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The needs in continuing education courses for professional engineers

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ABSTRACT: In this article, the authors present a case study on the current needs in continuing education courses for professional engineers. This study is based on data from the Technical Chamber of Greece (TEE) regarding the attitudes of professional engineers of different specialties. Specific surveys on the demographic profile, engineering education and preparation for the profession, the employment and competition in the profession, the unemployment experience and searching for jobs, entrepreneurship, as well as earnings have indicated the need of continuing education courses in certain subjects. These subjects cover the areas of computers and new technologies, business and marketing, renewable energies, the environment, quality control, health and safety, energy saving, refurbishment, waste and pollution, biotechnology, and electronics. Also, continuing education courses are needed in the fields of employment benefits, labour standards, equal employment opportunities, employee rights and responsibilities, labour-management relations, safety and health in the workplace, and job interviewing and negotiating.

INTRODUCTION

This article is based on data from a survey performed on behalf of the Technical Chamber of Greece (TEE). Two companies were involved: TNS/CAP, which selected the data, and VENTRIS, which performed the analysis [1]. The research involved interviews with engineers from all over Greece using a telephone interviewing system, ie Computer-Aided Telephone Interviews (CAITI). The timing of the research was within the period 25 October to 7 December 2006. For the evolution of certain issues, data were used from the 1997 research made on behalf of the TEE by MRB-Hellas and ORCO, and the 2003 research conducted by MRB-Hellas [1][2].

The membership to the TEE is compulsory to all engineers of Greek nationality with degrees from the National Technical University of Athens, other university-level engineering schools in Greece, or with accredited degrees from engineering universities abroad. The requirement to become a member of the TEE is the obtaining of the Professional Engineering (PE) license.

The Technical Chamber of Greece is the organisation that grants the PE license to engineers of all the specialties, graduates of engineering schools in Greece and their equivalent schools from abroad. The PE license is given after examinations that are organised by the TEE three times a year.

Those engineers who are members of the TEE number approximately 93,000 and are distributed among 11 specialties as shown in Table 1 [3]. The number of engineers in each specialty is also shown in Table 1 (end of 2006 data).

The goal of this article is to utilise the data from the TEE survey, and formulate the engineering and business areas in which continued education courses are needed. These courses can assist engineers in their profession, not only regarding areas of engineering and technological developments, but also labour issues, the rights of employed engineers and the knowledge needed in starting new businesses.

Table 1: The distribution of TEE members into specialties.

	Specialty	No. members
1	Civil engineers	25,969
2	Architects	16,843
3	Mechanical engineers	12,819
4	Electrical engineers	13,813
5	Mechanical-electrical	2,458
6	Surveying engineers	5,989
7	Chemical engineers	8,312
8	Mining and metallurgical engineers	2,166
9	Ship-building engineers	84
10	Naval and mechanical engineers	1,482
11	Electronic engineers	2,677
	Total	92,612

SAMPLE EXAMINED AND SIMILAR STUDIES

The sample examined included 2,400 engineers, and it was an ad hoc sample, representative of the body of engineers who are members of the TEE. The sample was based on the membership database of the TEE and included all the specialties of engineers and could separate groups of engineers with PE licenses from 1971 to 2006 at five-year intervals.

For the members of the sample, the same participation was kept as in the total of the TEE members with regard to the specialty of engineers, the year of obtaining the PE license, and the area of professional activity. Also, special research was performed on the 209 engineers who belonged to the new specialties compared to those engineers with traditional specialties.

Specific questions were asked concerning the goal to assemble information regarding demographics, family situation, engineering education, preparation for the profession, employment, competition, unemployment, searching for jobs, earnings and entrepreneurship.

Greek engineering universities and the TEE are the main organisers of continuing education courses with respect to the needs and the wants of the professional engineers [4]. University education in Greece is public, while new legislation expected in 2008 will allow education in private universities in Greece, which will grant accredited degrees. Since the areas of technology and business are those moving at a great pace, private companies may organise continuing education courses in the future as being more flexible in their management decisions and finances.

The assessment methodologies that have been used repeatedly in the evaluation of engineering courses, curricula and educational research suggested the need for sound and rigorous assessment in engineering education [5]. Engineering courses should be restructured every year, not only to apply educational theories, but also to upgrade the contents of each course in areas of fast technological developments [6-8]. In the same way, continuing education courses should be regularly assessed, and continuously restructured and upgraded.

While effective teamwork implies producing high quality engineering products, the need for knowledge on how to work effectively in teams was not considered in the survey [9]. Teamwork skills need to be practiced professionally in engineering classrooms [10]. Students with work experience in engineering companies expressed the necessity to incorporate business classes in the curricula that would facilitate their positioning in the workplace and understanding their responsibilities [11].

New technologies in distance learning were not considered in the questionnaire as a means of continuing education, although the World Wide Web (WWW) and the computer technologies can deliver engineering education content, not only to engineering students, but also to professional engineers in continuing education programmes [12].

The gender influence was considered in certain aspects of this study, such as unemployment and graduate studies. However, the education of engineers at universities is the same for men and women, and the degrees obtained have the same value, although there are slight differences in the educational outcomes of students regarding gender [13].

The level of emotional intelligence of the sample was not considered in this study, although there was the general question to the sample of the satisfaction gained from the profession. Considering that people may be positive or negative in their attitudes towards the profession, as well as other aspects, like starting their own business, the emotional intelligence consideration of the sample might show extreme cases of positive or negative behaviour, similar to the emotional intelligence of engineering students [14].

The retention of engineers in the profession was considered in this study. The low earnings of engineers, unemployment and competition within the profession can make some engineers consider changing their profession. The belief that an engineering degree enhances career security at a respectable salary was the main predictors of short and long-term persistence in engineering [15]. This belief may have been true up to a certain level in this study.

Continuing education in Greece is private and not public, while undergraduate and graduate education is public. Greek engineering universities develop and upgrade their courses to keep up with technological developments and the needs of professional engineers, but only in engineering areas. In other areas, such as business administration, management, human resources, marketing, labour laws, employment issues, the rights and responsibilities of employees, laws when starting and operating a company, finances and risks, taxation laws, plus other issues, engineers do not have the necessary education and they need to take courses at business schools before entering the workforce or starting their own businesses.

RESEARCH FINDINGS

The research findings are presented and discussed below regarding the demographics and family status of the surveyed engineers, engineering education and their preparation for the profession, the level of employment and competition within the profession, unemployment and jobs searches for professional engineers, and the entrepreneurship and engineering earnings.

Demographics and Family Status

Demographics refer to selected population characteristics as utilised in government, marketing or opinion research. A demographic profile is a term used in marketing and broadcasting to describe a demographic grouping or a market segment. This typically involves age bands, economic characteristics, gender, occupation and consumer preferences. Several programmes at the Bureau of Labour Statistics (USA) provide significant amounts of data available for specific demographic categories.

The demographic profile of the participation rate in various engineering specialties of TEE members versus the year of obtaining the PE license is shown in Figure 1. There has been a continuous increase in the number of civil engineers, since one in three new graduates is a civil engineer. The average age of engineers is 40.8 years with 1 out of 3 members being within 31-40 years of age. Younger ages were detected in new engineering specialties (eg naval and electronic engineers) with an average age of 30.8 years. This indicates a fast growing redistribution of ages among engineers and an increase of engineers in numbers, since one in five engineers entered the workforce during the last five years [1].

The demographic profile of male and female professional engineers according to the year they obtained their PE license is shown in Figure 2. A continuous demographic development of the gender participation of engineers showed that one in three new engineers was a woman. This indicates a trend of equal numbers of men and women engineers within the next 10 to 15 years.

Female engineers whose specialty was architecture comprised $^1/_3$ of the total number of engineers in the TEE (46.6% of women within the specialty). Women also constituted 36.6% in the chemical engineering group, 33.5% in the civil engineering group and 30.9% in the surveying group. Women in the mechanical and electrical engineering group comprised only 2.3% of that group and 9.8% in the naval engineering group [1].

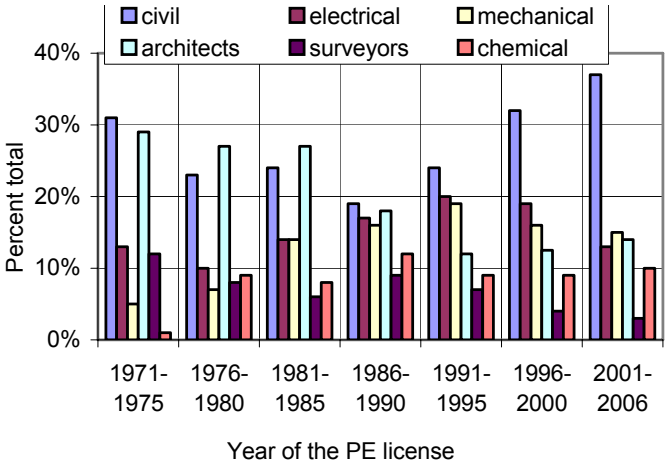

Figure 1: Demographic profile of the participation rate in engineering specialties in the TEE membership by the year of acquiring the PE license.

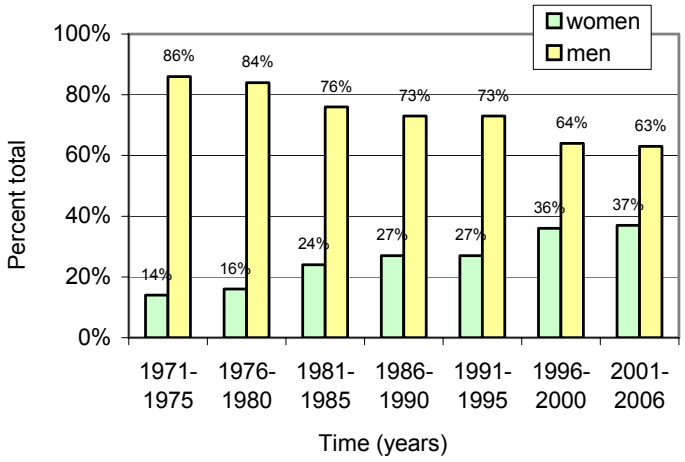

Figure 2: Demographic profile of men and women professional engineers according to the year of obtaining their PE licenses.

Family status was structured upon family obligations incorporating socially agreed-upon duties. Also, the converging demographic trends of increased longevity indicate obligations to aging parents.

Family obligations can take many forms in different societies, and trends in both the labour market and the family are making the more family-friendly work conditions increasingly necessary. Marrying and having children created conditions that made it difficult for women and men to enter the workforce regarding the available type of work and place of work. Temporary medical conditions or family emergencies made people see employment as a threat to life, a perceived inability to fulfil family obligations, or a conviction that getting a job and staying away from home during work hours was against their beliefs.

Family status and the number of children of the sampled engineers are shown in Figure 3. The percentage of unmarried engineers was high, as well as the percentage of those who did not have a child, since seven out of 10 above the age of 40 lived alone. The children of engineers of the 1970s followed (up to a degree) the steps of their parents to become engineers. The proportion of 22% of TEE members in 2006 declared that one of their parents was an engineer compared to the low 5% figure for the 1971-1980 period. This suggests that engineering is becoming a type of *hereditary* profession [2].

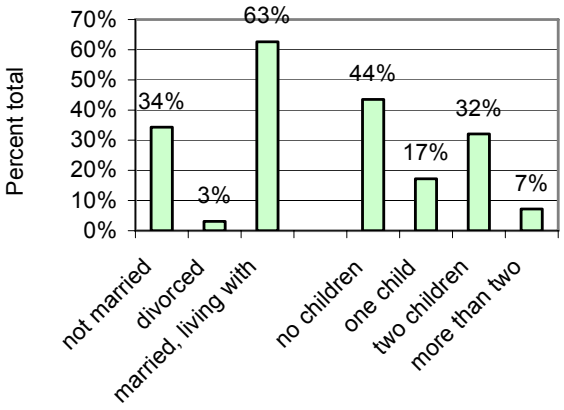

Figure 3: Family status and the number of children of the sample of engineers participating in the survey.

Engineering Education and Preparation for the Profession

Regarding the undergraduate studies of the surveyed engineers, one out of four (25%) of those questioned obtained their first engineering degree abroad. More accurately, 24.7% declared that they gained their first engineering degree from a university abroad, with men being 27.2% and women 18.2%. The preferred specialities for those choosing to study abroad was architecture (44.5%) and electronics (41.9%) as a participation rate, while at the other extreme regarding study abroad preference, surveying engineering was 0.7% and civil engineering was 18.7% [2].

From those who obtained their undergraduate degree abroad, the country of preference with a 30.7% participation rate was Italy, as shown in Figure 4. Of those, the amazing percentage of 59.9% studied architecture. The second preference was found to be Great Britain with a score of 24.5% for studies in mechanical and civil engineering.

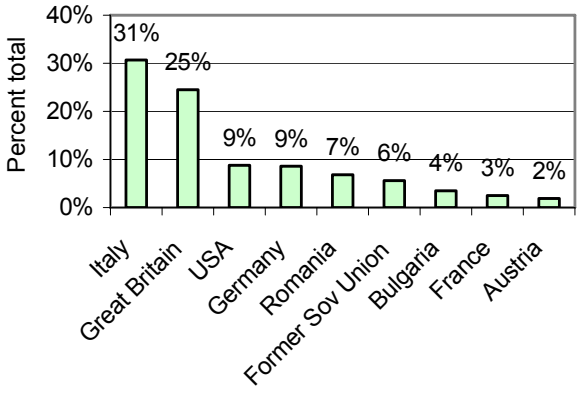

Figure 4: Country of preference for the first engineering degree from abroad.

Regarding graduate studies, 37% of the total engineers surveyed had a graduate degree, a percentage that has increased continuously over the last 15 years, with more than half of the engineers today pursuing a graduate degree mainly within Greece. More specifically, regarding graduate studies, 37.2% of those engineers with graduate degrees declared that they continued directly after their Bachelor's degree, with women being 38% compared to men being 36.9%. Regarding specialty, 47.7% of chemical engineers and 47.3% of electronic engineers had graduate degrees, followed closely by mechanical engineers, electrical engineers and naval engineers [1].

Of those with PE licenses in the period 2001-2006, 53.4% declared graduate studies, which is almost twice as much as the proportion of 27.1% for the 1986-1990 period. Today, six out of 10 engineers gained their graduate degrees from a Greek university, while in the 1971-1980 period, seven out of 10 acquired their graduate degrees from a university abroad [2]. Figure 5 shows the distribution of graduate degrees gained by Greek engineers between Greece and abroad.

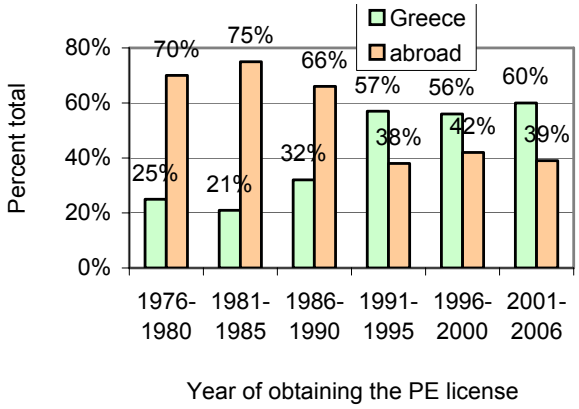

Figure 5: Graduate studies in Greece and abroad for the period 1976-2006.

Over the last few years, there has been the impression that Greek universities do not prepare engineering students well for the engineering profession. Today, less than half of the surveyed engineers (44%) considered that the engineering curriculum prepared them well to face the job market. In 2003, 27.6% of engineers declared that the university curriculum had not adequately prepared them for the job market. In 2006, this percentage had dropped to 20.8%. The specialties in which engineers considered themselves less prepared for their profession were mining-metallurgy, surveying, civil and mechanical.

Regarding the needs of engineers in continuing education courses, the lack of knowledge and skills was found to be mainly in subjects that were complementary to the main subjects of their studies. Most engineers (66.1%) considered that the level of their theoretical studies was excellent to very good, 45% of the surveyed engineers thought that their engineering knowledge was good, 23.1% considered themselves knowledgeable of how to use specialised computer programs, while 21.5% thought that they had obtained good engineering skills in general, but only 16.2% considered that they had obtained financial and managerial knowledge [2].

These percentages indicate that there are large numbers of engineers with interests in new computers technologies, business management and marketing. There was also a large percentage of those who needed continuing education in renewable energy and the environment. The preferences of the questioned engineers in subjects of continuing education courses are shown in Figure 6.

Regarding the question of the length of studies at engineering universities, which is five years today, the majority disagreed with the lowering of the length of studies, with architects being scoring the highest in this regard. Naval and mining engineers favoured the lowering of the length of the studies from five years to four [1].

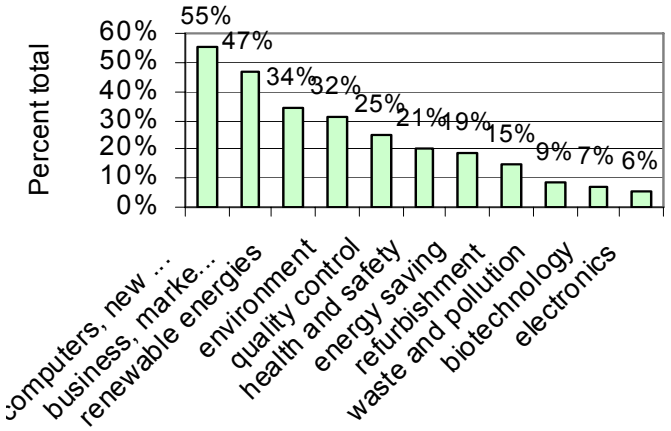

Figure 6: Areas of interest for courses in continuing education for engineers.

Employment and Competition

Economic data are considered as measures of employment and unemployment, which in turn reveals the general level of economic activity. Labour force surveys on employment, unemployment, earnings and other labour market topics are associated with demographic characteristics.

Only 8.3% the total number of engineers worked in the secondary economic sector of production (de-industrialisation of the country), while 2% worked in the primary economic sector. The majority of engineers worked in the tertiary economic sector of services, which covered employment in building construction and public works (49.4%), education and research (7.4%), and in the general public sector (6.9%) [1].

Two out of four engineers were found to have their own engineering practice, one over four worked in public services, and one over four worked in private companies. There was a continuous trend of more engineers to try self-employment (32.1% today compared to 24.8% in 2003), while the proportion reduced for those employed in government jobs (18.1% today compared to 23.8% in 2003), as well as self-employed with personnel in their offices (15.1% compared to 17.3 in 2003), those employees with short contracts in public offices, and those contracting their services.

Almost one out of three (or 29.3%) engineers answered that they were not covered by a labour contract, while 11% did not know if they were covered. Figure 7 shows the study results with the percentages of engineers who had a second job [1].

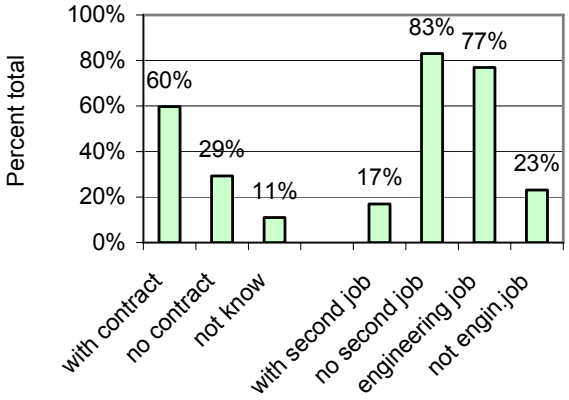

Figure 7: Percentage of employed engineers with or without labour contracts and those with a second job.

Almost two out of 10 engineers (17%) were employed in a second job; of those, 23.1% did not work as an engineer. This, along with the fact that about six out of 10 (61%) who worked in the private sector paid by themselves the contribution to the Pension Fund of Engineers and Contractors of Public Works (TSMEDE), indicates the difficult position encountered by engineers within the last few years. If this was combined with the number of working hours, which averaged 8.8 hours a day in the main job and 2.8 hours a day in the second job, then for those who have a second job, it is obvious that engineers are working long hours. It was revealed that 11.9% of those who had a second job worked in this job for more than five hours a day, which made a total of 13 to 14 hours a day, while those with one job worked more than 10 hours a day [1].

Seven out of 10 engineers (69.3%) worked or were employed in their specialty in 2006, compared to eight out of 10 in 2003. Also, the work in non-specialty jobs was 11.7% and had increased in 2006 compared to the 2003 results. The results on the employment both within and outside the specialty are shown in Figure 8.

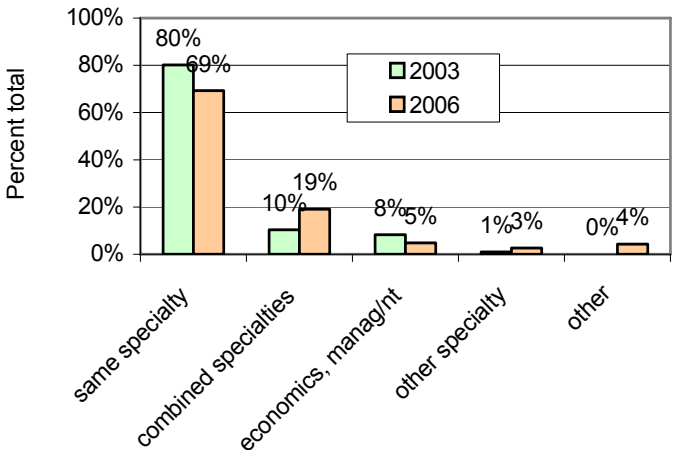

Figure 8: Employment within or outside the specialty.

An important employment issue was found to be professional competition. The main competitors of engineers who are TEE members were graduates of Technological Educational Institutions (TEIs), other specialties of engineers, engineers from within the European Union (EU), university graduates with degrees in different disciplines, and graduates of business and economic schools, as shown in Figure 9.

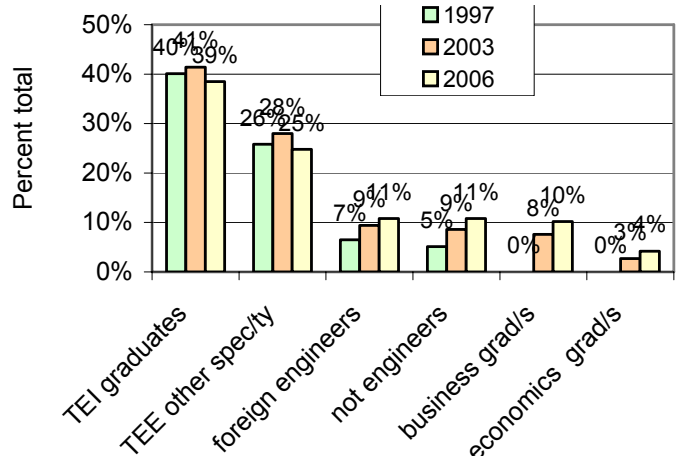

Figure 9: Sources of major competition for professional engineers in Greece.

In connection with the conditions of employment is the degree of knowledge that engineers have regarding the legal aspects and social security status of their labour contract. The statistics were disappointing: 6.2% declared that they were very informed, 26% said that they were rather informed, while 67.8% declared that they were not informed [2].

Engineers declared that from year to year, they were satisfied with the profession, 67.2% stating this now when compared to 66.4% in 2003 and 52.7% in 1997. While 77.7% accepted that they were satisfied with the subject of their job, 51.7% were not satisfied with their earnings.

Unemployment and Searching for Jobs

The unemployment rate was 4.5% and has remained constant over the last 10 years. Employment in non-engineering fields was 11%, while 11% considered that their job required a lower level of education than what they presently had. Currently, the highest unemployment rate of 13.7% is for young engineers and women, and in the specialties of metallurgical engineering (11.3%) and chemical engineering (10.2%), which are connected to the diminishing branch of manufacturing (transformation) [1].

The percentage of unemployed increased in 2006 and the proportions for new specialties were large as well, although the population of new specialties was small. The employment status of the sample of engineers is shown in Figure 10.

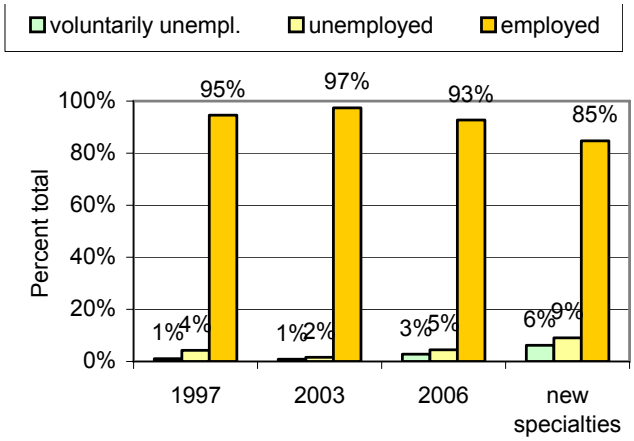

Figure 10: Employment status for the period 1997-2006.

The percentages of unemployed engineers regarding specialty and gender are shown in Figure 11. The unemployment rate was larger for metallurgical engineers and chemical engineers, young engineers (65% for those who obtained the PE license within the last five years), new specialties (9.1% of the total), women (7.1% of the total compared to 3.5% of men). Regarding the location of engineers, unemployment was greater in Thessaloniki compared to Athens [1].

Continuous demographic development was also present for the engineers who lived and worked outside the large urban areas of Athens and Thessaloniki. The demographic profile of engineers in the areas of Athens, Thessaloniki and the rest of Greece in 1997, 2003 and 2006 is shown in Figure 12 and shows that the decreasing proportion of engineers in the Athens and Thessaloniki areas is accompanied by an increased percentage of engineers in the rest of Greece. Regarding the unemployment rate in Athens, Thessaloniki and the rest of Greece, Thessaloniki suffered the largest unemployment rate of 7% [1].

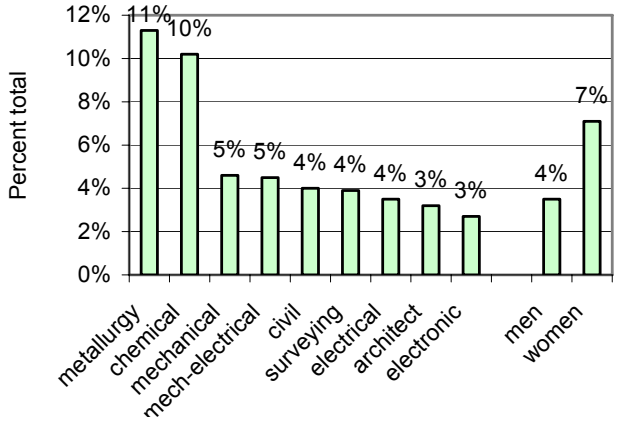

Figure 11: Percentage of unemployed engineers regarding specialty and gender.

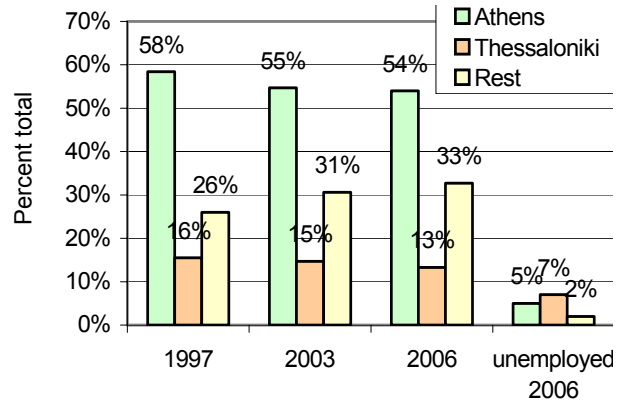

Figure 12: Demographic profile of engineers and unemployed in the areas of Athens, Thessaloniki and the rest of Greece for 1997, 2003 and 2006.

The new unemployment rate of 15.7% belonged to those entering the job market. The long-term unemployed, who had been seeking a job for more than 12 months, regardless if they were young or old engineers, comprised 20.3% of the total unemployed. According to the government data for the last quarter of 2006, the unemployment rate of engineers was 8.9% and for new engineers, this rate was 36.2%, while the old unemployed rate was 54.8%.

A rather unusual result was associated with long-term unemployment in that 20.3% of unemployed engineers had looked for a job for a period longer than 13 months, and of those, 8.3% for a period longer than 25 months. From those unemployed, one out of three declared that he/she had worked for less than six months before being fired, while one out of five worked for a period of seven to 12 months [1].

In order to find a job when unemployed, personal contacts and recommendations were considered very important by 56.5% of respondents and former professional experience also rated highly with 54.4%. On-the-job experience was also deemed to be important [2].

Entrepreneurship and Earnings

Entrepreneurship for engineers means taking an opportunity to start their own business. For younger engineers, it is important to think about developing good business ideas and starting their own companies. Self-employment and entrepreneurship have become increasingly important in modern economies. Immigration fuels entrepreneurship since immigrants are more likely to start businesses because they are younger and less risk-averse on average.

The majority of engineers declared that they intended to remain in the profession, since almost seven out of 10 (or 67.2%) considered themselves satisfied with their profession. However, almost 10.8% of employees and those who gained their PE license in the last five years answered that their job was temporary until they found something better, while 11.8% said they would remain in the engineering profession only if they gained better professional development or better income from their job [1].

The rate of self-employment has increased – especially among new engineers. Employment by contracting engineering services was similar to self-employment, but was subject to employment rules, which was not what engineers preferred, particularly the younger ones. Although 43.8% of employees declared that they chose to be self-employed by contracting their services, 54.8% of those reported that it was at the suggestion of their employer.

Entrepreneurial activity was preferred as the choice for free time, independent and flexible employment conditions, rather than as an exit from unemployment. More than half of those asked did not have their personal business and of those, about seven out of 10 (69%) declared that they did not intend to start their own business in the future. Of those who intended to start their own business, building construction and public works was most preferred at a rate of 56.3%, while second was engineering consulting at a rate of 10.1% and informatics at 9.3%. Also, 0.8% considered the sector of engineering economics [1]. The indication of interest in developing entrepreneurship is shown in Figure 13.

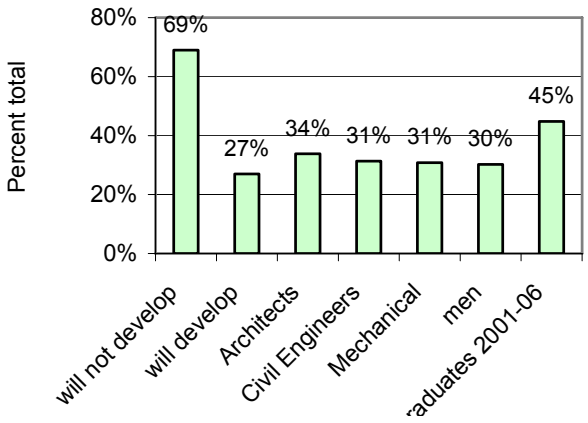

Figure 13: Indication of interest in developing entrepreneurship as a total of the sample, separate specialties, men and 2001-2006 graduates.

Engineers who had their own business and employed personnel created businesses by themselves at a rate of 87%. Concerning private businesses, 83.3% remained with the same number of employees that they had started with, while only 11.7% declared an increase of the number of employees. The reasons for developing private businesses were independence in engineering and economic activities, and a better future for professional development (68.3%) [1].

Six out of 10 unemployed engineers faced unemployment with the financial help of their family, while 13.9% found occasional

employment in other types of jobs. The variation of low and high earnings of engineers living with family or alone is shown in Figure 14 for the total of the sample and for portions of the sample regarding engineering groups of certain age intervals.

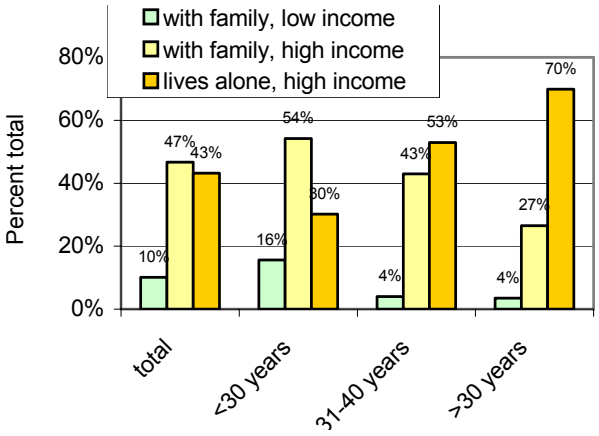

Figure 14: Variations of low and high earnings of engineers living with family or alone.

The annual earnings (in Euros) according to engineering specialty are shown in Figure 15. One in 10 of those questioned gave no answer as to what his/her income was. Four out of 10 declared income over €25,000, and 51% declared income less than €25,000. The amount of income shown in Figure 15 is the gross income before taxes and insurance. One in 10 engineers (10%) declared a gross monthly income of €1,000, while 6.9% declared €1,000-1,150 [1].

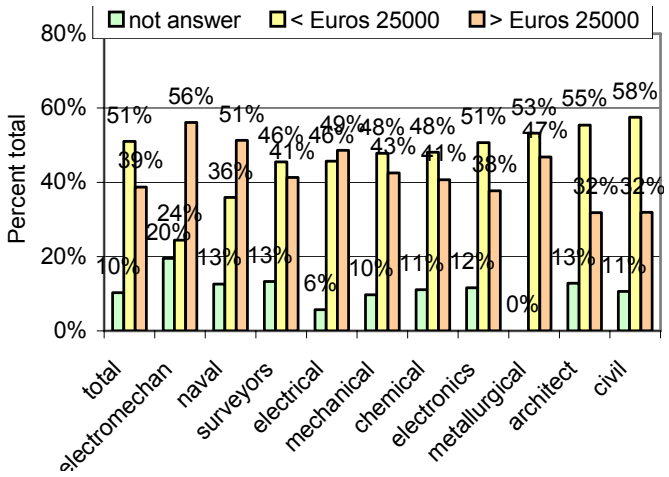

Figure 15: Annual earnings in Euros according to engineering specialty.

Mechanical-electrical engineers and naval engineers declared higher incomes, while architects and civil engineers claimed lower incomes. Self-employed engineers declared higher incomes, and those employed in the public and private sectors with long-term contracts followed. Employees with short-term contracts were at the lower end of gross earnings.

DISCUSSION

With regard to the demographic profile, it can be seen that the majority of engineers who are TEE members comprise civil engineers and architects with an average age of about 40 years, although this trend is becoming smaller. Those engineers of certain specialties, being at the halfway point of their professional lives, were willing to pursue continuing education courses.

The constant increase of the participation of women in the membership of the TEE did not seem to have an effect on the organisation regarding continuing education programmes, since women get exactly the same education as men, and have the same professional rights and responsibilities. Family responsibilities, such as taking care of children and aging parents, were major issues for engineers that affected their employment status and continuing education participation. However, only about half of the engineers were affected at any particular time, and for those engineers family responsibilities could be intense for only short periods of their professional lives, restricting them temporarily from their professional development and continuing education.

With consideration to engineering education, the data shows that the engineer members of the TEE have university degrees from Greek universities at a rate of about 75% and from foreign universities at a rate of about 25% without distinguishing or affecting the level of the mobility of engineers in their professional employment. Graduate studies pursued in Greece are at a rate of 60% and abroad at about 40%; this indicates more a financial problem of engineers or job obligations in Greece, than expressing an aversion to pursue a graduate degree abroad.

Regarding preparation for the profession, most of the surveyed engineers considered that they were well prepared for the profession from their university-level engineering studies. However, during their professional life, they declared a great interest in attending continuing education courses in the following areas with a scale from 55% (maximum) to 6% (minimum): computers and new technologies, business and marketing, renewable energy, the environment, quality control, health and safety, energy saving, refurbishment, waste and pollution, biotechnology, and electronics.

With regard to employment and competition, almost half of the engineers were employed in the building construction industry, and less in the education and public sectors. One third of the engineers surveyed were self-employed, while one fifth were employed in public jobs, and one sixth had their own businesses. Almost 40% of the engineers were not covered or did not know if they were covered by a labour contract, indicating the need to provide education in labour law and the contents of labour contracts. Engineers face competition in their profession from technological university graduates, other specialties, foreign engineers and non-engineers with university degrees in applied science, business and economics. Courses in the rights and responsibilities of the engineers, along with the laws covering the rights and responsibilities of each specialty, should be offered to engineers in their continuing education. However, in the free market environment, competition is present and the priority of the competitiveness of the company becomes the priority of those engineers employed by it. This also has an effect on the satisfaction levels of engineers and the retention rates in the profession.

Concerning unemployment and searching for jobs, about 10% of the surveyed engineers declared that they were unemployed, with younger engineers, women and certain specialties having larger percentages. Unemployment and searching for jobs may be short-term or long-term. Although engineers declared that personal contacts and recommendations were very important in finding a job, as well as professional and on-the-job experience, no one mentioned the importance of CV writing,

interview skills and the salary negotiation process as subjects that could be taught. Also, the issue on how much the candidate fitted in the activities of the company and whether the company needed this candidate should be considered. Hence, courses on job interviewing and negotiating are needed to better match the candidate to a company.

Regarding entrepreneurship and earnings, about 70% affirmed that they did not intend to start their own business in the future, while only about 15% had their own businesses. Of the different specialties, those who would be willing to start their own enterprises were civil engineers, architects and mechanical engineers. Also, a large proportion of new graduates were oriented towards entrepreneurship. Although about 60% of those unemployed were assisted by their families when facing economic problems, and from those employed, one half had an annual income of less than €25,000, there was not much interest indicated in starting their own firms. To start a new business, especially by younger people, and beyond the financial support needed for starting the business, education in labour management relations would be useful, as well as employee benefits and labour law, and business courses in business administration, finance and accounting.

Organisations, such as the TEE, are interested in organising continuing education courses for their members, and seek sponsorship from private companies plus state and local governments where engineers are employed. The TEE is committed to original public policy research and education on economic security, compensation and employee benefits regarding pensions, health and other employee benefit plans. Courses can be prepared on employment benefits, labour standards, equal employment opportunities, employee rights and responsibilities, labour-management relations, and safety and health in the workplace.

CONCLUSIONS

The demographic profile indicates that the majority of professional engineers are civil engineers and architects, with the increasing participation of women. Family responsibilities affect the employment status and continuing education of engineers.

Regarding engineering education and preparation for the profession, the survey indicated that engineers have university degrees from Greece or abroad, an increasing rate of graduate degrees, and interest in continuing education courses like computers and new technologies, business and marketing, renewable energy, the environment, quality control, health and safety, energy saving, refurbishment, waste and pollution, biotechnology, and electronics.

The employment and competition parts of the survey showed that almost half of the engineers were employed in the building construction industry with a large percentage facing competition from other professionals, highlighting the need for courses in labour law, the rights and responsibilities of employees, etc.

The unemployment survey showed an unemployment rate of about one tenth, with larger participation from young engineers, women and certain engineering specialties. In order to achieve success in searching for jobs, courses on job interviewing and negotiating are required.

The entrepreneurship survey revealed that civil engineers, architects and mechanical engineers, as well as younger engineers, were willing to start their own business. Some of the reasons for this might be that some engineers are assisted financially by their families, while one half of engineers have an annual income of less than €25,000. For those engineers who start new businesses, and beyond financial support, courses are needed in labour-management relations, labour law, employee benefits, business administration, finance and accounting.

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