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RESOURCE-EFFECTIVENESS EVALUATION IN QUALITY METERING AND COMPETENCE MANAGEMENT OF YOUNG SPECIALIST SELECTION

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Abstract

The purpose of this work consists in the presentation of theoretical investigation results with regard to the problem of the management in young specialist selection for filling vacant seats under conditions of modern engineering industry on the basis of a quality metering and competence approach by means of the development of an index system of effectiveness in the realization of this process.
Investigation results. The systems of analytical indices of realization efficiency are developed: a) in the process of a purposeful selection of young specialists for filling engineering seats in the system of quality management (SQM) of enterprises; b) in processes of designing and realization of basic educational programs and a process for the university SQM graduates support in the job placement. The systems are grouped into three sub-systems: absolute indices, relative indices and social-professional indices.
Conclusions. The introduction of the model of quality metering – competence management in young specialist qualitative selection for filling vacant seats at enterprises allows reducing the non-correspondence level of the professional competences system of young specialists and official requirements to their competence under conditions of production; reducing working time and amount of financing for retraining young specialists in accordance with the requirements to the competence of personnel carrying out work affecting the correspondence to the requirements to products quality of the standard of ISO 9001.

Key words: Personnel quality metering; competence; young specialist; personnel selection; quality management; resource-effective technology.

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Corresponding Author: A. Morozova
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1. Introduction

One of the urgent problems discussed actively in current scientific literature is a multi-dimensional problem of staff resources effective use under conditions of modern industry. On the one hand, specialists' competence evaluation is necessary (Chamorro-Premuzic, & Furnham, 2014; Lester, 2014) and also the development of such a procedure for filling vacant engineering seats is needed at which there would be maximum used worker's competence potentiality (Sandberg, & Pinnington, 2009; Willis, & Dubin, 1990). At that the account of the specificity of the system formation just with regard to engineering competences has priority (Aleksandrov, & Devisilov, 2013; Baine, 2015). On the other hand, the process of the potential formation of young specialist professional competences is realized at university and just because of this reason a university is responsible to its customers (enterprises) (Kugytė, & Šliburytė, 2015; Yeremeyeva, 2016) for their quality, completeness and a system (Sergeev, 2015; Walther, 2011). Besides, it should be taken into account also an experience available in the evaluation of the efficiency in the matter of the application of management technologies oriented to the increase of production resource-effectiveness as a category of universal quality (Bonato, & Quartieri, 1999; Roelich, 2015; Ruževičius, 2010; Savall, & Zardet, 2011).

The problem of quality increase in young specialist selection for modern industry in general consists in the realization of such a conceptual model in which there is established an effective correlation of an enterprise (personnel consumer carrying out personnel selection on the competence basis), the university system (a provider of personnel of a certain area) and the centers for evaluation and certification of personnel (independent experts on the evaluation of personnel quality). Within the bounds of such a model the basic vectors of a management process are specified.

1.1. Research methods

In the work there are used methods of a system and structural analysis, the theory of complex systems, the methodology of the universal quality management (UQM), a process approach in accordance with the standard of ISO 9001.

1.2. Research objective

The purpose of the investigation is the increase of resource-effectiveness in mechanical engineering by means of the introduction of the system for quality management in a quality metering selection of young specialists for filling vacant seats.

2. Results

2.1. General concept of quality metering competence management in young specialist selection for filling vacant seats at enterprises as resource-effective technology

One of the promising ways to solve the problem of an effective involvement of young specialists as a personnel resource of an enterprise in labor activity is the realization of a conceptual model of the project integration in the form of the system of a strategic partnership of the quality management system (QMS) at an enterprise with universities, providers of technical and engineering employees and also with the centers of personnel evaluation and certification. Its purpose is the support and assurance of enterprise competitiveness increase and that of the industrial production quality by means of a quality management

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in the matter of young specialist selection for filling engineering positions based on the evaluation of individual levels in the system formation of their social-professional competences. Such a model is considered thoroughly in the work by Morozova & Kirichek (2015).

The methodological basis showing the realization specificity of the procedure of young specialist social-professional competences evaluation is many-sided, hence, it may be investigated from the positions of different sciences and different approaches to modeling. On the one hand, it supposes the investigation of the complex of scientific approaches investigating a psychological-educational and social-economic essence of young specialist's competence and competitiveness. On the other hand, taking into account a priority position of the QMS of an enterprise in the realization of this procedure the application of the quality metering approach in the system development of models with the aid of which is carried out a quality metering typification of specialists on the basis of the examination with the use of a neural network which afterwards forms a possibility to carry out their identification with a certain type of an engineering-technical employee is substantiated.

More over both the process itself of a young specialist selection at filling engineering seats of an enterprise and the model of its development require the application of the methods of a prognosticating character at the formation, for instance, a specialist model essential for industry which within the bounds of the project integration with universities is manifested in the educational programs of young specialist training. At the same time the increased level of industry requirements to the level of the formation of young specialist professional competence is designed to facilitate the modernization of college QMS processes by means of the introduction of new methods of an efficiency analysis and the effectiveness of the scientific-educational process oriented to a competence model.

Finally, the formation of the interaction system of QMS processes both of an enterprise and a college is carried out mainly on the basis of the purposeful quality metering management of a young specialist selection process at filling engineering seats at the QMS system-forming priority of an engineering enterprise. That is why a systematic study of the interaction of efficiency values of this process and the values of a unified system of industrial produce quality is necessary. It allows considering the quality metering and competence quality management in the selection of young specialists for filling vacant seats at industrial enterprises as an urgent resource-effective technology.

2.2. Design of quality metering and competence management in selection of young specialists (YS) for filling engineering positions (EP) based on Deming cycle (PDCA)

The development and introduction of the strategic partnership system integrated in the QMS of an engineering enterprise and universities and colleges (providers of engineering employees for the personnel) and the centers of the evaluation and certification of the staff is carried out on the basis of a number of Russian engineering enterprises carrying out manufacturing high-tech products for a long period of time with the use of the methodology of a system integration and realized in an inter-project mode. At the same time the activity on the formation and realization of the project was structured and contained some components.

The author has developed a general model of the quality metering management system (Fig.1) and the technology of the adaptive quality metering and competence typification of engineering personnel based on the application of the methodology of bisubject quality metering evaluation of objects of arbitrary nature (Morozova, & Kirichek, 2015).

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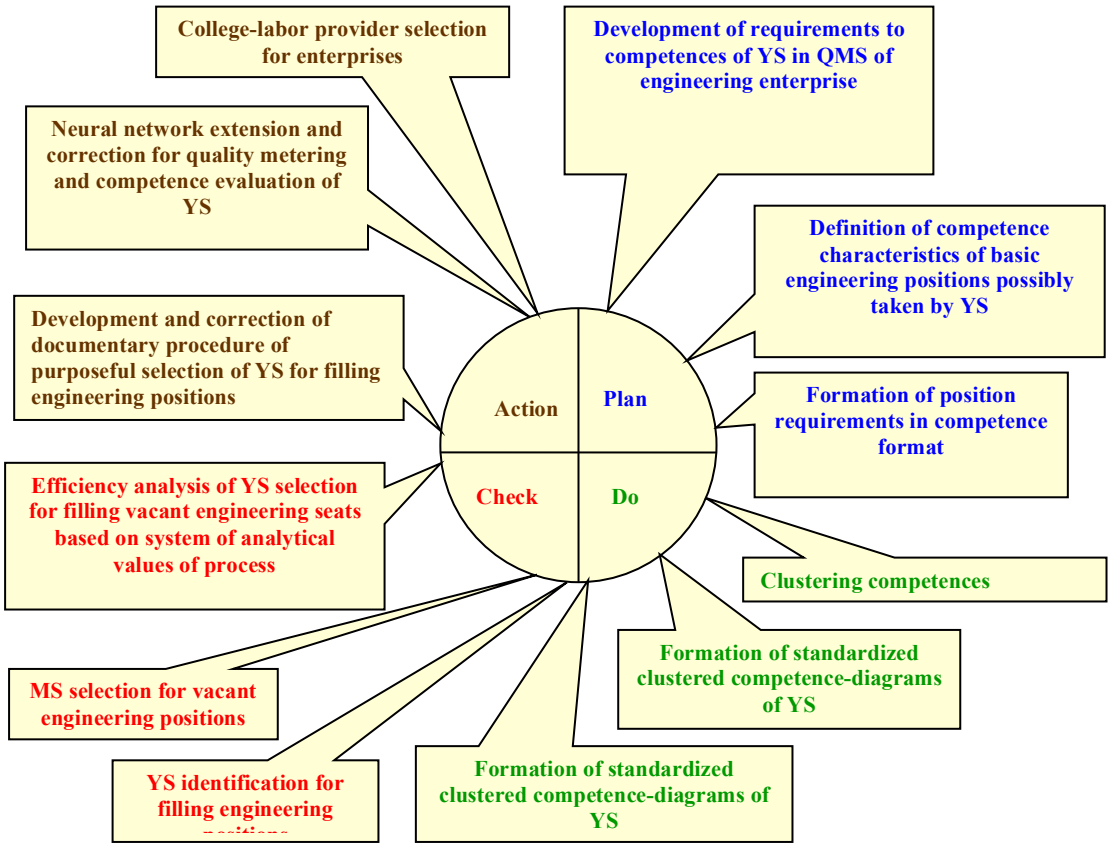

Fig. 1. A general model – Deming Cycle (PDCA) at the realization of quality metering and competence management in young specialist (YS) selection for filling engineering positions (EP).

2.3. Efficiency evaluation in young specialist selection for vacant seats under conditions of modern production

The efficiency in the realization of the model of quality metering and competence management at young specialist selection for filling engineering positions at an enterprise may be estimated by means of the author's developed systems of analytical values of personnel resource-efficiency (for an enterprise and for university):

а) of the process of the purposeful young specialist selection for filling engineering positions in the QMS of an engineering enterprise (Table 1.);

б) of the process of designing basic educational programs and the process of the assistance in the matter of job placement of the graduates of universities with the QMS (Table 2).

Table 1. The system of analytical indices in the efficiency of the realization of a purposeful young specialist selection process for filling engineering positions in the integrated QMS of an engineering enterprise.

№	General formula for computation	Index name
1	2	3
Absolute indices		
1	m_{Σ}	Total amount of vacant seats for technical and engineering employees (TEE) of an enterprise for a certain period which may be taken up by young specialists in accordance with position requirements
2	m	Total number of young specialists employed at vacant engineering seats of an enterprise for a certain period

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3	p^{n}	Total number of young specialists, graduates of p -th college employed at vacant engineering seats of an enterprise for a certain period
4	${}_{p}n_{I}^{w}$	Number of young specialists, graduates of p -th college employed at vacant engineering seats for a certain period having a high (w) level of the formation of maximum (I) competence cluster
5	${}_{p}n_{I}^{v}$	Number of young specialists, graduates of p -th college employed at vacant engineering seats of an enterprise for a certain period and having an increased (v) level of the formation of maximum (I) competence cluster
6	${}_{p}n_{I}^{w+v}={}_{p}n_{I}^{w}+{}_{p}n_{I}^{v}$	Number of young specialists, graduates of p -th college employed at vacant engineering seats for a certain period exceeding a threshold ($w+v$) level of the formation of maximum (I) competence cluster
7	m_0	Number of young specialists employed at vacant engineering seats of an enterprise for a certain period and their educational level corresponds to the required educational level of the position occupied
8	m_0^{+}	Number of young specialists employed at vacant engineering seats of an enterprise for a certain period with their educational level below the required one for the position occupied
9	m_0^{-}	Number of young specialists employed at vacant engineering seats of an enterprise for a certain period with their educational level higher of that required for the position occupied
10	T_i	Level of the formation of i -th competence cluster of a graduate
11	$Z_j=\frac{\sum_{i=1}^{6}T_i}{6}$	Personal level of the professional competence formation of j -th graduate
12	$\overline{Z_m}=\frac{\sum_{j=1}^{m}Z_j}{m}$	Average level of the professional competence formation of young specialists employed at vacant engineering seats for a certain period
13	${}_{p}\overline{Z_m}=\frac{\sum_{j=1}^{m}{}_{p}Z_j}{m}$	Average level of the professional competence formation of young specialists, graduates of p -th college and employed at vacant engineering seats of an enterprise for a certain period
14	$\overline{Z_t}=\frac{\sum_{j=1}^{m}Z_t}{m}$	Average level of the professional competence formation for all vacant engineering seats occupied by young specialists at an enterprise for a certain period

Relative indices

15	$p^{k}=\frac{p^{n}}{m}$	Part of graduates of p -th college of the total number of young specialists employed at the vacant engineering seats of an enterprise for a certain period
16	${}_{p}k^{w}=\frac{{}_{p}n_{I}^{w}}{m}$	Part of young specialists, graduates of p -th college of the total number of young specialists employed at the vacant engineering seats with their high (w) level of the formation of a maximum (I) competence cluster
17	${}_{p}k^{v}=\frac{{}_{p}n_{I}^{v}}{m}$	Part of young specialists, graduates of p -th college of the total number of young specialists employed at vacant engineering seats of an enterprise for a certain period with their increased (v) level of the formation of a maximum (I) competence cluster
18	${}_{p}k^{v+w}={}_{p}k^{v}+{}_{p}k^{w}$	Part of young specialists, graduates of p -th college of the total number of young specialists employed at vacant engineering seats of an enterprise for a certain period exceeding a threshold ($v+w$) level of the formation of a maximum (I) competence cluster
19	$k_m=\frac{m_0}{m}$	Part of young specialists employed at vacant engineering seats of an enterprise for a certain period with their education level corresponding to the required educational level to the position occupied of the total number of young specialists employed at vacant engineering seats during this period

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20	$k_m^+ = \frac{m_0^+}{m}$	Part of young specialists employed at vacant engineering seats of an enterprise for a certain period with their education level below the required educational level to the position occupied of the total number of young specialists employed at vacant engineering seats during this period
21	$k_m^- = \frac{m_0^-}{m}$	Part of young specialists employed at vacant engineering seats of an enterprise for a certain period with their education level higher of the required educational level to the position occupied of the total number of young specialists employed at vacant engineering seats during this period
Social-professional indices		
22	$I_m = I_S = \frac{m}{m_\Sigma}$	Efficiency index of the young specialists purposeful selection realization for filling engineering positions in the integrated QMS of an engineering enterprise (a statistical index of structural shifts): a part of young specialists employed at vacant engineering seats of an enterprise for a certain period of the total number of vacant engineering positions of an enterprise during this period which could be occupied by young specialists in accordance with post requirements
23	$I_Z = I_F = \frac{\overline{Z_m}}{\overline{Z_t}}$	Efficiency index of the young specialists purposeful selection realization for filling engineering positions in the integrated QMS of an engineering enterprise (a statistical index of a fixed structure): an index of the competence correspondence of young specialists employed at vacant engineering seats of an enterprise
24	$I_{PQ} = I_V = I_m \cdot I_Z$	Quality index in the realization of young specialists purposeful selection for filling engineering positions in the integrated QMS of an engineering enterprise

Table 2. The system of analytical indices of efficiency in the processes of design and realization of basic educational programs (BEP) and the process in the graduate employment assistance of a university with QMS.

№	General formula for computation	Index name
1	2	3
Absolute indices		
1	m	Total number of graduates for a certain period
2	n	Number of graduates for a certain period employed in engineering enterprises manufacturing science intensive products
3	m_I^w	Number of graduates for a certain period having a high (w) level of the formation of a maximum (I) competence cluster
4	m_I^v	Number of graduates for a certain period having an increased (v) level of the formation of a maximum (I) competence cluster
5	T_i	Level of the formation of i -th competence cluster of a graduate
6	$Z_p = \frac{\sum_{i=1}^{6} T_i}{6}$	Individual level of the professional competence formation of p -th graduate
7	Z_m^a	Lower bound among individual levels of the professional competence formation of all graduates for a certain period
8	Z_m^b	Upper bound among individual levels of the professional competence formation of all graduates for a certain period
9	Z_n^a	Lower bound among all individual levels of the professional competence formation of all graduates for a certain period employed in engineering enterprises manufacturing science intensive products
10	Z_n^b	Upper bound among individual levels of the professional competence formation of all graduates for a certain period employed in engineering enterprises manufacturing science intensive products

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11	$\overline{Z_m} = \frac{\sum_{p=1}^{m} Z_p}{m}$	Average level of graduates' professional competence formation for a certain period
12	$\overline{Z_n} = \frac{\sum_{p=1}^{n} Z_p}{n}$	Average level of graduates' professional competence formation for a certain period and employed in engineering enterprises manufacturing science intensive products
Relative indices		
13	$k^w = \frac{m_I^w}{m}$	Part of graduates having a high (w) level of the formation of a maximum (I) competence cluster of the total number of graduates during this period
14	$k^v = \frac{m_I^v}{m}$	Part of graduates for a certain period having an increased (v) level of the formation of a maximum (I) competence cluster of the total number of graduates during this period
15	$k^{v+w} = k^v + k^w$	Part of graduates for a certain period exceeding a threshold ($v + w$) level of the formation of a maximum (I) competence cluster of the total number of graduates during this period
Social-professional indices		
16	$I_K = I_S = \frac{n}{m}$	Efficiency index in the process of the employment assistance of young specialists for filling engineering seats in science intensive industry (a statistical index of structural shifts): part of graduates employed in engineering enterprises manufacturing science intensive products of the total number of graduates for a certain period
17	$I_Z = I_F = \frac{\overline{Z_n}}{\overline{Z_m}}$	Efficiency index in the basic educational program (BEP) realization for science intensive industry (a statistical index of a fixed structure): index of the competence demand of college graduates in science intensive industry
18	$I_D = I_V = I_K \cdot I_Z$	Index of demand in college BEP of a labor-market of technical staff for science intensive industry
19	$C = \frac{Z_n^b - Z_n^a}{Z_m^b - Z_m^a}$	Efficiency index in the realization of employment assistance at the selection of graduates for filling engineering positions in science intensive industry

3. Results

The introduction of methodological fundamentals of the bi-subject quality metering evaluation of objects with arbitrary nature (Morozova, 2015) as applied to the process of young specialist selection for filling vacant seats in Russian enterprises oriented to manufacturing science intensive products has shown the existence of a considerable social effect due to the introduction of such a system of management: the reduction of inadequacy in the system of professional competences of young specialists and functions to their competence under conditions of production; the reduction of working time and financing for young specialist re-training in accordance with the requirements to personnel competence carrying out work affecting the correspondence of requirements to product quality in accordance with the standard of ISO 9001.

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