Vocational And Engineering Education In Poland[1]

Iwona Staniec, Faculty Organization and Management, Technical University of Lodz, Poland
Agnieszka Zakrzewska-Bielawska, Faculty Organization and Management, Technical University of Lodz, Poland

ABSTRACT

In this paper, following a general introduction of personnel education issue, the principles of technical, engineering and continuous education have been approached from the point of view of the valid education law and of economy demands, together with resulting expectations regarding the requirements, imposed onto graduates of technical schools at university level. The grounds of the actual status are discussed, indicating trends towards the necessary changes.

KEYWORD: education in Polish, vocational education, engineering education, continuing vocational training in polish enterprises

INTRODUCE

Development of the educational system and investment in education are the prerequisites of economic and civilization progress. However, it should be remembered that the development of education is beneficial for people and the society if certain optimal structures of vocational education are retained, in accordance with predicted labour demand. In Poland, education seems to be completely out of touch with demand for various levels of education and opinions of Polish entrepreneurs. Neither is experience of countries with the highest work culture and productivity taken into account.

The system of education in Poland needs changes due to the increasing level of education and unsatisfactory quality of teaching, as shown by great differences between student achievement of various schools, different access to and quality of education in urban and rural regions and a mismatch of competences between labour supply and demand.

The evolution of thought towards a knowledge-based economy has a long history, originating in research of economic growth factors in various countries and periods and in a new technical revolution which has created the framework of an information, post-industrial, service-based society in which service sectors tend to prevail over production sectors.

Human investment is the main economic growth factor as demonstrated by the following research results:

- a 58% rise in productivity over a period of forty years (1929–1969) was caused by improved knowledge and qualifications of US personnel [Denison, E., 1974, *Accounting for United States Economic Growth, 1929–1969*, Washington, p. 127.];
- knowledge as well as technical and organizational progress (i.e. factor which is external to rise in work quantity and capital) had the greatest impact on the pace of economic growth in most countries (Germany – 61%, Italy – 69%, the Netherlands – 54%, France – 62%, Norway – 53%, Sweden – 73%, Great Britain – 46%) [*UNECE Economic Survey of Europe*, *Part 2: Some Factors in Economic Growth in Europe*, 1964, Geneva, p. 46 (Chapter II)];
- human capital investment is the most important factor of social and economic growth and progress in the contemporary situation – the participation of skilled human resources in global wealth amounts to as much as 64% [*World Bank Monitoring Environmental Progress – a Report on Work in Progress (March 1995)*, 1995, Washington, pp. 52–53];
- education accounted for about a quarter of economic growth – as shown in a study carried out in 29 countries in mid-1980s [Psacharopoulos, G., *The Contribution of Education to Economic Growth*, in

[1] Scientific project co-financed from the scientific fund in the years 2006–2008 as a research project.

J.W. Kendrick (ed.), *International Comparisons of Productivity and Causes of the Slowdown*, 1984, Ballinger Publishing Co., Cambridge];

- a study of 22 OECD countries, measuring the percentage of the working age population attending secondary school and the effects on productivity levels, showed that education has a great positive impact on economic growth [Mankiw, G., Romer, D., Weil, D., 1992, "A Contribution to the Structure of Economic Growth", *Quarterly Journal of Economics*, Vol. 106];
- on-the-job training helps improve productivity by 5–15% [OECD, *Employment and Growth in the Knowledge-based Economy*, 1996, Paris];
- an increase in training expenditure in a large US firm yielded a rate of return of 20% to 35% [Partel, A., 1995, "Training, Wage Growth and Job Performance: Evidence from a Company Database", *Journal of Labour Economics*, Vol. 13];
- the fastest increase in productivity, welfare and technical progress is observed in countries with the highest increase of expenditure on labour resources development. The share of education expenses in economically developed countries is 4–7% GDP.

The objective of this article is to show changes and opportunities of vocational education, engineering education, access to adult education, in particular production staff, and to draw attention to the necessity of adjusting education to labour market needs.

EDUCATION IN POLISH SCHOOL

Development of vocational education in Poland until 2010 is based on two premises. First of all, the percentage of lower secondary school graduates attending vocational schools will drop steeply from 52% to 20%. Secondly, as regards higher education, the scolarization coefficient is meant to increase sixfold (from 11% in 1990 to 65% in 2010) [*Strategy for Expanding Higher Educational in Poland Until the Year 2010 (Strategia rozwoju szkolnictwa)*, p. 37]. It is related, above all, to dissolution of vocational schools and an increase in the number of higher education students. Time will show whether this means that potential production staff will more frequently have higher education or whether they will learn their occupation during training.

Implementation of the first assumption regarding development of education in Poland resulted in large-scale dissolution of vocational schools. Between 2001–2003 local authorities dissolved (or initiated dissolution of) 1,646 primary vocational schools (almost 70% of the 2001 figure) and 1,052 secondary vocational schools. In line with the reform, more than 2,100 vocational schools will have been dissolved by 2010 [*Sectoral Operational Programme*, 2003, p. 37, *Strategy for Expanding Higher Educational in Poland Until the Year 2010 (Strategia rozwoju szkolnictwa)*, p. 7]. It is connected with changes introduced in the new educational system, namely orientation at a "broad educational spectrum" which is tantamount to general education without any professional skills. These are meant to be taught, above all, during training courses[2]. In the opinion of H. Świda-Zaremba, it means that "*young people should not be given any specific vocational training; instead, they should be taught orderly thinking – if they can think, they will learn their profession quickly, too, in their place of work*" [Świda-Zaremba, H., 2002].
W. Książek holds a similar view: "*school prepares students for continuing education by providing them with appropriate general knowledge as well as fostering appropriate attitudes in the teaching process (...). Therefore, large-scale vocational and specialized training in the course of permanent education will be abandoned in favour of student-specific education paths which can be continued in the course of continuing education*" [Książek, W., 2002].

In Poland prevails a general atmosphere of disregard and ridicule of vocational schools; a vocational school is described as "*a school for blockheads: if you are dull and lazy – you go to a vocational school; if you have low grades – you go to a vocational school; if you are capable and ambitious – you go the a comprehensive upper secondary school*" [*What school should I go to after graduation from the lower secondary? (Jaka szkoła po gimnazjum?)*, 2002].

Alas, these opinions are in striking contrast with the experience of the most advanced European countries. It is common knowledge that in countries with the highest work culture, productivity and competitiveness (e.g. Germany, Austria or Switzerland) craftsmen and skilled workers, i.e. specialists, take four-year dual education courses.

In the school year 2005/2006, there were almost 13,000 post lower secondary schools (including "expiring" upper primary schools). Their number dropped by 6.2% as compared with the preceding school year. A large percentage of adult schools (16%) were supplementary schools (on the basis of the primary vocational school).

[2] Interview with Professor Leszek Zienkowski in "Gazeta Wyborcza" (magazine) of November 21, 2001.

Comprehensive upper secondary schools enjoyed the greatest popularity among lower secondary graduates; they were attended by almost a half of all first-grade students of post lower secondary level. Unfortunately, young people in Poland tend to lose interest in primary and vocational education. Currently 57% of lower secondary school graduates choose those schools. Interest in technical secondary schools is falling slightly, too; in comparison with the previous year it dropped by 2 pp. Students more frequently choose vocational or specialized upper secondary schools which offer occupational qualifications as well as comprehensive secondary education.

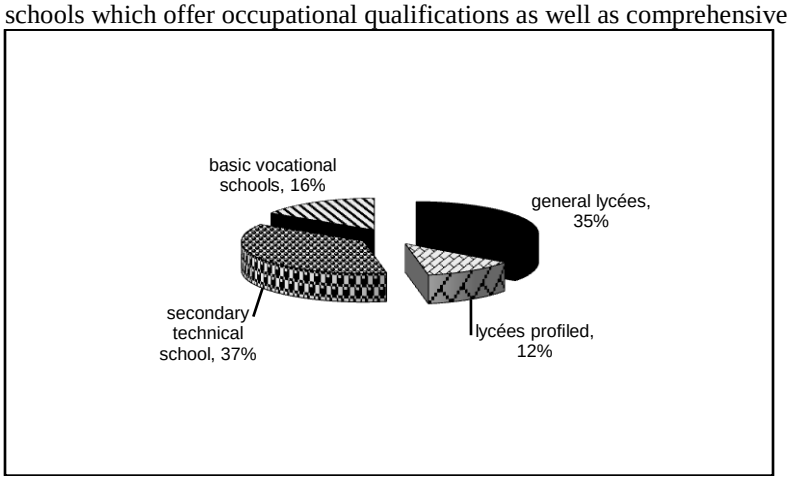


Figure 1. Post lower secondary schools by type in the school year 2005/2006
Source: *Education and upbringing in the school years 2005/2006*, GUS 2006.

In the school year 2005/2006 the number of primary vocational schools for youth continued the downward trend (66 primary vocational schools ceased to operate which resulted in a drop of 3.6% in comparison with the preceding year). Interest in individual groups of occupations, both in the overall student group and when broken down by sex, changed only slightly over the last 5 years. About 1/3 of all students of primary vocational schools attended the course for "metalworking workers and mechanics of machinery and equipment" while since 2000/2001 occupations in the group "personal service employees and security guards" have become more popular (an increase in the overall student group by 6.8%).
In the past 5 years also a relatively lower number of women started primary vocational schools – in the school year 2000/2001 they accounted for more than 34% of all students and currently – for ca. 28%.

The weakness of the Polish system of vocational education consists in slow adaptation to a changing economy and the labour market. It also lacks an efficient system of cooperation between schools and businesses which could help improve the structure and content of education and their economic and social efficiency. Probably only overcoming these weaknesses will guarantee that education of young people will be a synonym for a greater number of frustrated and potentially unemployed graduates, but will bring satisfaction and economic benefits.

Students can learn specific occupations also in the continuing education system. Poland has a high percentage of unemployed people for whom acquiring specific knowledge and skills provides an opportunity to find a job. At the same time employees, especially production staff, often have to improve their occupational qualifications as work systems and production processes change due to technological progress. They are faced with new tasks which require learning new skills, new work organization and performance of various tasks. Therefore, they are sent to courses and trainings funded, in part of in full, by their organizations.

ENGINEERING EDUCATION IN POLISH HIGER SCHOOL

European business organisations, Polish enterprises, etc. have already been suffering from the lack of engineers. The problem is such that the observed deficit of engineers is at the base of the lack of specialist staffs to create and support innovative business solutions, without which Poland is liable to collapse into depths of technological and civilisational obsolescence. The causes of the status are to be searched for in the mismatch between the qualifications of graduates and labour market demands (see the data for academic year 2006/2007)

- the total number of students (both intra- and extramural studies) in all universities and higher education units is approximately 2 million;

- the classical engineering branches (mechanical engineering, electrical engineering & technology, electronics, chemical technology, chemical engineering, etc.) comprise only 7.2% of all the students;
- all engineering studies at all technical university schools group 13.2% of students;
- mathematics is studied by the scarcity of 0.72% and physics – 1.8% of students.

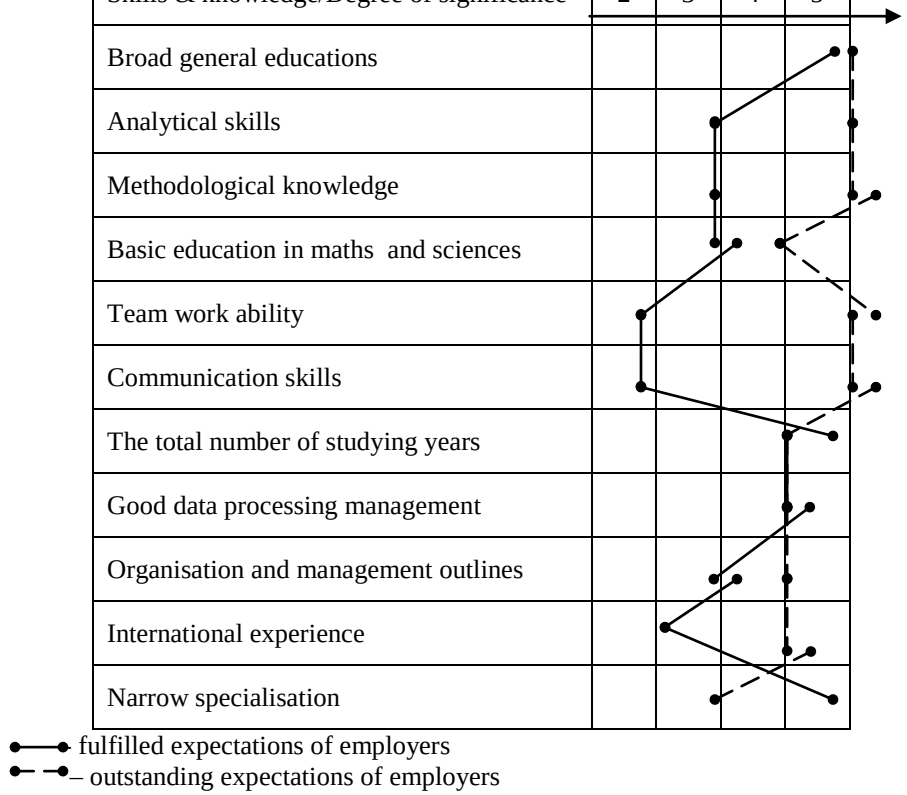
The main causes of little interest in studying sciences and technology include, among others:

- the high degree of difficulty and laboriousness associated with studies in these branches;
- fascination by economical and management studies (everybody wants to manage), as well as by pedagogy, law, psychology and by fine arts in general;
- depreciation of mathematics in secondary schools and its removal from the obligatory scope of subjects to be passed at the Examination for Secondary School Certificate.

The problem results also from the tendency, which prevailed in Poland at the beginning of the nineties of the twentieth century and consisted in overt marginalisation of technical education and the role of engineers in economy, instead of providing firm foundations for the economy based on technical knowledge and in the atmosphere supporting the modernisation of our economy by implementation of advanced technologies.
Engineering education assumes the transfer of the necessary basics of the natural sciences and technical knowledge, appropriate for a given branch of studies and at the highest educational level. On the other hand, the level of research undertaken by academic school considerably influences the level of academic education. Unfortunately, a number of universities and higher education units, while facing high numbers of candidates for studies, have recently undergone a specific transformation into mass education organisations. Such schools usually present with much developed bureaucracy, student anonymity and drop of the education level of engineers. This status results, among others, from underfunding of technical studies; they are expensive, therefore, there are no technical faculties at non-public higher schools, as well as from the unsatisfactory preparation to sciences in secondary schools and from the prevailing discouragement of potential candidates to maths, physics or chemistry in general. Reduced funds for engineering studies result, among others, in fewer hours for practical exercises and design projects, what deprives students of practical background and their knowledge is then much below the level to be expected from a technical university graduate. The latter issue has been raised not so much by the schools themselves as by the employers of new graduates.
Table 1 below summarises the skills and knowledge level as expected from technical university graduates by industrial managers in Poland.

Table 1. Employers' expectations with regards to graduates of technical universities

Skills & knowledge/Degree of significance	2	3	4	5
Broad general educations				
Analytical skills				
Methodological knowledge				
Basic education in maths and sciences				
Team work ability				
Communication skills				
The total number of studying years				
Good data processing management				
Organisation and management outlines				
International experience				
Narrow specialisation				



●——● fulfilled expectations of employers

●– –● – outstanding expectations of employers

Source: The Author's own study results.

As it appears from the presented comparison, only few of employers' expectations are either fulfilled or almost fulfilled. In their majority, the graduates fail the expectations of their employers, especially with regards to team work ability, communication skills, analytical thinking, methodological apparatus or experience in international contacts. Industrial managers assume that students are educated in too narrow branches. It means that the obtained knowledge becomes obsolete after a few years, facing so dynamic and quick changes in technology. Therefore, it should be noted that:

- technical universities should be more flexible and, first of all, more quickly respond to social and economic changes ,
- the universities should become more open to the outer would, undertaking commissioned research and providing services,
- various prompts and encouragements – also financial - should be defined to increase general motivation to better teaching and more effective research.

In Poland, clearly more time is dedicated to specialist training, while non-technical subjects are treated with much neglect, while it appears from various analyses that it is the basic knowledge which provides the core of engineer's knowledge and the basis for his/her future professional mobility. Learning the general outlines during studies is, therefore, of so high significance, as their later completion during working years becomes difficult or impossible. The basic knowledge, obtained by a student, provides him/her with foundation for the specialist knowledge, emerging from a deeper analysis of only few technical examples. It should, however, be very strongly underlined that, taking into account the very rapid progress in technology and the limited time period of studies, Professional, specialist knowledge on selected objects should be conveyed only in the scope necessary for effective introduction of a graduate into the specificity of a given profession. It is so because, following the results of appropriate studies it has been demonstrated that the ability of acquisition of knowledge and skills in the course of active project implementation is much better, more comprehensive and universal than during lectures, i.e., passive participation. Professional, hands-on practice at production plants is indicated as a necessary element in the education curriculum. In order to reverse these unfavourable tendencies, observed in education, it is necessary to:

- increase the educational level with regards to mathematics and physics in secondary schools (more hours and higher educational competence of teachers);
- restitution of mathematics at the General Certificate of Secondary Education exam as obligatory subject;
- modification of the media image of engineer's profession and studying sciences, providing the youth with awareness that an engineer's profession is "the profession of the future" and physics after university opens perspectives to discovery of a "new world";
- establishment of scholarship grants for students, encouraging to study sciences, including technical faculties.

It is also advantageous that, following Directives 89/48/EEC and 92/S1/EEC, as well as "The Guideline for the system of recognition of professional qualifications", the engineer's profession has been accounted into the general system of professional qualification recognition. It means that there is no need to verify engineer's diploma in any of the EU countries.

The requirements, regarding the system of engineer education are, first of all, influenced by dynamic economic changes, the dynamically changing environment in which a given organisation functions, economy globalisation, vanishing transportation restrictions, liberalisation of customs regulations, global IT networks, decreasing costs of transport and innovativeness. These factors are responsible for the situations in which engineers are faced with the demand for flexible responding and openness to new strategies, especially in new product development. The technological progress imposes the necessity to introduce significant innovations to technical education, facilitating quicker adoption of engineers to the rapid changes which are likely to be occurring during their professional careers. Such quick and, in fact, continuous improvements to education curricula will be easier to implement when the structures of technical universities become more open and flexible.

The uniformity of teaching and research, including technical (applied) research is still a guarantee that the knowledge, as it is transferred to students, will be based on solid theoretical foundations, taking into account current practical issues. It should also be kept in mind that, following the abolition of professional education at secondary school level, B.Sc. graduates of technical schools will only be performing operational and maintenance tasks, while only M.Sc. graduates will be included into design and engineering programmes.

CONTINUING VOCATIONAL TRAINING IN POLISH ENTERPRISES

On the basis of an analysis of the situation of continuing education in Polish enterprises, we can state that in 2005 35% of businesses organized various employee trainings and 24% of them held courses. The average working time per employee in enterprises which organize courses and trainings is higher than in others; the cost of labour per employee in enterprises which offer courses and trainings is also much higher and differs significantly from the average cost of labour in all enterprises.

In 2004, course education was offered in 15,412 enterprises (21% of the total number of active enterprises). In this group, courses were organized in 92% of enterprises in the following year, while 25% of firms which did not offer courses in 2004 organized them in 2005. Only 86% of businesses which offered courses in 2005 intend to organize them in the following year, and 20% of those which did not offer them. The situation of other forms of continuing education appears similar in the years 2004–2006 – in 2005 such education was offered in 92% of companies which organized continuing education in 2004 and in 24% of firms which did not offer such training in 2004. Only 84% of companies which offered other forms of continuing education in 2005 intend to organize them in the following year, and 18.5% of those which did not offer them.

Table 1. Reasons given by enterprises for not organizing trainings (%)

Reasons	Total	Small enterprises	Mid-sized enterprises	Large enterprises
Employees' skills and qualifications satisfy company needs	79.1	79.4	77.6	72.6
The company launched a strategy of employing people with a suitable level of qualifications	59.5	58.3	66	69.6
The company had difficulties with evaluating its training needs	3.1	2.9	3.6	4.2
Lack of an appropriate offer of training	5.7	5.6	6.1	5.8
The cost of training was too high for the company	29.4	29.3	30.2	26.9
The company focused on induction vocational training rather than continuing training	9.3	8.8	12.1	12.5
The company invested in trainings in previous years and training was not necessary	6.9	6.5	8.7	9.3
Company staff did not have the time to join training	10.1	10	10.3	9.3
Other reasons	33.9	33.5	35.6	39.5

Source: *Continuing Vocational Training in Enterprises (Ustawiczne szkolenia zawodowe w przedsiębiorstwach)*, survey report, GUS, Gdańsk 2007.

The most frequent reasons given for not organizing trainings for employees:

- employees' skills and qualifications satisfy current company needs;
- the company launched a strategy of employing people with a suitable level of qualifications;
- the cost of training is too high for the company;
- company staff did not have the time to join training.

Reasons given for not organizing trainings listed in /Table 1/ do not depend on the size of the company.

Table 2. Organizational forms of continuing training in enterprises

Organizational forms of continuing training	Total	Small enterprises	Mid-sized enterprises	Large enterprises
Courses, of which	17,380	8,943	6,377	2,060
internal	7,480	3,370	2,853	1,257
external	16,512	8,206	6,277	2,029
Other forms of training, of which	20,081	11,783	6,453	1,845
planned for a given position	12,146	7,161	3,738	1,247
planned training by rotation, change, replacement	2,794	1,576	878	340
planned training by participation in study groups	1,338	420	627	291
planned guided self-study	2,990	1,649	942	399
participation in conferences, workshops, fairs and lectures	14,252	7,609	5,154	1,489

Source: *Continuing Vocational Training in Enterprises (Ustawiczne szkolenia zawodowe w przedsiębiorstwach)*, survey report, GUS, Gdańsk 2007.

On the basis of an analysis of organizational forms of continuing education in enterprises, it should be claimed that the most frequent courses are external (95%), while internal courses are most often organized in large companies. Course accessibility coefficient in 2005 was 0.206 and was the highest for large firms. Irrespective of size, companies frequently organize on-the-job training: in 2005, 60% of all internal trainings were on-the-job trainings provided to 764,800 employees. The accessibility rate of such trainings in 2005 was 0.221. Such forms as planned learning by participation in study groups, participation in conferences, workshops, fairs and lectures and planned guided self-study are significantly more often offered in large companies.

62.4% of course participants were male and 37.6% – female. If we look at the age structure of participants, we can see that 7.9% are aged below 25, 87.4% are aged between 25–54 years and 4.7% – over 54. In 2005, accessibility of training in enterprises which offer continuing education was as follows:

- 0.269 for people aged below 25;
- 0.325 for people aged 25–54;
- 0.202 for people over 54.

The most popular courses were: languages (3,123,700 hours), sales and marketing (5,669,100 hours), accounting, finance and insurance, management and administration, office work (4,892,800 hours), personal development and development of professional career (5,701,200 hours), IT and using a PC (2,897,300 hours), technical aspects of the production process and provision of processing and construction services (6,521,200 hours), environmental protection and protection of the work environment (906,900 hours) and selected HR, transport and physical protection services (2,173,600 hours).

In 2005, the cost of 1 hour of training was PLN 36.76, the cost per student was PLN 1,108 and the share of the cost of training in the cost of labour was 0.87%. These costs differ depending not only on the subject, but also on the region and training centre characteristics. In 2005, companies allocated PLN 3,488,700 of their own funds to training and obtained another PLN 9,024,300 from other sources.

Continuing (school and non-school) education is funded from many sources. The most important of them are:

- funds from the state budget and local government budgets transferred by the Ministry of Education and other ministries (e.g. agriculture, economy);
- special purpose funds such as the Labour Fund, PFRON (National Disabled Persons Rehabilitation Fund) and WAZON (Support Program for the Occupational Activity of Disabled Persons); they are special-purpose subsidies for support programs transferred mostly by the Ministry of Labour;
- aid funds (Phare, World Bank);
- company funds;
- EU funds;
- funds contributed by course participants.

There is no research which would enable us to calculate total funds allocated in the national budget for continuing adult education.

Factors affecting the size of training activity indicated by companies:

- high cost of courses;
- adjustment of the offer of trainings to company needs;
- high workload of staff;
- satisfaction of training needs earlier, e.g. in the preceding year;
- more emphasis on induction vocational training rather than continuing training;
- lack of an appropriate offer of training on the market;
- difficulties in evaluating the training needs of the company.

In 2005, induction vocational training was organized in 6,522 (8.9%) enterprises. 74.1% of participants were male. In 2005, a total of 47,583 people received training. The cost of training per participant is PLN 60.52. These costs depend to a great extent on the size of the company. Induction vocational training is the most expensive in large firms (PLN 99.17).

CONCLUSION

As a summary of this part of the survey, we can say that there is a range of opportunities of vocational education and continuing vocational training in Poland, but it is still insufficient. Human capital investment is the main factor of economic and social growth and progress in the modern world. Polish society needs to be made aware that proper education is the guarantee of jobs. On the other hand, vocational training should be constantly updated and occupations and specializations need to be adapted to changes in the Polish and European labour markets. Similarly, continuing education should promote creating conditions which would help adults acquire the necessary knowledge or improve their skills.

Without doubt, diversification of offers of training depending on the changing social and economic needs, conducting research and surveys which help evaluate demand for employees with specific occupational qualifications, establishing a database of educational offers and constant monitoring as part of a flexible response system to labour market needs and disseminating information about opportunities of acquiring appropriate qualifications will significantly improve the social and economic situation in Poland.

REFERENCES

Denison, E., 1974, *Accounting for United States Economic Growth, 1929–1969*, Washington.

Edukacja w roku szkolnym 2005/2006 (*Education and upbringing in the school years 2005/2006*) GUS. Warszawa 2006.

Jaka szkoła po gimnazjum? (What school should I go to after graduation from the lower secondary?), „Gazeta Wyborcza" z 19 marca 2002.

Koch J., *Tendencje w kształceniu inżynierów* (*Trends in the education of engineers*), Pryzmat 115, Politechnika Wrocławska, 2006.

Książek W., *Realizacja reformy edukacji w aspekcie polityki zatrudnienia*, dokument powielany, MEN 2002.

Mańkiewicz-Cudny E.: *Kształcenie, prestiż i potrzeby* (*Education, prestige and needs*), Przegląd techniczny November, 2008.

Mankiw, G., Romer, D., Weil, D., 1992, "A Contribution to the Structure of Economic Growth", *Quarterly Journal of Economics*, Vol. 106.

OECD, *Employment and Growth in the Knowledge-based Economy*, 1996, Paris.

Partel, A., 1995, "Training, Wage Growth and Job Performance: Evidence from a Company Database", *Journal of Labour Economics*, Vol. 13.

Psacharopoulos, G., *The Contribution of Education to Economic Growth*, in J.W. Kendrick (ed.), *International Comparisons of Productivity and Causes of the Slowdown*, 1984, Ballinger Publishing Co., Cambridge.

Sektorowy Program Operacyjny (Sectoral Operational Programme), MGPiPS, Warszawa 2003.

Strategia rozwoju szkolnictwa w Polsce do 2010 r. (*Strategy for Expanding Higher Educational in Poland Until the Year 2010)*, MEN, Warszawa, styczeń 2003.

Świda-Zaremba H.: *Sąd nad zawodówką, (The court on a vocational school* „Gazeta Wyborcza", 25–26 maja 2002.

UNECE Economic Survey of Europe, Part 2: Some Factors in Economic Growth in Europe, 1964, Geneva, (Chapter II).

Ustawiczne szkolenia zawodowe w przedsiębiorstwach (Continuing Vocational Training in Enterprises), survey report, GUS, Gdańsk 2007.

World Bank Monitoring Environmental Progress – a Report on Work in Progress (March 1995), 1995, Washington.

World employment report 2001: life at work in the information economy. 2001