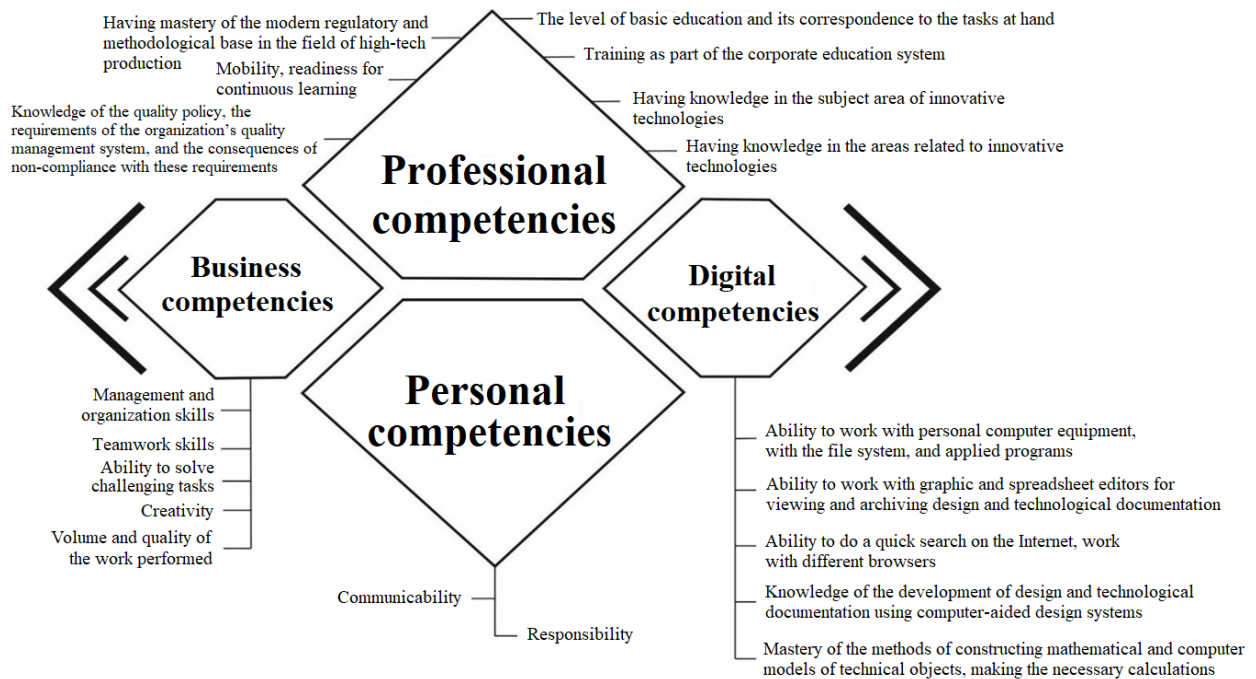
(Table 3): Criteria for the assessment of high-tech production personnel

Group of personnel assessment criteria	Personnel assessment criteria
Professional competencies	1) The level of basic education and its correspondence to the tasks at hand.
	2) Training as part of the corporate education system
	3) Having knowledge in the subject area of innovative technologies.
	4) Having knowledge in the areas related to innovative technologies.
	5) Having mastery of the modern regulatory and methodological base in the field of high-tech production.
	6) Mobility, readiness for continuous learning.
	7) Knowledge of the quality policy, the requirements of the organization's quality management system, and the consequences of non-compliance with these requirements.
Digital competencies	1) Ability to work with personal computer equipment, with the file system, and applied programs.
	2) Ability to work with graphic and spreadsheet editors for viewing and archiving design and technological documentation
	3) Ability to do a quick search on the Internet, work with different browsers.
	4) Knowledge of the development of design and technological documentation using computer-aided design systems.
	5) Mastery of the methods of constructing mathematical and computer models of technical objects, making the necessary calculations.
Business competencies	1) Management and organization skills.
	2) Teamwork skills.
	3) Ability to solve challenging tasks.
	4) Volume and quality of the work performed.

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	5) Creativity.
	6) Discipline.
Personal competencies	1) Communicability.
	2) Responsibility.

The results of the conducted research are summarized in a model of competencies of high-tech production personnel presented in Figure 1.



(Figure 1): Model of competencies of high-tech production personnel

Discussion

Herein, we will proceed with a closer examination of the personnel assessment criteria and the methods of their implementation.

1. Professional competencies

1.1 The level of basic education of the staff and its correspondence to the tasks at hand.

This criterion requires a higher level of professional training of staff, including the presence of specialized education, as well as well-planned and well-organized training of staff, which, in turn, is designed to convey to employees information about the current state of affairs in the company and help develop their understanding of the prospects for

the organization and the main directions of its strategy, increase the level of labor motivation.

1.2 Training as part of the corporate education system.

Implementation of corporate training programs for personnel allows supporting the level of employees' competence necessary to ensure the competitiveness of the educational organization in the market of goods and services, as well as to train specialists in advance, focusing on changes in the external environment. As the purposes and missions of corporations differ in content and the degree of ambition and aggressiveness, so do the educational tasks and, hence, the methods of their achievement can also greatly vary.

1.3 Having knowledge in the subject area of innovative technologies.

Novelties, or innovations, are characteristic of any professional human activity and, therefore, naturally become a subject of study, analysis, and implementation. Innovations do not arise by themselves, they are the result of scientific research, the experience of entire teams. This process cannot be spontaneous, it needs to be managed. That is why there is a great interest in the topic of introduction and application of innovative technologies in the process of personnel training and obtaining high results from their use.

1.4 Having knowledge in the areas related to innovative technologies.

Modern scientific branches typically develop at the intersections of different sciences, combining knowledge from different scientific fields. Therefore, it is vital to not only have "narrow" knowledge in a particular field but also understand its interrelation with the related fields that expand the prospects for the development of a particular innovative technology.

1.5 Mastery of the modern regulatory and methodological base in the field of high-tech production.

To work effectively in high-tech production, personnel need to know the regulatory framework in this area. This will allow them to quickly navigate the standardized requirements for equipment and its management, as well as allow them to perform their duties effectively.

1.6 Mobility, readiness for continuous learning.

To enhance their competitiveness in the labor market, a professional of any level and specialization must be constantly advancing their theoretical knowledge, obtaining new

skills, and perfecting the already acquired ones. The labor market dictates strict requirements to the present reality. Human resources are known to be the backbone of the economy. The more competent and professional specialists are, the more efficient is the production, and the better the entire organizational structure works.

1.7 Knowledge of the quality policy, the requirements of the organization's quality management system, and the consequences of non-compliance with these requirements. Persons performing work under the management of the organization should be aware of the company's quality policy, the corresponding quality objectives, their contribution to the performance of the quality management system, including the benefits of improved performance, and the consequences of non-compliance with the quality management system. Awareness is achieved when employees understand their responsibilities and how their actions contribute to the organization's goals.

2. Digital competencies

2.1 Ability to work with personal computer equipment, with the file system, and applied programs.

This criterion implies the presence of such knowledge and skills as the ability to use basic MS Office programs (Access, Word, WordPad, etc.) and programs for sending and receiving e-mail, such as Outlook Express.

2.2 Ability to work with graphic and spreadsheet editors for viewing and archiving design and technological documentation.

This criterion assumes knowledge and skills of using Excel, Powerpoint, and other programs.

2.3 Ability to do a quick search on the Internet, work with different browsers.

There is a need for skills in working with different browsers to carry out a quick search for the necessary information: Opera Firefox, Chrome, Amigo, Internet Explorer.

2.4 Knowledge of the development of design and technological documentation using computer-aided design systems.

To the aforementioned systems belong the ones under the general title of CAD-systems, namely AutoCAD, which is the basic and most common system of computer-aided design allowing to design in two-dimensional and three-dimensional environment; Autodesk Inventor, a professional complex for the three-dimensional design of industrial products

and production documentation; SolidEdge, a system for three-dimensional modeling of engineering products; Compass-3D, a system of parametric modeling of parts and assemblies used in mechanical engineering, instrument making, and construction; T-Flex, a system for the parametrization of parts and assemblies; RTS Creo – a 2D and 3D parametric design system for large assemblies in aircraft construction, shipbuilding, etc.

2.5 Mastery of the methods of constructing mathematical and computer models of technical objects, making the necessary calculations.

Modeling allows investigating the essence of complex processes based on a model and to study the properties and parameters of a future product or a technological process at the earliest stages of development.

3. Business competencies

3.1 Management and organizational skills.

The presence of such skills implies the mastery of modern analytical tools of management, the methods of diagnosis, analysis, and problem-solving, as well as the methods of decision-making and the implementation of decisions in practice. In addition, it refers to the ability to carry out the distribution of powers and responsibilities based on delegation, as well as the mastery of the skills of organizing one's work and the work of other executors of managerial decisions within one's competence.

3.2 Teamwork skills.

The specifics of high-tech production presuppose involvement in the company's business and collaborative work with people working in different positions and different spheres. In this, of great importance is openness for communication, including online, on social media, via e-mail, and personal contacts; the ability to listen; the ability to convince and influence one's colleagues; the ability to convey information without losses; the ability to collaborate, cooperate, constructively overcome disagreements, harness the potential of the group, and achieve collective results.

3.3 Ability to solve challenging tasks.

More than half (60%) of employers value in their subordinates the ability to solve complex problems and put this competence at the first place in importance. The skills of solving complex problems have always been valued in employees because they are most often possessed by people who are endowed with an analytical mind and, at the same

time, have extensive practical experience. Such employees are also creative and demonstrate unconventional approaches to finding answers.

3.4 Volume and quality of the work performed.

The specific nature of high-tech industries and the prospects for their development requires professional knowledge in the field of innovative technologies, which is associated with constantly increasing requirements for the quality of products. In view of this, it is necessary to form the intent of the personnel in this area to constantly improve the quality of the products produced with a constant increase in their quantity.

3.5 Creativity.

A person's ability to make creative decisions and understand, accept, and create fundamentally new ideas is highly important.

In daily life, creative abilities manifest as ingenuity – the ability to achieve a goal and find a way out of a seemingly hopeless situation by using the environment, objects, and circumstances in an unusual way. In a broad sense, it means a non-trivial and ingenious solution to a problem, usually with non-specialized tools or resources. It also refers to the ability to develop bold, unconventional solutions to problems.

3.6 Discipline.

An employee's discipline shows itself in their disciplined behavior, both at work and in everyday life, in the performance of official duties, in their attitude to requirements and superiors, that is, "in productive actions in strict compliance with the requirements of statutes, orders, and instructions of superiors". Disciplined behavior implies, first of all, the achievement of the set goals with constant volitional self-regulation ensuring the concrete use of the necessary objects, processes, and situations.

4. *Personal competencies*

4.1 Communicability

The ability to communicate is a valuable skill ensuring the high quality of relationships not only between close people but also with colleagues. A communicative person can make a public speech without preparation. It is a person able to not only win the attention of the audience but also control it. Leadership, temperance, and flexibility of character are the natural traits of such a person. The concept in question also implies the ability to make connections and establish contacts, as well as the ability to listen. These skills are

especially important for all kinds of managers: account manager, sales manager, public relations manager. Their success depends on the ability to make people talk to you, as well as the literacy of speech. The ability to find common ground, quickly change the line of behavior, and tune in to the same frequency with completely different people is part of the professional competence of these specialists.

4.2 Responsibility

This criterion is extremely important for employees. Its benefit comes from the fact that a responsible employee will do their best to fulfill the commitments they have made. At the same time, a responsible person will not undertake those obligations with which they assume they may not be able to cope. In turn, if they promise to perform the task, they make maximum efforts to achieve it: conduct preliminary analysis and minimize possible risks, search for the necessary resources, and take active action when facing difficulties.

Conclusion

Based on the conducted analysis of requirements for personnel and the specifics of high-tech production and considering the requirements of mastery of digital technology, criteria for the assessment of personnel in high-tech production are developed and described in detail. The proposed criteria provide the opportunity to account for the peculiarities of high-tech production and form the workforce correctly to meet the modern production requirements.

The key aspect in developing criteria for a specific company is bearing in mind the connection of the company's strategy with the goals and planned results of specific departments and each employee. Thus, the development has to be based on the analysis of the company's strategic plan, business processes, standards and regulations of work, and other types of regulatory documents.

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