MODELING KNOWLEDGE WORKERS COMPETENCES

Anna Bagieńska

INTRODUCTION

A knowledge-based economy is an economy in which knowledge is the main resource and factor for development. This is an economy using knowledge, creativity, and technology to produce products and services. The key to the realization of this goal is innovation [8]. The purpose of this work is to analyze the competences of a knowledge worker and to show methods for modeling these competences. Special attention has been given to the competences of an engineer, due to the fact that the development of technology has caused S&E graduates to become, in large measure, knowledge workers. Literature studies, Eurostat statistical data, and the results of studies conducted in Poland: Human Capital Balance and Podlasie Graduate, have been used in this work.

1. KNOWLEDGE WORKERS

In a knowledge-based economy, economic development does not depend on several economic sectors but on all sectors that must intensively use knowledge in processes of production and rendering of services. A knowledge-based economy can be considered using the macroeconomic approach and the microeconomic approach. From the macroeconomic point of view, it can be accepted that a knowledge-based economy has the following qualities:

- widespread use of new technological and organizational solutions, particularly those related to the acquisition, processing, accumulation, and use of information serving innovation; practical utilization of new technologies and their development requires the appropriate knowledge base of employees;
- a developed higher education and research and development unit sector as well as implemented mechanisms and institutions that make it possible to use the created knowledge in the entire economy [11].

There is a growing demand for highly qualified and competent employees, called knowledge workers, in the modern economy, known as the knowledge economy. In the modern economy, a graduate becomes a knowledge worker with a high level of specialized knowledge acquired through education or experience. The task of a knowledge worker is to create pioneering solutions in the fields of production, organization, and technology. Knowledge workers are characterized by creativity, tolerance for diversity, openness to changes and challenges. They have the awareness of a need and necessity for constantly raising their qualifications [2]. In the modern economy, qualifications and competency gained mainly through education and experience are the basis of worker development. P. F. Drucker notes that knowledge workers become the carriers of capital, not work, as was the case up to this point. In relation to this, the requirements of the labor market towards a graduate do not only pertain to his knowledge but also to other qualities necessary for creating knowledge and cooperation in a team (4).

1.1 ENGINEER - KNOWLEDGE WORKER

In publication Science technology and innovation Eurostat shows two group knowledge workers: employment in R&D and human resources in science and technology (HRST). Human resources in science and technology are defined as persons having graduated at the tertiary level of education or employed in a science and technology occupation. Human resources in science and technology are major actors in innovation. Science, technology and innovation, together with high-quality education and lifelong learning, are essential to turn Europe into a

leading knowledge-based society, thus creating the right conditions for long-term prosperity.

In 2010, HRST accounted for 40.5% of the active population aged 25-64 years in the UE-27. At country level the proportions exceeding 50% were observed in Luxembourg (55.9%), followed by Switzerland (54.4%), Denmark (51.9%), the Netherlands (51.9%). In the UE-27, the HRST population increased at an average rate of 2.4% a year between 2005 and 2010 [12].

In 2009, close to one third (29.6%) of the EU population aged 20-29 years was in tertiary education. At EU level, about one quarter of tertiary education students chose science and engineering (S&E) as their main field of study, representing 7.2% of the population aged 20-29 years [12].

Graduates of science and engineering study are of special significance in the modern economy, because, firstly, they are responsible for the creation of new solutions, and secondly, the utilization and service of new technologies requires the appropriate staff. In terms of HRST stocks, the EU counted more than 93 million highly qualified knowledge workers in 2010. Human capital employed in science and technology can not only be an indicator for the development of the knowledge market but also one of the factors for development. The structure of education should meet the demand for highly qualified specialists and engineers.

2. ASSESSMENT AND DEVELOPMENT OF COMPETENCES OF KNOWLEDGE WORKERS

Knowledge workers are characterized by a series of competencces. The first and most important discriminant of knowledge workers, in the author's opinion, is their knowledge, which they use, create, and develop. Thus, the development of a knowledge worker is connected to the need for updating possessed knowledge. M. Morawski indicates that a knowledge worker combines knowledge from many fields in his activity, and at the same time, he has in-depth specialized knowledge and specific and verified abilities based on this knowledge that are often unavailable to others. In the opinion of E. Skrzypek, knowledge workers are people who possess unique competences, and the utilization of these competences creates added value in modern products and technologies. Among the qualities of a knowledge worker, much attention is paid to their independence and responsibility.

Increasing the efficiency of knowledge workers also proves to be a big challenge for organizations. This is not an easy task, because their work is based on processing a specific type of matter – intangible and elusive knowledge. According to P.F. Drucker (5), there are several main factors that have an influence on the efficiency of knowledge workers. Above all, an organization must accurately define the tasks set before them and must also ensure their constant development. Furthermore, it is important for a knowledge worker to be able to independently manage his work, to have – as mentioned earlier – much autonomy, and for responsibility to be placed upon him. Constant education and transfer of knowledge to others is significant for increasing the efficiency of a knowledge worker. The managing staff must also understand that knowledge workers constitute a valuable resource for the organization that must constantly be invested in, not a cost.

R. Kozlowski [7] proposes to use a mapping technique to assess the competences of knowledge workers, that is, to determine the required competences at a given post, then to assign individual competences a required level in points (from 1 to 5) and to assess individual employees from the angle of required competences.

Tab. 1: Level of competences at post X

Name of competence	Required competence level (in points)	Competence assessment worker 1		Competence assessment worker 2	
		Assessment	Deviation	Assessment	Deviation
Specialized knowledge	5	3	-2	4	-1
Creativity	3	3	0	2	-1
……					

Source: own work

In the author's opinion, apart from assessing competences, this tool can be used by company management to prepare actions to supplement competence deficiencies. Internal specialized training, participation in thematic conferences and seminars, and provision of specialized literature can serve to develop specialized knowledge. The following actions can serve to supplement social competences: career planning for workers, which motivates them to work better, creation of new research teams, integration meetings of employees.

3. FORMING THE COMPETENCES OF S&E STUDENTS – FUTURE KNOWLEDGE WORKERS

The K.W.M. Siu [138] proposes eight Cs as evaluative criteria for all-around engineering curricula. They are:

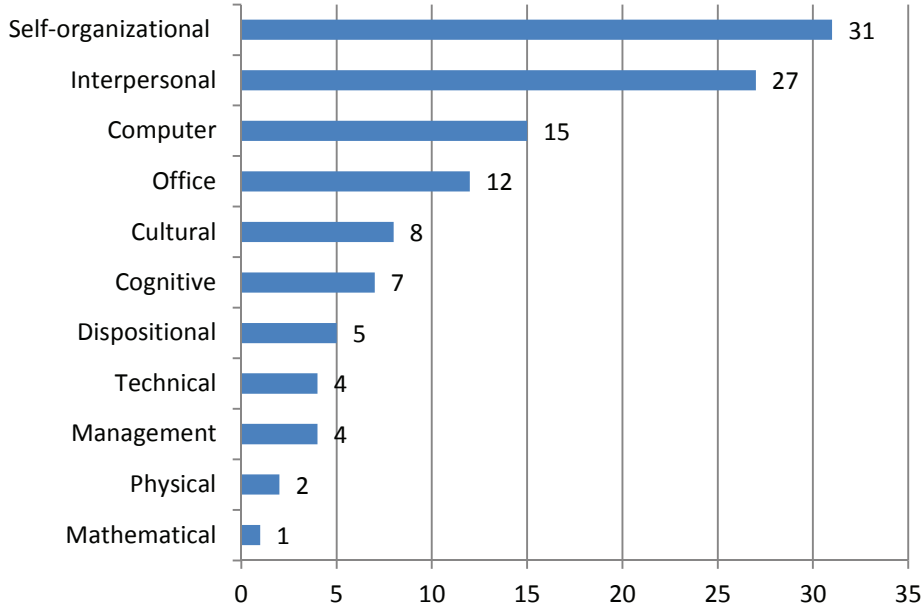
- competent - Engineering education emphasizes both the understanding and the application of knowledge.
- comprehensive - the engineering curricula must be organised to allow students to gain a more comprehensive understanding of engineering and related subject areas
- critical- curricula should allow students the opportunity to initiate, explore, identify, make decisions and then present their own opinions and ideas. In other words, nourishing students' critical thinking ability should be an important objective of engineering education. Critical thinking skills come from students' direct experience with engineering problems
- creative- it is important for students to learn how to generate creative ideas rather than model answers,
- curious- engineering curricula and their related activities and materials should encourage students to be self-motivated and self-initiated to study, to discover, and to explore,
- continuous - curricula should encourage students to engage in continuous learning. Students should be taught not only the knowledge and skills they need today, but also to how to decide what they should continue to learn in the future,
- collaborative the engineering curricula should provide more opportunities for students to collaborate, not only with those studying the same discipline, but also with those from other disciplines and other levels and
- compulsory - it should be compulsory for both male and female students, as well as those with disabilities, to take engineering subjects at the secondary level, so that they can make informed choices about studying engineering at the university level.

According to Dirk van Damme [2] the international harmonisation of curricula is an important tendency as well. The rapid growth in international trade in professional services has provoked several professions to organise themselves at an international scale. These international professional associations started to deal with issues of education and training, such as quality assurance, international minimum standards, criteria of professionalism, accreditation, etc. Some professions have been very active in this matter, such as the engineering, the medical or the legal professions.

Larry A. Braskamp [1] also sais that engineering is a global profession and engineering education has been charged to prepare engineers accordingly. Students' knowledge and acquisition of technical skills in the field of engineering are necessary but insufficient in the preparation of future engineers. Personal and interpersonal skills and attitudes are also worthy and essential requirements in the preparation of engineers. Despite of it is widely recognized that engineering knowledge and the acquisition of technical skills are necessary but insufficient in the preparation of future engineers. Of equal importance are personal and interpersonal skills and attitudes. Larry A. Braskamp propose to use description of Global Perspective Inventory scales. The GPI measures three interconnected domains of learning and development – cognitive, intrapersonal, and interpersonal. It goes beyond the acquisition of technical engineering knowledge and includes indicators of the attitudes, values, and competences that student need to function and lead in a global profession.

The Human Capital Balance Study conducted in Poland in 2010 was related to the qualities and skills required from a graduate -future worker. In work offers, the most requirements for competences were formulated in regard to professions requiring the greatest responsibility and qualifications, that is, in regard to the group of higher management and government officials, specialists, technicians, and other middle level personnel. Employers, above all, stressed the importance of self-organization related to undertaking initiatives and punctuality in realizing entrusted tasks. The requirements in second place were related to interpersonal skills necessary for effective teamwork. Computer skills were also important in relation to the computerization of a series of work stations. Graduates with interdisciplinary education, with knowledge of foreign languages, and having broad personal skills are also sought for. (fig.1)

Fig 1. Skills of an ideal worker according to employers (% of work offers)



Source: M. Kocór,A. Strzebońska, [6, p.66]

A relative drop in the significance of academic qualifications (knowledge and cognitive skills) and skills of a technical nature has been observed. There is an increase in the significance of social and psychological skills among the qualifications of graduates sought after in the labor market.

On the basis of literature studies and analysis of the Podlasie Graduate and Human Capital Balance studies conducted in Poland, the

author proposes a model of 10 general (universal) competences of S&E graduates indispensible for knowledge workers sought for by modern companies and methods for verification of these competences.

Tab. 2: Modeling student competences

No.	Name of competence	Method of verification
1	High level of specialized knowledge from a given specialty	Transfer of theoretical and practical knowledge during higher education
2	Tendencies of developing and acquiring new knowledge	Motivation of students to acquire new skills, participate in courses, workshops, conferences
3	Combining specialized knowledge with knowledge from other fields (marketing, finance)	Curricula should include knowledge from outside of the specialty
4	Practical skills of using advanced technologies	Classes conducted using information technologies
5	Knowledge of foreign languages	Foreign language classes
6	Creativity in problem solving	Case study problem solving, support in searching for new solutions
7	Teamwork skills	Creation of project groups
8	Work organization skills	Requirements of punctuality and a systematic approach
9	Motivation and sacrifice for realized projects	Promotion of project leaders
10	Personal culture	Required ethical behaviour, respect for copyrights

Source: own work

Apart from the universal requirements for knowledge workers presented above, every organization can required specific competences related to a given profession.

In the student education curriculum, knowledge from a given specialty should also be supplemented by competences that are indispensible for knowledge workers. At the Bialystok University of Technology, educational programs have been developed, the realization of which has been specified in the form of the effects of education: knowledge-skills-social competences. The realization of this program develops a future knowledge worker not only by developing his specialized skills but also his social skills. Very large significance is tied to combining theoretical knowledge and practice. Students take internships in enterprises, teachers have the possibility of interning in companies, and company employees are invited to lecture. Group projects and case studies solved during classes as well as other forms of inciting self-organizational competences serve to develop the social skills of students.

CONCLUSION

The significance of knowledge workers is increasing in the modern economy. Employment in the HRST sector is rising on the labour market. Science & Engineering graduates are becoming the potential knowledge workers of the future. Managing the development of knowledge workers, increasing their efficiency, and measuring their competences is not just a problem for modern organizations. Schools of higher learning must meet the demands of the labour market and equip their graduates with the appropriate qualifications and competences. Ten universal competences of a future knowledge worker have been defined in this work, and methods of

verification of these competences have been given. Modeling of detailed competences must take place at the company employing the worker. Further education and self-improvement is necessary, and that is why such habits must be developed among young students as well as workers.

REFERENCES

[1] BRASKAMP L. A., Using a Measure of Student Holistic Development for Quality Assurance w: A.S. Patil and P.J. Gray (eds.), Engineering Education Quality Assurance:A Global Perspective, DOI 10.1007/978-1-4419-0555-0_16, © Springer Science+Business Media, LLC 2009

[2] DAMME D., Quality issues in the internationalisation of higher education Higher Education 2001 Volume 41 pp. 415–441,

[3] DAVENPORT T.H., Thinking for a Living: How to get better performance and results from knowledge workers, Boston-Massachusetts: Haward Business School Press, 2005, ISBN 1-59139-423-6

[4] DRUCKER P.F., They're not Employees. They're People, Harvard Business Review, February 2002.

[5] DRUCKER P.F., Zarządzanie XXI w. - wyzwania, MT Biznes, Warszawa 2009, ISBN: 978-83-61040-84-2

[6] KOCÓR M., STRZEBOŃSKA A., Jakich pracowników potrzebują polscy pracodawcy?, Human capital Balance, PARP,Warszawa 2011. ISBN 978-83-7633-070-9

[7] KOZLOWSKI R., MATEJUN M., Problemy obsługi zaawansowanych technologii w przedsiębiorstwie informatycznym - studium przypadku, [w:] Lachiewicz S., Matejun M. (red.), Współczesne koncepcje zarządzania produkcją, jakością i logistyką, Wydawnictwo Politechniki Łódzkiej, Łódź 2010, ISBN 978-83-7283-352-5

[8] MEJER P. TURCHETTI P., GERE E., Trends in European education during the last decade, Eurostat Statistic in focus 54/2011

[9] MORAWSKI M. Zarządzanie profesjonalistami, PWE, Warszawa 2009 ISBN: 978-83-208-1816-1

[10] OECD Science, Technology and industry scoreboard 2009, OECD 2009. http://www.oecd.org

[11] POSKROBKO B. Gospodarka oparta na wiedzy, Białystok: Wyd. WSE. 2011, ISBN 978-83-61247-27-2

[12] SCIENCE, TECHNOLOGY AND INNOVATION IN EUROPE, EUROSTAT 2012 edition ISBN 978-92-79-218743

[13] SIU K.W.M.: Quality Assurance in Engineering Education: An All-round Perspective, Engineering Education Quality Assurance: A Global Perspective, DOI 10.1007/978-1-4419-0555-0_16, © Springer Science+Business Media, LLC 2009

Author:

Bagieńska Anna
Bialystok University of Technology
Faculty of Management
e-mail bagienska@o2.pl

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Key words: knowledge worker, competences

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