

A comprehensive analysis of the information and communications technologies' professions in Greece

Vassilis Kostoglou¹, Konstantinos Paparrizos²

¹Department of Informatics, TEI of Thessaloniki, P.O. Box 141,
574 00, Thessaloniki. E-mail: vkostogl@it.teithe.gr

²Department of Applied Informatics, University of Macedonia, Egnatias 156,
540 06, Thessaloniki. E-mail: paparriz@uom.gr

Abstract. The expansion of the Information and Communications Technologies (ICT) and their catalytic effects on the labour market of most countries give particular interest to the study and analysis of the different professions exercised by the field's specialists. This work concentrates on the examination of the presence of the ICT professions in the Greek market and on the capabilities for employment of the relevant specialists. Additionally the impacts of the enterprise characteristics on each profession are thoroughly investigated with the use of statistical analysis. All relevant first-born data have been yielded through a survey to nearly 350 enterprises using as research tool a structured questionnaire. The ICT jobs are categorised according to three distinct criteria: their spreading in the enterprises, the professional capabilities of the corresponding practitioners and the identity and number of the significantly affecting enterprise profile characteristics on professions' presence and employment capabilities. As a result of the analysis some professions are suggested as the relatively best selections. The conclusions drawn are commented regarding their novelty and the practical implications for the prospective and young professionals seeking for a career with low unemployment risks and fruitful prospects.

Keywords. Information and communications technologies, profession, labour market, employment, job selection.

1. INTRODUCTION

The rapid development of the Information and Communications Technologies (ICT) and their accession on most aspects of the human activities cause research interest for the investigation of the professional opportunities they offer to the newcomers in the labour market. Furthermore, learning and following a job with positive prospects is today one of the principal priorities of the youngsters. Therefore the examination of the ICT professions presents particular interest for both; young people desiring a favorable professional future and researchers intending to arrive to conclusions with practical contribution. Keeping informed with the latest trends of the labour market could lead to a successful job selection by the youngsters. This information could be very beneficial for their career, as the educational service quality was during their studies [21].

Several bodies and individual researchers have turned their interest on the determination and investigation of the ICT professions. The reasons are evident: the distinct jobs reflect the current situation and trends of the ICT market, which influences significantly the national economies. Also their observed significant dissimilarities between states or even between regions in the same country reveal the large existing differences in the development of the ICT sector [18]. Furthermore the definition of the professions constitutes the first step for the calculation of their balance of supply and demand, one of the important issues in job selection [7].

The examination of a large number of bibliographical sources proved that some hundreds of different ICT professions have been determined and profiled up to date. An early relevant major project of the European Commission attempted to name all different professional activities and adapt them to every state's specific environment. This effort resulted to the formation of a large table named "National Nomenclature of Economic Activities". According to the adapted table for Greece, 11 distinct occupations are determined in the form of activity directly related to information technology [2]. In a study on definition of forthcoming skills for Information Technology (IT) the "Northwest center for emerging technologies" appoints 128 distinct specialities / professions, which have been used up to date in USA [14]. For the determination and classification of IT professions the US Ministry of labor is based methodologically on the dictionary of occupational titles (O*NET). This does not refer to employees but describes the content of specialities by upgrading the requirement of each profession separately. According to O*NET 17 major distinct ICT professions are determined [20]. Also the IT training company New Horizons published the detailed profiles of 15 distinct IT professions [13].

Only a few research studies carried out in Greece have determined or used IT professions. The last published national statistical classification of professions, based on data of year 1992, includes only five major IT jobs [12]. The first relevant attempt by an official scientific body was carried out later. According to a Greek Computer Society's study 46 distinct, existing in Greece, specialities have been determined [4]. Some other studies attempted to estimate the prospects of graduates and therefore derive the IT professions they use from the educational system. Katsanevas on an attempt to calculate the balance of supply and demand of most existing professions initially determines 34 IT jobs [6] and more recently 38 jobs [7], all of them directly correlated to the corresponding minimum required education level. Another labour market's investigation dealing with the demand of higher education specialities uses and investigates 16 IT professions [8].

The main conclusion drawn from the literature review is that due to the existing significant dissimilarities in the degree of the IT accession any analysis of the professions should be carried out at a certain time in a specific geographical area, probably a country, with uniform socio-economic characteristics. This paper deals with the analysis of the 30 more important ICT professions in Greece, focusing on their spreading in the labour market and on the professional prospects of the corresponding specialists. The effects of enterprise characteristics on each one of the ICT professions are also examined through analytical statistics. The next section deals with research objectives and implications. The methodology adopted is described in the fourth section. The statistical analysis and research's principal results are reported in the fifth, paper's main section. Finally, research's concluding remarks are summarized and commented.

2. RESEARCH OBJECTIVES AND IMPLICATIONS

This work focuses on a vital variable of the ICT labour market; the professions exercised by the field's specialists. Its main objectives are to detect the 30 more popular jobs of the Greek ICT market and identify their differences regarding their spreading and prospects as well as the corresponding effects of the enterprise profile characteristics.

Paper's results are novel as it is the first one attempting to categorize these professions according to three distinct criteria: 1) their presence in the labour market, 2) the potentialities for employment of the corresponding professionals and 3) the number of significantly affecting enterprise profile characteristics on their spreading and on the capabilities for employment of the corresponding specialists.

Regarding this work's practical implications, its results and the conclusions derived are mainly addressed to the ICT professionals; prospective ones who look for appropriate studies and specialization for a fruitful professional future and more experienced who, having entered the labour market, seek for a career with low risks for unemployment and promising prospects.

3. METHODOLOGY

A two-phase research model has been adopted for the overall analysis of the ICT professions. The first phase was carried out at an earlier stage and its contribution to this research work was the selection of the existing ICT professions in Greece. The approach used consists of the formation of a panel of 20 prominent IT specialists from the academic community and the labour market. All panel members were individually interviewed in order to select the presently existing occupation areas, specialization sectors and professions in the Greek ICT labour market. Scientists' answers were coded and analyzed. The relative selection frequency, i.e. the percentage of the positive corresponding answers by the panel members, has been determined as the main decisive criterion for the inclusion of a profession in the final list. The first research phase yielded a 30-item ICT professions' list [9].

The main research phase described in this paper is based on first-born data collected through a national survey to all ICT enterprises residing in Greece. It was decided to focus on these companies because they constitute a well defined large population (consisting, at the time of the survey, of 1134 active members) and representing satisfactorily sector's total labour market. A structured questionnaire was chosen as the most feasible and reliable data collection tool. Survey's design and realization were according to internationally accepted techniques for the improvement of its quality and validity [3]. Main priorities were the response rate maximization and the answers credibility taking into account that most of the questions deal with attitude measurement of the respondents [15]. In order to raise the response rate some effective techniques were applied, such as pre-notifying potential respondents [17], keeping a strict privacy policy [16], supplying a response envelope [1] and adopting a strong follow-up policy by sending two reminding letters to all nonrespondents and contacting to some of them personally [5]. Enterprise representatives had at their availability four methods for returning the completed questionnaires (post, fax, World Wide Web and personally to the researchers). This variety contributed significantly for the collection of a large number of responses. Totally were collected 343 valid questionnaires. The total response rate was over 30%, which is considered as absolutely adequate for deducing reliable conclusions [11].

Four 'closed' questions were used for outlining the enterprises' profiles. The characteristics examined are: a) the location (analyzed for Athens, Thessaloniki and rest of the country), b) the age (in four, five-year interval, categories according to the year of establishment), c) the size (in six categories based on employees' number) and d) the geographical range of activities (local, regional, national and international activation) [10]. The questions related to the examination of the professions are also closed, pre-coded and give to the respondent the possibility of multiple choices. Before its distribution to the enterprises a pilot survey was carried out. The questionnaire was given out to 12 specialists for the evaluation of its validity and clarity.

4. ANALYSIS AND MAIN RESULTS

The statistical analysis was carried out with the use of SPSS 12.0, the statistical package for the social sciences [19]. The items examined are the 30 ICT professions gathered from the preliminary stage of the research; the personal interviewing of 20 IT scientists. Two main parameters are examined, being considered as the dependent variables: a) the employment of

ICT personnel for each profession, which snapshots its spreading in the labour market and b) the estimations of the market about the degree of easiness/difficulty for finding such personnel for employment. The principal characteristics outlining the ICT enterprises' profile are problem's independent variables.

4.1 Professions' spreading

As criterion of a profession's spreading in the labour market is considered the employment of corresponding workforce in the ICT enterprises. Informants were asked whether their company employs personnel practicing each one of the 30 selected professions. Table 1 presents the professions' sorting according to their use in the enterprises.

Table 1. Classification of professions according to their spreading in ICT enterprises

	ICT profession	Enterprise percentage ¹
1	PC Technician	54.2
2	Network Technician	47.8
3	Programmer	47.2
4	Technical Support Manager	47.2
5	Information Technology Engineer	40.5
6	Network and Computer Systems Administrator	37.6
7	Database Analyst	37.3
8	Database Developer	37.3
9	Computer Operator	37.0
10	Information Technology Project Leader	34.4
11	Customer Service Representative	32.9
12	Applications Analyst	31.8
13	Database Administrator	29.2
14	Systems Analyst	27.1
15	Communications and Networks Engineer	26.8
16	Network Analyst	25.7
17	Web Producer	25.7
18	Operating Systems Programmer/Analyst	25.7
19	System Programmer	22.2
20	Computer and Network Security Specialist	21.3
21	Information System Services Director/Manager	21.0
22	Business Analyst	19.5
23	Information Systems Planner	19.0
24	E-Business Specialist	18.4
25	Webmaster	17.5
26	Database Security Expert	15.7
27	Computer Science Lecturer / Trainer	14.3
28	Multimedia Specialist	12.2
29	E-Publishing Specialist	6.1
30	Geographic Information System (GIS) Analyst	5.0

¹: Percentage (%) of enterprises employing currently corresponding personnel

These results show that professions' spreading is very different varying from 5% up to 54% and allowing their classification in three distinguished categories:

1) Professions with high spreading:

They are used by at least 40% of the companies. In this category belong the first five professions of table 1.

2) Professions with medium spreading:

Their frequency of existence in the enterprises is between 20% and 40%. Medium spreading have 16 professions (from the 6th until the 21st of table 1).

3) Professions with low spreading:

They are used by less than 20% of the enterprises. Low spreading have the last nine professions of table 1.

Table 2. Degree of easiness/difficulty in employing personnel practising every ICT profession

	ICT profession	Easy finding (%) ¹	Not easy neither difficult finding (%) ¹	Difficult finding (%) ¹
1	Database Analyst	8.0	46.7	45.3
2	Network Analyst	20.2	48.2	31.6
3	Business Analyst	17.9	34.7	47.4
4	Applications Analyst	11.9	47.6	40.5
5	Systems Analyst	14.0	45.8	40.2
6	Customer Service Representative	26.2	42.9	31.0
7	Database Administrator	20.2	52.9	26.9
8	Network and Computer Systems Administrator	20.8	52.3	26.9
9	Information System Services Director/Manager	20.4	45.2	34.4
10	Web Producer	37.3	44.9	17.8
11	Database Security Expert	4.7	35.3	60.0
12	Computer and Network Security Specialist	7.2	38.1	54.6
13	Geographic Information System (GIS) Analyst	2.0	27.5	70.6
14	Multimedia Specialist	31.6	49.4	19.0
15	E-Business Specialist	25.8	43.0	31.2
16	E-Publishing Specialist	16.7	46.3	37.0
17	Webmaster	30.7	45.5	23.9
18	Computer Science Lecturer / Trainer	42.7	40.2	17.1
19	Information Technology Engineer	40.5	42.6	16.9
20	Communications and Network Engineer	27.8	46.1	26.1
21	Programmer	37.9	42.0	20.1
22	Operating Systems Programmer/Analyst	23.4	46.7	29.9
23	Database Developer	23.6	47.9	28.6
24	System Programmer	19.4	52.7	28.0
25	Information Systems Planner	9.0	51.7	38.3
26	Network Technician	40.0	45.3	14.7
27	PC Technician	58.7	29.9	11.4
28	Information Technology Project Leader	13.8	40.0	46.2
29	Technical Support Manager	28.9	48.8	22.3
30	Computer Operator	72.3	20.4	7.3

¹: Percentage (%) of enterprises estimating the particular degree of easiness/difficulty

4.2 Capabilities for employment

The degree of easiness or difficulty for finding specialized personnel practising each of the ICT professions is considered - along with the spreading in the market - as one of the principal criteria for its evaluation regarding the professional prospects of the relevant ICT graduates. Table 2 includes the results concluded by the analysis of the corresponding answers.

The next stage of the analysis consists in the classification of the ICT professions according to the degree of easiness or difficulty enterprises face in finding corresponding personnel for employment. For this purpose two lists have been composed including the 10 “easiest” (table 3) and the 10 “most difficult” professions in employing relevant personnel respectively (table 4).

A high degree of easiness in finding personnel for employment in a certain profession is originally a preventive factor for practising it. On the contrary, the extensive spreading of a profession in the labour market constitutes a strong reason for a young professional in selecting it. Based on these grounds the two most tempting jobs of table 3 are the “network technician” and the “technical support manager” as they present a high spreading in the labour market, whereas finding corresponding personnel for employment is not considered as easy.

Table 3. The 10 “easiest”¹ ICT professions

	ICT profession	Labour market's estimation ²	Enterprise percentage ³
1	Computer Operator	72.3	37.0
2	PC Technician	58.7	54.2
3	Computer Science Lecturer / Trainer	42.7	14.3
4	Information Technology Engineer	40.5	40.5
5	Network Technician	40.0	47.8
6	Programmer	37.9	47.2
7	Web Producer	37.3	25.7
8	Multimedia Specialist	31.6	12.2
9	Webmaster	30.7	17.5
10	Technical Support Manager	28.9	47.2

¹: According to the degree of easiness in finding relevant personnel for employment

²: Percentage (%) of enterprises estimating that it is easy to employ a relevant professional

³: Percentage (%) of enterprises currently using the corresponding profession

On the other hand a high degree of difficulty in finding corresponding specialized personnel is obviously a lure for selecting it, especially if it couples with relatively high spreading in the market. The most attractive professions of table 4 are the “database analyst” and the “IT project leader”. Both of them present an extensive use (being existent in more than a third of ICT enterprises) and simultaneously a high degree of difficulty in finding corresponding personnel. Very good options are also the professions related to software or computer security (“database security expert” and “computer and network security specialist”). A very high degree of difficulty is reported, whilst the fast evolution of ICT prescribes a spectacular raise of the relevant needs.

Table 4. The 10 “most difficult”¹ ICT professions

	ICT profession	Labour market’s estimation ²	Enterprise percentage ³
1	Geographic Information System (GIS) Analyst	70.6	5.0
2	Database Security Expert	60.0	15.7
3	Computer and Network Security Specialist	54.6	21.3
4	Business Analyst	47.4	19.5
5	Information Technology Project Leader	46.2	34.4
6	Database Analyst	45.3	37.3
7	Applications Analyst	40.5	31.8
8	Systems Analyst	40.2	27.3
9	Information Systems Planner	39.3	19.0
10	E-Publishing Specialist	37.0	6.1

¹: According to the degree of difficulty in finding relevant personnel for employment

²: Percentage (%) of enterprises estimating that it is difficult to employ a relevant professional

³: Percentage (%) of enterprises currently using the corresponding profession

4.3 The impact of the independent variables

As quoted previously problem’s independent variables are the four main characteristics forming enterprises’ profile; namely the location, the age, the size and the geographical range of activities. The impact of these variables on the professions’ spreading and the capabilities for finding corresponding personnel for employment are examined using two statistical techniques. Initially the X^2 test is applied and furthermore the Spearman’s correlation coefficients (at significance levels of 95% and 99%) are calculated for all 120 possible combinations in order to detect any existing trends.

4.3.1 Effects on professions’ spreading

Regarding the effects of enterprise profile characteristics on professions’ spreading the following findings are gathered (only the cases where the statistically significant statistical result is accompanied by a specific trend are commented):

- 1) The impact of enterprise size is acute. The presence of the majority of jobs (73%) is increased in companies with larger number of employees.
- 2) Enterprise location does not play a significant role. Only two professions (“multimedia specialist” and “e-publishing specialist”) are used more by enterprises located in Attica, the prefecture of the capital.
- 3) The impact of enterprise age is low. Merely four professions (“technical support manager”, “computer science lecturer/trainer”, “e-publishing specialist” and “multimedia specialist”) present increased presence in older companies and in four others emerge similar trends.
- 4) The geographical range of enterprise activities affects the use of eight professions. The presence of seven of them is greater in enterprises activating at international or national level, whereas the “lecturer/trainer” is used more by locally acting companies (table 7).

According to the number of independent variables affecting significantly the professions’ spreading in the labour market, they are classified in the following categories:

1st category of ICT professions (7 jobs):

Their use is not affected by any of the enterprise characteristics. Their spreading in the labour market is uniform (table 5).

Table 5. ICT professions with uniform spreading

	ICT profession
1	Network Analyst
2	Systems Analyst
3	Database Administrator
4	Web Producer
5	Programmer
6	Operating Systems Programmer/Analyst
7	Information Technology Project Leader

2nd category of ICT professions (13 jobs):

Their use is affected only by enterprise size. Their use is greater in enterprises with a large number of employees (table 6).

Table 6. ICT professions with greater use in large enterprises

	ICT profession
1	Data Base Analyst
2	Applications Analyst
3	Customer Service Representative
4	Network and Computer Systems Administrator
5	Information System Services Director/Manager
6	Database Security Expert
7	Computer and Network Security Specialist
8	Geographic Information System (GIS) Analyst
9	E-Business Specialist
10	Information Technology Engineer
11	Database Developer
12	Network Technician
13	Computer Operator

3rd category of ICT professions (7 jobs):

Their presence in the labour market is affected by two profile characteristics. The first two jobs of table 7 present greater use in larger and older enterprises and the next five in larger and with wider (international or national) geographical range of activities enterprises.

Table 7. ICT professions with greater use spreading in large and old¹ or internationally activating enterprises²

	ICT profession
1	System Programmer ¹
2	Technical Support Manager ¹
3	Business Analyst ²
4	Webmaster ²
5	Communications and Network Engineer ²
6	Information Systems Planner ²
7	PC Technician ²

¹: Greater use in larger and older enterprises

²: Greater use in larger and internationally activating enterprises

4th category of ICT professions (2 jobs):

Their use is affected by three enterprise profile characteristics:

- 1) “Computer science lecturers/trainers” are employed more by older, larger and locally activating companies
- 2) “E-publishing specialists” are employed more by central (located in Attica), larger and internationally activating companies

5th category of ICT professions (1 job):

It’s spreading is affected by all main enterprise profile characteristics. Central, large, old and internationally activating companies employ more “multimedia specialists”.

4.3.2 Effects on the capabilities for employment

The results of the preceding elaboration (table 2) show that the labour market’s estimations for the degree of easiness or difficulty for finding specialized personnel for employment depend substantially on the specific specialization.

The analysis regarding the effects on the capabilities for employment detected very few statistically significant results. The application of the X^2 test gave only seven - out of the totally 120 - cases with a value less than 0.05, while there were found 13 scattered statistically significant Spearman’s correlation coefficients. The sole effects verified by both statistical tests are the following:

- 1) Small companies as well as those located in the province face greater difficulties in finding for employment “technical support managers”
- 2) Small enterprises have more difficulties than larger ones in finding “customer service representatives”

Furthermore, in professions related to programming or education emerge trends of less difficulty for employment by large companies. The remaining significant coefficients are detached and do not prove the existence of any worthy of mention effects.

5. CONCLUDING REMARKS

This paper focused on the analysis of the ICT professions in Greece. The main issues examined are their spreading in the labour market, the capabilities for employment of the corresponding specialists and the effects of the enterprise profile characteristics on each one of 30 professions.

According to their presence in the labour market the ICT professions are allocated in three categories: 17% of them present high spreading (more than 40% of the companies use them), 53% have medium spreading (between 20% and 40%) and 30% low spreading (being used by less than 20% of the companies).

It has been detected that the easiness (or difficulty) for finding ICT personnel for employment depends significantly on its specialization. The combination of this “employment degree” and the spreading of every profession in the market give a reliable criterion for effective job selection. Six ICT professions are suggested to the young professionals as the most promising for a career with low unemployment risks. Jobs related to technical support, databases, security and IT project management offer the relatively best prospects.

The impacts of enterprise profile characteristics, despite not being large, show that the market’s “local” profile plays a significant role towards a more successful professional orientation and job selection.

REFERENCES

- [1] Armstrong J. S. and Lusk E. J. (1987) "Return postage in mail surveys" *Public Opinion Quarterly*, 51, pp. 233-248.
- [2] Communautés Européennes (1990) "Nomenclature générale des activités économiques dans les Communautés Européennes".
- [3] Fowler F. J. (1995) "Improving survey questions: Design and evaluation", Thousand Oaks, CA: Sage.
- [4] Greek Computer Society (1996) "Development of qualifications/tasks index for professionals in information and telecommunications technologies of the public sector".
- [5] Jolson M. A. (1977) "How to double or triple mail response rates" (1977) *Journal of Marketing*, 41, pp. 78-81.
- [6] Katsanevas T. (1998) "Professions of the Future". Athens: Papazisis publications.
- [7] Katsanevas T. (2002) "Professions of the future and of the past: professions prospects in 13 prefectures and career orientation", Athens: Patakis publications.
- [8] Klimopoulos S., Giziakis K., Xouvardas B., Kehagias D., Bardi E. and Reizis, N (2001) "Investigation Study of the Labour Market with Respect to the Demand of Universities and Technological Educational Institutions Specialities".
- [9] Kostoglou V. and Paparrizos K. (2003) "Occupation areas, specialization sectors and professions in ICT: An overall analysis and selection methodology" in Proceedings of the 9th Pan-Hellenic Conference of the Greek Computer Society, Thessaloniki, Greece, pp. 310-321.
- [10] Kostoglou V., Paparrizos K. and Zafiroopoulos C. (2004) "Investigating human resource management in ICT labour market", *Operational Research an International Journal*, 4(1), pp. 57-72.
- [11] Linsky A. (1975) "Stimulating Responses to mailed questionnaires: A review", *Public Opinion Quarterly*, 39, pp. 82-101.
- [12] National Statistical Service of Greece (1995) "Statistical Classification of Professions STEP – 92", Athens.
- [13] New Horizons. (2002) "Your IT future", Retrieved January, 14 2004 from the World Wide Web: <http://www.youritfuture.com/english/index.asp>".
- [14] Northwest Center for Emerging Technologies - NWCET (1999) "Building a foundation for tomorrow, Skills standards for information technology".
- [15] Oppenheim A. N. (1966) "Questionnaire design and attitude measurement", London: Heinemann.
- [16] Rucker M., Hughes R., Thompson R., Harrison A. and Vanderlip, N. (1984) "Personalization of mail surveys: Too much of a good thing?", *Educational and Psychological Measurement*, pp. 893-905.
- [17] Schegelmilch B. B. and Diamantopoulos S. (1991) "Prenotification and mail survey response rates: A quantitative integration of the literature", *Journal of the Market Research Society*, 33, pp. 243-255.

- [18] Siskos Y., Krassadaki L., Karagounakis A. and Fortsas V. (2003) “Vocational training and computer glossaries”, Technical University of Crete, DSS Laboratory-ERGASYA, Retrieved December, 2, 2004 from the World Wide Web: <http://www.astrolavos.tuc.gr>.
- [19] SPSS Inc. (2003). “Base 12.0 User’s Guide”, Chicago: SPSS Inc.
- [20] US Ministry of Labor (1998) “O*NET – The Occupational information network”.
- [21] Zafiropoulos, C. (2005). “Service quality assessment in higher education. Some methodological comments”, *Review of the Greek Academy of Business Administration*, 3 (3-4), in press.