THE STATUS AND PRIORITIES FOR DEVELOPMENT OF THE COMPETENCIES OF THE ENGINEERING PERSONNEL IN THE IRON AND STEEL INDUSTRY

[a]ALEXANDER KOZHEVNIKOV, [b]NATALIYA BOLOBANOBA, [c]IRINA KOZHEVNIKOVA, [d]DMITRY SHALAEVSKII

Engineering Department, Cherepovets State University, Cherepovets, Russia
162600, 5, Lunacharsky str.,Cherepovets, Russia
email: [a,b,c,d] avk7777@bk.ru

Abstract: This article presents the results of the investigation of the demand for the engineering personnel competencies in the iron and steel industry. The paper provides competency profiles of the research engineers involved in designing energy-efficient production technologies and predicting quality indicators of steel products. It is established that development of competencies required for implementation of innovations is only possible in case of close and coordinated cooperation between educational institutions and steelmaking enterprises.

Keywords: iron and steel industry, engineering personnel, competencies, innovative production

Introduction

The effective development of the iron and steel industry, which constitutes a basis for many other industrial sectors, is driven not only by investments, but by the provision of steelmaking companies with highly qualified personnel. The latter fact makes investigations into the knowledge and skills of the engineering personnel in the iron and steel industry of great importance. In present-day conditions, the knowledge and skills not only become a source of innovative development, but a main driver of economic growth as well. It is uncontroversial that the innovative development, which is aimed at designing new technologies and improvement of the existing ones in order to manufacture high-end steel products with new application properties, is strongly dependent on the readiness of the engineering personnel to work efficiently.

1 Current condition of the problem

Over the recent years, a lot of iron and steel making companies have been upgrading their steelmaking operations. Technical availability and environmental performance of iron and steel works have been improved, consumption of all types of utilities has been reduced. At the same time, the problem of provision of iron and steel making companies with the most valuable resource - highly qualified personnel - has been aggravated, hindering the proper development of the industry. Resources of personnel are determined by the set of competencies they possess and the level of development of these competences, and depend on the quality of higher technical education, including the content, relevance and adequacy of the knowledge and skills obtained.

2 Recent experience in personell training

For the purpose of implementation of efficient HR policy in the iron and steel industry the urgent tasks are selection and training of highly qualified professionals with due regard to the demand for new competencies needed in the course of adoption of technological innovations. Early identification of the need for new competencies enables iron and steel companies and their employees to prevent and quickly cope with the lack of the required skills, to timely organize the required higher professional training and to formalize the set of the required competencies and skills.
Cherepovets State University has completed a pilot study of the demand for the engineering personnel competencies in the iron and steel industry.

2.1 Methods of problem solving

First, an array of competencies was identified based on the analysis of theoretical and practical works in the area of education, management, staffing requirements of iron and steel companies, interviews with executives, benchmarking and assessment of the engineering personnel professionalism [1–7]. Further study of the identified array of competencies showed that it would be appropriate to split competencies into general competencies (Fig. 1) and special competencies (Fig. 2), which are associated with the specific area of expertise - development and adoption of technological innovations.

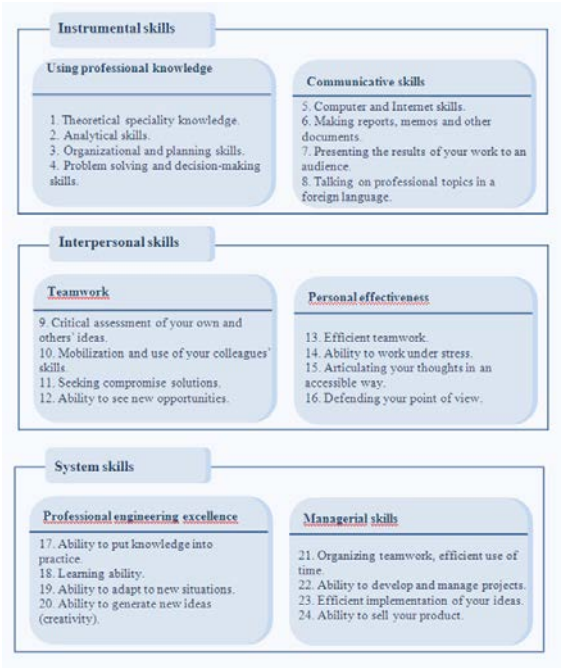

Fig. 1. Classification of general competences of engineers

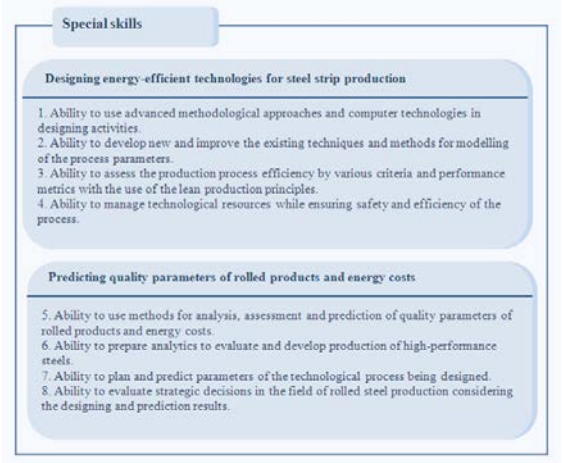

Fig. 2. Categories of special competencies

General competencies, which do not depend on the area in which an engineer works, were divided into the following groups: 1) instrumental competencies, characterizing professional knowledge and communicative skills; 2) interpersonal competencies, representing functional flexibility and teamwork; 3) system competencies, characterizing managerial skills, the ability to mobilize the available resources, the ability to perceive the new. Special competencies were the ones related to the implementation of innovations as part of the current development activities of Severstal in designing energy-efficient technologies and high-performance steels. These development

areas were selected in line with the strategy of the Russian iron and steel industry development for 2014 – 2020 and for the period up to 2030 (Order of the Ministry of Industry and Trade of the Russian Federation No. 839 dd. May 5, 2014).

The survey which was conducted as part of the study of the engineering personnel competencies in the iron and steel industry covered only general competencies. The tools used in the survey were the ones presented in the European study [8] and in paper [4]. These tools involve self-assessment of competences by respondents based on the offered list of competencies on the unified 7-point scale for each of the 24 skills on the list. The survey was conducted among the engineers from various disciplines, all of them employed by the industrial enterprises of the Severstal Russian Steel division. The total sample size amounted to 125 respondents.

Based on the survey results, competency profiles were developed for two professional groups – research engineers and production engineers (Fig. 3). The competencies are indicated by their sequence numbers as given in Fig. 1.

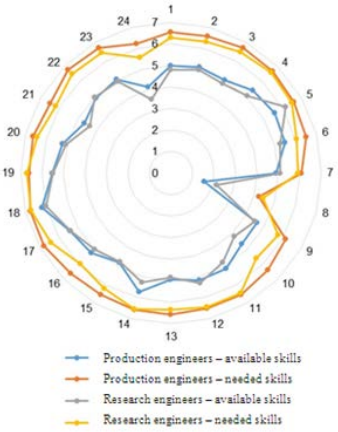

Fig. 3. Competency profiles of the research engineers and production engineers

Also the evaluation of the competency profile of the engineers not holding an advanced degree and of the engineers holding an advanced degree (Fig. 4) was done. Results of the evaluation showed that, when performing a self-assessment, the latter put higher demands on themselves, while having a higher level of the available competencies.

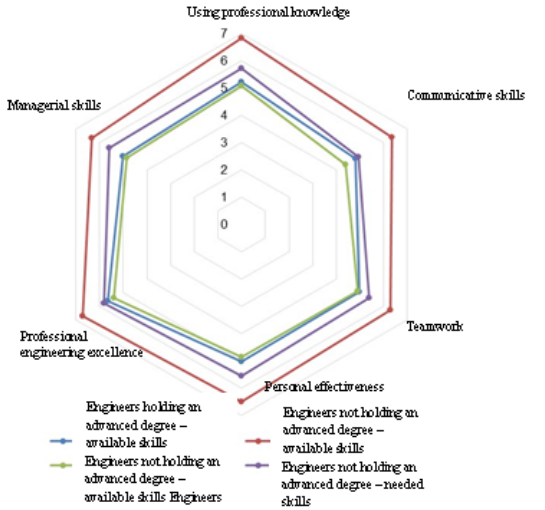

Fig. 4. Competency profiles of the engineers holding an advanced degree and of the engineers not holding an advanced degree

2.2 Results and its discussion

The competency profiles of research engineers and production engineers are very close to each other in terms of both the available and the needed skills and abilities. The biggest gaps between the available and the needed skills are observed for the following competencies: holding a discussion on professional topics in a foreign language (competency 8), organization and coordination of teamwork (competency 21), ability to sell your product (competency 24).

Regarding self-assessment of the available skills, the research engineers were more critical in assessment of most of their available skills, which can be explained by the specifics of their work – the level of criticality in the judgements of the research engineers is higher, and this is where the lower scores are coming from.

The self-assessment results show that the engineers of different groups give rather high scores to almost all the knowledge and skills offered for assessment: the scores given are hardly ever lower than 5 out of 7 possible points. At the same time, it can be seen that the required competency proficiency level is higher than the available one, which means that most of the engineers have low level or lack of competencies that are supposed to have been obtained during their study at technical educational institutions.

The expert surveys conducted among HR experts in the field of recruitment and training of personnel for iron and steel companies suggest that despite a large variety of skills and knowledge required of engineers, a common set of skills (core skills) may be identified. This set of skills includes:

- theoretical speciality knowledge;
- ability to use modern software tools;
- efficient teamwork and ability to see new opportunities;
- ability to put knowledge into practice;
- ability to adapt to new situations;
- ability to generate new ideas; efficient implementation of the conceived ideas.

According to the experts, a lack of all the mentioned competencies related to designing energy-efficient technologies for steel strip production (Fig. 2) is observed already now, and the situation may become significantly worse unless measures on targeted and systematic development of these skills during training at the educational institutions are taken.
Among other underdeveloped skills and abilities required for work in the field of development and implementation of fundamentally new steel products and processes the experts indicated the ability to use methods of analysis, assessment and prediction of quality parameters of rolled products and energy costs and the ability to plan and predict parameters of the technological process being designed.

3 Summary

The results of the conducted investigation show that the priorities for development of the competencies of the engineering personnel in the iron and steel industry are linked to forecasting the future innovation-focused development of iron and steel making plants. Development of the competencies required for implementation of innovations is only possible when technical graduates have solid fundamental academic background, when they are able to work in a team, to go beyond the scope of narrowly assigned tasks, to act in a constantly changing environment, and thus, when they are able to adapt, to generate and implement new ideas.

The growing demand for skills in designing energy-efficient technologies and predicting quality indicators of steel products requires close and coordinated cooperation between educational institutions and steelmaking enterprises. Such cooperation is a guarantee of the proper transfer of knowledge and development

of those particular skills and abilities that will be needed by industrial employers in the future.

Literature:

1. Kozhevnikov A.V. Competences of engineers in the iron and steel industry // IOP Conference Series: Materials Science and Engineering. 2017. Vol. 287. 012008 DOI 10.1088/1757-899X/287/1/012008.
2. Boyatzis R. Competencies in the 21st century // Journal of Management Development. 2008. Vol. 27, Is. 1. P. 5–12. DOI 10.1108/02621710810840730.
3. Widdet S., Holliford S. Rukovodstvo po kompetenciam [Guide in the area of competencies], per. s angl. Moskva: GIPPO 2008. 228 c.
4. Shmatko N.A. Kompetentsii inzhenernykh kadrov: opyt sravnitel'nogo issledovaniya v Rossii i stranakh YeC [Competences of engineering personnel: the experience of comparative research in Russia and the EU countries]. Forsyth, 2012, No. 4. P. 32-47.
5. Roberts G. Recrument I otbor. Podhod, osnovanniy na competencijah, per. s angl [Recruitment and selection. Competency based approach]. Moskva: GIPPO 2010. 278 c.
6. A.V. Kozhevnikov, N.L. Bolobanoba, I.A. Kozhevnikova Practico orientirovanniy podhod c mezhdisciplinarnymi componentami pri podgotovke cadrov [Practical oriented approach with interdisciplinary components for personel training] // Scientific and technical progress in ferrous metallurgy - 2017: Materials of the III International Scientific Conference. Cherepovets: Cherepovets State University. 2017. P. 135-141.
7. Solomennikova S.I. Primenenie competentnosnogo podhoda dlya otsenki personala proisvodstva visokotehnologichnogo sectora economic [Applying of competence-based approach for personnel evaluation of high-tech industry sector]// Bulletin of IzhGU, 2011. № 1 (49). P. 139–140.
8. Allen J., van der Velden R. The Flexible Professional in the Knowledge Society: New Challenges for Higher Education. Springer Dordrecht Heidelberg London New York, 2011. 260 c.

Primary Paper Section: A

Secondary Paper Section: AM, J