EDULEARN 13

5TH INTERNATIONAL CONFERENCE ON EDUCATION AND NEW LEARNING TECHNOLOGIES

BARCELONA (SPAIN)
JULY 1ST, 2ND AND 3RD, 2013

CONFERENCE PROCEEDINGS

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WELCOME INTRODUCTION

Dear EDULEARN13 participants,

It is a pleasure to welcome you to the 5th annual International Conference on Education and New Learning Technologies.

During the conference time, we will all have the opportunity to meet colleagues from all parts of the world, share our experiences, and discuss the most relevant trends in education.

EDULEARN13 welcomes delegates from more than 80 countries. This multicultural experience gives us the opportunity to meet new partners and learn from each other in an international and friendly atmosphere.

We hope you enjoy your participation in EDULEARN13. All presentations will be scheduled according to specific topics so we encourage you to attend the different oral and poster sessions and join the networking experiences that this conference will provide you.

We wish to express our sincere thanks to all participants for their contribution to EDULEARN13. This conference would not be possible without you, your enthusiasm, work, ideas and motivation that will make this conference alive.

We hope you enjoy these conference days and your stay in the wonderful city of Barcelona.

EDULEARN13 Organising Committee

«SKILLS BAROMETERS» AS AN INSTRUMENT FOR CURRICULA UPDATING

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Abstract

This study suggests a methodology for monitoring skills in demand of employees in high-tech industries of economy. The methodology was developed according to modern requirements and using the best practice in the field. The monitoring is carried out in several stages. Firstly, lists of occupational skills for each high-tech industry are determined by means of trends analysis, foresight, employers' survey, etc. Then "skills barometers" are drawn as a result of employees' surveys and expert evaluation. The monitoring results can be used in decision making by different parties of interest: authorities, educators, enterprises, individuals.

Keywords: competencies, curricula development, occupational barometers, skills barometers, labour market.

1 INTRODUCTION

Ongoing technological change and increasing globalization lead to significant changes in all the components of economy, and workforce is no exception. Knowledge and skills lose their relevance rapidly. Employers want to plan their future skills needs, young people and workers want to know which skill set offer the best job prospects, education institutions need to adapt curricula [1]. That is why an important task is to develop and constantly update the list of workers' occupations, competencies and skills in demand. It is also essential to disseminate this information among actors involved in order to develop curricula and to inform people interested in choosing their educational path and career.

2 OCCUPATIONAL BAROMETERS – FINLAND'S BEST PRACTICE

Both anticipation systems for labour market and educational system parameters should necessarily include anticipation of skills needs. Finland provides a good example of labour market parameters monitoring and anticipation system, which was evaluated as one of the best in Europe, "sophisticated and institutionalized" anticipation systems [2]. The main fields taken into account in the model are technological development, education, innovations. The system as a whole is complex and interrelated.

At heart of the Finnish anticipation system there is a model by the Government Institute for Economic Research (VATT) – so-called VATTAGE model. This model is one of the applied (computational) general equilibrium models (AGE/CGE models) widely used for economy's analysis in many countries and international research organizations [3]. On the regional level the anticipation processes are carried out by regional authorities (Regional councils, Regional centres for economic development, transport and environment – ELY-centres, Employment offices – TE-offices) by means of foresight method [4]. The ELY-centres together with enterprises conduct short-term anticipation processes, used for economic development forecasts by branches of economy.

Another important feature of the Finnish anticipation system is the combination of quantitative and qualitative anticipation methods.

One type of labour market analysis and anticipation tools used in Finland is "occupational barometers" [5]. This is a very convenient tool for assessment of labour market current state and informing all interested parties of job-seekers shortage or surplus by occupations. The barometers are drawn up by Employment offices together with employers. First, demand and supply for labour by occupations for the following year is estimated. After that, all occupations are classified in three groups: job-seekers

shortage, job-seekers surplus and vacancies/job-seekers balance. Special posters with the results of labour market analysis by occupations are published three times a year.

Effectiveness of this anticipation tool is confirmed by its fast spreading in Baltic countries. The barometer was first developed in Finland in 2008 at the ELY-Center for South-West Finland. In 2010 ten regions of Finland and one region of Poland were developing their own barometers. Beginning with 2011 all the regions of Finland develop and publish the barometers. Also, other countries (Estonia, Latvia, Slovakia, etc.) are interested in implementing the barometers.

3 SKILLS BAROMETERS IN RUSSIA

In the meantime, labour market and educational needs quantitative forecasting in Russia is developed far better, than qualitative forecasting [6]. One way of qualitative forecasting development is transfer of the best foreign practice. For example, the Finnish experience was transferred to Russian realities within the context of a large-scale research project “Forecasting skills demand in high-tech industries” ordered by the Ministry of Education and Science of Russia.

The main aim of this three-year (2011-2013) project was to evaluate the demand for skills for employees, who are involved in development and implementation of technological innovations in priority areas of science, technology and engineering, and to update correspondingly the educational and training system. One should keep in mind that the priority areas in Russia match with those accepted world-wide perfectly [7]. In Russia the priorities coincide with the high-tech industries and are the following: Information and Communication Technologies (ICT), biotechnologies, medicine and health, new materials and nanotechnology, space transportation systems, environmental management, power-engineering and energy performance.

During the project lists of occupational competences in demand were determined for each high-tech industry by means of trends preliminary analysis, emerging technologies identification, foresight, employers surveys [8]. The schematic representation of this process is shown on Fig. 1.

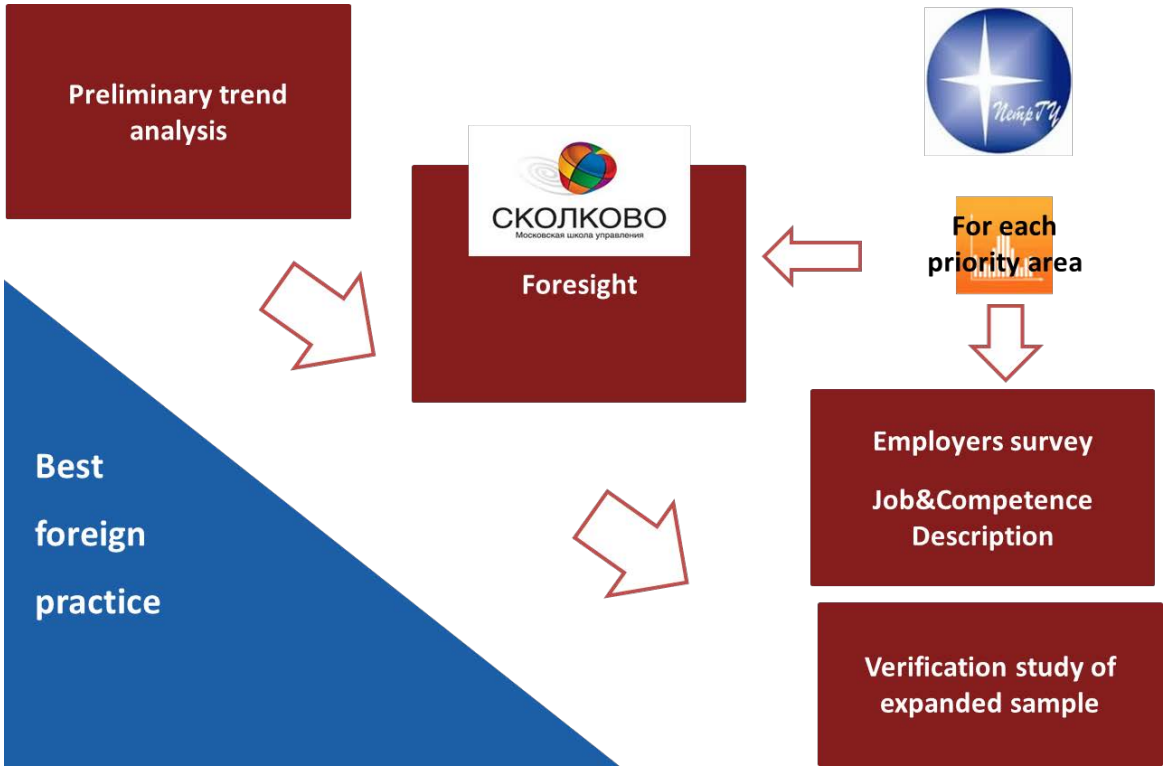

Fig. 1 Determination of occupational competences in demand for each priority area

Next important issue after determination of competences in demand for each industry is to evaluate employees’ competence levels by means of the skills barometers.

Similarly to occupational barometers, new skills barometers were developed by researchers from Petrozavodsk State University. This is a tool for monitoring and dissemination of information on occupational skills in demand in high-tech industry. The term “skills barometer” is not entirely new, tools for labour market monitoring with such title are already used in Austria[1], Poland[2], but the proposed research methodology is brand-new. The anticipation methodologies are very different, but the success factors in them can be grouped into three global trends:

- Communication between education and labour;
- Taking into account the impact of skills mobility;
- Skills anticipation in partnership [9].

Skills barometers were drawn up in two stages. The monitoring was carried out by the Center for Testing and Development “Humane technologies” of Moscow State University [10] by means of surveying employees responsible for technological innovations implementation.

Large and medium enterprises’ representatives from each of seven high-tech industries filled in special enlarged questionnaires about three competence groups (hard skills, specific hard skills and soft skills). On this stage 20 to 40 representatives from each high-tech industry took part in the survey.

On the second stage 80 to 110 representatives from each high-tech industry – this time employees – took part in the data verification process. The survey was based on a system of objective, measureable and verifiable criteria. The aim of the survey was in obtaining data on the current level of “innovative” competences development by three types:

- Hard skills - knowledge, teachable abilities that can be defined and measured and are applied for successful work in general;
- Specific hard skills - knowledge, teachable abilities that can be defined and measured and are applied for successful work in specific professional field;
- Soft skills - personal attributes that enhance an individual's interactions, job performance and career prospects.

The system of objective, measureable and verifiable criteria was implemented as a level of “innovative” competences development scale. The scale consists of three levels:

- shortage – the competence is not developed enough among the particular group of employees;
- balance - the competence is developed enough among the particular group of employees;
- surplus - the competence is developed enough among the particular group of employees, but is not in demand at the enterprise.

The following five groups of employees were interviewed (Fig. 2):

- production department employees;
- research department employees;
- engineering and experimental department professionals;
- executives;
- operational staff.

The described methodological framework for survey implementation allows obtaining data as skills barometers in different views:

1. all skills for each high-tech industry by level of “innovative” competences development scale;
2. all skills for each high-tech industry by level of “innovative” competences development scale and by employees’ groups.

Collected data was verified during the second stage of the survey.

[1] http://bis.ams.or.at/qualibarometer/berufsbereiche.php

[2] http://www.mpips.gov.pl/analizy-i-raporty/raporty-sprawozdania/rynek-pracy/zawody-deficytowe-i-nadwyzkowe/rok-2011/

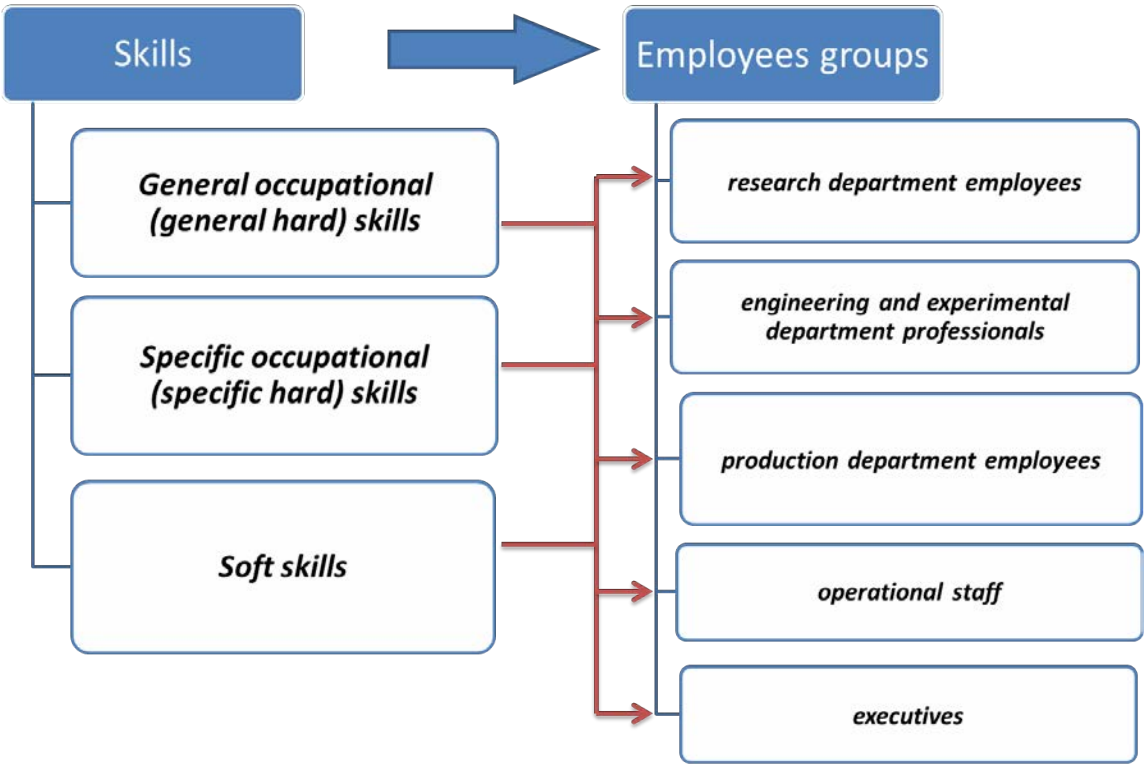

Fig. 2. Skills evaluation matrix

On Fig. 3 and Fig. 4 one can see fragments of skills barometers. On Fig. 3 examples of possessing/non-possessing of both hard and soft skills for executives from seven high-tech industries are presented. It can be easily seen, that the most problematic group is the soft skills group, which becomes more and more important and relevant nowadays.

EXECUTIVES	BIO	ICT	MED	NANO	ENVIR	TRANS	ENERGY
Hard skills							
Information technology	☺	☹	☺	☺	☺	☺	☺
Handling information	☺	☺	☺	☹	☺	☺	☺
Basic knowledge of the subject area	☺	☹	☺	☺	☺	☺	☺
Standards	☹	☺	☺	☺	☺	☺	--
Soft skills							
Adaptivity/flexibility	☹	☺	☹	☺	☹	☺	☺
Self-discipline	☺	☺	☹	☹	☺	☺	☺
Information search	☺	☺	☹	☹	☺	☺	☺
Attitude to further education/training	☺	☺	☹	☺	☺	☺	☺

Fig. 3. Fragment of a skills barometer: executives

Skills	Executives	Professionals (higher vocational education)	Proffesionals (secondary vocational education)
Hard skills			
Knowledge of modern fundamental and empirical research methods	☹	☹	☹
Knowledge of fundamental mathematics, physics, chemistry	☺	☹	☹
Results anticipation and process models development skills	☹	☹	☹
Knowledge on how to adhibit crude drugs, pharmaceuticals, biopharmaceuticals and nutritional supplements effectively	☺	☺	☹
Working knowledge of modern equipment	☹	☺	☺
Ability to apply statistical and applied mathematics methods and software in order to solve computational diagnostics and forecasting problems	☹	☹	☹
Soft skills			
Decision making	☹	☹	☹
Respect/understanding	☹	☺	☺
Motivating others	☹	☺	☹
Authority delegation	☹	☹	☹

Fig. 4. Fragment of a skills barometer: “medicine and health” industry

On Fig. 4 a fragment of a skills barometer for “medicine and health” industry is presented with the most problematic employees’ skills.

Detailed analysis of results obtained for each high-tech industry allows getting information necessary to update existing curricula according to economy’s demands. In case of industry “Medicine and health”, the survey showed that all the employees groups, from operational staff to executives, are lacking several demanded skills. For example, among hard skills such skills are basics of experiment planning, mathematical methods of data processing, mathematical modeling, results anticipation, process models development and practical use and implementation of research results. On the contrary, all the employees’ groups showed mastery of scientific methodology, computer technologies.

Another potential problem is handling different types of information. The survey showed that many specialists as well as executives are lacking skills of analyzing foreign and local best practice, planning the research. Though all the groups showed good command of specific literature analysis and reports compiling, only executives and research department employees are able to analyze information using system approach.

Among soft skills the most problematic are self-discipline, commitment to strategy, authority delegation and for most of the groups – analytical thinking and general understanding of the company (except executives), information search, decision making (except engineering and experimental department professionals), loyalty (executives and engineering and experimental department professionals), creative thinking and motivating others (except production department employees).

More detailed analysis can bring to light the weaknesses for each group of professionals.

Thus developed for each high-tech industry skills barometers enable carrying out analysis of how well did employees in the field of technological innovations develop skills in demand. This should be the basis for training and vocational education curricula updating.

4 CONCLUSIONS

The results of competence development analysis correspond to the general structure of workforce competence balance in high-tech industries. An important conclusion can be made, that the greater

part of the skills studied belong to the “balance” category, meaning that most of the skills in demand are developed enough by the employees from all groups. Very few skills are in demand at the enterprise, but turn out to be developed not enough among employees. It is worthwhile to mention that the skills in “shortage” category differ a lot for each industry, but within one industry the structure is similar.

The skills barometer developed and the survey results are necessary when making recommendations for vocational education system and updating curricula for vocational educational, training and career development. It is obvious, that special attention should be paid to the skills not developed enough among employees, according to the survey results.

Applying the best Finnish practice and implementing skills barometers allows obtaining up-to-date information on employees’ competences in demand by employers. This information guarantees timely curricula development according to current economy’s demands. Besides, these tools contribute to information dissemination among different social groups and employers involvement into the qualified personnel training process. All of this makes it possible to eliminate structure mismatch common to Russian labour market.

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