THE ANACHRONISTIC GENDER-SCIENCE IMBALANCE: TECHNOPHOBIA AND THE TECHNOLOGICAL GENDER GAP IN GREECE

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'Research is on the highest peak of the agenda. Gender equality is a priority to be followed in the next years […] excellence requires diversity […] the anachronistic gender science imbalance must be removed […] 60 percent of university graduates in the European Union are women […] and only 15 percent of full professors are women […] If we do not create a system, which allows everybody to contribute in the same way, we throw away potential, which in truth we cannot afford to simply abandon.' European Science and Research Commissioner Janez Potočnik announced at the recent EU-conference on 'Re-searching Women in Science and Technology'[1] *held in Vienna, Austria.*

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Abstract

Qualitative research conducted with specific focus groups in areas representative of Greece - urban, industrial and agricultural populations, confirms the gender impact factor on digital illiteracy. A large part of the population in Greek society today is displaying technophobia, women in particular, as is the case internationally. Gender-constrained attitudes against science and technology are formulated very early. The compatibility of private life and career is essentially a female problem, a factor that is clearly evident in the latest EU average employment quota for women which is marked by a decrease of 14.3 percent, in contrast to the 5.6 percent increase in the employment quota for men. The situation is even worse in the science and technology fields. Alarming are the results of the latest study of the EU-Commission 'She Figures 2006', according to which women remain a minority among researchers in the EU. The first part of the study is based on questionnaires, group interviews and discourse analyses with specific focus group: (1) female

and male university students, (2) female students, and (3) primary and secondary male and female school teachers. In the second unity, social theories and theoretical approaches are used to examine the multivariable inclusive vs. exclusionary factors that result in the 'leaky pipeline' and the 'glass ceiling', namely the digital divide, the under-representation of women in science and technology. Although efforts are being made to attract women to the knowledge economy and IT professions, educational reforms alone will have very limited impact without the systematic promotion of inter and multidisciplinary research, international collaborations, interdisciplinarity in Education, the promotion of a gender-inclusive labor market that recruits and retains women as well as the establishment of a more flexible and family-friendly oriented working environment.

1. Introduction

The Greek public school system's inadequate technological infrastructures, deficiencies in the vocational orientation of students and the continuous techno-education of teachers, including the lack of collaboration of the education system with the employment sector and the ICT industry, have made it impossible for the gender subject to keep up with the accelerated speed of technological developments.

In its aim to counter digital illiteracy and technophobia, namely exclusion from participation in the information society (IS), the public school system in Greece has been focusing on the continuous training of teachers and students in new technologies and on an equal distribution of technological infrastructures in high schools.[2] For instance, in the 3rd Community Framework Support Programme for Structural Development in Greece, the Greek Ministry of Education implemented the training of 76,000 teachers in ICT. However, it seems to have failed to reach the aspired levels of effectiveness. Specifically, according to our findings, students continue to demonstrate technophobia or negative attitudes towards computers and information and communication technologies (ICT). Digital illiteracy has also been detected amongst primary and secondary school teachers throughout the country who explicitly express a technophobic unwillingness to use computers in their classrooms, although they claim to agree on their significant educational value and usefulness. Positive attitudes towards computers and technology have been displayed by a restricted percentage of male and female pupils, students and teachers who have had previous out-of-school experience or access to computers at home. (Pantouli, 2006) Undeniably, many international studies confirm that awareness, familiarity and a change in attitudes have been achieved through regular use, rather than formal training, however, other factors, such as gender, also exercise a dynamic impact. (Warrington & Younger, 2000)

In Greece, as is the case internationally, more male high school pupils and university students use computers at home compared to female pupils and students. Female teachers and students, in contrast to their male counterparts, consistently display technophobia when they have to use computers. (Pantouli, 2006) Although the use of computers or the internet as a tool is *gender-neutral*, access to and motivation of use is evidently *gender-constrained*. Closing the gender gap in science and technology education requires new ways of educating girls in the computer age. New teaching methods are needed to eliminate technophobia and ensure that girls and women change their attitudes concerning science and technology. Specifically, methods that are developed by teachers and for teachers through school programs, as well as teachers in new roles. International data shows that teachers, who ensure equal opportunities, can be effective in reducing the technological gender gap. (Jenson & Brushwood, 2003; Schlager & Fusco, 2003) By moving in a gender-oriented direction, digital illiteracy, gender-stereotyping of computer use, gendered educational choices and attitudes towards ICT, as well as other science and technological fields could effectively be eliminated. Additionally required are computers in all classrooms, equitable and non-discriminatory distribution of technological infrastructures, appropriate policies, international educational benchmarking and collaboration with the ICT industry.

The digital divide based on gender, socioeconomic class, age, race or cultural 'difference', as opposed to respect for diversity, is increasingly becoming apparent as a social problem. Research on information society related technophobia, today's 'digital exiles', is very scarce. Studies have been focusing on socio-economic research, consumer-related issues, market analyses, the user-friendliness and diversity of technologies and designs, etc. However, very little is known about today's social groups that are progressively becoming excluded from this sphere of economic activity as well as the factors that lie behind human 'digital rights' or the disrespect and exploitation of the electronic personality. If appropriate measures are not taken it may no longer be an issue of technophobia, but one of 'absolute exclusion.' (Kamberidou & Patsantaras, 2006)

In the process of European integration and emancipation to the diverse forms of progress and developments, social exclusions cannot be tolerated, as exclusion from knowledge and participation in the information society contradicts European values. Closing the technological gap for many non-mainstream social groups requires an action plan to be integrated into policies, including educational reforms, best practices, innovatory elements, even gender distribution, raising awareness, definition of proper indicators, impact measurements, targeted socio-economic research, the systematic promotion of multidisciplinary international research and collaboration, the promotion of a more flexible and gender-inclusive labor market that recruits and retains women and the establishment of a family-friendly oriented working environment.

2. Methodology

Qualitative research conducted with specific focus groups in areas representative of Greece since they include urban, industrial and agricultural populations, confirms the gender impact factor on digital illiteracy. The first part of the study based on discourse analysis, group interviews and questionnaires distributed to specific focus groups— (1) female and male freshmen students, (2) female students, and (3) primary and secondary male and female school teachers— indicates that new and innovative educational reforms are required to eliminate the digital divide.

Analytically, in the first unity of this study, the qualitative method used to evaluate the material that arose from questionnaires[3], group interviews and discourses with specific focus groups in Greek society was the interpretative phenomenological analysis (Smith, 1999). Additionally, the Computer Attitude Scale (CAS), designed and developed by Gressard & Loyd (1986), formulated through views of teachers who received continued training in ICT, was applied in order to examine computer competency, attitudes and views on ICT. (Pantouli, 2005) According to the findings, despite the evolving and transformative process of gender perceptions, stereotypes, and identities, women in particular continue to display technophobia.

Firstly, male and female freshmen students from three university departments were interviewed and responded to questionnaires, specifically in three departments of the Aristotle University of Thessalonica: the Mathematics Department, the Department of Philosophy and Education and the Department of Psychology. The statistical analysis program SPSS for Windows Release 10 was used to analyze the data. The questionnaire had been formulated on the basis of bibliographical sources related to the subject (Schlager & Fusco, 2003; Webster, 2002; Erwin & Maurutto,1998 et al.) as well as the observations and comments of female university students who had initially been invited to participate in a pilot-test or pre-test session, namely to answer the first questionnaire and subsequently discuss:

1) gender as an analytical category in Greek society,
2) the computer skills they acquired in the school framework or in the out of school context,
3) their academic experiences, etc.

Secondly, female students in the Department of Philosophy and Education were interviewed and took part in group discussions to examine women's computer skills, attitudes and interest or lack of interest in ICT. In other words, how women evaluate themselves, their abilities,

their experiences, their achievements, their social environment, and in particular their school and academic experiences, including teacher's attitudes, the influence and support of their families and peer groups, the personal and social factors influencing their professional choices, etc.

Thirdly, the Computer Attitude Scale (CAS) was used to examine the computer competency, ICT attitudes and views of female and male primary and secondary school teachers, who were undertaking training courses on computers in regions that are considered representative of Greece.

The second unity focuses on current discussions, EU programs and efforts to attract women to the knowledge economy and IT professions (EU-Council Presidency, 2006a), including the multivariable 'inclusive' vs. 'exclusionary' factors that result in the 'leaky pipeline' and the 'glass ceiling', issues repeatedly examined and confirmed by social theorists. (Kimmel, 2004; Tooley, 2003; Hodgson, 2001; McNay, 2000) The European Commission, in acknowledging this anachronistic gender-science imbalance as a social problem, has been consistently taking steps to mainstream gender into its projects in order to eliminate the massive under-representation of women in science and technology. (European Commission 2001, European Commission, 2005) Moreover, this unity examines the role of education in combating digital illiteracy, the complexities of E-economy logic and E-technologies, and in particular discusses the protection of human 'digital rights' and the electronic personality, in view of 'virtual' globalization.

3. The gender factor in digital illiteracy

The deficiencies in the techno-education programs in Greek high schools were confirmed following a study— with male and female freshmen students in three departments of the Aristotle University of Thessalonica— based on questionnaires, group interviews and discourse analysis. The results obtained amongst students of the Mathematics Department, who had followed a science orientation/background in high school, served as a baseline for the comparison of primary research data obtained in the Department of Philosophy and Education and in the Department of Psychology. (Pantouli, 2006)

Specifically, according to the findings, the male and female university students' experience with computers in high school did not assist them in the out-of-school context or in their undergraduate studies— even though the majority of the students participating in the study had been taught 'computer technology' in high school, sometimes under the best of conditions: adequate equipment and computer rooms, one or two students per computer, etc. The data reveals that these high school computer classes were unsuccessful, namely the students lacked needed skills such as text editing, calculation via spreadsheets, connecting to the internet, essentials of web design, use of search engines, etc.

Of particular interest are the results concerning the geographical area of study. The hypothesis that the level of computer competency or knowledge in ICT is higher for male and female students who come from urban areas could not be confirmed in this study. In other words, the district, region or residential area of the participants-respondents did not play a significant role, as had originally been expected. It did not influence attitudes and opportunities concerning technology and computers. Consequently, the place of residence, i.e. urban area, does not appear as a factor that determines the gender subject's relationship with computers and ICT. The majority of the students from rural and agricultural areas, as well as those from urban and suburban areas, claimed that they had not benefited by the technology classes or computer lessons they had received in high school. Irrespective of the area of residence, female and male students claimed to have a 'low' level in computer skills and consistently displayed technophobia or acknowledged they felt 'insecure' when they had to work with computers.

A factor that seemed to play a decisive role was the gender subject's access to a computer at home. Specifically, the impact factors that determine the degree of digital literacy, according to the findings, are firstly the male or female student's familiarization with a computer prior to high school or access to a

computer at home, and secondly, the educational level of his or her father. Students with fathers who had high educational levels or backgrounds display positive attitudes towards ICT as well as greater computer skills, in comparison to those with fathers of a medium or lower educational background.

Additionally, the gender variable seems to play a decisive role in the development of attitudes about computers and ICT. According to the results, not only the female students enrolled in the theoretical sciences or departments of theoretical studies, but those in the science department as well, who in high school had followed a science orientation, claimed they felt 'insecure' and that they did not do well in the use of computers. In other words, regardless of their scientific orientation and background, women displayed negative attitudes towards computers and a lack of familiarization with ICT or information technology (IT) in general. The majority of the female students displayed technophobia and repeatedly maintained they had 'low' levels in computer skills, competency and knowledge.

In an earlier study interviews were conducted with another focus group, namely female freshmen students in the Department of Philosophy and Education, to examine women's computer competency, interest or lack of interest in ICT. (Pantouli, 2006) The qualitative method used to analyze the material that arose from the interviews (with (7groups/40students similar in gender, age and major/specialization) was the interpretative phenomenological analysis (Smith, 1999). According to the findings the female students did not view their computer competency or incompetence as a matter of capability or aptitude, but perceived it as an issue of interest or lack of interest, especially in regard to the family-children-career balance. Firstly, they claimed that computers conflicted with their interests. Secondly, some female students maintained that this was a matter of 'nature', and others a result of socialization. Thirdly, the female students associated the professional use of computers with gender-based employment distribution. On the other hand, they did not question or doubt their intellectual abilities, capabilities, potential or aptitudes.

It seems that gender-constrained attitudes against science and technology are formulated very early, before the choice of one's field of study. The compatibility of private life and career is essentially a female problem (Kimmel 2004 et al.), a factor that is clearly evident in the latest EU average employment quota for women which is marked by a decrease of 14.3 percent, in contrast to the 5.6 percent increase in the employment quota for men. (EU-Council Presidency, 2006b) The situation is even worse in the science and technology fields. **(**EU-Council Presidency, 2006a) The female interpretation of technology perceives the use of computers in the service of society, in other words in the service of societal operations and functions in contrast to the male perspective which focuses on the machine itself. Women seem to display more altruism in their professional targets, and according to their gender attitudes, stereotypes and perceptions, prefer professions that offer personal satisfaction, greater humanistic prospects and horizons with emphasis and priority first on children and family, and then on work. Unquestionably, a more family-friendly oriented working environment is needed to change attitudes, including an attractive open labor market that recruits and retains women.

4. The gender factor in teachers' technophobia

Primary and secondary school teachers, who were undertaking a training course on computers in regions that are considered representative of Greece since they include urban, industrial and agricultural populations,[4] took part in a study to examine teachers' attitudes. (Pantouli, 2005) The Computer Attitude Scale[5] (CAS) was given to 135 teachers, 54.1% female and 45.9% male. The majority (54.8%) were between the ages of 35-45: 76 secondary school teachers (high school) of science fields, theoretical studies, foreign languages, physical education, as well as 58 primary school teachers. According to the findings the largest percentage (60%) displayed technophobia, in other words they claimed they felt 'uncomfortable' and 'insecure' using computers. Nevertheless, an overwhelming majority (85%) expressed a desire to receive further techno-training.

As was the case with the undergraduate students cited earlier, the findings reveal that firstly, teachers' computer attitudes (levels of anxiety/confidence/liking/usefulness) do not seem to be influenced by their specific field of study or specialization, in other words, if they come from a science background instead of a theoretical one. Secondly, a teacher's geographical or demographic district of residence and employment was not a factor that differentiated or influenced attitudes about computers and technology. Thirdly, positive attitudes were shown only by the teachers who had previous experience, familiarization or contact with computers, regardless of gender. Additionally, the 'anxiety' rate for teachers who had previous experience with computers was lower, regardless of gender. Fourthly, female teachers, in particular, expressed 'insecurity', namely technophobia when they had to work with computers (60 percent of the sample responded not to have had previous experience). Fifthly, the majority of teachers - male and female- acknowledged computer usefulness and expressed a desire for further computer training and techno-education. They also acknowledged the fact that today techno-education is a requirement and an absolute necessity in order to avoid marginalization and social exclusion. (Pantouli, 2005)

The results confirm that gender is a factor that influences attitudes towards computer use and new technologies. To reiterate, female teachers, regardless of their scientific or theoretical orientations, displayed 'less positive attitudes' towards computers than their male counterparts. Greater 'anxiety' levels, and negative attitudes in general, were displayed by female teachers, a factor which we believe makes them unwilling to get involved in the process of computer use as a tool for their work in the classroom.

5. Combating digital illiteracy and exclusion: 'Education is the place to start'

International and European organizations have consistently warned against the dangers of digital illiteracy and the exclusion of non-mainstream groups, unable to keep up with high-speed developments, including women who are massively underrepresented in the fields of science and technology. Science and technology intertwine, intermingle and interact with society, thereby increasing the complexity of their nature and their relations. Basic computer training is no longer sufficient to eliminate digital illiteracy. A higher level of competency is required to combat technophobia and social exclusion, as is evident in Greece and other developed countries.

Democracy requires the participation of the citizen in the decision-making processes, but decisions without knowledge and adequate access to information lead in the wrong direction. All important technological developments and innovations are based on knowledge, information and know-how, access to which the majority of the EU population is still largely 'denied' and as a result will continue to be marginalized if access into this sphere of economic activity is not ensured (Schlager & Fusco, 2003). However, the crucial issue of equality in the information society must be dealt with, not only as an issue of increasing the number of consumers or the production of goods and services, but also as an opportunity for all citizens to become active agents and active members in society, regardless of gender, race, color, religion, etc.[6]

The essence of new technologies is in applying information and not merely in providing it. Due to an overabundance of information, the gender subject is finding it difficult to distinguish between useful, credible sources of information and useless, incredible ones. This manifests itself in an inability to process and interpret information as well as in incapacity of choice. Consequently, it is crucial to formulate and adopt educational curricula supported by specific teaching methods as well as new methods of learning that will contribute to the gender subject's progression and future integration into a society of information production and use, and not merely one of information consumption. The technological revolution is not only about how the gender subject, thinks, produces, moves, communicates, shops, conducts transactions, is entertained or interacts with others. One of the most basic and crucial results of technology are the changes in the way the gender subject

learns, is trained and obtains access to knowledge.

Undeniably, technology has made our lives better in many ways: significant innovations in commodities, a new wave of products, health care innovations and services, social benefits, etc. On the other hand, although technology has made our lives easier, sometimes the price is too high: the continuous and systematic destruction of our natural environment, as observed in Greece during the Olympic Games (Papadopoulos, 2005), the under-representation or the total exclusion of women and other less privileged gender subjects, the exploitation of the digital personality, electronic surveillance (the 'Big Brother' phenomenon), and the alienation, solitude and loneliness of the individual in front of his or her computer, his or her interface with the information society. As a result socio-ethical debates and arguments on commercialization, professionalization, information capitalism, digital exploitation, and the invasion of privacy and the formulation of a techno-ethos need to be intrinsically examined (Patsantaras & Kamberidou, 2004).

As Bill Bryson, the 2005 Laureate of the European Descartes Prize, correctly pointed:

'Education is the place to start. Textbooks shouldn't be written like PhD theses - there's no reason why we can't make them interesting. So much science is inherently interesting, and more effort is needed to get that across […]. In addition, schools should teach science to pupils in two different ways […]. It has to be taught seriously, to encourage more young people to become scientists, but you also need to teach 'normal' people the wonder of science - you should be getting that even if you're never going to be a scientist.' (Cordis, 2006b)

Educational reforms alone, however, will have very limited impact, if interdisciplinary international research is not systematically promoted and encouraged. The setting up of an intercultural-interdisciplinary network of researchers from the social sciences, the humanities, gender studies, the sciences, industry, and technological research and development is needed in order to contribute to the knowledge base required for policies of inclusion, equal opportunities, gender equality, *gender-neutral* technological education, vocational training, etc. This international research network, for example, could provide us with a clearer picture in reference to the topography of the excluded social groups within society. It could introduce proposals for the establishment of a techno-ethical code, a *technoethos* that could contribute to eliminating the factors that lie behind the disrespect, violation and exploitation of the electronic personality. (Patsantaras & Kamberidou, 2004) Moreover, it could examine how science and technology can become attractive, motivating and inclusive for large parts of the population, including women, and in the long run eliminate the leaky pipeline and the glass ceiling. In this framework the EU has been consistently mainstreaming gender issues into its policies and programs.

6. 'The EU takes equality seriously': a report from the EU-Gender Mainstreaming Conference

Alarming are the results of the latest study of the EU-Commission 'She Figures 2006', according to which women remain a minority among researchers in the EU: only 18% of researchers are women in industrial research and the situation is even worse in management positions where women are almost 'invisible' or non-existent. To eventually eliminate such social exclusions and support young women throughout their scientific careers, national and international initiatives and support programs have been established. One of these initiatives is 'FEMtech', a support program of the Federal Ministry of Transport, Innovation and Technology (BMVIT) (www.bmvit.gv.at) for women who are working in research and technology. The objectives of the program are to gradually improve women's access into research and technology and eliminate the leaky pipeline and the glass ceiling— to be exact firstly retaining women in the science and technology fields once they are in, as well as providing improved conditions, career opportunities and advancement for women in research and technology— through collaborations and networking with European companies, industries and EU programs. (EU-Council Presidency, 2006A) The result of such efforts was the recent EU-conference on 'Re-searching Women in Science and Technology'[7] held in Vienna, Austria.

In the context of this EU-Gender Mainstreaming Conference in the Vienna Museumquartier, the Austrian Minister of Transport, Innovation and Technology, Hubert Gorbach told the participants: *'Gender equality must be our primary goal',* stressing that *'the EU takes equality seriously.'* Moreover, Gorbach pointed out that:

'The pipeline, which makes women leak out of the scientific and technological world, already starts to leak in primary school. This means that the decision against science and technology is in many cases already made a long time before the choice of study and career […] What can we do to make the working conditions in industrial research more attractive, so that we will win more female scientists? How could work life be managed, so that both genders find ideal conditions for their development?'

European Science and Research Commissioner Janez Potočnik told the conference participants that not only a more family-friendly working environment is needed in order to combine family, children and a working career, but also an attractive open labor market that recruits and retains women in science and technology.

Commissioner Potočnik also pointed out that this gender imbalance and discrimination will not disappear overnight. He said it took Italy 200 years to achieve the same percentage, an equivalent percentage, of female and male professors that it has today. According to the Commissioner:

'If Europe is to become a real knowledge-based society, then it needs more researchers. We know that women are underrepresented in research and this is particularly true in the business sector: the industry average is about 18 percent despite the growing number of female university graduates.'

7. 'Frontier research' in the social sciences and the humanities

Five months earlier in Brussels, speaking at the opening session of a two-day conference on 'Social sciences and the Humanities in Europe,' Commissioner Potočnik said that all research in the framework programs should have a social sciences and humanities component. Commissioner Potočnik told the conference of social sciences and humanities researchers to be bolder in their efforts to integrate themselves into the European Union's research framework programs. 'It will not happen in a top-down manner. I rather believe that you, as social scientists, have to take that responsibility into your hands [...]. By not doing so, you will remain as you are, not even being accepted to discuss today's important issues.' (Cordis 2006a)

Commissioner Potočnik also pointed out that the social sciences and humanities are vital for understanding social change and informing policy making, as well as providing input on the social, economic and political dimensions of other areas of EU research. He announced that researchers from these disciplines will have their own dedicated theme under the Commission's proposals for the Seventh Framework Program. This will include completely new issues for EU research, such as Europe in the world, lifestyles and families and European integration.

'The whole aim of the theme is interdisciplinarity. Of course, inter-disciplinarity is not always the solution. But I am convinced that getting to know what other disciplines have to say on the subject is not only an intellectual obligation for all social scientists, but it brings new ideas, new concepts, new metaphors that help social sciences develop.' (Cordis, 2006a)

Helga Nowotny, chair of the European Research Advisory Board (EURAB) and Professor of Social Studies of Science at the Swiss Federal Institute of Technology in Zurich also made this point: *'My message to you is be more proactive, mobilize, organize, and be bold.'* As a member of its Scientific Council, Professor Nowotny added that the proposed European Research Council (ERC) will offer social scientists many new opportunities:

'But it's up to you to define what constitutes frontier research in the social sciences and humanities […]. You have much to contribute, as you help us all to see ourselves more clearly. Ideas still matter, and so do people [...] so draft your own research agenda and sell it.' (Cordis, 2006a)

8. E-economy logic, E-technologies and globalization

The last few years have been marked by a rapid acceleration in the development and adoption of new ICT-based business solutions and practices for work and business. Challenges range from issues related to trust and confidence to novel technologies, applications, business practices aimed at empowering individuals - whether as entrepreneurs, workers or consumers - and enterprises, small and large, as participants in a sustainable global economy and an inclusive information society.

E-economy logic is penetrating traditional sectors. Ultimately, the old economy and the e-economy will become integrated. This is mainly due to two key developments. The first is the exponential growth of the internet. The internet responds to the needs of economic actors in the global economy, and it further amplifies globalization – of the economy, of people, and of ideas. The second is the power of information. Knowledge, ideas and brainpower are becoming the world's main economic resources. Today, the main added value of a product is in the know-how required to design and market it, including the services which follow. Intangible goods— content, software, knowledge, etc.—represent an ever-growing share of the economy.[8] (Filos, 2006)

In the past the economy was somehow static, involving little change. Today, the rapid switchover to the e-economy requires radical changes in attitudes, challenging people's ways and habits. It opens up an era of intense creative thinking, with ideas competing against ideas. The digital age calls for bold minds, an innovative spirit, open-mindedness, and vision. Entrepreneurship at all levels is becoming the backbone of all businesses. The e-economy challenges business in many ways. E-technologies and globalization are leading to a blurring of organizational boundaries. The creation of value becomes more and more dependent on intangible assets. Uncertain and fast-changing environments require organizational abilities such as flexibility, speed, and adaptability. The networked economy will ultimately change the way businesses relate, both to each other, to the individuals who provide their core competencies, and to their environment. (Filos, 2006)

The European strategy for growth and employment, adopted by Heads of State and Government at the Lisbon Summit in March 2000 set the challenging goal of increasing participation in employment to near 70 percent by 2010. This requires action to improve the employment prospects of groups with low employment rates, especially women and older workers. Work can be made more attractive and accessible through flexible work arrangements such as e-work. Particular efforts are being made to attract women to the knowledge economy and IT professions where they are massively underrepresented and where they represent a largely untapped resource in most countries. This goes hand-in-hand with the modernization of work organization, greater flexibility which brings benefits of variation in the time and place of work. Social partners are encouraged to support agreements on flexible work to the benefit of both employers and employees. (Filos, 2003)

9. Can the 'European social model' work in the information age?

In June 2005 the European Commission adopted the initiative 'i2010: A European Information Society for Growth and Employment.' The initiative aims at modernizing and deploying EU policy instruments to encourage the development of the digital economy: regulatory instruments, research and partnerships with industry. Specifically, to promote an inclusive European information society, i.e. to close the gap between the information society 'haves and have nots.'

'As the use of ICT grows, so does its impact on society. […The initiative] recognizes this in three ways: making sure that ICT benefit all citizens. ICT are becoming more widely used and are benefiting more people. But today over half of the EU population either does not reap these benefits in full or is effectively cut off from them. Reinforcing social, economic and territorial cohesion by making ICT products and services more accessible, including in regions lagging behind, is an economic, social,

ethical and political imperative. In i2010, strong emphasis is given to full participation and to providing people with basic digital competence. […] Digital convergence brings new challenges for e-Inclusion. The Commission will therefore adopt a comprehensive approach. During 2005, it will address e-accessibility through a mix of research and stimulation measures to make ICT systems easier to use for a wider range of people. It will give guidance to extend the geographical coverage of broadband in under-served areas and will review the contribution of ICT and digital literacy to key competences targets in the 'Education and training 2010' initiative. In addition, the Commission intends to propose a European Initiative on e-Inclusion, addressing issues such as equal opportunities, ICT skills and regional divides. It will be prepared through actions on active monitoring, digital literacy and research into accessible technological solutions. All available instruments should be deployed, including integration in the strategic guidelines for the Structural Funds, rural development funds, national support, regulatory intervention and research.' (European Commission, 2005)

10. The information elite and 'virtual servitude'

Digital illiteracy has increased the ranks of the unemployed, while the emergence of a new 'information elite' seems to be drawing the boundaries of exclusion for many more vulnerable social groups. (Jenson & Brushwood, 2003; Kamberidou & Patsantaras, 2006). Today we are witnessing the creation of 'a bodiless society', a *gender-neutral* society of services that is gradually replacing industrial society. We are in a transitional period that not only disorganizes and disorientates but also marginalizes an extremely large sector of the population, women in particular (European Commission, 2001). In view of the technologically induced rapid disorganization of existing structures, that which was familiar is being eradicated, and no longer understood. Everything as we know it today is in the process of transformation due to significant changes in the global scene - the globalization of the economy, aggressive competition, information capitalism, the management and manipulation of information according to the laws of economics, the 'invasion' of technology in every sector of public and private life, electronic surveillance and electronic terrorism. (Kamberidou & Patsantaras, 2006; Webster, 2002). As a result, the gender subject is having dramatic difficulties in adapting and comprehending what is going on during this transitional stage of the postmodernist period, and our social system is faced with difficulties in defining the problems and thus providing solutions.

Within this emerging information world order, globalization is being established in the virtual domain as well. The information elite whose key objectives are to gain control over technological research, design, development and its applications seems to be characterized by a lack of support for human values that are increasingly being sacrificed to technological progress and priority given to information. The new class of information technologists, this 'invisible elite' that possesses the means and the know-how to promote the new technological society while bypassing and ignoring basic human values, disregards social solidarity, gender equity, equal opportunities, democratic dialogue, economic justice and aesthetical creativity. As a result, new questions and issues have arisen, such as: (1) Has this new aggressive 'ruling class', the emerging information elite, divided the world into three functional-operational categories? Firstly, the information 'ruling masters or class'; secondly, the 'clone-function' class; and, thirdly, the 'slave-servant function' class, clearly observed in Third World countries. (2) Are we witnessing the emergence of new underprivileged social groups or non-mainstream groups? (3) Is this a prediction or foresight into future exclusions, and primarily the massive under-representation or exclusion of women? (4) Are we witnessing the emergence of a new form of modern 'slavery', virtual servitude and alienation, notably the emergence of new vulnerable social groups destined to become the servants of the new information elite, since they will not be able to participate in the socio-production processes, thereby developing, not only technophobia, but an imaginary or metaphysical relationship with technology rather than a productive one? (5)

Does the production, transfer and distribution of information take less and less place in the centers of government and political parties and more in the board rooms of large private industries? (6) Does the private sector and the high-tech industry formulate public opinion and intervene decisively in the political process at national and international levels in order to open roads to world markets, while marginalizing the role of national governments? (7) Does this industry inherently promote cultural commonality and the loss of cultural identity?

Noteworthy examples for this loss of cultural identity are current discussions concerning language. For instance, many young people have become accustomed to communicating, not only in brief, but also in incomprehensible forms of language. The computer version of Shakespeare's 'to be or not to be' (i.e. '2B or not 2B') is linguistically destructive and devastating to the English language and culture. The so-called 'greeklish', notably the elimination of the Greek alphabet and language, is another example of this metaphysical/transcendental virtual environment. It leads to a new form of digital illiteracy: illiteracy that is virtually induced, characterized by the bombardment of images and out-of-context informational bits difficult to decipher, interpret or decode by those who have been traditionally educated.

Among the plethora of new questions and issues that have emerged, are the effects of technological developments on our natural environment (Gibbs et al., 2003; Papadopoulos, 2005). In order to preserve life and an environmental balance on our planet, we must look for solutions, not in the traditional economic profit rationale, but in the framework of a socio-economic, life-centric rationale and in the formulation of a technological code of ethics. Environmental policies and directives must be firmly and strictly implemented and self-restriction, self-restraint and self-control exercised as far as consumption and production are concerned-avoiding or limiting the unnecessary, needless and extravagant squandering of resources.

The technological elite, including the social groups with the know-how, is in a position to determine the speed of developments. Consequently, vulnerable social groups who are unable to keep up will suffer exclusion or 'virtual servitude'. If measures are not taken to broaden or increase the inclusion of the gender subject into the information society, digital despotism may in the end succeed in drawing the boundaries of exclusion for many non-mainstream groups, and women in particular.

11. Recommendations

- A techno-ethical code is needed to ensure that Europe's social achievements in the past are transposed into the information society and the virtual environment. A *technoethos* must be established to combat the violation/exploitation of the environment and the digital personality, and specifically in regard to the latter, the disrespect and 'castration' of free will: domination of the imaginary (fantasy), the explosion of pornography, the slave-trafficking of women and children, electronic conspiracy networks, electronic terrorism, surveillance, etc.
- The institutionalization of mandatory techno-education as an integral part of the curricula in public schools, beginning in kindergarten and extending to vocational training.
- A more flexible and family-friendly working environment in order to combine family, children and a working career, as well as an attractive open labor market that recruits and retains women in science and technology.
- A widespread campaign to change attitudes about science and technology: to inform, introduce and familiarize citizens with technologies, technological tools, services, best practices, etc.
- The continued development of a wide-ranging network of public internet access points, free of charge and easily accessible to the public, in every prefecture or municipality, staffed with employees to assist users, and with hours that accommodate women's schedules.
- Interdisciplinary research: The establishment of an international, inter-

cultural, multidisciplinary network of researchers - from the social sciences, the humanities, gender studies, the sciences, government, industry, and technological research and development. For instance, interdisciplinarity in Education in order to formulate new pedagogical methods and approaches.

- Support of research in the social sciences and the humanities to provide a clearer picture, especially in reference to the topography of the excluded groups.
- Collaboration between industry and gender research in order to influence mainstream ICT development from a gender perspective. Gender equality in the information society, in science and technology, may be achieved through a better balance of gendered content to change attitudes, perceptions and stereotypes: promote better technology, support enterprises run by women, encourage female users to take a more active role, keep up with developments, share information, establish a female technological culture, etc.
- Indiscriminate cooperation between all stakeholders, the researchers, the citizens, policy makers and industry.
- Best-practice-models[9] and Mentors, namely mentoring projects: the involvement of professional women already employed in the science and technology sectors.

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[1] The two-day European conference was jointly organized by the Austrian Presidency and the European Commission. (Co-author Dr. Irene Kamberidou participated in this EU-Gender Mainstreaming Conference in Vienna on 15-16 May, 2006).

[2] Specifically under the Business Development Programme 'Information Society,' part of the 3rd Community Framework Support Programme for Structural Development in Greece, the Greek Ministry of Education implemented the activity 'Training of Teachers for the Use of ICT in Education', in order to train 76,000 primary and secondary school teachers.

[3] The statistical analysis program SPSS (10th ed) was used to analyze the data.

[4] Specifically, at the 1st and 2nd Regional Training Centers (15.6% and 39.4%, respectively), in Thessaloniki, at the Support Training Center in Katerini (43%) and at the Support Training Center in Aliveri (9.6%).

[5] The CAS scale, designed and developed by Gressard & Loyd (1986) was formulated through views of teachers who received continued training in ICT.

[6] As a result, the European Union is mainstreaming gender and promoting equality, as well as a technology that will be more socially oriented, accessible and user-friendly, namely focused on the needs of diverse users. To be precise, a technology designed for diverse social groups, for

a diversity of users, with diverse needs and not determined and established exclusively on the basis of technical, economic and commercial terms. In this framework the EU has been examining the present state of affairs and working towards measures to ensure a better integration of women in the information society. (European Commission, 2001; European Commission, 2005)

[7] Co-author Dr. Irene Kamberidou participated in this EU-Gender Mainstreaming Conference in Vienna on 15-16 May, 2006, which was jointly organized by the Austrian Presidency and the European Commission.

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[9] Best-practice-models of successful women in industrial research can be found in the BMVIT/FEMtech-brochures 'Role Models' and 'Forscherinnen 2005", www.femtech.at.