



Meta-analysis of gender and science research – Country group report
Southern countries

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The purpose of the study was to collect and analyse research on horizontal and vertical gender segregation in research careers, as well as the underlying causes and effects of these two processes.

The objectives of the study were to:

- Provide an exhaustive overview and analysis of research on gender and science carried out at the European, national, and regional levels.
- Make the study results accessible to researchers and policy-makers via an informed bibliography (online database) and a set of reports.
- Steer policy-making on gender and science and define future research priorities within the Framework Programme, in particular through good practice examples and gap analysis in the various research topics.

For the purposes of the study, 'science' was understood in its broadest meaning, including social sciences and humanities as well as research and technological development.

The study covered the research on gender and science produced between 1980 and 2008, in all European languages, in 33 countries: the 27 EU Member States as well as 6 Associated Countries to the Seventh Framework Programme for Research and Technological Development (FP7) (Croatia, Iceland, Israel, Norway, Switzerland, and Turkey).

The study produced five country-group reports, seven topic reports and the final synthesis report:

Country-group reports	Authors
Continental countries	Hafsatou Diallo, Danièle Meulders, Síle O'Dorchai & Robert Plasman
Eastern countries	Mária Palasik, Nikolina Sretenova, Robert Takács & Núria Vallès
Nordic countries	Seppo Roivas
Southern countries	Elisabetta Addis & Costanza Pagnini
United Kingdom and Ireland	Cinnamon Bennett, Marina Larios, Louise Norman & Emma Parry
Topic reports	Authors
Horizontal and vertical segregation	Danièle Meulders, Robert Plasman, Audrey Rigo & Síle O'Dorchai
Gender wage gap and funding	Danièle Meulders, Síle O'Dorchai, Robert Plasman & Audrey Rigo
Stereotypes and identity	Felizitas Sagebiel & Susana Vázquez-Cupeiro
Science as a labour activity	Maria Caprile & Núria Vallès
Scientific excellence	Elisabetta Addis with the assistance of Costanza Pagnini
Gendered innovations	Londa Schiebinger, Ineke Klinge, Addison Arlow & Sarah Newman
Policies towards gender equity in science and research	Cecilia Castaño, Jörg Müller, Ana Gonzalez & Rachel Palmen
Synthesis report - Authors	
Maria Caprile (coord.), Elisabetta Addis, Cecilia Castaño, Ineke Klinge, Marina Larios, Danièle Meulders, Jörg Müller, Síle O'Dorchai, Mária Palasik, Robert Plasman, Seppo Roivas, Felizitas Sagebiel, Londa Schiebinger, Núria Vallès, Susana Vázquez-Cupeiro	

All the reports and the online database (Gender and Science Database, GSD) are available at the website of the study: www.genderandscience.org

EXECUTIVE SUMMARY

1. The Report presents the situation of research about Gender and Science in the Southern European Countries (SECs : Cyprus, Greece, Israel, Italy, Malta, Portugal, Spain ,Turkey), from 1980 to 2009, as described in the National Reports and with reference to selected publications indexed in the Gender and Science Database (G&SD).
2. **Research on Gender and Science in quantitative terms follows the European trends rather closely.** It started growing in the late 1980s and increased steadily until reaching a peak in 2006. It is characterised by a similarity of research interests, as witnessed by the distribution of publications on the topics indexed in the G&SD (Horizontal Segregation, Vertical Segregation, Pay and funding gaps, Stereotypes and Identity, Science as a Labour Activity, Scientific Excellence, Gender as research content, Scientific Policies).
3. At the beginning of the 1980s, the SECs were not homogeneous from the political point of view: some were recent democracies or had experienced periods of instability. As a consequence, gender relations were different as measured by economic indicators and by prevailing cultures and ideas. All countries experienced institutional innovation on gender issues: the signing of the CEDAW, creation of Equal Opportunities Authorities etc. At the end of the period, most SECs had joined the EU and had a common currency.
4. The sociological literature identifies a common feature of the welfare regimes of the largest countries in the SECs area: they are continental welfare regimes, which, unlike the Nordic and the Anglo-Saxon Regimes, generate greater gender asymmetries. The main indicators of this asymmetry is the lower female participation in the labour force, higher rates of female unemployment, and higher average number of hours spent on unpaid domestic work, which together constitute women's relative 'social weakness' with respect to men in these countries. However, the data does not show a corresponding disadvantage with respect to women in science in the Southern European countries. Women's presence in the scientific sector is similar to that of other European Countries, and similarly problematic. This similarity may be due to the peculiarities of two countries, Portugal and Turkey, where national historical circumstances allowed for a relatively larger presence of women in science, with Spain also gaining ground in this respect.
5. Four main strands of research have been identified: **epistemological research, socio-economic research, historical research, and biomedical research:**
 - The epistemological debate is connected to the criticism of science as an instrument of power over humankind and nature, a crisis of science symbolised by Hiroshima and Chernobyl. This crisis led feminist philosophers of science to question the foundations of western scientific thought. Science appeared as built by a male-only scientific community trying to defeat and control 'nature' as a passive entity endowed with feminine qualities. According to the authors in this strand, methodologies, questions and the results of science are expected to change for science to be able to incorporate women on truly egalitarian grounds.
 - Sociological, statistical and economic research extended their findings on gender in other sectors and in the labour market to science, in which as in the overall economy, horizontal segregation, vertical segregation and earning differentials are the results of discrimination practices and women's dual role both as remunerated employees and as unpaid main family caretakers. The choices that women themselves have made in favour of caretaking are partially forced by the lack of public and private services and

partially chosen, as an assertion of the positive values of traditionally feminine caring activities. In addition, some specific mechanisms of career progression and funding may affect the scientific sector.

- The historical research recovered the biographies of women scientists of the past from oblivion, pointing out the difficulties they faced in their chosen field.
6. Biomedical research is the research initiated in medicine and its related fields studying physiological, pathological and pharmacological differences between the sexes. It refers both to the physiology of the biological differences between the sexes and to the pathologies related to socially constructed differences. The latter is a very important contribution and innovation in this strand of research.
 7. **Research questions** asked are: Why are there so few women in science? Why is there horizontal segregation in some disciplines? Do men and women have different research interests? Why were so many women scientists of the past forgotten? Is science inherently masculine? Why do women not reach scientific excellence as much as men with similar characteristics? Why are there so few women in the top echelons of science? What is the special contribution that women can bring to science? How do family commitments interfere with women doing science? Is there discrimination against women doing science? How many women are there in science, is the number growing, and why is it growing at differential rates?
 8. **Methodological approaches** to research are historical analysis i.e. texts and archives, philosophical discussion, case studies and interviews, and statistical analysis of numerical data. The latter used simple data tabulation, cross tabulations, OLS regression, Logit and Probit regressions. Appropriate methodologies are used in medical and life sciences.
 9. Most countries report a sharp increase in the number of women entering university education between the 70s and 80s, and a corresponding trend of decreasing horizontal segregation a few years down the line. In all countries except Turkey, women today account for more than half of the university graduates and their presence is continuing to grow. Horizontal segregation is present in all countries: women's presence is strong in the humanities and weak in engineering fields and, in some countries in the technical fields, it has been even declining. Research finds that gender segregation is higher in the technical fields of study where there is a predominance of men and in the humanities, education or health which have a greater number of women. Vertical segregation and the existence of glass ceilings is also documented by an overwhelming amount of evidence.
 10. **Horizontal and vertical segregation** are two aspects of the same underlying mechanism. The process of segregation is a dynamic process that puts people into available positions according to their perceived social value. In this context we can identify a real 'gender' effect, i.e. the relative devaluation of femininity with respect to masculinity. If two people are similar in other characteristics other than their sex, it is expected that the female will be put in a position which is inferior to that of the male. When a sector is feminised, it loses value and funds with respect to the more masculinised disciplines. Men in feminised sectors have a greater chance than men in integrated sectors to reach the higher positions in the hierarchy of the sector.
 11. In SECs the low presence of women in science has been attributed to:
 - work-family reconciliation problems and time constraints on women due to their traditional burden of care:
 - gendered and stereotyped evaluations of competence;

- socialisation into science by cooptation mechanisms affected by homosociability;
 - inborn attitudes unrelated to real scientific capacity, but to other personality traits such as assertiveness, appreciation of intellectual confrontation.
 - the inherent conceptual 'masculinity' of science produced by the once male-only scientific community.
 - informal barriers and discriminatory attitudes, which keep women in inferior positions to men in terms of earnings and hierarchical status in many other professions.
12. **Stereotypes** and how the use of stereotypes affects the creation of identities, and how in turn the creation of the scientists' identities determines the social construction that we call science, is a topic that generated very high interest and most publications in the SECs countries. Stereotyping is one of the reasons why women have been excluded from science, and at the same time is a mechanism of its reproduction. Of particular interest are the studies in applied psychology about the effects of stereotype threats to performance. However, there is very little research on how to overcome stereotype-created biases.
13. The issue of **pay** strictly correlates with the issue of vertical segregation, since in most countries in the public sector there is no individual pay variation among people with the same job title and seniority in their position. In the private sector, where one may expect to find instances of pay discrimination, research is very scarce. Similarly, there has been relatively little research in Southern Europe on the issue of gender differences in **funding**.
14. **Competition is often based not on competence but on use of time** e.g. men dedicate all their time to science while many women are not willing to totally sacrifice the time that they dedicate to their personal, domestic identity or on aggressive feelings i.e. creating a working environment where confrontation, strategies, battles and point scoring are the norm, which allows some mediocre male scientists to surpass excellent female scientists, thus lowering the overall quality of scientific output. The solution suggested is to create a new **identity** for the scientist, which entails both the practice of science as a creative, remunerative and satisfactory job, and the practice of those activities that provide the identity of a good parent, of either sex. This may happen in a process that will also modify both men and women's gender image as a sex.
15. The study of **science as a labour activity** in the SECs shows the interaction of discrimination practices whether direct and covert (such as the allocation of less prestigious jobs to women, the use of double standards for performance evaluation) and of male and female choices. The issue of 'conciliation' or work/life balance is a highly gendered one. The burden of adjustment to masculine rhythms and profiles appears to fall disproportionately on women. Aspects studied are:
- gender specific determinants of segregation, including domestic and and distribution of working time between male and female researchers by family status with the distribution of funds, teaching loads, administrative and organisational tasks;
 - presence, field of specialisation and women's career paths within traditionally male, scientific professions such as those of doctors, engineers, architects, teachers, ICT...);
 - discriminatory attitudes in the workplace and involved power strategies and perceptions;
 - gendered effects of geographical mobility typical of the academic organisational arrangements of particular professions that require more time commitments than average, such as medicine, including nursing and personal travelling;

- organisational arrangements of particular professions that are considered more masculine and masculinised, such as engineering and the ICT;
16. The question of why women do not achieve **scientific excellence** at the same rate as men and at the rate that would be expected from the promise they show in the early stages of their career has been investigated in recent years following the publication of the report 'Gender and Excellence in the Making' (Addis & Brouns, 2004), but it is still an underresearched topic in the SECs with respect to the rest of Europe. It was found that excellence is not an inborn characteristic but it is the result of gendered social processes. Women's position in professional networks, their absence from gatekeeping positions, the use of selection standards which are gender blind and gender biased, psychological interactions devaluing women, mechanisms of honour attribution, problems in developing and accepting female leadership abilities, are all elements that have been found to add to the problem.
 17. The research having **gender as content** is of particular relevance and is present in many disciplines with a strong interdisciplinary character. The presence of this kind of research is stronger where gender studies are recognised and taught autonomously. Of particular importance are gender studies that analyse the production of well-being from unpaid domestic and care work and on the gender effects of the Welfare States.
 18. **Policies towards gender equality** in the sciences is an underresearched topic in the SECs. The creation of dedicated units in the ministries of research, of equal opportunities commissions or observatories in universities, the introduction of courses in gender studies, the use of quotas and of earmarked funds are policies which are proposed and/or described, but seldom evaluated in the literature. This may be because of the fact that they are relatively new, of too small a scope or sometimes of too large an undefined character.
 19. The main **gaps in research** are due to the lack of a **systematic collection of sex disaggregated data**. Such data would allow the **monitoring of gradual changes in horizontal and vertical segregation in research at the national level** across both public and private education and research institutions, including the distribution among administrative/educational positions within the universities. A lack of relevant data and studies is particularly alarming concerning the **business sector and the world of private research** which is often the recipient of large amounts of research funding. An additional important gap, remarked on in almost all the countries' reports, refers to lack of **panel data making longitudinal studies possible**, for example, studying the correlation between secondary education and tertiary education choices as well as career outcomes. Related to this, is the relative **lack of truly analytical studies** as opposed to the compilation of statistics. A **detailed analysis of funding mechanisms** is also missing in most countries. A number of very interesting national studies exists, which should be replicated in other nations and/or at the European level, to identify the most problematic issues in each country and the institutional characteristics.

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1 Introduction

1.1. Presentation and background of the report

This report analyses the literature on gender and science, produced over the past thirty years in the so-called group of Southern European Countries, i.e. Cyprus, Greece, Israel, Italy, Malta, Portugal, Spain and Turkey, that can be found in the Gender and Science Database (GSD) developed within the framework of the activities of the Meta-analysis on gender and science Project. The report summarises the main research strands and approaches, the most important findings and identifies areas of research which are not adequately covered by the literature collected and should be strengthened. It is mainly based on country level analyses carried out by national social science correspondents and on the information contained in the GSD.

The low presence of women in science has been attributed to a number of different factors, such as:

- a) 'gendered' behavioural expectations and stereotypes affecting study and career choices;
- b) work-family reconciliation problems and time constraints on women due to the traditional burden of care;
- c) gendered and stereotyped evaluations;
- d) socialisation into science by cooptation mechanisms where similarity to the co-optants is prized (homosociability);
- e) differences in inborn intellectual ability between men and women;
- f) inborn attitudes that do not relate to real scientific capacity, but to other personality traits such as assertiveness and the appreciation of intellectual confrontation, useful for gaining status in science;
- g) any other mechanisms, including informal barriers and discriminatory attitudes, which keep women inferior to men in terms of earnings and hierarchical status in many other professions.

All these factors have been examined in the literature of the SECs. This first chapter presents the general debate on gender and science in each country, in relation to the debate in the other SECs. The following chapter examines how each topic classified in the GSD is dealt with in the Southern European Countries (SECs) as a whole, what the main gaps in research findings are and, where relevant, highlights country specific peculiarities, similarities and dissimilarities. The conclusions present recommendations for furthering the research on the issue.

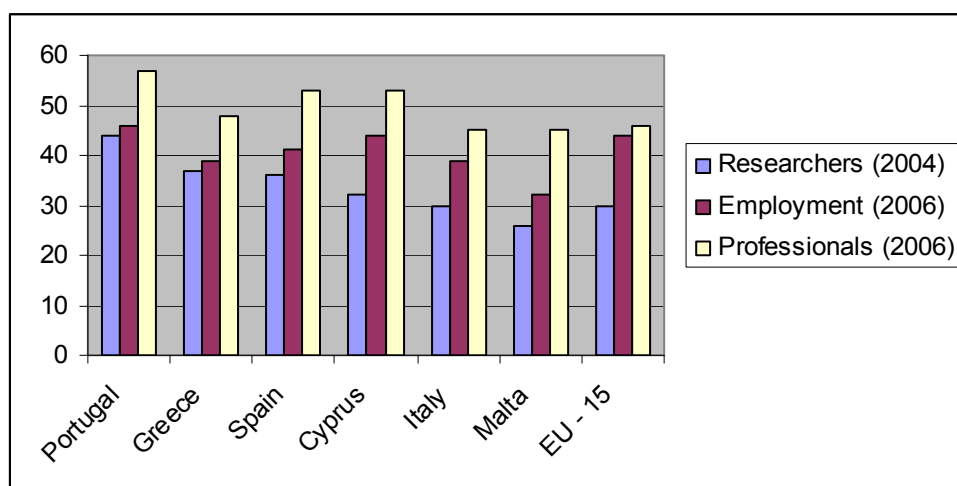
The above points are analysed from different perspectives, such as the specific situation of the Southern countries with regard to gender segregation, gender infrastructure, or specificities of the national research systems. The hypothesis is that there is a connection between the 'welfare regime' and, therefore, the 'gender pact' existing in each country, and women's relationship with science and status in the research community in that country. The concept of 'welfare regime' was introduced into the literature by the seminal work of Gosta Esping-Andersen (Esping Andersen, 1990). Welfare regimes have been classified according to four models: The Nordic, Liberal, Continental, and Latin version of the Continental. Each regime determines a particular allocation of the total burden of care between the three main institutions where care activities take place i.e. the public services, market produced services, and households, and, therefore, also determines a particular allocation of time and resources between the sexes. Thus, welfare regimes are an important determinant of gender relations, and of the time spent by men and women in paid employment, in unpaid domestic work and on leisure.

Thus, in Southern European Countries, the hypothesis says that women scientists should encounter additional difficulties over and above the 'normal' difficulties that women scientists find in any other regime, due to women's relatively greater social weakness and to the relatively underdeveloped status of gender relations. This social weakness can be deduced by indicators such as women's low participation rates and the greater than average amount of time women spend on unpaid domestic work. Although confirmation of this hypothesis does not emerge strongly in the data, there are reasons to believe that this is due to some institutional anomalies, especially prevalent in Portugal and Turkey, and to other problems explained in Section 1.6.

There is not very much to be happy about, however: first of all, we will see below that there may be national peculiarities that may mask this effect. Moreover, the fact that the difficulties encountered by Southern European women are no greater than the difficulties of the Continental countries does not mean that they are small in number. There are still a lot of consistent 'normal' difficulties.. They are related to the fact that science has been an almost completely masculine endeavour for centuries, with occasional exceptions of the great women scientists.

Box 1 - Southern European Countries and women's employment in science

The graph below illustrates the correlation between the percentage of women employed in science i.e. researchers and the percentage of women in total employment across the SECs. Where a large percentage of women are employed, the percentage of women researchers is also greater. It shows how Portugal has a relatively high proportion of women employed in science (44%), followed by Greece and Spain (37% and 36% respectively, with Italy and Malta lagging behind both in scientific employment (30% and 26%) as well as in the percentage of women in employment. In Turkey (not shown in the graph) the hypothesis would not seem to be valid, since the percentage of women researchers (37% in higher education and 25% in business) is above the European average, whereas the employment percentage is 24.9 % (2006 data).



Source: own elaborations from Ruest-Archambault, E. (ed.), et al (2008)

1.2. Main political debate on gender and science from 1980-2007

The debate on gender and science in the 1980s originated in the late 1970s following the last wave of feminism that took place in the 1970s as a consequence of a number of social and technical developments, among which the mass mandatory enrolment of boys and girls and the availability of safe contraceptives should be included.

At the beginning of our period of analysis (1980) the political situation of the SECs was not homogeneous. Three countries, Greece, Portugal and Spain, had recently become democracies. Before then they had been dictatorships, in which masculinity was consequently dominant both in the symbolic and social realm. Italy became a democracy in 1946, and continued to be so at the time when Israel followed suite in 1948, Turkey had been an intermittent democracy since the time of Ataturk, witnessed a coup in 1980, and was ruled by the army for three years before democratic elections were restored. Malta became fully independent from the United Kingdom in 1979.

Today, all the countries except Turkey, Israel and part of Cyprus are members of the European Union and they have a common currency. As we will see in more detail in the following paragraphs, among the social changes, women's increasing presence among university graduates as well as in the labour force, and the parallel development of the provision of public

and private care services are the most striking. The political and the cultural landscapes have completely changed.

Among the social movements that brought about these changes, feminism has perhaps been the most influential. A concept useful to describe the changes that occurred is the concept of the **gender pact**. The **gender pact** is the implicit set of coherent rules regulating gender relations in a given moment in a country or geographical area. The **gender pact** defines the expectations and behaviour prevailing in society for people of both sexes (Pfau-Effinger, 2005). It assumes that women are not just the passive object of timeless, historical, male oppression: they are instead a complex and plural group. They are endowed with their own personal and collective agency, and they have their own political goals and agendas to achieve. These goals and agendas interact with the goals and agendas of other individuals and of other collective beings. Humans often have multiple identities related to their class, religion or other beliefs, their ethnical or geographical affiliation, and also gender. Alliances, the contamination of ideas, the sharing of goals happens continuously among some groups of men and women, determining social change.

In the 1970s, women, together with industrial workers, formed an important part of the political coalition that led to the creation of the “Welfare States”. Some strands of critical Marxism were still present in the political culture of the parties representing the industrial workers, socialists and communist parties. A critical view of science as one of the instruments of the class oppression of the bourgeoisie over the proletariat existed in this tradition. Criticisms of science as a practice related to power were also present in the liberal tradition. These were the years of the campaigns for informed consent, to be given by the patient if his/her case was to be included in a study, campaigns initiated by physicians within the medical community itself that questioned the absolute authority of the clinical doctor about his cases. New studies in the history and philosophy of science such as those proposed by Popper, Kuhn, Lakatos, Feyerhabend, and, with a rather different slant, Michel Foucault, questioned different aspects of the activity of science. Against the background of all this turmoil was the knowledge that the practical application of the most advanced nuclear physics led the world to Hiroshima and to a situation in which the two superpowers had accumulated enough atomic weapons to completely destroy humankind in the event of a third world war. The traditional male role of protecting women and children against the external enemy had subtly turned into the possibility that the male fight for supremacy could become the very cause of the total destruction of that very same private ‘core’ of society, made up by women and children, that fighting was supposed to preserve.

Reflections on women and science began in this cultural climate. This was an epistemological debate that included not only Europe but also the U.S.A.: the pioneering work of Evelyn Fox Keller and Carolyn Merchant were the product of this climate. *Reflections on Gender and Science*, by Fox Keller, and *The Death of Nature, Women, Ecology and the Scientific Revolution* were translated in several SECs. The academic ties with the U.S.A. were close enough to steer the debate in all the countries on the issues outlined in these contributions. We may call this the epistemological debate.

This debate highlighted the topic of women and science as an issue worth philosophical reflection and scientific investigation. From this point to realising the basic fact characterising the issue, i.e. the relative scarcity of women in the scientific community especially in the higher echelons is a short step.

Box 2 - The radioactive cloud and the limit of Western science

An interesting experience and reflection was carried out in Italy by Elisabetta Donini, both a professor of Physics and a pacifist at Turin University. She introduced the work of Evelyn Fox Keller in the Italian debate by publishing an interview with Fox Keller in Italian. Elisabetta's book, entitled “The cloud and the limit” linked considerations about the Chernobyl disaster, in which the radioactive leakage from a broken nuclear reactor contaminated a vast area, with extremely serious health consequences on the civilian population and produced feminist criticism of science. According to the author, will-power, conquest and domination permeate contemporary western technological society. She chooses to focus on those aspects of the relationship between gender and science which are directly linked to her critique of such will-

power. The cloud mentioned in the title is the Chernobyl radioactive cloud, which marked the limit, made the boundaries visible where technology and science should stop, and should have stopped already facing the prospect of the atomic annihilation of the entire planet. The concept of 'limit' that emerged from her work interacts transversally and unifies the theory of knowledge and ethics. It is a concept that forces scientists to reconsider the issue of the relationship between the subject and the object of knowledge, giving value to the awareness of the standpoint of the scientist who knows. In ethics, her notion of 'limit' is the core of a theory of care and responsibility, and allows a connection between self-love/self-interest, and the recognition of the other person as an object of love and the subject of legitimate interests. This responsible and other-oriented attitude in her opinion characterises women more than men, and provides the grounds for a relationship between people and with the world based on reciprocal compatibility instead of domination. She is quoted for saying in an interview "I do not wish that there be more girls, women and children, educated with great enthusiasm for science, unless at the same time we are not capable of changing the meaning of 'scientific knowledge'. A radical viewpoint which, however, represents one of the reference points of the debate on women and science.

At the same time, feminist economists and sociologists began to study the gender issue in the labour market, discovering the existence of discrimination and of horizontal and vertical segregation. The statistical tools and model they developed were applied by researchers to try and understand how gender works in the scientific community. This second strand of research may be called the sociological debate. An important benchmark that collects some of the ideas of both strands of research and transforms the analysis into policy proposals is the so-called ETAN report (Osborn, M. et al, 2000).

A third strand of research is related to the fact that the few women scientists who existed in the past tended to be forgotten. Historians of women and historians of science began to rediscover their role, thus finding that in some crucial moments of the development of science, it was often possible to find a woman who made a fundamental contribution to science. This strand is perhaps smaller than the other two. What is most impressive is that this strand exists in most countries.

Box 3 - An example from Turkey: biography of Remziye Hisar

The study by Fusun Oralalp, 'Bir "Çalýkuðu" Öyküsü.. Ýlk Kadýn Kimyacýmýz Remziye Hisar', Bilim ve Teknik, vol. 28, no. 333, pp. 56-63, 1995, is based on the story of the life of Remziye Hisar (1902-1992), who was the first woman chemist in Turkey. She was among the first female students attending the Darulfunun or the House of Science, which was the highest educational institution in the Ottoman Empire. The article is constructed on references to the writings on Remziye Hisar, her autobiography, the records of the interview she gave, and the family archive. The author emphasises that Hisar's life story reflects the ideological and social context of the period in which she lived. Her scientific efforts started with science lessons at Darulmuallimat – The Teachers' School for women, which was the only institution leading to a profession for women in 1918-1919 and she continued her studies at the Sorbonne University in Paris. After she got her Ph.D. at the Sorbonne, she went back to Turkey. Hisar can be considered the prototype of the woman who had personally experienced the overall modernisation process of society and the education system especially in Turkey. From this narrative, it is possible to see how she had suffered between the contradicting roles of wife, mother and scientist.

An important aspect of the political debate revolving around the issue of gender equality in science relates to the policies and strategies established in the countries examined to specifically promote women's presence in science. All the SECs have adopted equal treatment legislation and are endowed with designated institutional bodies to pursue such an objective. Similarly, all SECs offer women's or gender studies courses in their universities. Yet, the awareness of the need to establish clear and focused policies has not emerged clearly from the political debate across all the SECs. As a matter of fact, within this general framework several differences in national machinery can be traced, especially in the pace with which gender in science legislation and initiatives are adopted. Over the past ten years, for example, Spain, Greece and Israel as a result of the stimulus offered by E.U. directives and orientations, have adopted new policies and reinforced gender infrastructures in this direction. A specific section of

the next chapter, will analyse the underlying debates in more detail and focus on the literature produced in the different countries concerning the presentation and assessment of foreseen instruments and tools.

It is also important to notice that many of the SECs country reports mention advances in the political institutions and legislation that accompany and follow the feminist movement as one of the sources of energy that allows women in science to begin their analysis of the difficulties women encounter. Turkey especially mentions the signing of the CEDAW and the institution of Women's Studies Departments, Portugal mentions the creation in 1977 of the "Feminine Commission", the creation of a Master in Women's Studies in 1999 and of a journal, Spain mentions the creation of Equality Observatories in the universities and the creation of the Unit of Women and Science (UMYC) of the Ministry of Education. Italy and Greece lament their inadequacy or lack of institutional developments.

1.3. Horizontal and vertical segregation in scientific careers: main trends from 1980 to 2007

The most important fact that the data show in the almost thirty years of our inquiry is the rapid increase of women's tertiary enrolment, which happens at different rates in different fields, more in the humanities field and, least of all in the technical disciplines but which takes place in all the SECs. This increase is parallel to the growth of women's participation in the labour force. The growth in participation rate is not homogeneous, and is marred by horizontal and vertical segregation. Horizontal segregation is the definition given to the fact that men and women are divided in the kind of tasks they perform and sometimes in the places where they work; vertical segregation refers to the fact that women are, on average, lower in a hierarchy that has a top and a bottom defined by various parameters, the main one being decision power. Vertical segregation is therefore always also horizontal segregation: people at the top do different jobs from the people at the bottom, meet different people, live different lives, and many more things.

Horizontal and vertical segregation are two aspects of the same underlying mechanism. The process of segregation is a dynamic process that allocates people into available positions according to their perceived social value. In this context we can identify a real 'gender' effect i.e. the relative devaluation of femininity with respect to masculinity. If two people are similar in other characteristics other than their sex, it is expected that the female will be given a position which is inferior to the male. Gender is not the only characteristic that defines position. Age, background, education, continuous immediate availability for work, availability of information about where the good jobs are among other things also play a role in determining where each individual finishes in the network of sectors and job positions. The gender effects are also evident in the fact, empirically verified in many sequences, that when a sector becomes feminised, it loses value with respect to the more 'masculine' sectors.

The way in which these two topics have been dealt with by the literature on gender and science in the SECs, together with the main findings and research gaps is presented in more detail in sections 2.1 and 2.2.

1.4. Main trends on research on gender and science from 1980 to 2007

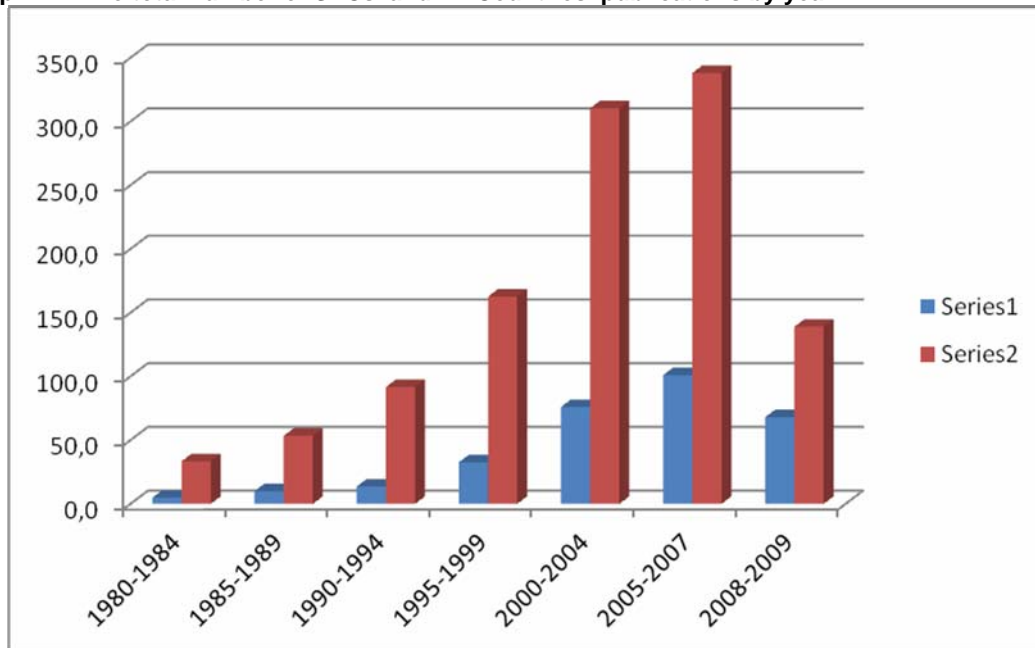
In order to better understand the dynamics of the research on gender and science in the countries of Southern Europe we can follow two strategies:

- a) analyse time trends in research
- b) use comparisons, of two kinds
 - between the Southern European Countries and the average of all the GSD countries, covering EU-27 Member States as well as Iceland, Israel, Norway and Turkey
 - of the differences among Southern European Countries.

1.4.1 Time trends

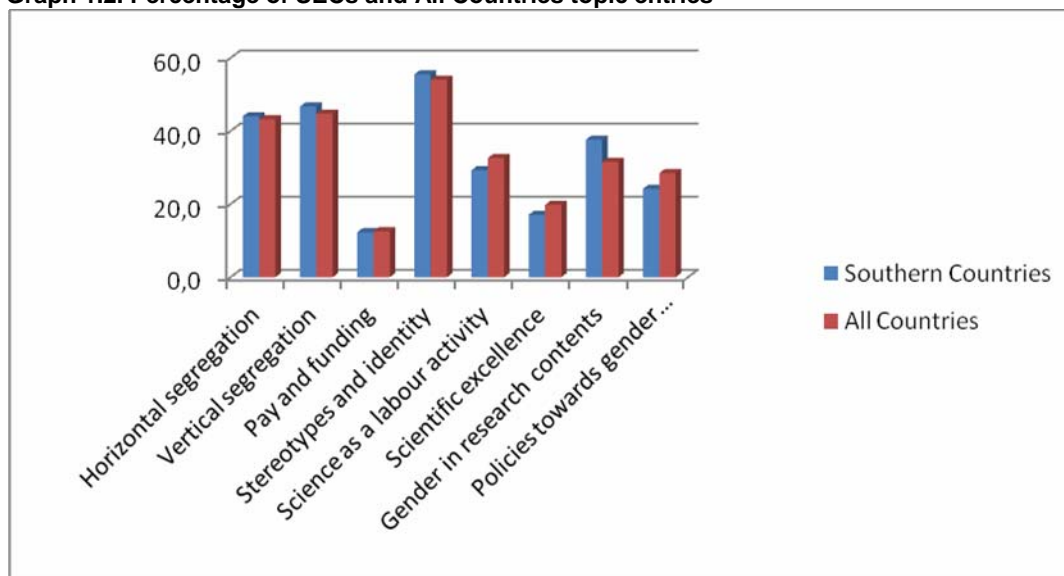
Graph 1.1 shows the total number of publications in SECs (in blue) and in of all the GSD countries (in red). In general it shows a constant growing trend but the record for 2008-2009 is not relevant since many entries have not yet been registered their numbers in the electronic archives used for the database. The total yearly average number of publications for SECs in the period analysed is of 43.7.

Graph 1.1. The total number of SECs' and All Countries' publications by year



Source: GSD Statistics

Graph 1.2 shows the percentage of entries related to the different topics analysed in the SECs. This number is different from the number of publications since each publication may deal with one or more main issues. The topic most researched is stereotypes and identity, followed by vertical segregation. These are also the issues with the longest history of research as they were already present in the literature of the eighties. The study of scientific excellence and of pay and funding starts later, but progresses in the last decade. Gender in research content, a topic studied extensively between 1995 and 2005, seems to be less investigated recently, but its relative decline is counter-balanced by the increase in the research on policies.

Graph 1.2. Percentage of SECs and All Countries topic entries

Source: GSD Statistics

1.4.2 Comparisons

The fact that trends are very similar between the SECs and all the GSD countries allows us to continue the analysis by comparing the blocks of publications, i.e. the sum of the publications over the year, by topic, in the various nations and with respect to the rest of the countries, to see whether research interests have been similar in the SECs and in the rest of the GSD. The tables below show the ratio between the values found for the Southern Countries and the values found for all the countries in some key variables measured by the GSD.

The SECs together provided approximately 17% of the total entries in the database. 'Stereotypes' is the most common topic for both groups. This may be due to the fact that stereotyping may be either a very precise psychological research topic, or used as a generic word to indicate the fact that the behaviour of the two sexes is expected to be different. 'Scientific excellence' is for both groups of countries, the subject least studied. This is probably related to the fact that scientific excellence is a relatively new topic of research which presupposes an already mature gender awareness, not only ready to claim that women can be good scientists, but also to allege that the way science, which was totally masculine, previously defined excellence is not the only possible definition.

Table 1.1 presents the number of publications per topic in the Southern European Countries and in all All Countries, from now on referred to as ACs, in the meta-analysis study.

Table 1.1 Presence of topics in publications in SECs, and ACs and their ratio

Presence of topics in publications	HS	VS	PG	SI	LA	SE	RC	PE	Total
N. publ, SECs	495	525	138	624	329	192	423	272	2,998
N. publication ACs	1,965	2,035	571	2,458	1,483	900	1,434	1,296	10,177
Ratio SECs/ ACs	0.25	0.26	0.24	0.25	0.22	0.21	0.29	0.21	0.29

Source: GSD Statistics

The percentage of studies that deal with a specific sector, presumably because they refer to science in general, is almost 50% both in the entire dataset and in the SECs, and higher education i.e. the university is the institutional sector most studied (Table 1.2) Although the distribution between the entries that deal with an All/General non specific institutional sector and entries that have a specific sector or other sector, is the same in both groups of countries, the SECs study the Government sector and the Private non-profit sector to a greater extent, and the Business Enterprise Sector and the Higher education sector to a lesser extent, than in the group

of ACs. This may be related to the fact that data concerning the private sector in the SECs is particularly inadequate.

Table 1.2 The most studied Sectors. Southern European Countries over All Countries ratio

Institutional sector	SECs (%)	All Cs (%)	Ratio SECs/Acs
All/General	55.6	48.8	1.1
Other	44.4	51.2	0.9
Total	100.0	100.0	1.0
Institutional sector - Other	SECs (%)	All Cs (%)	Ratio SECs/Acs
Business enterprise sector	11.2	10.6	1.1
Government sector	48.1	26.0	1.9
Higher education sector	74.1	86.7	0.9
Private non-profit sector	5.0	3.4	1.5

Source: GSD Statistics

By looking at the last column we can see that the distribution of topics is not very different for the SECs and for the ACs, as all the ratios approach the unity. The topics of Pay and Funding and of Scientific Excellence are studied less often in the SECs than in the ACs. Stereotypes and identity and Gender in research contents are instead relatively more frequent than in the ACs.

Table 1.3. Presence of topics. Southern European Countries, All Countries and their ratios

Southern European Countries

Presence of topics in publications	HS	VS	PG	SI	LA	SE	RC	PE	Total
Horizontal segregation	100.0	64.0	65.2	44.4	55.9	46.4	34.5	50.0	44.0
Vertical segregation	67.9	100.0	85.5	37.2	71.4	62.5	35.7	54.0	46.7
Pay and funding	18.2	22.5	100.0	11.1	21.9	27.1	10.4	21.0	12.3
Stereotypes and identity	56.0	44.2	50.0	100.0	53.2	50.0	59.3	39.7	55.5
Science as a labour activity	37.2	44.8	52.2	28.0	100.0	43.2	24.6	29.8	29.3
Scientific excellence	18.0	22.9	37.7	15.4	25.2	100.0	18.7	25.0	17.1
Gender in research contents	29.5	28.8	31.9	40.2	31.6	41.1	100.0	46.7	37.6
Gender policies in research	27.5	28.0	41.3	17.3	24.6	35.4	30.0	100.0	24.2

All countries

Presence of topics in publications	HS	VS	PG	SI	LA	SE	RC	PE	Total
Horizontal segregation	100.0	57.1	59.7	49.1	47.3	54.2	36.3	48.5	43.2
Vertical segregation	59.1	100.0	77.9	36.0	68.0	56.1	30.2	54.8	44.7
Pay and funding	17.4	21.9	100.0	10.7	20.8	24.9	10.9	20.0	12.6
Stereotypes and identity	61.4	43.4	46.1	100.0	46.5	58.7	64.2	45.0	54.0
Science as a labour activity	35.7	49.5	54.1	28.1	100.0	39.2	23.1	32.8	32.6
Scientific excellence	24.8	24.8	39.2	21.5	23.8	100.0	24.6	26.1	19.8
Gender in research contents	26.5	21.3	27.5	37.4	22.3	39.2	100.0	34.3	31.5
Gender policies in research	32.0	34.9	45.4	23.7	28.7	37.6	31.0	100.0	28.5

Ratio SECs to ACs

Presence of topics in publications	HS	VS	PG	SI	LA	SE	RC	PE	Total
Horizontal segregation	1.00	1.12	1.09	0.90	1.18	0.86	0.95	1.03	1.02
Vertical segregation	1.15	1.00	1.10	1.03	1.05	1.11	1.18	0.99	1.04
Pay and funding	1.05	1.03	1.00	1.04	1.05	1.09	0.95	1.05	0.98
Stereotypes and identity	0.91	1.02	1.08	1.00	1.14	0.85	0.92	0.88	1.03
Science as a labour activity	1.04	0.91	0.96	1.00	1.00	1.10	1.06	0.91	0.90
Scientific excellence	0.73	0.92	0.96	0.72	1.06	1.00	0.76	0.96	0.86
Gender in research contents	1.11	1.35	1.16	1.07	1.42	1.05	1.00	1.36	1.19
Gender policies in research	0.86	0.80	0.91	0.73	0.86	0.94	0.97	1.00	0.85

Source: GSD Statistics

With respect to the scientific field studied, the SECs entries in the GSD tend to deal more with Education and Services and less with Agriculture & Veterinary and Humanities & Arts.

Table 1.4. Scientific field explored in the literature. The SECs over All countries ratios

Scientific field	HS	VS	PG	SI	LA	SE	RC	PE	Total
All/General	1.05	0.93	1.01	1.01	0.99	1.04	1.12	0.93	1.00
Other	0.97	1.06	0.99	0.99	1.01	0.97	0.96	1.07	1.00
<i>Total</i>	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Scientific field	HS	VS	PG	SI	LA	SE	RC	PE	Total
Education	1.44	1.01	1.08	1.47	1.16	0.94	1.27	1.07	1.28
Humanities and arts	1.03	0.70	0.78	0.68	0.68	0.54	0.81	0.83	0.60
Science, maths and comp.	0.87	0.91	0.98	0.85	0.84	0.85	0.98	0.74	0.84
Agriculture and veterinary	1.01	0.70	0.92	0.47	0.75	0.60	1.39	0.58	0.57
Health and social services	1.09	0.89	0.98	0.96	0.94	0.89	1.33	0.85	0.98
Engineering, manuf construct	0.94	1.00	1.03	0.79	0.96	0.86	1.15	0.75	0.80
Social sciences business law	1.28	0.93	1.25	0.95	1.05	1.13	0.92	1.28	0.90
Services	2.60	2.53	2.78	2.77	3.13	1.61	1.96	2.67	2.77
Specific scientific discipline	0.61	0.64	0.32	0.65	0.38	0.53	0.65	0.58	0.72

Source: GSD Statistics

The SECs tend to focus on a specific grade of education or a specific age group with respect to the ACs. It would appear that Southern European scholars are particularly interested in the levels above ISCED 6.

Table 1.5. Life course stage studied, Southern European Countries to All Countries ratios

Scientific field	HS	VS	PG	SI	LA	SE	RC	PE	Total
All/General	0.8	0.7	0.7	0.8	0.7	0.8	0.8	0.6	0.7
Other	1.1	1.1	1.2	1.1	1.1	1.1	1.3	1.3	1.1
<i>Total</i>	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Scientific field	HS	VS	PG	SI	LA	SE	RC	PE	Total
ISCED 0	0.7	0.7	0.6	0.9	0.3	1.7	0.9	0.6	0.8
ISCED 1	0.9	0.6	0.9	0.9	0.5	1.0	0.6	0.6	0.8
ISCED 2	1.0	0.6	0.5	0.9	0.5	1.2	0.7	0.7	0.8
ISCED 3	1.1	0.6	0.7	0.9	0.7	1.4	0.6	0.8	0.9
ISCED 4	0.9	0.8	0.9	0.9	0.9	1.4	0.7	0.7	0.8
ISCED 5	1.1	1.0	1.0	1.0	1.1	1.1	1.2	1.0	1.1
ISCED 6	1.1	1.2	1.1	1.4	1.3	1.4	1.3	1.0	1.3
Early-career scientists	1.0	1.1	1.1	1.3	1.1	1.0	1.1	1.0	1.1
Mid-career scientists	0.9	1.1	1.1	1.3	1.1	1.0	1.1	1.0	1.1

Source: GSD Statistics

In the SECs, the approach was 'conceptual' in approximately the same percentage as for the ACs countries. A total of more than 65% of the entries used an empirical technique, whether quantitative or qualitative. Overall, the SECs used empirical quantitative techniques as a

methodological approach in a rather larger subset i.e. 37% of the entries. This is almost one and a half times (1.39) higher than in the ACs. The paucity of state-of-the-art methodologies is somewhat puzzling, as one would have expected it to be a generic category for many types of methodology. According to the database, building gender indicators is not a methodology that is very widespread, either in the SECs or in the ACs. The SECs used this methodology in 6% of the entries, and this is more than twice the amount of entries that build gender indicators in the ACs.

Table 1.6. Methodological approaches used in the SECs. Percentages and their ratio to ACs

SECs

Methodological approach	HS	VS	PG	SI	LA	SE	RC	PE	Total
Conceptual	42.2	37.1	47.8	44.6	39.2	45.8	63.6	47.8	40.6
State-of-the-art	33.7	32.8	39.1	26.3	34.3	24.0	36.4	37.5	30.2
Compilation of statistics	37.4	39.0	44.2	16.2	32.8	20.3	13.0	32.0	23.0
Building gender indicators	6.9	5.7	10.1	4.6	7.0	15.1	7.3	13.6	6.0
Empirical research. Quantitative techn	36.2	35.2	26.8	39.1	38.0	39.1	21.7	26.8	37.0
Empirical research. Qualitative techn	28.9	34.7	19.6	28.0	39.2	35.9	27.2	30.5	28.4

Ratio SECs to ACs

Methodological approach	HS	VS	PG	SI	LA	SE	RC	PE	Total
Conceptual	1.09	1.15	1.10	0.99	1.39	0.91	0.93	1.11	1.04
State-of-the-art	0.88	0.76	0.99	0.76	0.86	0.63	0.78	0.72	0.75
Compilation of statistics	1.18	1.17	1.38	1.10	1.27	1.12	1.10	1.23	1.12
Building gender indicators	1.85	1.53	1.61	1.76	2.16	2.89	1.75	2.45	2.13
Empirical research. Quantitative techn	1.28	1.29	0.87	1.41	1.20	1.52	1.46	1.26	1.39
Empirical research. Qualitative techn	0.90	1.01	0.80	0.82	0.87	1.12	1.09	1.03	0.90

Source: GSD Statistics

When using quantitative techniques, the sample was representative in 63.7% of the cases in the SECs, and this percentage is slightly higher than in the ACs. 49.5% of the entries used micro data, which is quite a high proportion as in order to obtain micro data one must more often than not carry out an ad-hoc survey. This data may be slightly biased by the fact that often one survey produces a collective book, in which many authors analyse different aspects of the same survey. Therefore, we do not expect there to be such a high number of micro datasets available to analyse the topic of gender and science.

Table 1.7. Use of quantitative techniques in the SECs (%) and ratio of SECs to ACs

Quantitative techniques	HS	VS	PG	SI	LA	SE	RC	PE	Total
Representative sample	59,8	64,9	67,6	59,8	68,0	82,7	66,3	74,0	63,7
Micro-data	40,8	50,3	56,8	45,9	48,8	69,3	42,4	41,1	49,5
Longitudinal/cohort	3,4	3,8	8,1	1,6	2,4	6,7	1,1	1,4	2,2
Multivariate analysis	21,2	21,1	24,3	26,6	21,6	29,3	22,8	26,0	25,5

Quantitative techniques	HS	VS	PG	SI	LA	SE	RC	PE	Total
Representative sample	1,20	1,32	1,27	1,27	1,89	1,58	0,99	1,25	1,26
Micro-data	2,26	3,00	2,53	2,47	2,57	4,46	5,29	3,60	2,76
Longitudinal/cohort	0,15	0,16	0,51	0,06	0,07	0,30	0,06	0,07	0,10
Multivariate analysis	2,09	1,98	2,89	2,91	1,70	2,90	3,31	2,64	2,91

Source: GSD Statistics

The qualitative methodology which is most often used in the SECs is content analysis, which these countries use twice as much as in All Countries, followed by interviews and biographical research which comprise 20.1%.

Table 1.8. Use of qualitative techniques in the SECs and ratio of SECs to ACs

Qualitative techniques	HS	VS	PG	SI	LA	SE	RC	PE	Total
Biographical research	21.7	20.3	18.5	18.9	27.1	18.8	26.1	13.3	20.1
Case studies	14.7	18.1	22.2	13.1	16.3	15.9	22.6	26.5	14.7
Content analysis	26.6	24.2	11.1	26.9	18.6	23.2	28.7	27.7	27.9
Interviews	66.4	67.0	70.4	64.0	69.8	62.3	57.4	61.4	62.4
Observations	16.8	13.2	29.6	20.0	15.5	17.4	18.3	18.1	15.7

Qualitative techniques	HS	VS	PG	SI	LA	SE	RC	PE	Total
Biographical research	1.33	1.04	1.43	1.27	1.06	0.81	1.06	1.08	1.14
Case studies	0.89	1.04	1.24	0.89	1.12	0.92	0.85	1.03	0.96
Content analysis	1.48	1.64	1.03	1.72	2.07	1.24	1.26	1.42	1.81
Interviews	1.02	0.99	0.96	0.99	0.97	1.03	1.08	0.96	0.96
Observations	1.02	1.19	2.06	0.95	1.78	1.11	0.89	1.15	1.03

Source: GSD Statistics

1.5. Is there a relationship between welfare regimes and women's presence in science?

The hypothesis made at the commencement of the Meta-analysis of Gender and Science Research project is that there may be a correlation between the characteristics of the 'welfare regime' in certain countries and women's presence in science in those countries. Although this hypothesis is difficult to verify taking in account only the Southern European countries, due to a lack of variation in the experiment i.e. because the Southern countries have very similar welfare regimes, this paragraph shows the results for the Southern countries in the light of the hypothesis, to make it possible to then compare the Southern European Countries with other European Countries.

As was mentioned in the Introduction, the initial identification of 'welfare regimes' was due to the Danish sociologist Gosta Esping Andersen, whose book *Three worlds of Welfare Capitalism* (1990) originated a great amount of literature. He identified three main models of the Welfare State, i.e. 'Liberal', 'Nordic' and 'Bismarckian'. They differ with respect to the main sources of care financing: private purchase, taxation, contribution, the main place where care take place: private services, public services, the family, the amount and the channels of resources directed to those in need i.e. cash transfers or transfers in kind by the state, private intra-family transfers, the prevailing labour relations systems, a 'free' market with few legal restraints, contracts among social partners. Each model is a 'regime', because it is a set of coherent practices, fitting together in different ways to satisfy care needs. It is also difficult to make piecemeal reforms or to import specific policies which function well within one regime but may not function within another.

In the original classification by Esping Andersen, polarity seems to exist between the Nordic and Liberal models, with the Continental model being somewhere between the two. This polarity is correct if we look at the problem of income distribution, or 'class'. The Nordic Welfare State is extensive and universal for all citizens, while the Liberal Welfare State is small in size and residual, only for the very poor. However, with respect to gender relations, the 'Liberal' and 'Nordic' models are similar because they foster more "symmetric" gender relations, because in these models men and women are similarly situated with respect to production and redistribution of resources (Addis, 2003). The Bismarckian and especially the Latin models, however, are "asymmetric", because they direct different sexes towards specialisation in different types of work, unpaid care work if they are women, remunerated non-care work if they are men. Thus, they create and reinforce women's dependency on male family members for monetary resources, reduce women's available free time, and produce overall gender inequality.

In the Nordic welfare model, which has its ideological basis on democratic socialism, the state-provided care by means of public services is paid by income taxes. Women were given employment in large numbers by the state to provide such services. The belief that women are entitled to a remunerated job became widespread and, gave rise to the notion that the public sphere should be as open to women as it is to men. The belief that women who wish to engage in a professional scientific career should be able to do so on the grounds of equal opportunities followed.

In the Liberal countries, such as the USA and the UK, the market is the central institution. This means that the strong force of competition acted to encourage women's participation in the labour force, since they could be employed with lower wages, and also their participation in science, since the ultimate product of science can sell on the market either as technology or as the high quality services of a physician. Time spent in domestic production by educated women has a high opportunity cost, since the same time could be used producing anything, including science for the market. Even if the welfare state is small and residual rather than universal, the market provides services to substitute for unpaid domestic work, of different quality for different levels of income, from schools open in the afternoon to nursing homes for the elderly, to restaurants for all tastes and purses. In some instances, the availability of these services facilitates women's participation in the sciences.

The continental model of welfare, which according to Esping Andersen covered continental Europe including southern Europe, is definitely more complex. In the subsequent literature a marked difference was found among the two main countries, Germany and France. A larger degree of similarity was found, however, among the continental Southern European Countries, i.e. Spain and Portugal, Italy and Greece, at least as they were at the end of the twentieth century. A characteristic of these countries was the provision of cash rather than of services by the state, financed by payroll contributions rather than from general taxation, and, therefore, the male breadwinner's entitlement to the benefit rather than a citizen of either sex.

In the Nordic countries, the welfare state is the result of a political and cultural climate where socialism was the strongest political influence. Anglo-Saxon countries after post-Thatcher England and the USA, due to the prevalence of liberalism as a political culture, have reorganised their welfare states along market lines, paying special attention to the incentive and disincentive effects of their policies. The political culture prevailing in the continental states is Christian, and Christianity in Europe differentiates from Catholicism and the varieties of Protestantism, and, with a stronger or weaker influence of the church on political life. Some of the largest countries considered in this study, i.e. Italy, Spain, Portugal, and Greece, have been classified in the literature as a specific version of the continental welfare regime. One of the characteristics of this Latin version is its connection with the Catholic and the Orthodox culture. Whilst protestant ethics privileges work, to the extent of creating tension between paid employment even for women and housewifery, both seen as legitimate forms of female activity, Catholicism and Orthodoxy's peculiar view of femininity has long preached housewifery as the only recommended activity for women.

The combination of these ingredients made the regime in most Southern European countries "familistic": i.e. the main institution for care was not the market or the state, but the family; women's unpaid labour was necessary since it was not easily replaced either by public services or by the market; the male breadwinner could use his wages and the cash transfers from the state to exchange them for the domestic care carried out by his wife. The Southern European welfare state 'produced' housewives, and was one of the reasons for women's low participation rate. If women are not expected to have a career, they are also unlikely to be expected to have a scientific career.

Women's relationship to science obviously depends on the possibility of women devoting time to science. This possibility is related to the welfare regime, because it depends on the fact that either public services or commercially provided services can replace the care that in traditional societies is provided by the women in the household for the other members of the family, and they do so at a standard of quality acceptable to women themselves.

The existence of a non-familistic welfare regime, i.e. the development of alternatives, to home-provided care for children, the elderly, the sick, and otherwise needy members of the household is a prerequisite for women's presence in science. One may say, using economic jargon, that the supply of women scientists is a function of these developments in the provision of care services. The alternative to domestic care can be either provided by the welfare state or by private, commercial enterprise. This will change the status of women who are paid workers, because they will be either civil servants or private employees, with different kinds of wages and job security.

The link between welfare institutions and presence in science has been a beautiful theory. Unfortunately, it could not be supported with adequate evidence for the Southern countries, although this may be due a) to the strong effect of demand rather than supply factors b) to the existence of national and historical peculiarities.

Like other economic variables, the number of women in science is determined by the supply of women willing to be scientists as well as by the demand for their skills. It is not enough for women to feel that their families can receive good care in public institutions or in commercial facilities, so that they can devote their time to science. Science must be willing to accept and integrate them. Even if women like Marie Curie and Lise Meitner had to accept doing unpaid research, a majority of contemporary European women expect to hold a regular job that pays a wage. If women were willing to do research at home and without pay, like Rita Levi Montalcini dissecting chicken embryos in her bedroom at the time of the Italian racial laws, such personal sacrifice would not be enough, since doing science nowadays requires participation in a structured community that holds the keys to all the necessary technologies, from authorised laboratories, to up-to-date libraries, to research funds. The strong and widespread belief, among men and women, that women's legitimate place of work is not just the kitchen, or the nursery school, the elementary school or the secretarial office, women's full acceptance within the scientific community is an important prerequisite for women's increasing presence in science.

This fact is an object of concern because it makes it relatively difficult to test our hypothesis of a relationship between welfare regimes and women's presence in science. In the presence of a similar rise in supply in two countries, it may happen that in one of the countries, there is greater institutional resistance to women entering science and in the other less, this may break the correlation between welfare regimes, women's labour supply and women's presence in science.

As far as the Southern European Countries are concerned it is believed that the existence of **national historical peculiarities**, in particular in Portugal, Turkey and Israel, prevents us from observing such a correlation. In section 1.6 a review of such peculiarities is introduced.

1.6. National peculiarities

As we discussed in the introduction, the countries we are studying can be aggregated into two groups. The first group is located in the southern part of Continental Europe i.e. Portugal, Spain, Italy and Greece. It is made up of nation states with a relatively long history of independence and sovereignty. Three of them i.e. Portugal, Spain and Greece have a history of dictatorships lasting late into the twentieth century. Three of them i.e. Italy, Portugal and Spain witness the important influence of the values of the Catholic Church on civil society; the values of the Orthodox Church of Greece are not very different. The influx of the latter was one of the cultural forces shaping the Welfare State.

Among these countries, Portugal stands out because of the relatively high number of women who are employed in research and academia. One of the reasons for this phenomenon is related to the fact that Portugal was for a long time a small country trying to keep the remnants of a colonial empire. Therefore, the dictatorial regime governing the country until 1974, when democracy was established, recruited more and more young men to the colonial war, during the 1960s and the early 1970s. Because of this, there was a shortage of men entering the academic profession, and larger numbers of Portuguese women were able to enter research employment.

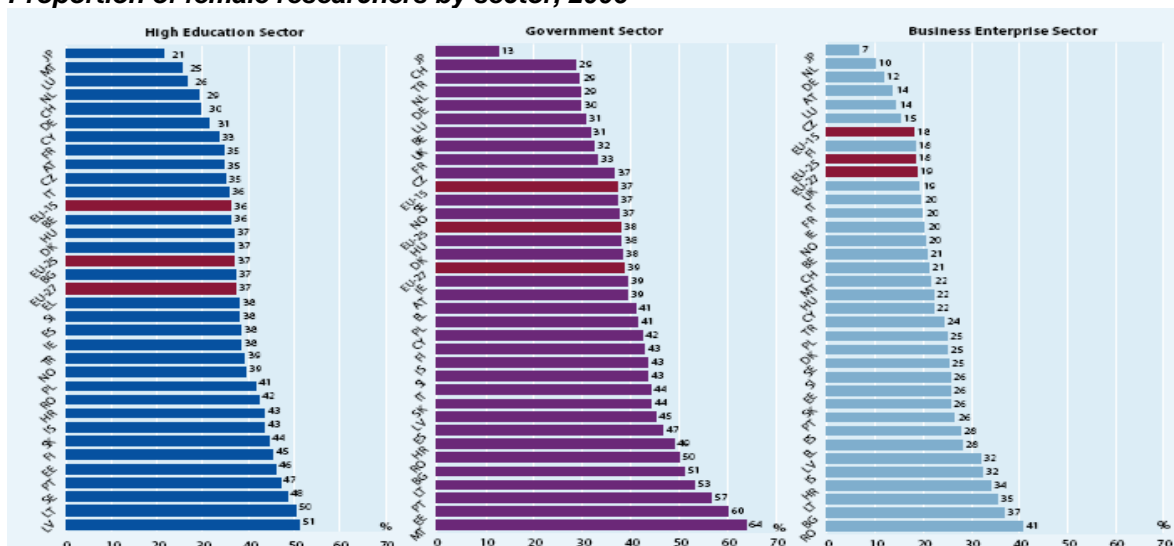
Countries belonging to the second group i.e Israel, Turkey, Malta and Cyprus are more heterogeneous. In **Malta**, a small island that was under British sovereignty for many years, there is only one university and the activities related to equal opportunities and gender studies seem to be in line with that of small universities in the continental mainland countries, with quite low rates of women's employment as researchers in higher education as well as in the Government sector. **Cyprus** is connected culturally to nearby Greece and it was also considered connected in the database.

Israel and Turkey are cultural outliers with respect to the countries of continental Southern Europe. Both countries have very peculiar political histories. In **Turkey** women's high presence in academia is connected to the complex interplay of various social, cultural and economic factors. Among these, the cultural movement in favour of secularisation initiated at the time of Kemal Ataturk has been considered a major force. It is very important to highlight that the Turkish report is the only national report that indicates the possibility of a downward trend for women's participation in the labour force. Although possible consequences of such a trend for the female scientists and professionals cannot be estimated at present it is an issue to watch and examine in the near future. The **Israeli report** shows an advanced knowledge of the issue of Israeli women and science that does not correspond, however, with an advanced role of female scientists, at least in terms of their relative numbers compared to the other SEC countries (see box 4 below). It should be mentioned here that the research published *in the country* itself about Israel is also very limited: a total of 5 publications; therefore, most research about Israel is published outside Israel.

Box 4 - Women's participation in science

The figure below shows the proportion of female researchers by sector in the EU and some non-EU countries in 2006. Participation is not homogeneous by country or by sector and the Southern European Countries are not a homogeneous group, **although in general it could be said that the relative position of the SECs is generally above the EU average. Portugal has a high proportion of female researchers – well above the EU27 average - in all three sectors considered: Higher Education, Government and Business Enterprise. Spain and Israel also show proportions above the EU27 average, while the situation of Italy, Cyprus and Turkey is less homogeneous across the sectors, but above the average respectively for the government and business sector i.e., Italy and Cyprus and in higher education and the business sector, Turkey. Malta has the highest proportion of women researchers in the government sector of all the countries examined.**

Proportion of female researchers by sector, 2006



Source: European Commission, (2009) *She Figures 2009*

Socio-cultural, religious and historical differences characterising the SECs are also reflected in differing levels of overall gender equality. Table 1.9 below compares the SECs according to two gender equality indexes, the Gender Equality Index developed by Social Watch, listing 202 countries and comprised of three main dimensions: the gender gap in education; in economic

activity and empowerment, and the EU Gender Equality Index developed for the EU-25 Member States by Plantenga in 2009 and comprising four main dimensions of gender equality: Equal sharing of remunerated work; money; decision-making power and time. For both indexes and all sub-dimensions a higher score indicates a smaller gender inequality gap.

According to the Social Watch index, while differences in the education gap would not seem to be too relevant for the SECs, the greatest differences are noted in the empowerment gap – summarising information about women’s ability to influence the economic and political agendas of their countries with Spain scoring particularly well and Greece, Cyprus, Malta and Turkey lagging behind. Israel, Portugal and Cyprus have relatively good indicators for economic activity, denoting that women’s participation in the labour market and their share of income in these countries is more satisfactory than in the rest of the SECs and particularly in comparison with countries like Turkey, Malta and Italy.

The index developed by Plantenga, of which we only list the overall composite score, groups the European Union countries according to high, medium or low scores on the GEI. All the SECs fall into the lowest group, with the exception of Turkey and Israel, which are not considered in the study and Portugal, which falls into the middle score group together with other Eastern and Central European countries

Table 1.9. Gender Equality Index scores of the SECs

COUNTRY	SOCIAL WATCH GENDER EQUITY INDEX 2009				EU GEI
	SW GEI 2009	EDUCATION GAP	ECONOMIC ACTIVITY GAP	EMPOWERMENT GAP	
Spain	77	98.4	58.3	74.1	0.37
Portugal	73	97.6	69.1	52.8	0.55
Israel	72	97.1	75.2	44.1	n.a.
Greece	65	95.9	61.2	38.6	0.26
Cyprus	65	97.9	68.2	29	0.32
Italy	64	96.8	54.6	42.1	0.41
Malta	58	96.7	49.5	28.5	0.33
Turkey	46	85.3	35.8	17.3	n.a.

Source: Social Watch 2009; Plantenga et al. 2009

1.7. Conclusions

The SEC Report summarises the main elements of the research in each country. In this Introduction we have given a general outline of interpretation according to two main dimensions: a) a statistical analysis of the database, to analyse trends and to check for homogeneity of the SEC group with the entire database; and b) the search for a correspondence between welfare regimes and country peculiarities and women’s presence in the sciences.

The statistical analysis did not provide evidence of significant differences in the amount of literature published and in the approaches followed. As concerns the situation of women in science and the differences in national contexts, the SECs appear a well integrated group in general trends. No correlation would seem to exist between the SECs, their allegedly more “familistic” gender regimes and women’s particularly low representation in science, data would actually seem to point in the opposite direction. This is true notwithstanding the presence of national historical peculiarities, which acted upon the presence of women in academias, and the processes of horizontal and vertical integration in some countries such as Portugal, Turkey and Israel.. There is a noticeable similarity in the issues studied and in the stages of development of the research on gender in science, which is present in all the countries.

National peculiarities, however, hide the existence, if any, of a link between the overall **gender pact** of a country and women’s status in science. Moreover, the gender pact, and in particular the principal component, the welfare regime, are similar in many countries, so that within the

SECs there is not enough cultural and institutional diversity to accept or reject this link. It is worth investigating further whether the existence of such a link can be inferred by analysing the European-wide situation.

2. Analysis by topics

The analysis by topics will follow the conceptual organisation that has guided the methodological approach of the Meta-analysis of gender and research project. The structure of these topics has four dimensions:

- A first descriptive dimension, which includes the three topics of Horizontal gender segregation; Vertical gender segregation; and the Gender pay gap;
- A second dimension dealing with the analysis of gender bias in structural social dynamics that are reproduced in scientific work. It includes the two topics of Stereotypes and identity and Science as a labour activity.
- A third dimension, dealing with issues related directly to gender bias in the scientific culture and scientific institutional practices. It includes the two topics of Scientific excellence and Gender in research content.
- A fourth and final contextual dimension, dealing with policies towards gender equality in research.

2.1. Horizontal segregation

2.1.1 Links between horizontal and vertical segregation

Horizontal and vertical segregation are two useful concepts to measure the different positions of men and women within a given employment structure. Horizontal segregation reflects the fact that men and women are divided in the kind of tasks they perform and sometimes in the places where they work; vertical segregation refers to the fact that a hierarchy has a top and a bottom, defined by various parameters and a certain kind of person is usually found at the top, and another at the bottom. Vertical segregation is, therefore, always also horizontal segregation: people at the top do different jobs from the people at the bottom and meet different people among other things.

One might imagine a utopian state of affairs where horizontal segregation is only a sectoral difference and a difference in job contents that does not involve hierarchical inequality. In this utopian state, people freely choose what they like to do best, and if men and women end up doing different things, this is not a problem because this difference does not involve a difference in power and reward. The fascinating aspect is, however, that when we look at the data, we find not only that the feminised sectors are relatively badly paid and have low prestige, but also that there is a dynamic feminisation effect. Feminisation, i.e. increasing horizontal segregation in a given sector, is often accompanied by vertical segregation of the entire sector, i.e. a decrease in the social ranking of the entire sector. In science, the topic of horizontal and vertical segregation and the feminisation effect on the status of a discipline are particularly important because they relate to the issue of why there is a much higher probability of finding women in some, so called 'soft', disciplines, and men in the other 'hard' disciplines, and the difficult explanation for this fact.

The topics of horizontal and vertical segregation, therefore, provide data, in terms of statistical facts and of the possibility of testing causal hypothesis and correlations, on the structural social dynamics that produces gender discrimination. If we understand how allocation of the two sexes along the horizontal and the vertical axis of possible job position works, then we can grasp the underlying epistemological and institutional set up that are the roots of women's under-representation in science.

Box 5 – Hard and soft sciences

Hard science and soft science are colloquial terms often used when comparing fields of academic research or scholarship, with 'harder' meaning perceived as being more scientific, rigorous, or accurate. For example, the fields of the natural sciences or physical sciences are often described as hard in contrast to the soft social sciences. The hard sciences are characterised as relying on experimental, empirical, quantifiable data or the scientific method, and focusing on accuracy and objectivity. Different approaches to the scientific method can be distinguished by the research called 'soft science' and what is considered 'hard.' The issue is important to the philosophy of science, which does not always support the possibility of drawing a distinction between 'hard' and 'soft' and to science studies and the sociology of science, which study scientists' implicit perceptions of research and methods. In her seminal work 'Gender and economic ideologies' Julie Nelson presents a feminist analysis of the distinction. Softness and femininity are often associated with hardness and masculinity. Softness is perceived as a good and desirable quality in the stereotypical woman, while it is thought of as a bad undesirable quality in the stereotypical man. Therefore, women who have the qualities to pursue 'hard' science have incentives to hide this personality trait in order not to be thought of as unfeminine. Men are given the incentive to leave the 'soft' fields of knowledge so as not to appear unmanly. Or, if they agree to stay, they may require an extra echelon in the hierarchy to confirm their manhood. This explains why in the more feminised sector there is even higher vertical segregation with men occupying the top managerial positions.

Nelson J. A. 1993, 'Gender and economic ideologies', Review of Social Economy, Vol. 51

One important aspect of segregation is the fact that feminisation, i.e. increasing horizontal segregation in a given sector, is often accompanied by a change in the ranking of the entire sector, so that vertical segregation is maintained. The topics of horizontal and vertical segregation are particularly important because they relate to the issue of why there is a much higher probability of finding women in some, so called 'soft', disciplines, and men in other 'hard' disciplines, and the difficult explanation for this fact. Whether it is the presence of men that determines the 'hardness' of a field, or whether men are attracted to hard fields and viceversa for the association of women with 'softness' resembles a "chicken or egg" question.

2.1.2 Horizontal segregation in the GSD – An overview

Horizontal segregation studies the phenomenon by which women are more present in specific sectors e.g. the educational and professional sectors alike, in proportions higher or lower than men. When women enter the world of tertiary education and the labour force, they do so in an irregular fashion which partially imitates the traditional division of labour induced by early industrialisation.

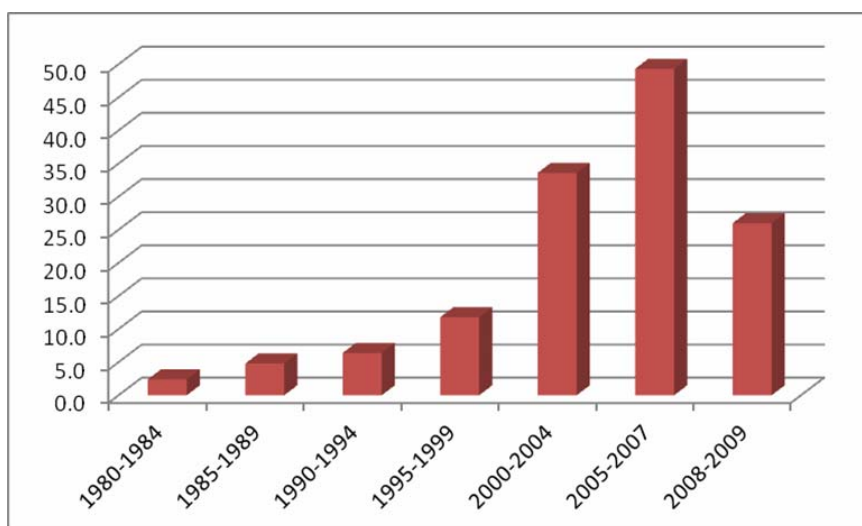
The topic of horizontal segregation is the third most covered topic by entries covering the SEC, with 44.0 % of entries dealing with this issue. This is not surprising since, from a conceptual point of view, the issue of women's horizontal segregation in science, together with that of vertical segregation and pay and funding provide a first descriptive dimension of the phenomenon of women's multi-faceted under-representation in the scientific fields and professions.

Table 2.1 Horizontal segregation - Number and percentage of publications

	n	%
Cyprus	90	41,3
Greece	200	50,4
Israel	40	53,3
Italy	207	46,1
Malta	111	44,8
Portugal	166	46,0
Spain	174	37,5
Turkey	50	21,9
Southern CS	495	44.0
All Cs	1,965	43.2

Source: GSD Statistics

In terms of **time trends**, starting from the late 90s, the topic has been attracting growing attention in the SECs' literature. At least 20% of the GSD entries published since the year 2000 deal with this issue

Graph 2.1 Horizontal segregation - Average number of publications per year groups

Source: GSD Statistics

2.1.3 Horizontal segregation – Research questions

The entries collected articulate the topic of horizontal segregation in a rather wide range of research questions, such as:

- Analysis of horizontal gender segregation as regards both university students and scientists by scientific field of study or professional field, respectively;
- Analysis of the choice of scientific subjects by boys and girls and occupational choices by women;
- Analysis of the mechanisms by which gender stereotypes determine horizontal and vertical segregation throughout the various stages of education and career paths
- Analysis of the mechanisms by which educational choices have an impact on professional choices.
- The feminisation of teaching and certain departments in the academy;
- Gender composition of the main areas of higher education as well as the participation patterns of women in metropolitan and provincial universities;
- Women's concentration in certain branches of medical specialisation;
- Gender-specific attitudes of students or teacher candidates towards various scientific areas.

The main question asked by the literature examined, about gender segregation is whether it exists and what the sectors/scientific disciplines are in which women experience segregation.. The focus of the analysis across the SECs is mainly on the higher education sector, namely concerning the distribution of women in the different disciplines in universities, both as students and professors. Particular attention has been dedicated to women's underrepresentation in the technical or 'Science and Technology' disciplines and careers. Some entries also refer to horizontal segregation within specific professions, mostly the medical, teaching and engineering ones.

The second question asked across all the SECs although with differing degrees of intensity of investigation, is what the main factors are that could explain women's different educational choices. The existence of horizontal segregation in fact may be declined in two different ways, one as a result of women's own choices of the field of study and profession, the other as a result of women's 'imposed' choices following an exclusion process by men. Both aspects are strictly linked to the topics of stereotypes and identity and of science as a labour activity. Many women feel discriminatory pressure and as a result of this, they are forced to choose some specific fields and subfields or are given some specific tasks. Furthermore, women might be influenced in their field of study or career selection by their perception or society's perception of the 'family friendliness' of certain professions.

Another hypothesis advanced by some studies on horizontal and vertical segregation is that there might be gender specificity in the selection of the field of study in the fact that women might feel that they like to do things that men do not. It is undeniable that women are also agents of choice processes, as they choose their own educational processes.

An important characteristic of the questions faced in the topic of horizontal segregation is that it is often closely interrelated with the issue of vertical segregation and it is sometimes difficult to separate one from the other and cause-effect relationships among the two certainly exist. In this respect the Country report on Italy clearly states that horizontal and vertical segregation are strictly interconnected as feminisation, i.e. increasing horizontal segregation in a given sector is often accompanied by vertical segregation in the entire sector, i.e. a decrease in the social ranking of the entire sector, in its funding, in the pay of the scientists involved. Similarly, the Israeli Country report focuses on the inter-relationships between vertical and horizontal segregation of women in scientific fields and technical careers in Israeli society.

2.1.4 Horizontal segregation – Research approaches

The predominant research approach adopted in the analysis of horizontal segregation has to be descriptive. In the SECs, horizontal segregation in research careers studies the issue of girls' choice of scientific subjects and women's occupational choices. At the academic level it may occur in disciplines, in subfields of each discipline, in different types of institutions in higher education such as polytechnics versus universities versus teaching colleges, in departments/faculties within the same university, between 'major' universities versus peripheral ones, in which case the analysis also focuses on vertical segregation, between universities or research institutions. In schools and universities women may be horizontally segregated into teaching or into the administrative positions related to caring for students. Horizontal segregation also happens across the institutional occupational sectors such as Government research, higher education and the business/enterprise sector. With regards to the non-academic professions, horizontal discrimination is analysed by branches of specialisation or types of profession eg. a general practitioner vs a surgeon; a civil engineer vs a mechanical engineer.

When focusing on the analysis or description of the phenomenon, methodologies overwhelmingly refer to a quantitative basis, counting men and women's presence. Data is often collected from existing databases, either from central national institutions i.e. national statistics bodies or ministries of education and research and from sectoral associations such as professional bodies or specific organisations such as universities or research bodies.

When the analysis also aims at understanding the underlying factors, i.e. the mechanisms of the reproduction of gender stereotypes influencing education and career choices, qualitative research is also present. Methodologies for collecting qualitative information may take different forms, such as interviews, open-ended questionnaires, case studies or focus groups. Other types of qualitative research examined are more theoretical and mainly focus on the contribution of feminist criticism of the scientific paradigm in explaining why women would be more attracted to certain disciplines and career choices. More detailed information about these types of entries can be found mostly under the topics 'Stereotypes and Identity' and 'Science as a labour activity'.

Box 6 - Statistical publications on women's horizontal and vertical segregation in science and research

In Spain women have accounted for more than 50% of university students since the beginning of the 1980s but women's low presence in technical fields remains. It is for this reason that, since 2000, interest in this subject has started to gain importance. A consistent number of detailed studies have been carried out in various institutions such as the Centro Superior de Investigaciones Científicas (CSIC), the Spanish National Research Council (Garcia and Goya, 2002; Ruiz, 2002); Public universities, where equality observatories have been created (Izquierdo et al., 2005); the Royal Academy of Science (Garcia de Leon, 2005); and Professional Associations (Ortiz et al., 2004). The dissemination of relevant results has been ensured by the FECYT through comprehensive state-of-the-art reports (Alcalà et al., 2005 and 2007)

In Italy the most representative and inclusive collection of data on women's presence in universities as students, not as teachers has been published by ISTAT, the national statistics institute, in 2001 (ISTAT, 2001). Individual Universities published an analysis of the students and professorial distribution (such as Comitato pari opportunità dell'Università degli Studi di Padova, 2006; Galbani, A. 2001 on the Milan Polytechnics).

In Greece one of the most relevant and inclusive studies, cross-sectional quantitative and qualitative research, conducted on women's segregation was carried out by the National Centre for Social Research (EKKE) and the General Secretariat for Research & Technology (GSRT) in 2002 (Maratou A., 2002). The Perikioni Network of Women Scientists published a study in 2007 recording and analysing the situation of women researchers participating in R&D, the situation of women researchers in universities and research institutes as well as their participation in decision-making centres, through both quantitative and qualitative techniques.

In Turkey important studies by NGOs and other agencies provide a clear insight into women's segregation in science and research, such as the TUSIAD reports on participation rates in higher education and women's presence in Turkish universities (Tan et al., 2008).

2.1.3 Horizontal segregation – Research findings

Most countries report a sharp increase in the number of women entering university education between the 70s and the 80s, and a corresponding trend of decreasing horizontal segregation a few years down the line from this increase. In all the countries but Turkey, women account for more than half of university graduates and their presence continues to grow.

In most SECs, the growth rate of female PhD holders in traditionally masculine fields is higher than for men, indicating that horizontal segregation across the fields of study is slowly decreasing. The desegregation follows different patterns in each discipline: it happened more quickly in humanities, whilst engineering and technical disciplines seem to be the fields most resistant to integration, across all the SECs. Although major improvements have also been experienced in these fields, such a trend is not uniform across the countries and there is no clear-cut evidence that the gap is closing across all the SECs. There is one study on Italian data (Marzano and Rossi, 2008) that shows that in some countries, even at the present growth rate, the resulting equilibrium will still see women become only about 40% of the total.

At the PhD graduate level, gender segregation is strongest in the technical fields of study such as Engineering, manufacturing & construction, which are predominantly male, and in Education,

Health and the Humanities, which are predominantly female. Table 2.2 shows that in 2006, on average, throughout the EU-27, women PhD holders accounted for 64% of all the PhD graduates in education and 54% in health and welfare. A more or less balanced gender composition characterises the humanities, 52% female, and the agricultural and veterinary sciences, 51% female. The field of science, mathematics and computing and especially that of engineering, manufacturing and construction are characterised by higher numbers of male PhD holders.

An analogous pattern can also be shown at the level of the SECs with some interesting differences. The most noticeable fact is that the **masculinisation of engineering studies is much lower in the SECs than in the rest of Europe**. The feminisation of the field of education is not only most pronounced in Portugal, Israel and Italy but well above the EU-27 average: it is important to note that, although education appears to be 100% feminised, in Cyprus this is probably due to very small sample sizes of PhD graduates in this field in these countries. Greece and Portugal have very high levels of feminisation in the field of health and welfare, with 86% and 69% respectively of the PhD holders in this field, being female.

The masculinisation of the field of engineering, manufacturing and construction is stronger in Greece, Israel and Spain but still in line with the EU average and less evident in Portugal, Turkey and Italy, in which less than 35% of the PhDs are female. It is interesting to note that Portugal and Italy are also the countries that showed the strongest feminisation of the education sector.

Table 2.2. Proportion of female PhD (ISCED 6) graduates by broad field of study, 2006

	Education	Humanities & Arts	Social Sciences, business & law	Science, maths and comp	Eng Manuf and Constr	Agriculture and Veterinary	Health and Welfare	Total
Greece	47.22	51.67	32.98	30.83	24.70	26.97	86.44	35.58
Spain	57.30	48.23	46.42	47.89	24.86	44.27	54.33	46.75
Italy	67.77	59.06	51.98	51.72	35.96	54.59	62.36	51.70
Cyprus	100.00	66.67	28.57	75.00	..	..	..	65.52
Malta	0.00	..	..	100.00	0.00	..	0.00	25.00
Portug	76.31	67.48	60.36	55.40	39.25	54.90	69.37	60.15
Turkey	41.00	34.52	37.53	38.29	35.95	38.13	55.36	40.44
Israel	73.81	51.35	51.64	44.01	25.00	45.45	55.56	34.64
EU27	63.76	52.12	47.10	41.44	25.35	50.78	54.04	44.79
SECs	66.55	55.14	51.36	48.78	34.09	47.23	60.06	44.43

Source: own calculations based on European Commission (2009), She Figures 2009 - 2006

Note:

For Malta and Cyprus the absolute numbers are very low and as such percentages should be considered with caution

For Israel data refer to 2003

For Italy and Greece The total refers to 2005

As concerns horizontal segregation by sector, Table 2.3 below shows that in the first place female researchers in the SECs are **relatively more numerous than across the rest of Europe**, with their proportions in countries like Portugal and, to a lesser extent, Spain, Greece and Turkey being above 35%, against a EU-27 average of 31%. **The same holds true if we look across the sectors**. Portugal's feminisation rate of the Government research sector is second only to Estonia and its gender balance in the Higher Education Sector is close to equilibrium.

Table 2.3. Percentage of female researchers by institutional sector, 2005

	All sectors	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector
Greece	36	28	41	38	51
Spain	37	27	47	38	54
Italy	32	20	40	35	48
Cyprus	33	22	44	33	32
Portugal	44	26	57	47	42
Malta	26	23	44	27	:
Turkey	36	25	27	38	:
EU27	31	19	38	37	43
EU15	30	18	36	37	43

Source: Eurostat, Research and Development Database

An important finding concerning horizontal segregation, which will be illustrated in more detail when dealing with the topic of stereotypes and identity, is that segregation is developed at an early age when students choose their secondary studies.

2.1.4. Horizontal segregation – Gaps in research

Even though this topic is addressed by nearly all the publications reviewed, there are also important gaps.

The main gap is related to the lack of the **systematic collection of sex disaggregated data**. This would allow the monitoring of **changes over time in horizontal segregation in research at the national level** across both public and private education and research institutions, including the distribution among administrative/educational positions within the universities. The lack of relevant data is particularly alarming concerning the **business sector and the world of private research** which are often the recipients of large amounts of research funding.

While in most countries comprehensive studies and efforts to collect such sex-disaggregated series have been undertaken, they have not led to regular publications of such data. Even though studies at the European Commission level provide an important source of homogeneous data in this respect, the degree of gender mainstreaming in tracking changes in the gender 'composition' of the scientific disciplines is still inadequate at the level of the countries in the SECs. Related to this, is the lack of regular, official surveys of university graduates and PhD holders.

Also **indicators of horizontal segregation** allowing comparison between fields or institutions are an issue that has not been adequately addressed and deserves more attention.

An additional important gap, remarked on by almost all country reports, refers to the lack of **panel data to make longitudinal studies possible**, for example, studying the correlation between secondary education and tertiary education choices as well as career outcomes. Related to this, is the relative **lack of truly analytical studies** as opposed to the compilation of statistics. This issue will be analysed in more detail in the subsequent topics.

2.2. Vertical segregation

Vertical segregation refers to the fact that in hierarchical structures, such as most organisations, enterprises and other public or private employers, some people have a higher rank, which entails greater power of strategic decision making, decision power with respect to their working time and content as well as regards other people's working time and content, higher pay and sometimes higher responsibility and accountability.

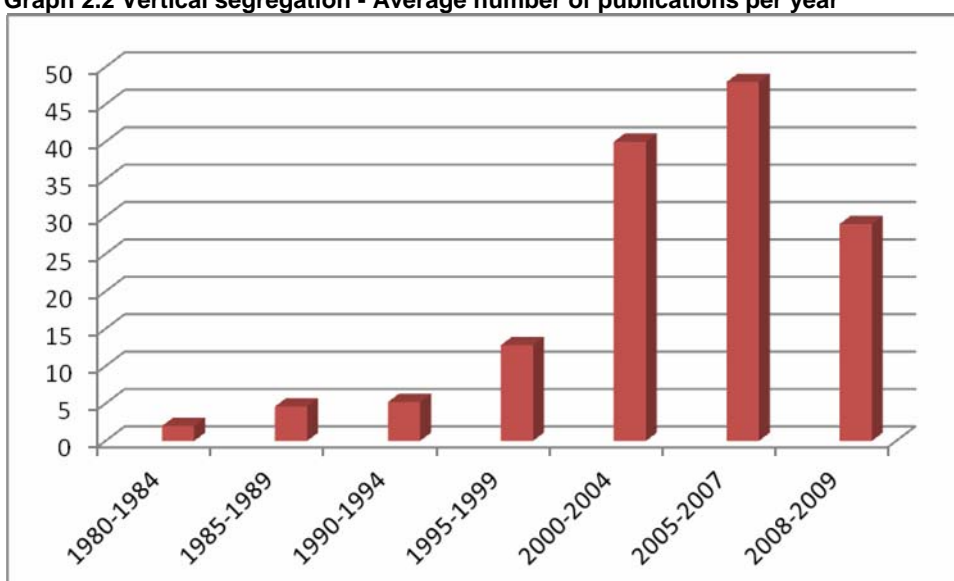
The topic of vertical segregation is the second most covered topic by entries covering the SECs, with 46.7% of entries dealing with this issue. Interest in vertical segregation has been growing constantly over time in SEC literature starting in the mid 1990s and reaching a peak around 2005.

Table 2.4 Vertical segregation - Number and percentage of publications

	n	%
Cyprus	103	47,2
Greece	201	50,6
Israel	27	36,0
Italy	233	51,9
Malta	112	45,2
Portugal	177	49,0
Spain	190	40,9
Turkey	88	38,6
Southern CS	525	46,7
All Cs	2.035	44,7

Source: GSD Statistics

Graph 2.2 Vertical segregation - Average number of publications per year



Source: GSD Statistics

2.2.1 Vertical segregation – Research questions

The first task of research on vertical segregation is descriptive: counting how many women are missing from the high ranking positions at each level, given how many women there are among those who might be promoted. Particularly important is the task of analysing women's presence in decision making and monitoring positions/bodies. In some instances, women's failure to advance in their careers misrepresents the usual pyramidal structure, according to which there are more people at the researcher/assistant level, fewer at the associate level and even fewer at the full professor level. This pyramid still holds for men, whilst for women the failure to

achieve the top level creates a bottleneck, giving a circular distribution, with as many researchers as associates, but no top ranking full professors.

Accurate knowledge and analysis of the forms of vertical segregation in the scientific world is important not only because it enables us to know the extent of the phenomenon in a given country or sector, but also because it determines the future pattern of segregation and scientific research. The scientific community is in fact also a structure of power, in which scientists at the top of the pyramid use their power to allocate funds, positions and tasks, therefore, determining the direction of scientific investigation, and deciding who their successors will be in the top positions. Furthermore, the existence of horizontal segregation, i.e. the fact that men and women seem to be interested in different subfields, implies that if women were as numerous as men in the top positions, i.e. if there were no vertical segregation, research might be directed more towards some subfields than others.

The questions asked by the literature on vertical segregation in the SEC are rather homogeneous, the main one referring to the analysis of the gender composition of staff in research institutions and in scientific professional fields and the existing glass ceiling, which is in turn related to the 'lack' of 'power' and prestige of some professions and to the analysis of the mechanisms by which gender stereotypes determine vertical segregation throughout the various stages of education and career paths. Such analyses usually encompass several years, although it is difficult to find detailed historical analyses. Another issue that is dealt with under this topic, and which requires more elaborate methodological instruments and more specific data and information refers to male and female educational and professional trajectories.

2.2.2 Vertical segregation – Research approaches

Methodologies used to study vertical segregation usually have a quantitative basis, counting men and women's presence, and in some cases, checking for correlation factors such as cohort analysis, enrolment rates, etc (see for example Facchini 1996). This quantitative basis is mostly coupled with qualitative research in order to try to understand the roots and consequences of the phenomenon, especially with regards to educational and professional trajectories. Qualitative research may be in the form of interviews. Sometimes biographical research is also used to clarify vertical segregation.

A more sophisticated tool of quantitative analysis, borrowed from labour economics, is multivariate analysis. The probability of being in a sector is linked by a statistical procedure called probit regression to various characteristics of each individual, as registered in a microdata set derived from distributing a survey. This kind of methodology is used in Italy by economists (Carabelli et al, 1999) and by eminent statisticians studying their own institutions (Palomba, 2000).

As in the case of horizontal segregation, a great deal of the attention is of a theoretical and conceptual nature and focuses on the contribution of feminist criticism on power dynamics established by men who adopt a rent seeking behaviour and 'defend' their 'fortress' from outsiders, namely women.

Vertical segregation is a complex phenomenon, related to many other dimensions of the problem of gender and science. The main theoretical framework of reference is the 'glass ceiling' theory, while the issue of career trajectories, which requires more elaborate methodological instruments and more specific data and information mainly refers to the theoretical framework of the leaky pipeline, which studies how men and women progress in their careers by focusing on a set of consequential career steps such as an undergraduate diploma, a PhD diploma and entry into the university teaching system among other things. In this sense the literature published on the measurement and analysis of gender segregation mainly refers to existing theoretical frameworks without suggesting truly original innovative methods of analysis.

The concept of the glass ceiling is particularly important for the study of vertical segregation. According to many contributions, women seem to come up against an invisible barrier that prevents them from reaching the top positions. In the SECs the glass ceiling has undoubtedly moved upward in recent decades, as more and more women developed the experience necessary to compete for the top positions and have in fact been successful. However, the fact that an increasing number of women are able to go beyond the glass ceiling, does not seem to remove it, and does not seem to induce a situation in which men and women are valued in spite of their sex. By looking at the main findings of the literature analysed, the overall impression perceived is that the ceiling has not been broken, but rather that it has moved higher up.

When too many women go beyond the glass ceiling, the function or sector that is above the ceiling becomes feminised, and the value of that function or sector appears to decrease, with respect to the value of the functions or sectors previously having the same value, which have instead remained exclusively masculine. Gender stereotyping is one of the mechanisms that perpetuate vertical segregation.

Box 7 - Dynamics linking horizontal and vertical segregation: sectors becoming feminised are disadvantaged.

An important comparative contribution by F. Jones confirms and summarises a finding which has been repeated over and over again in national and sectoral works. Horizontal and vertical segregation are linked. Jones's international comparative research (a) distinguishes between measures of occupational gender segregation and measures of occupational gender inequality, and (b) examines whether occupational segregation and occupational inequality are differentially related to structural characteristics of national labour markets. Analysis of data from 56 nations shows that measures of nominal segregation are not equivalent to measures of hierarchical inequality. Nominal segregation seems to increase with industrialisation and in the presence of the service industries but decreases as the participation of the female labour forces increases. In contrast, occupational inequality seems to decrease with industrialisation and in the presence of the service industries but increases as both the participation of the female labour force and level of educational inequality rise. The data further demonstrate that nominal segregation and ordinal status inequality are interrelated. Where nominal segregation is high, women's relative representation in high status occupations tends to rise. The authors argue that occupational segregation should not be equated with occupational inequality, and that theoretical propositions regarding occupational gender segregation may not be applicable to issues concerning occupational inequality. The summary measures used in past research on occupational gender differentiation can be classified into two distinct and substantively different types: measures of nominal segregation that ignore the ranking of occupations, and measures of ordinal inequality that take the vertical ordering of jobs into account. The research uses the major occupational categories distinguished in the ILO publications which include: (1) professional, technical and related workers; (2) administration and related workers; (3) clerical and related workers; (4) sales workers; (5) service workers; (6) production, transport equipment operators and labourers; (7) agriculture, animal husbandry, forestry, fishing

Jones, F. L. 1999, 'Dimensions of occupational gender differentiation in segregation and inequality : A cross-national analysis', Social indicators research, vol. 6, no. 2, pp. 225-247.

As has already been mentioned most of the literature analysed specifically related to gender segregation but also concerned other related topics, mostly in an attempt to understand the cause-effect dynamics, such as stereotypes and identity, research as a labour activity, etc. These issues will be dealt with in more detail in the relevant sections.

The study of **career trajectories** is dealt with in several important publications. In Italy the main ones being Facchini, 1996 and Bianco, 2002 for universities and Benigni et al (eds), 1988 and Palomba (ed.), 2000 for non-university public research institutions. In Spain interesting analyses of female career trajectories can be found in Izquierdo Benito et al 2007 and Ruiz Valero 2002. Ruiz Valero, through a series of interviews carried out at the Spanish National Research Council (CSIC) among female scientific staff, showing that, while equal opportunities hold in the early stages of the academic career, gender inequality increases with career progression. Izquierdo Benito studies the factors that condition the different trajectories of men and women in

the Universidad Autónoma de Barcelona, including age of access to a given position, scientific field as well as family background and links the advancement of women scholars with the retirement of first generations rather than with egalitarian trends. This evidence contrasts with a common belief among Spanish scholars (see for example Juárez, 2002 or García-López, & Goya Laza 2002), who consider women's underrepresentation among professors to be the result of the low female presence among students at the time when the current professors graduated.

In Malta the analysis focuses on the gender composition of the academic staff among the teaching body of the only Maltese university, the University of Malta. In Turkey a special focus is dedicated to women's segregation with regard to the high-level, administrative positions in the university institutions, while Israel focuses on the interrelations between the vertical and horizontal segregation of women in the scientific fields and technical careers in Israeli society, as well as independent factors influencing both kinds of segregation.

2.2.3 Vertical segregation – Research findings

Findings in the SECs about the extent and level of vertical segregation confirm the existence of both a glass ceiling and a leaky pipeline. Although women are reaching gender equality in access to education, and also gradually to the higher levels of education in spite of the fact that the number of women leaving research after having obtained a degree is higher than men, **findings confirm that in all the SECs women's underrepresentation becomes greater as they gain prestige and power** in their progressive career steps, and this underrepresentation is also confirmed in those subjects in which they are most represented.

The pipeline that goes from the graduate student to the full professor is even leakier for women than for men. Integration is higher at the lower levels of the discipline than in the higher levels, i.e. the search for horizontal segregation leads to the identification of vertical segregation. In Spain, for example, it was found that after completing their degree studies, a smaller proportion of women than men undertake to do research. This is especially true for particularly feminised studies (Alcala et al, 2007). The report *Academic women in numbers*, responding to the mandate of the Spanish Government of March 2005 and to the Law for the effective Equality of men and women because of a compelling need to release national statistics with respect to gender shows that although women constitute the majority of students and university titleholders, they comprise the minority of research and academic personnel and that their presence diminishes with a rise in professional level and responsibility. (Unidad de Mujeres y Ciencia, 2007).

Women's presence is very limited in those bodies that control the research institutions and take decisions as to funding decisions, hiring, work organisation. This limited presence certainly reproduces male-specific patterns of behaviour. No evidence has been found that this glass ceiling is due to differences in merit or intellectual achievements.

Research on the participation of women in academia today shows that there is agreement about the following major problems: the increasing number of women at the lower levels, dead end jobs and less commendable positions; the absence of widespread socio structural mechanisms to provide for the redefinitions of women's family roles; vertical segregation in promotion to managerial positions.

Although with differing degrees of segregation and depending on the disciplines involved, the findings highlight some common trends across the SECs. Even in those countries that have a better representation of women in science as well as in terms of the positions they cover such as in Portugal and Turkey, gender segregation is deeply embedded in organisations and in the dominant culture of science. Subtle ways of discrimination persist and men tend to be in the superior, managerial positions.

In spite of a significant increase in the number of women who have been awarded a PhD degree, equality has still not been reached. Vertical segregation in academic careers continues to be very prominent. The number of women in teaching and research positions is growing very

slowly and fails to correspond to the rapid increase in the number of female graduates and PhDs but no conclusive evidence has been found that this might be due to differences in scientific productivity so, no kind of hierarchical discrimination is justified on the basis of merit. Women's 'attrition rates' increase as they progress in their educational careers resulting in a smaller proportion of women than men deciding to continue their careers in research. In Spain it has been found that this is particularly true for the feminised sectors.

In universities women tend to be relatively more represented in the lowest ranks of the academic positions, **even in subjects where they are overrepresented as graduates** (see for example Maragoudaki, 2007; Perez Seden et al, 2006; Statistical Service of Cyprus, 2007 or Vosniadou & Vaiou 2006).

Table 2.5 shows the distribution of female academics across the SECs and different grades in decreasing order of prestige and responsibility, with Grade A corresponding to the highest level of the academic teaching position, i.e. full professorship. In all the SECs with the exception of Cyprus and Malta, the proportion of female academics decreases with the increase in academic grade as in the rest of Europe. The proportion of female full professors is highest in Turkey with 28%. Portugal, Italy and Spain are in line with the EU average while Malta, Cyprus, Greece and Israel show significant degrees of vertical segregation, well below the average.

Table 2.5. Proportion of female academic staff by grade and total, 2007

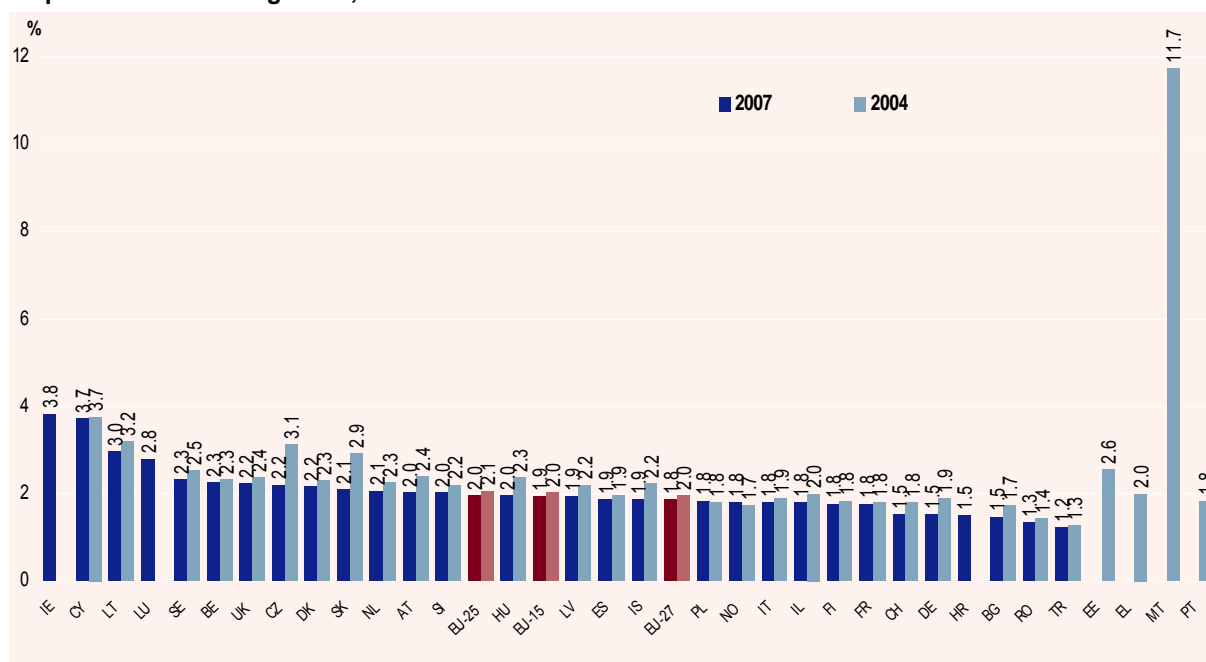
	Grade A	Grade B	Grade C	Grade D	Total
EU27	19	36	44	44	38
EU15	17	35	43	43	38
EL	11	23	32	39	29
ES	18	36	48	52	43
IT	19	34	45		33
CY	10	20	46	30	33
MT	2	32	14	25	27
PT	21	34	43	50	42
TR	28	34	46	47	40
IL	13	22	36	46	26

Source: European Commission, (2009) She Figures 2009

As has already been mentioned, the concept of vertical segregation is linked to that of the Glass Ceiling. Graph 2.3 below shows the Glass Ceiling Index (GEI) for EU and some non-EU countries, comparing the proportion of women in grade A positions to the proportion of women in academia. A higher value of the index points to a greater difficulty for women in moving up the hierarchical ladder in their professions.

Based on 2004 data, for which complete statistical information is available, it should be noted that all the SECs except for Cyprus and Malta, the latter being an outlier, show GEI values below the EU average.

Graph 2.3: Glass Ceiling Index, 2004/2007



Source: European Commission, (2009) She Figures 2009

Going into more detail, and considering the findings of the literature produced in the SECs and collected in the GSD, it should be noted that the relevant research **shows that women are more likely to be found in the less prestigious branches of teaching and more marginal universities** (David, 1994; Tan, 1995). In research institutions women are less likely to be assigned project coordination tasks, to be found in the top managerial positions and their promotion patterns tend to be slower (see for example Palomba, 2000; Mirbach, 2005; or Paiva & Lobo 2007).

It should be added that, as different studies have shown, seniority is an important determinant of career advancement patterns in the public sector e.g. university, research and healthcare and it seems that this determinant acts against gender equality. This is due to the fact that the main fluxes of women entering research institutions have taken place at a relatively later stage than their male counterparts, this explanatory hypothesis being coherent with the growing number of female academicians across most SECs. This, however, has created a bottleneck effect in the hierarchical structures of these institutions which is further worsened by the more or less subconscious 'rent seeking behaviours' adopted by the males in the higher ranks.

Several studies have shown that the greater the proportion of women in a certain field is, the smaller their chances are of achieving the high positions in the field. In academia, for example, a woman is more likely to reach high status in the natural sciences than in humanities. In education, a largely feminised profession in Israel, it has been found that men enjoy higher occupational status. In Turkey, where teaching is the occupation most in demand for women, Tan (1995, 2003) illustrates how educational statistics show that women teachers have neither qualitative nor quantitative superiority in the educational sector as teachers and administrators. The author discusses women teachers' problems under the topics of marginalisation, which refers to the concentration of women in the lower levels and 'less esteemed' branches of a profession, in this case teaching, and the glass ceiling phenomenon in education which refers to the cultural and institutional obstacles confronting women teachers' advancement.

Vertical segregation within the government and higher education sector is often accompanied by '**contractual segregation**', i.e. women's over-representation in temporary or project contracts, suggesting that women are more likely to accept, even for long periods, precarious forms of employment. This issue has come up in several studies, mostly by Italian authors (Palomba, 2001; Mancarella, 2008; Zajczyk, 2005; Donazzan et al., 2008; but also Maratou Alipranti, 2001 and Moya de Guerra, 2002).

Another aspect that is highlighted by research analysed on vertical segregation in the SECs is that in both universities and public research institutions **women's presence is especially limited in the decision making bodies/positions and scientific advisory councils.**

It has been found that women, independent of their better or worse representation among research or academic staff, are virtually absent from such high-level, strategic positions. A study by the Equal Opportunities Committee of the University of Padua in Italy found that women were not represented in the Academic Senate and the Board of Directors (Comitato Pari Opportunità Università di Padova, 2006). Sepou (2001) and shows that, until 2001, no women participated in the Research Committee of the University of Cyprus (but see also Günlük Şenesen, 1994; Adak Çözçelik & Cömertler, 2005).

Maratou Alipranti (2006) finds that within the scientific personnel of the Greek governmental research sector only 22.4% of the women are responsible for research programmes compared to 78.6% of the men. The presence of women as executives is even more disappointing as only 9% of the total number of directors and presidents of the research centres are women. A similar situation holds for the distribution by sex in the scientific advisory boards. A survey by the Periktion Female Researchers Network conducted in 2007 finds, nevertheless, that 69% of the female researchers surveyed, belonging to either the higher education or the government sector, were members of Advisory Boards.

Paciello (2002) highlights the total absence of women holding prominent roles in the directive and consulting bodies of the Italian Nuclear Physics Research Council. A similar situation can be found within the Italian National Institute of Health, where a study dating back to 2002 showed that, in spite of the fact that women comprised 54% of the permanent personnel, they were not represented in the Administrative Council nor on the Scientific or the Audit Committees (Torre, M., Calamandrei, G. & Orlando, M. 2002).

2.2.4 Vertical Segregation – Gaps in research

In introducing vertical segregation, it was mentioned that the first task of research on this topic is to be descriptive: nonetheless, this task is not accurately addressed in most SECs. Standard statistics refer only to cross-sectional data on men/women's presence at each step, without considering the relationship with the actual pool of scientists that might be promoted.

Research on vertical discrimination suffers from the same lack of data as the research on horizontal segregation i.e. **a regular and homogeneous collection of sex disaggregated data; historical series**, and especially of **panel data** to enable the monitoring of the variations of a same cohort through time. The latter are particularly important for a rigorous measurement of vertical segregation. In fact, a possible explanation for women's underrepresentation at the highest hierarchical level could be that a 'generation effect' is at work, meaning that women who are in the highest positions only accounted for a very small proportion of female students at the different study levels when they were young. To test this hypothesis, it is necessary to use data on women cohorts in order to monitor their progression in their academic careers at different points in time. Furthermore, the **research examined largely focuses on the public sector** and there is no exhaustive and homogeneous information available for the private research sector.

The analysis of vertical segregation in the SECs requires **deeper theoretical effort**. Literature published on the measurement and analysis of gender segregation mainly refers to existing theoretical frameworks without proposing truly original innovative methods of analysis. The determinants of vertical segregation are very poorly understood at the theoretical level, and as a consequence, counteracting policies may be adversely affected. The literature indicates supply and demand factors in vertical segregation but these need to be better understood. Whilst horizontal segregation may be partially related to women's specific choices for some sectors and professions, one would think that women would appreciate the chance to climb the hierarchical ladder to the same extent as men.

2.3. Pay and funding

The gender pay gap refers to the unadjusted difference between hourly wages earned by men and by women and is a phenomenon observed across countries, professions and sectors. There is general agreement in literature that pay differentials between men and women refer in the first place to the differences between two separate categories of workers: men and women are not employed in the same sectors, have different career trajectories and personal characteristics such as age, seniority, human capital endowments. Most importantly, women tend to be overrepresented in sectors and professions that are traditionally less remunerated and encounter more obstacles in career progression. A similar discourse applies for women within the scientific professions and as we will see in more detail in the following paragraphs the topic of the gender pay gap in science is, in fact, closely related to the two previous topics of horizontal and vertical segregation.

The issue of differential access to research funding for men and women is related to a certain extent to the gender pay gap in that it has to do with differential access to financial resources and is linked to gender segregation in the scientific professions. It is, however, also closely connected to the national research systems and policies at the national and increasingly so, for European scientists, at the supra-national (EU) level and to the interplay among those involved in the allocation of funds, including the gatekeepers. As such, research funding must also be analysed by studying both the national research policies and their organisational set-up.

2.3.1. Pay and funding – Research questions

When analysing gender-related financial differences in the scientific professions, the topics of pay gaps and unequal access to funding opportunities have many points in common, since they both deal with differential access to the financial resources scientists receive either for their personal income or for funding their research projects. Yet, the research questions underlying these two topics can be quite different, as is the type of literature dealing with them.

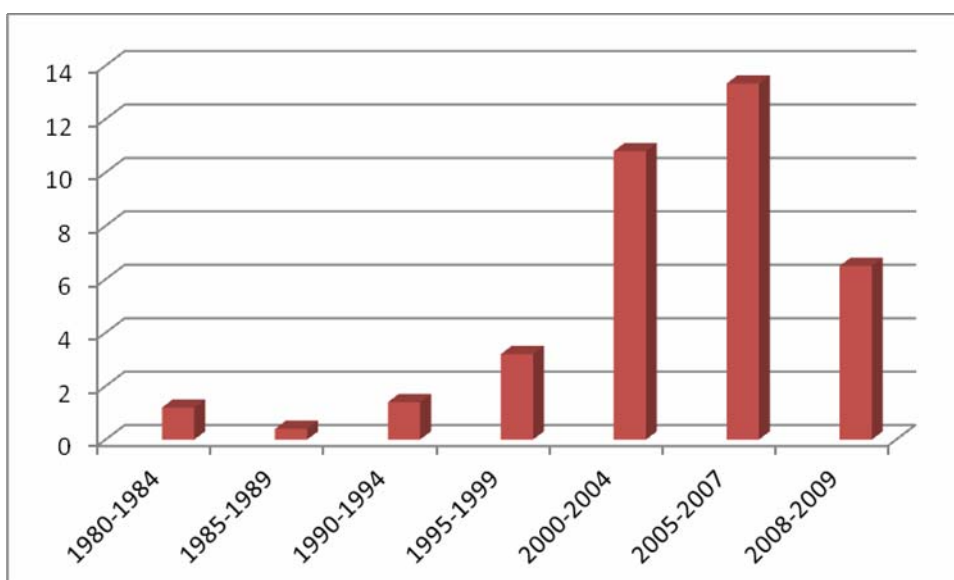
Both recent and earlier changes in employment legislation throughout all the SECs have removed some of the most obvious reasons that could account for the pay gap phenomenon, such as open discrimination in recruitment processes and employment policies. **Literature concerning the pay gap in the scientific professions hence mainly deals with the phenomenon of vertical segregation and bias in recruitment policies** that could be considered one of main reasons explaining the fact that women are overrepresented in lower pay-grade positions. The issue of **access to research funding and grants is more complex**, both in terms of its measurement as well as in terms of identifying possible causes and determining factors. It is more related to the issue of how scientific excellence is measured and defined and at uncovering possible discriminating mechanisms and distortions in the process of research grant allocations.

With regards to quantitative analysis of the GSD database, the topic is broadly speaking under-researched. The Southern European Countries contribute a total of 11% of the entries on pay and funding, while the overall percentage of such studies in the dataset is 12.6%. The number of yearly average publications is relatively limited, and, in line with most other topics, it has shown an increase over time, with a peak in 2005-2007.

Table 2.6 Pay and Funding - Number and percentage of publications in SECs

	n	%
Cyprus	29	13.3
Greece	60	15.1
Israel	5	6.7
Italy	72	16.0
Malta	43	17.3
Portugal	47	13.0
Spain	52	11.2
Turkey	25	11.0
Southern CS	138	12.3
All Cs	571	12.6

Source: GSD statistics

Graph 2.4 – Pay and funding. Average number of publications per year in SECs

Source: GSD statistics

2.3.2 Pay and funding – Research approaches

Across the SECs it would seem that the approach followed in order to analyse the issue of pay and funding disparities is **mainly descriptive and quantitative**. It also seldom focuses on the scientific professions. On the contrary, it is carried out within the scope of cross-sectoral analyses focusing on gender-wage discrimination and most of the efforts address the collection of sex-disaggregated information rather than undertaking a more complex analysis (see for example Ntermanakis, 2003), or is included within broader studies concerning the analysis of economic inequalities between men and women.

Studies focusing on the gender gap in men and women's participation in the labour force have also analysed the scope and the factors of the pay gap. This line of research appears to have used a wide range of methods such as multivariate analysis, determination scales, analyses of a legal framework or national machinery, interviews and organisational approaches. Different calculation methods have been employed in order to examine the possible correlation of the pay gap to various other demographic and occupational factors.

No particularly innovative approaches can be traced, although in the case of Spain growing interest in the issue of research funding is noted that may well lead to the elaboration of more interesting research methods.

Studies that empirically analyse wage discrimination are practically non-existent. A notable exception is a Spanish study using multivariate analysis by Moltò carried out in 1984. In this 'Empirical study of the discrimination of women in the academic labour market Moltò examines the existence of discrimination against women in the academic job market empirically, with reference to a specific academic setting, that of the University of Valencia. He measures wage discrimination indirectly and concludes that approximately 25% of the wage gap in the academic labour market could be due to gender discrimination i.e. it cannot be explained by noticeable differences in individual and personal productivity traits. Unfortunately this line of research, which was quite innovative at the time it was prepared, has not been followed up by other relevant studies.

Analysis of unequal access to research funding at the level of countries is almost completely non-existent. Nevertheless, in Spain it would seem that this topic is gradually attracting interest, although analysis is still at the stage of the collection of sex disaggregated data rather than undertaking more complex analyses.

At the EU level an important recent publication in this respect and one that helps us to better understand this topic and its dimension within the SECs is represented by the European Commission's report *Gender challenge in research funding*, mapping the research funding landscape of the 27 EU Member States and the 6 Associated Countries including Israel and Turkey of the 7th Framework Programme for Research and Technological Development. Mapping is done from a gender perspective and highlights the key issues and needs for future action and research. The report mainly collects and analyses publicly available data and publications and, most importantly, wherever this information was not publicly available an effort has been made to collect more information directly from funding organisations.

The study does not report large and systematic gender imbalances in terms of success rates in research funding. It has found, however, that a clear difference exists in application behaviour: women are less likely to apply for funding than men. As a result of the assessment carried out at national levels, the authors divide countries under consideration into two main groups: proactive countries, actively promoting and monitoring gender equality in research and research funding, and countries relatively inactive in this area. The **SECs mostly fall into the second group, with the exception of Spain**, due to its relatively recently increased commitment in this respect. What is interesting is that most of the countries within the first group with the exception of the gender equality 'champions' of Northern Europe as well as Spain are characterised by women's largest underrepresentation in research.

2.3.3 Pay and funding – Research findings

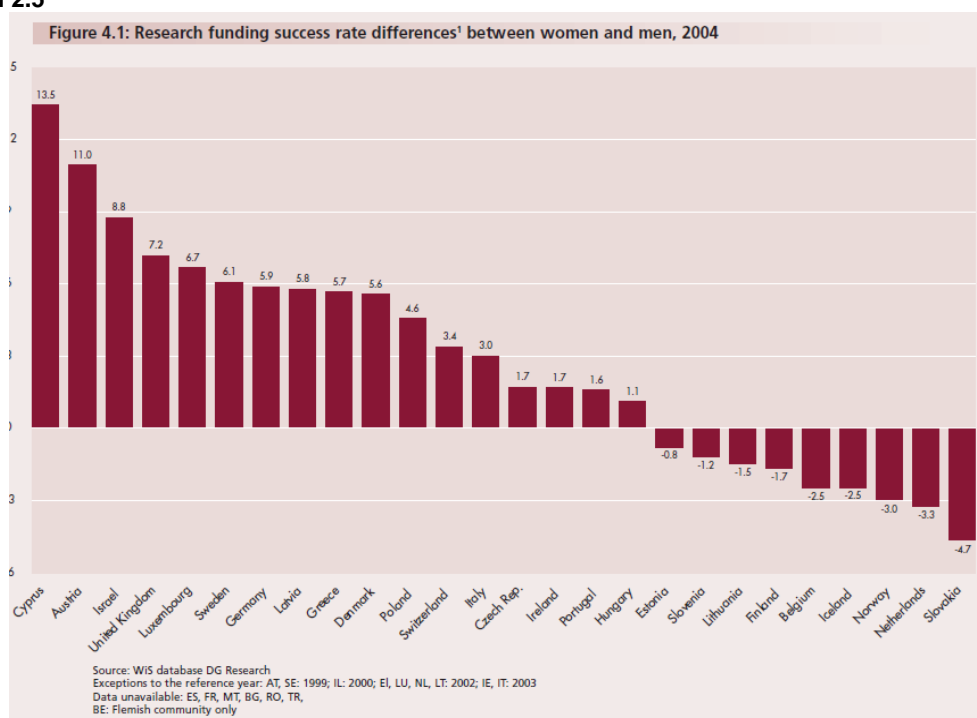
The unadjusted Gender Pay Gap (GPG) represents the difference between average gross hourly earnings of male and female remunerated employees as a percentage of average gross hourly earnings of male paid employees. The table below shows a high differential in pay between men and women in Cyprus, Greece and Spain, and a rather low gender pay gap in Italy, Malta and Portugal. Surprisingly, Turkey is the only country among those considered by the Eurostat research, which shows a negative pay gap, meaning that, apparently, Turkish women earn more than their male counterparts. For Israel, there is no data yet available.

Table 2.7 Gender Pay Gap in unadjusted form (%)

Country	2002	2006	2007
Cyprus	22.5	21.8	23.1
Greece	25.5	20.7	20.7
Israel	-	-	-
Italy	-	4.4	4.4
Malta	-	5.2	5.2
Portugal	-	8.4	8.3
Spain	20.2	17.9	17.6
Turkey	-	-2.2	-
EU-27	-	17.7	17.5

Source: Eurostat, Structure of Earnings Survey source - 2002 and 2006 onwards

The following graph, taken from *She Figures 2006*, shows that some countries are less virtuous than others when it comes to combating discrimination against women who apply for research grants. A positive score indicates higher success rates for men while a negative score shows higher success rates for women. All the Southern European Countries in the table, in which data is unavailable for Greece, Malta and Spain, exhibit a positive difference in the success rate between men and women indicating that in these countries female scientists who apply for research grants, on average, find greater obstacles than men in accessing research funds. Success rate differences are particularly high for Cyprus and Israel (13.5 and 8.8 respectively).

Graph 2.5

Source: European Commission (2006) *She Figures 2006*

Despite the relative lack of articles and books on the two issues examined, all SECs' reports acknowledge the existence of a consistent pay gap between men and women, as well as a differential in access to research and funding.

Findings emerging from the literature produced in the SECs do not allow us to have a comparable picture of the overall situation across the various countries. Most of all, the few studies that address the subject directly do not specifically focus on science, academia and industrial research. In general, findings refer to the overall labour market or highly-skilled population.

Pay differentials

A study by Dayıođlu & Kasnakođlu, (2007) by means of national and regional analyses clearly established the existence of discrimination against women in the labour market and found that depending on the model employed, 64% to 100% of the earnings gap between the genders can be explained by market discrimination i.e. it cannot be explained by measurable differences in skills qualifications, education level, position, sectors, etc.

Other studies instead of measuring the pay gap directly examine the impact of horizontal and vertical segregation across the sectors and professions on the wage differentials. A research on gender segregation in the medical profession in Turkey highlights that women are concentrated in low-paid and less prestigious specialities (Gediz Gelegen, D. 2002). Even if women themselves do not consider family commitments as impediments, employers use them as 'rationalisations' to discriminate against female employees in providing mechanisms, i.e. in-service education, scholarships, grants, etc. for promotion or higher earnings e.g. Turkey's Country Report. Although not specifically focused on scientific professions, Ntermanakis (2003) shows that in the Greek retail trade sector, the higher up in the hierarchy a profession is and the more specialisation required, the wider the gender pay gap is.

Moore (2006) shows that the gender pay gap is related to a mechanism of 'expectation' in women: studying wages among Jewish tradition-oriented women and 'modern' women, she finds that complacency regarding wages is more prevalent among the first group. Tradition-oriented women turn to low status, female-typed occupations, and prefer to work in part-time jobs. Secular women believe they should get equal wages when working in the same occupations as men, and they are less satisfied with their pay than religious women, even though they earn more. An interesting approach adopted by Corominas et al. (2008) focuses on the importance of devising and establishing job evaluation systems as a means to detect, combat and eliminate part of the existing wage discrimination in general but especially against women.

Access to funding

Falcone et al (1999) found out that in Italy the average amount of funding for women's economic research is below that of their male counterparts, with women getting between 9.2% to 28.1% less, according to different years and sources. This effect is partly due to the fact that full professors earn more than associate professors and researchers, and very few women are full professors. Female interviewees of a research project at Istanbul Technical University (Sađlamer et al. 2006) stated that they had no difficulty reaching the necessary resources for their academic activities, even though the need for external research funding is still strong. Limited administrative personnel force academicians to spend more time on official work causing loss of energy. Such problems can also be considered more serious deterrents for women than men in applications for funding.

In Spain, De Pablo (2006) made the first sex-disaggregated analysis of grant awarding of one of the most prestigious Spanish R&D post-doc programmes in the mid 2000s, finding that the female rate of success was notably lower than the male's for most of the scientific specialities. Castaño & González. (2008) arrive at a similar conclusion, analysing the distribution of the overall Spanish R&D resources in the same period: the women's rate of success for public grants was 20% as compared to 23% for men and 11% for R&D contracts with 18% for men's. González (2009) compares pre-doc and post-doc grants, concluding that women are clearly disadvantaged in post-doc grants, although in some traditionally masculine fields, like physics and engineering, it seems that efforts are made to promote women.

2.3.4 Pay and funding – Gaps in research

Among the literature collected in SECs very few specific studies focus mainly or only on gender pay gaps. This may be due to the fact that, in the SECs, most universities are public, and the

process of setting wages is collective, rather than individualised. Therefore, there are commonly agreed parameters of seniority and job description or level of hierarchy e.g. lecturers versus associates, versus full professors that determine the salary. In this setting, wage discrimination must be channelled via 'disqualification' and vertical segregation. Most national reports generally refer to the research on pay gaps in their countries, citing the evidence of unexplained earning differentials also among professionals, and therefore, presumably, also among scientists, as the sole information about pay discrimination. In this respect, it may be interesting to understand and describe the promotion mechanisms in academia and the public research sector to better understand how pay discrimination is channelled by vertical segregation.

The SEC countries are characterised by the strong influence of government funding within the academic system where open or concealed gender discrimination in income levels would be very difficult to implement, and as such, one would expect the gender pay gap among university workers for the same career and seniority level not to be significant. However, this does not hold for differentials in access to funding especially public funding or the distribution of research grants that remain undetected and, this field of study, if researched, would provide an important contribution to the understanding of the level of women's underrepresentation in science.

In all the countries examined, the proportion of researchers employed in the private sector is lower than that of the academic and government sectors. Their pay as private employees may be a matter of a personal bargaining process between the employer and the employees, although in many countries there are national contracts that should be used as guidelines. Therefore, direct discrimination i.e. paying a woman less than a man for the same job may happen. **The private research sector is the least analysed of the three.** Academics often supplement their academic wage with income from their side activities as experts or consultants, sometimes also as professionals e.g. lawyers, physicians, and architects who have a private practice. Research questions about this kind of supplement do not seem to be present.

Funding for research is a more promising field of inquiry. Wenneras and Wold in their seminal work on *Nepotism and sexism in peer review* (2007) were able to show nepotism and discrimination in the allocation of research funds in Sweden. **This line of research has not been followed in the Southern countries.** In most SECs even aggregate data for applicants is not public or easily found even though one would think that it should also be possible to obtain data easily about this kind of funding since the processes of awarding grants are now almost completely electronic and datasets exist in the Ministries of research about the allocation of public funds.

It would seem that a **lack of reliable data** is one of the main obstacles to analysing the issues of income from side activities and funding for research more in depth, and this is particularly regrettable since econometric advances in techniques for measuring discrimination have been quite important in the last decade.

Thus, research on gender differentials in pay and funding is virtually non-existent in any of the SECs, whose national reports lament a lack of comprehensive or even sectoral studies in analysing gender inequality in salaries or in access to funding among scientists, in the public as well as in the private sector. Still, while on the issue of pay gap some non-comprehensive studies do exist, **no comprehensive research has been detected on the issue of the differential access to funding**, thus showing an important gap in the research on women's underrepresentation in science.

A potential research approach that has been suggested in the Maltese report is one that could analyse latent mechanisms that indirectly contribute to inequalities in women's take-home salaries, when compared to their male counterparts. It is generally acknowledged that women find it more difficult to proceed upwards in their career paths when they need to take time off to look after their families, thereby they regress in their attempts to satisfy the requirements of promotion to higher grades and, therefore, of higher salaries.

2.4. Stereotypes and identity

Stereotyping is a mechanism deeply embedded in the human psyche as a device to spare the cost of acquiring information. When a certain experience in given circumstances is repeated a number of times, the human mind expects it to be repeated once more in similar circumstances. The adaptive power of this mechanism is clearly very high: it is the basis of learning itself. It induces the repetition of useful action and the avoidance of repetitive damage. However, unfortunately, it also sometimes prevents the understanding of completely new circumstances, which are mistakenly labelled as similar to former ones when, in fact, they are not, and it therefore prevents new learning and understanding.

In the traditional stereotype the scientist is male, wears a white lab coat, is somewhat unkempt and absent-minded with regard to the practicalities of life. Women are 'female', they may wear a white lab coat, but they are taught from an early age to care for their appearance and often cannot afford to ignore practicalities, because their family life depends on their being able to deal with day to day problems. However, this does not prevent them from having the ability to be excellent scientists.

Scholars who studied the topic of gender and science have correctly perceived the centrality of these issues. Therefore, the topic of stereotypes and on how the use of stereotypes affects the creation of identities, and how in turn the creation of the identities determines the social construction that we call science is one of the topics that has generated the most interest and publications in the majority of the SECs.

A vast body of the literature show that men and women pursue different fields of study and professional trajectories. The tension between gender stereotypes and the building of identity, as regards career choices, lies in the interplay of many individual, institutional, social and cultural mechanisms across different levels. The main issues in the literature are:

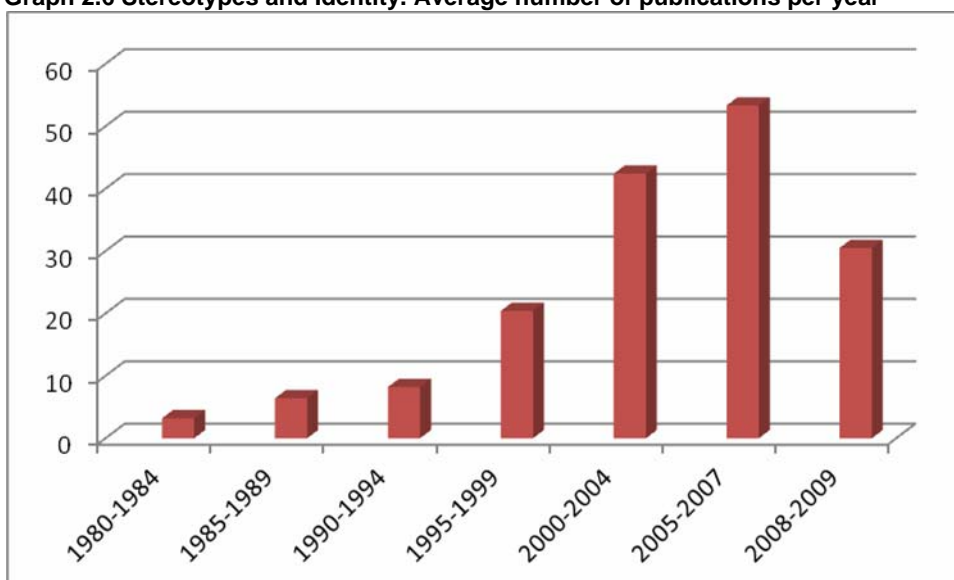
- In-born cognitive abilities and the lack of evidence concerning any differences between the sexes in this respect
- Gender stereotypes and career choices in adolescence/youth and the role of the school in these processes
- Gender stereotypes in science itself, patterns of persistence and change, the link with the masculinisation/feminisation of scientific fields, etc and their impact on men and women's professional choices .

In quantitative terms, entries about stereotypes and identity represent 55.5% of the total in the Southern European countries; the topic is very popular also in the entire dataset, with 54% of the entries dealing with the topic of Stereotypes and Identity. Malta, Turkey and Italy are the three countries where we find the largest percentage of entries on the topic. Malta in particular shows a rate of 87% which is amazingly high.

Table 2.8. Stereotypes and Identity. Number and percentage of publications

	n	%
Cyprus	90	41.3
Greece	199	50.1
Israel	44	58.7
Italy	204	45.4
Malta	120	48.4
Portugal	173	47.9
Spain	191	41.2
Turkey	164	71.9
Southern CS	624	55.5
All Cs	2,458	54.0

Source: GSD Statistics

Graph 2.6 Stereotypes and Identity. Average number of publications per year

Source: GSD Statistics

The issue of stereotypes and identity is transversal through many contributions. Although only a few articles are mainly dedicated to this issue, it occurs in very many articles as an issue of secondary importance.

2.4.1. Stereotypes and identity – Research questions

Questions asked by the literature analysed mainly refer to the understanding and definition of stereotyping: why is there a stereotype? What exactly does the stereotype contain? What are the effects of the existence and perception of the stereotype on men's and women's behaviour? Is there a conflict between a woman's identity as a woman member of her family and her identity as scientist dedicated primarily to science?

The debate also revolves around the issue of whether there are gender differences in science/maths performance at school and the role stereotypes play in the choice of field of study especially at the secondary school and university levels, thus linking the concept of self-

imposed or 'socialised' stereotypes with women's underrepresentation in specific technical fields of study

Authors who have tackled this issue also ask whether there is a problem arising from the fact that scientific debates are perceived as similar to fights and if we should have expectations as to who should be the winner among the scientists who enter the scientific arena with sexed bodies.

2.4.2 Stereotypes and identity – Research approaches

In general, there is an abundance of conceptual contributions about the epistemology of science. There are also more empirical studies that attempt to explain why boys and girls embark on different educational paths, with girls being a minority in technical studies. To a lesser extent, studies dealing with a critical review of teaching practices and teaching materials in school are also present.

Among the studies that deal with stereotypes and Identity we especially find many of the following:

- Conceptual reflections about the **epistemology of science** from a gender perspective, including a reflection on the supposed neutrality of science;
- Research on **the choice of career determinants and study topics** among high school students as well as undergraduates, and the role played by gender stereotypes on the role of men and women in society, the labour market, and knowledge production.
- The so called '**stereotype threat**' effect on performance including pupils' /students' self perception of scholar achievements according to sex
- Studies about the **re-production and transmission of gender roles** and their impact on the attitudes that children and young people have towards science, and how this also affects popular culture.
- Analyses of the **role of the media**, especially television, but also the printed press, advertising and other forms of communication, in building and reproducing the stereotype.

Box 8 - Why do women underperform under stereotype threat?

An international effort by four authors encompassing three different nationalities, Italian and German in an English journal provides us with evidence about the role of negative thinking related to the adequacy of a perceived gender role. This study investigated the role of negative thinking as a potential mediator of performance deficits under stereotype threat. After being assigned to a stereotype-threat or a non-threat condition, 60 female participants were asked to complete a difficult maths problem. Women under stereotype threat underperformed. Using the thought-listing technique, women under stereotype threat reported a higher number of negative thoughts specifically related to the test and to mathematics compared with women in the non-threat condition. Moreover, women under stereotype threat also showed a sharp decrease in performance that (a) was most pronounced in the second half of the test and (b) was mediated by the increase in negative thinking. Above all, the authors argued that the present findings are the first to demonstrate a link between negative thinking and performance deficits and to provide direct evidence that performance deficits under stereotype threat are caused by intrusive thoughts that occur during task performance.

Maas, A. (ed.), Cadinu, M., Rosabianca, A. & Kiesner, J. 2005, 'Why do women underperform under stereotype threat? Evidence for the role of negative thinking', Psychological Science, vol. 16, no. 7, pp. 572-578.

2.4.3 Stereotypes and identity – Research findings

Many studies converge on the idea that epistemological and methodological changes brought about by the critical movements within psychology and sociology, and influenced by the feminist perspectives, played a decisive role in the deconstruction of the dominating paradigm of traditional science. This process allowed scholars to identify the issue of conflict between

traditional and new identities in the making, and the need to overcome old stereotypes as a requisite of social change. This conflict of identities, together with the strong influence of old stereotypes and the lack of role models for women scientists are one of the ingredients of women's underrepresentation in the top echelons of science making.

It is possible to identify three areas of epistemological debate in the SECs: gender representation (a), construction of identity (b) and the social construction of science (c).

- a. **Gender representations** are mostly connected with women's segregation, being embedded in the organisational forms and in the dominant culture of science. Both scientists and scientific institutions have contributed to the perpetuation of stereotyped gender representations, especially concerning women's representation as a sexed category. This can explain the fact that in higher education, metal-mechanics, electricity and electronics, civil engineering and computer science present lower feminisation rates (Ravanis, 1995; Cardana, 2005). As far as education is concerned, many educational resources continue to contribute to the maintenance of stereotypes and to the enhancement of gender patterns of boys' and girls' behaviour. (Coimbra, 2007; Gouthier, Manzoli, & Ramani, 2008; Arias Correa, 1998). Sometimes young girls' and women's' representations in professions and/or activities of minor prestige can be observed, as well as the absence of young girls' and women's representations in the more powerful professions, with more social and economic value. Individuals that surpass traditional gender stereotypes and assume different social, family, and professional positions, construct their gender identity in labour contexts, based not only on their own expectations, but also on their colleagues' expectations. The association of gender stereotypes with typical male and female choices of scientific field of study, the social construction of gender stereotypes and their resistance to change through time, the gender stereotypes and teachers' attitudes and their impact on men and women's educational and professional choices and socialisation processes regarding gender roles, are also analysed (Zajczyk, 2005; Maas, 2005). It was observed in many studies that gender-based occupational segregation is an ideological operation owing to patriarchy. Horizontal segregation resulting in girls' estrangement from technological studies is largely explained by the internalisation of gender expectations starting in the family and continuing in school (Kordaki, M. & Tsagala, E. 2007). Gender based occupational segregation is also attributed to the ideology of family constraints influencing women's full access to advancement and training opportunities. (Kordaki & Tsagala, 2007).
- b. Some findings confirm the existence of stereotyping by both sexes, and stress the problems that the existence of stereotypes entails for the **construction of identity**, especially the identity of women scientists. Of particular interest is the work done to confirm the fact that the stereotype threat generates women's underperformance, by experimentally showing that a reminder of a stereotype reduced women's performance in maths tests. Interesting work was carried out by science teachers with pupils in secondary schools, analysing the best way to teach science so that stereotypes may be overcome and pupils of both sexes may find it appealing. (Muzzatti & Agnoli, 2007). Other studies highlighted the different manifestations of gender ideology in different professional contexts (Gouthier, Manzoli, & Ramani, 2008; Costas, 1994; Bayrakceken Tüzel, 2004). Research on the ways in which roles and relations are constituted, represented, transformed and modified in communications and cyberspace showed that gender is still the primary category of identity.
- c. The area of **the social construction of science** has been given less research attention in the literature analysed in the SECs than the area of the social construction of identity, even though a profound conceptual debate has taken place in the epistemology of science. Conceptual contributions have been made towards the detection of social perceptions which are gradually converted into 'scientific' predispositions (Gagliasso, 2007) The literature found evidence of dominating cultural values around sexuality within traditionally 'male-dominated' fields of science, the gender 'character' of science in the context of education and epistemology, as well as the identification of the promotion of scientists' masculine image through the mass media and textbooks. There

are also references on gender bias in scientific language and stereotypical representations of the scientist (Addis, 2008; Durán Heras, 2000). Critical historiographical reviews of women's contributions to modern science show the relationship between gender, power and scientific knowledge (Gómez, & Perdomo, 2002; Arranz Lozano, 2006; Berkday, 1994). Most women have had epistemological problems with the scientific establishment of their time or have had to practise science marginally under masculine scientific authority, working on issues not directly related to what today is understood as 'hard science' (Solsona Pairò, 2001). The proposal of an alternative approach is still at the centre of the discussion (Queiroz, 1987; Correa López & Ruiz Bejarano, 2004). Nevertheless, there are very diverse views and the theoretical framework is still weak. Some discussions focus around the masculine ethos of science and scientific professions and women's exclusion from these professions as well as power relations in general. Science is a realm of patriarchy in which women are subordinated, and even excluded by sexism from scientific institutions and academies (Ergin, 1997; Tan, 2006; Gabetta, 2003; Maragoudaki, 2009), due to a lack of critical and interpretative reflection on scientific methods and their social organisation with their basic assumptions of objectivity, neutrality and rationality: on the contrary, the sciences are sets of socially constructed knowledge that have meaning in certain cultures (Ortiz Gómez & Becerra Conde, 1996)

Few references have been found with respect to the '**Intersectional approach**', focusing on the entanglement of multiple discriminations such as gender, race/ethnicity, class, religion, disability, milieu, social class, nationality or sexual orientation. The notion of intersectionality assumes that social positions and corresponding social groups are created and delineated by social structures such as norms, laws, institutions and traditions that intersect, bearing in mind the different power relations linked to difference categories that are connected with dimensions of inequality (Saavedra, 2005). However, some references on multiple discriminations can be found in the discussion on the 'power of tradition' in professional choices and in research on gender stereotypes and identity as closely related to research on ethnic and religious stereotypes. The former has been discussed in terms of socio-cultural family backgrounds, influencing the courses that are chosen by young students. Thus, female students and students from less advantaged social milieux tend to choose general courses, while students from higher social classes tend to choose scientific and technological courses, contributing to women's low presence in professions traditionally characterised by a strong masculinisation. In technical and scientific professions, women are, by and large, from higher social classes than men (Vieira da Fonseca, 1987).

Research on gender stereotypes as well as on ethnic and religious identity is particularly abundant in Israel, the Israeli society being a melting pot of immigrants from different periods and parts of the world. In such a cultural climate gender roles become an important pillar of support for the ethnic and religious identities (Addi-Racah, 2001). On the other hand, science, and, if not science, certainly learning, is an activity highly regarded by 'the people of the book', and good-quality higher education has been actively pursued by public policy. Women belonging to the traditional, or religious, societies in Israel, regardless of ethnicity, hold a traditional perception of gender roles, and while they may not condemn the more liberal occupational choices other women might make, they do not aspire to high positions, which require academic education, or pay. Women who showed high abilities in science and technology in high school do not continue in these fields to higher education and many do not aspire or fulfill scientific, medical and technical careers (Ayalon, 2004) They transmit satisfaction with their lower paid and often part-time jobs. In contrast, secular women tend to hold higher and better paid positions, while feeling dissatisfied with their position and income. In addition, female immigrants from the former Soviet Union have suffered from the stereotype of sex-services providers, due to the difference in sex-roles between the former Soviet Union and Israel (Notzer & Brown, 1991; Lemish, 2000). It is as yet unclear which component of gender-roles in the family has a greater influence on women's self perception and career choice. Military service is largely thought to enhance stereotypes and gender-inequality in the Israeli society because of stereotypes related to women's positions in army service, but it was also found to dilute gendered personality dispositions (Golan, 1997; Sasson-Levy, 2003).

Some studies have a **historical approach**, analysing how choices, priorities and experiences as well as the organisation of the daily life of professional women are influenced by specific historical, social, and cultural structures. This is especially true in Turkey, where Kemalism and the reforms of the Kemalist state have created a positive and supportive environment for professional women in Turkey. The historical-biographical studies about women in science in the early Republican or Kemalist era attribute their success in scientific careers mainly to their socialisation in a time of revolutionary spirit. These women have considered themselves very fortunate to have been given the chance to receive the same education as their male counterparts. They were taught to believe that women were not inferior to men and could be successful in any field they chose to study. They were also the members of the generation that was devoted to the Republican ideals and felt the responsibility of building the nation. According to the same generation, science was the guide and motor of the modernisation and advancement of society. (Ural, 2001; Köker, 1998)

Regarding the **topics/scientific fields of analysis**, the most frequent are health sciences, teaching and ICT. Horizontal segregation remains in technological studies and is a result of the transmission of gender roles from an early age, as much in a family setting as in schools.

As regards the **reproduction of stereotypes in primary and secondary school** and the way these reflect on **male and female students' tertiary education and career choices** some findings suggest that achievement is not the determinant for girls to plan for further studies in the field of science, but girls are less eager than boys to pursue further studies in this field (Ravanis, 1995; Ekkekaki, 2004; Barbero García, et al. 2007; Muzzatti, 2005; Altınok, 2004). The analysis of educational practices and teaching highlights the fact that they tend to reproduce an image of science that is connected to stereotypical masculine attributes. This fact, along with the absence of female models in science and technology, has an impact on the attitudes of young boys and girls towards science, discouraging girls from entering scientific careers, especially the field of technology. (Sánchez Bello, 2002; Cussó, 2003).

The literature on ICT also makes great use of the concept of stereotyping, by trying to evaluate the stereotype according to which men have more affinity with computer related tasks than women. Research also suggests that information technologies play a critical role in the reproduction of gender identities and computer usage patterns of male and female workers differed significantly (Foschi, 2004; Erol, 2003). However, a common finding is that differences in the students' attitudes do not appear to be as relevant as initially foreseen: gender differences do not affect the appeal of S&T to boys and girls, when it is measured by a self-expressed attitude to scientific careers (Manassero Mas, & Vázquez Alonso, 1999; Ateş, & Altun, 2008; Guglielmi, 2008). Although pupils, high school students and university students do not demonstrate gender related gaps in achievements, males perceive themselves as more successful and aspire to more technological careers than females (Mangia, 2006; Crosta, 2006; Bocchiaro, & Boca, 2002; Işıkşal & Aşkar, 2003; Fonseca, & Conboy 2006). It has been suggested that this is due to women's self-stereotyping, as well as a different way of prioritising careers versus the family. (García-Molina, Puy Rodríguez & Barrera, 2009; Barreira Lopes, 1987).

The image of science appears to be strongly influenced by the media (Vázquez. & Manassero, 1997); the cinema, especially, spreads the stereotype of a scientist as a solitary, introverted man, which is far from the traditionally female stereotypical attributes (Tota, 2004). A gradual change in this tendency has been detected over decades, and it has been stipulated that the change in the role of the father in the family might be the reason. (Callus, 2005). Teaching practices and textbooks in school were also analysed. (Peleteiro & Gimeno, 2000; Kantartzi, 2001; Severege, 1998; Bandiera, 2006).

The research emphasised the social construction of technology and mutual relationships between technology and the patriarchal system. It was argued that the relationship between masculinity and technology is part of the process which leaves women out of the power realm, by keeping them out of the technology realm (WiTEC 2006). Women's isolation from the design process of technology was found to be related to the gender-segregated labour market and the consumer identity that is determined by gender. (Donini, 1980). Technology, on the other hand strengthened the male dominance in society by increasing the power of a small group of male

workers who had the ability to affect the design process of technology over other groups of labour and, specifically, with respect to women. Research also confirmed that information technologies played a critical role in the reproduction of gender identities and computer usage patterns of male and female workers differed significantly. (Binark, 2001; Alparslan 1997; Erol, 2003).

In health sciences, and more specifically in the fields of medicine and nursing, a large effort has been made to give visibility to the female contributions and highlight how the power relations between men and women can manage to structure the hierarchy of knowledge and professions (Ortiz Gomez et al, 2004; Maragoudaki, 2009). Research about professional women in such areas as health and education pointed out that women's traditional gender role as a mother is still quite strong. Yet, there are differences in the perception of this role among different professions. Although nurses and teachers belong to different sectors, they share similar, strong traditional gender role orientations; whereas women academicians and doctors are less traditional gender-role-oriented. The reason for this can be traced to modern value patterns which originate from the different educational and socio-economic levels. In addition, although nurses and female doctors come from the same sector, nursing is perceived as a continuation of a female gender caring role whereas the profession of medical doctors is seen as a continuation of a male gender role of knowledge and authority (Karakütük, Özdem, Bülbül, & Binali, 1980; Ergin, 1997; Cano-Caballero Gálvez, 2004; Simões, & Amâncio, 2004; Fajardo Trasobares, & Germán Bes, 2004).

As far as **study and career development** is concerned, research shows that career choices are greatly gender stereotyped: remarkable differences of male and female representation in course choices can be observed. It is argued that such differentiation can be explained by contextual variables (Saavedra, 2004; Ortiz Gomez et al. 2004). Given their professional expectations and their attitudes when choosing a career, girls are much less likely to pursue scientific careers such as engineering or physics. It is commonly thought that engineering and IT are predominantly male-oriented activities, due to the hands-on tasks done in these fields. On the other hand, biology is considered a more female-oriented subject, because it is connected with jobs that imply taking care of the health of humans or animals (GAPP Project).

The topic of **cognitive abilities** has received almost no research attention. Some conceptual contributions were identified, examining the scientific ideas and discussions around the cognitive sex differences and the political and social use of these ideas, as well as the efforts to attribute cognitive abilities to biological causes. (Kati, 1990; Grossi, 2008)

Box 9 - A look at gendered career choices

*Classic theories of career choices and development have frequently neglected the specificities of women's issues, as well as the interception of this category with other social categories, although this last question is equally valid for men. In spite of increasing attention, in the last decades, on men and women's different experiences as far as career development is concerned, studies continue to show that career choices are greatly gender-stereotyped. Besides, women still face numerous conflicts to conciliate personal and occupational life. In view of such a panorama, **vocational guidance professionals** have to be particularly careful to try to help adolescent girls make changes in their situation when they attempt to help them define their careers. Attention is called for the need to distinguish the concepts that can be used universally from those that are deeply influenced by the specificities of each cultural group. Drawing on data collected by Portuguese research from first year students at Minho University, in the school year 2002-03, the contribution by Saavedra (2004) concludes that remarkable differences in male and female representation in course choices can be observed. It is argued that such differentiation can be explained by contextual variables, such as sexual discrimination, different perceptions by men and women of their capacities, overlapping roles in women's lives, family socialisation, conceptions of femininity and masculinity associated with certain school subjects like Mathematics, as well as discourses and ideologies which reproduce inequalities in gender relationships, the author especially examines the family-work conflict and the impact of this problem on young adolescents.*

Saavedra, L. 2004, 'Género, diversidade e conflito no desenvolvimento da carreira' in Desenvolvimento vocacional ao longo da vida: fundamentos, princípios e orientações, Almedina, Coimbra, pp. 83-93.

2.4.4 Stereotypes and identity – Gaps in research

Notwithstanding the large amount of entries catalogued as dealing with stereotypes and identity, and the presence of important findings at the supra national level, the rapporteurs at the national level have found with impressive homogeneity that there are wide gaps in the studies dealing with stereotypes and identity at the national level.

Of the three subtopics, along which the broader issue of stereotypes and identity could be analysed, the one that received the most attention from the early stages of the period under analysis was that of the social construction of science, especially when it considers the lengthy epistemological debate on ‘masculinity’ and the false neutrality of modern science. And yet, probably because of their ‘explorative’ and ‘conceptual’ nature, there is an overall impression that **these studies do not follow a uniform or homogeneous method of analysis**. The debate reveals a certain discontinuity and thematic dispersion and lacks overall synthesis and appraisal, such as making the topic a central issue of the debate and making an effort to change the stereotype to allow newer identities to develop. Related to this, the whole debate on whether there exist different ways in which women and men relate to science and scientific professions, although addressed by the literature examined, mostly in the form of case studies on a small sample of subjects, is not adequately well developed and would benefit from closer analysis.

There is a lack of research on the issue of the **reproduction of stereotypes in primary and secondary school** and the way these reflect on **male and female students’ tertiary education and career choices**. Boys/men’s choices, in particular, are hardly ever the object of study and analysis (Tomé, & Rambla, 2001). Qualitative and conceptual studies as to the reasons underlying women’s and girls’ career choices and their occupational self-perception may be useful for the advancement from quantitative research to the drawing of applicable conclusions. Yet, the **proposal of methodologies and alternative tools should be developed further**, as well as innovative methods towards the deconstruction of gender stereotypes and the development of pedagogical approaches and the teaching material. Furthermore, most of the efforts and interventions aim to change girls’ choices and not both boys’ and girls’ choices towards traditionally masculine and feminine educational and professional fields, respectively.

An aspect that has been underresearched is that of the **interplay of gender identities with ethnic** or other types of **identities**. However, the case of Israel, where the issue has attracted a lot of attention, shows that the analysis could produce interesting and fascinating aspects. As most SECs are increasingly facing the challenges of multi-culturalism and multi-ethnicity due to an influx of growing migration, especially in Spain and Italy, this issue could prove to be particularly interesting for further analysis.

Finally, there seems to be insufficient empirical research on several other important issues, such as the dynamics that make some individuals surpass traditional stereotypes and chose professional fields dominated by the ‘other’ gender, including the importance of role models, the analysis of the construction patterns of gender stereotypes and the existence and nature of an empirical correlation between supposedly male/female characteristics and the relevant gender.

In conclusion, the study of stereotypes and identity is a particularly interesting field of analysis. Stereotypes operate in the human psyche, but they also change in content. ‘The stereotype’ is an abstraction and a generalisation of thousands and millions of stereotypical images of the scientists present in the same number of human minds. These stereotypes have common characteristics but they are not the same. It would be particularly interesting to be able to assess the **change in stereotypes and identities by questioning scientists of both sexes** and different ages and/or by following the self perception of scientists about their own identities in a long term study. The study of stereotypes and identities is a popular area for interdisciplinary research involving psychologists and cognitive scientists, sociologists and economists.

2.5. Science as a labour activity

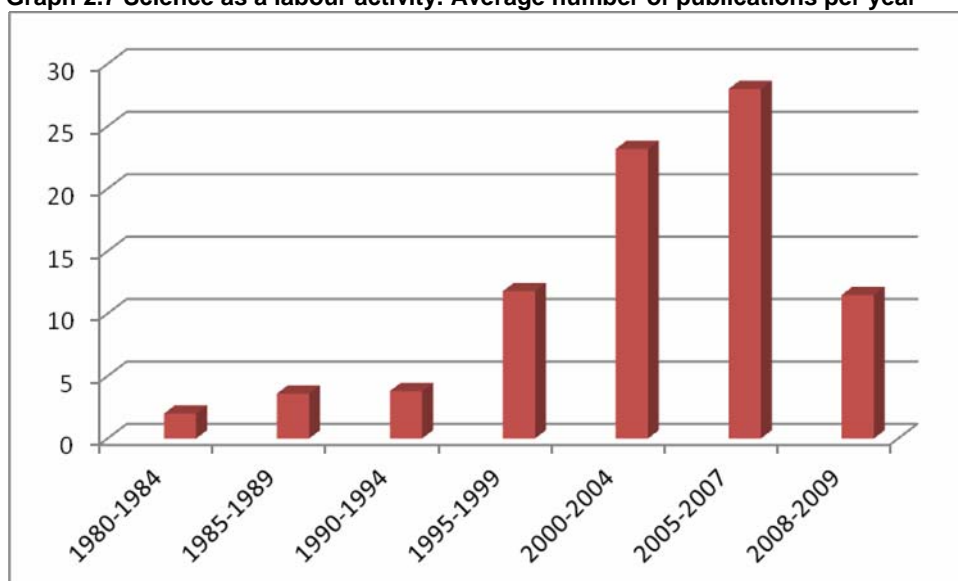
The topic of science as a labour activity is covered by 29.3% of the total SECs literature, a percentage which is below the ACs' average (32.6). The topic is most studied in Israel, Italy and Turkey. In terms of time trends, it should be noted that this strand of analysis developed at a relatively early stage in the SECs, with a relatively significant percentage of contributions in the 80s and 90s.

Table 2.9 Science as a labour activity. Number and percentage of publications

	n	%
Cyprus	42	19,3
Greece	98	24,7
Israel	25	33,3
Italy	122	27,2
Malta	60	24,2
Portugal	90	24,9
Spain	103	22,2
Turkey	62	27,2
Southern CS	329	29,3
All Cs	1.483	32,6

Source: GSD Statistics

Graph 2.7 Science as a labour activity. Average number of publications per year



Source: GSD Statistics

The entries found under this topic, in different ways and by referring to different theoretical frameworks and methodological approaches, attempt to clarify the underlying causes of women's low presence among scientists, related to the organisation of work and the difficulties of managing both a professional and personal life, for men and women in science. In other words they attempt to answer one main question: what are the work-related explanatory variables that might account for horizontal and vertical segregation, and for discrimination especially with regards to senior positions?

In order to answer this question the authors use different methodological approaches. Broadly speaking horizontal and vertical segregation could be explained as the result of:

- i) The unequal treatment men and women receive in their workplace resulting from often covert discrimination in terms of screening mechanisms for assumptions or promotion, the allocation of prestigious and less prestigious jobs among people of the two sexes, etc.

- ii) The different human capital stocks, shown by men and women deriving from gender-specific educational, professional and personal **choices** in the face of such discriminatory behaviour, which make their investment in human capital less productive in the case of women compared to that of men, or for purely private reasons including, educational choices, choices of family status, marriage and/or motherhood, and the choice of remunerated working time versus domestic working time and leisure, the so called 'work/life balance'.
- iii) An important element connected with the two points above and affecting both career outcomes and the choices of women scientists is the societal: the gender division of labour, or 'gender pact'. The concept refers to a set of complex preconceptions, values and norms, which studies the asymmetrical distinction between men and women's presence in the labour market, but, to a greater extent, generally speaking, in the private and the public spheres. It has to do with the distinction between paid and unpaid work, private life and professional life and the identification of male and female professions. The societal arrangement that regulates the gender division of labour, including the existing welfare state provisions and existing cultural norms, has important repercussions on how men and women organise their private lives, obtain a given work/life balance, use their time and manage their professional and career choices.

The twin concepts of 'conciliation' of employment with family life, and of work/life balance are frequently used in analysing the problems produced by women's growing participation rates in the labour force and the increased use of their time in paid employment, of which most authors make a well meaning use. However, these terms should be used only with reasonable caution, since it has been noticed that sometimes 'conciliation' is interpreted as an act and a policy that refers to women only, and that there is no problem of conciliation by men, i.e. no need for men to spend fewer hours in paid employment in order to contribute more fully, not just financially, but also with their time, to family life and parental care. The work/life balance is also an ambiguous term: it appears as if what is unremunerated work is not work, but exclusively leisure, and implies that work is just one's time sold to the best buyer rather than an important component of human life and identity.

Box 10 - Inequalities and academic career

A contribution answering the question : what are the factors responsible for inequalities between men and women in science and academic careers is made by Gaio dos Santos, 2002, O género na ciência – o caso particular da Universidade do Minho, APS. With the aim of ascertaining what discriminatory factors were present in the Portuguese academic context, thirty-two interviews were conducted on teachers of Minho University. Data obtained through the interviews show that women in this sample, experience the work-family conflict more acutely, because they have to divide their time to cover a great diversity of activities, while they are required to comply with a career model that is male and which assumes absolute dedication to a career, which is supposed to be uninterrupted. At the same time, the teaching overload and the absence of team work are pointed out by some of the individuals interviewed as some of the inhibiting factors regarding their scientific productivity; these factors seem to particularly affect women. Besides, 'subtle' messages transmitted by the academy that the maternity option is incompatible with the development of a successful academic career, together with the absence of a real policy of family support continue to penalise women, to a greater extent, than men.

The expectation is that, since the SECs belong to the traditional or 'familistic' welfare regime where the family still plays an important role as the main provider of care services that, cannot, otherwise, be claimed, the so called act of conciliation is harder to achieve in these countries than with respect to the Anglo-saxon or Nordic countries. The so called work/life balance will have to tilt towards 'life' rather than towards 'work'.

2.5.1 Science as a labour activity – Research questions

The main question that the entries analysed attempt to answer is: what are the reasons, related to the organisation of work, for women's segregation in the scientific profession? To what extent are the underlying causes external, or internal to the organisation of science and what is the

interrelation between the two? This main question is dealt with by touching and exploring different issues, such as:

- The analysis of gender specific determinants of segregation including time use and working time distribution between male and female researchers, also bearing in mind family status i.e. family of origin and family of choice;
- The analysis of women's presence/field of specialisation and career paths within traditionally male, scientific professions such as those of doctors, engineers, architects, teachers, ICT...;
- The analysis of discriminatory attitudes in the workplace and involved power strategies and perceptions;
- The analysis of the effects of the practice of mobility, which has always characterised academics through the centuries;
- The analysis of the research career as a 'peculiar' profession, whose monitoring and evaluation criteria are hard to set;
- The organisational arrangements of particular professions that require more time commitments than average, such as medicine, including nursing, personal travelling;
- The organisational arrangements of particular professions that are considered more masculine such as engineering and the ICT;
- The distribution of funds, teaching loads, administrative and organisational tasks;
- Organisational practices which are more or less conducive to the female presence in the workplace.

Parallel to this main question, another strand of analysis can be identified that answers a different question, i.e.: What can we learn from successful women scientists of the past and present? What can we learn from the battles they had to fight and from the coping strategies they established, also in relation to conciliation between the professional and private sphere?

The vast majority of the SECs literature analysed on the topic of science as a labour activity deals, albeit with different degrees of intensity, with the above subtopics.

2.5.2. Science as a labour activity – Research approaches

The historical and biographical analysis focuses on the biographies of well-known women in science, especially in the fields of natural sciences and experimental sciences, but also in the social sciences. This type of biographical analysis is carried out by means of in-depth documental analysis of different kinds of historical texts. They study the professional and personal paths of women with the aim of showing the relationship between the professional and the personal spheres and identify which elements have led to success in the scientific career. Research on women scientists of the past is historical in character, and often requires the reconstruction of the cultural history of a given period. In the case of contemporary women, interviews are also carried out. These studies try to explain the success of some women in scientific professions despite the existing discrimination.

Studies on discrimination at work are mostly of a descriptive nature, although they make reference to the relevant theoretical debate. A few are also of a conceptual nature, i.e. they attempt at building categories of analysis, models and theoretical frameworks. Part of the literature on discrimination also focuses, additionally, on qualitative-quantitative research. The issue of discrimination is dealt with either in general i.e. discrimination in the academic world as well as in specific subjects/professions i.e. doctors, etc. They analyse the scientific activity in the framework of a social patriarchal structure, focusing on issues such as the gender division of labour, the domination of 'masculinity' over 'femininity' or the use of dichotomies such as 'public/private' or 'natural/social'.

Studies on the 'demographic' determinants of career outcomes and scientific productivity, as well as on time allocation and the relationship between personal and professional life are done using different approaches. Either qualitative research, based on narratives and biographical analysis, or qualitative-quantitative studies mainly in the form of statistical techniques from simple tabulations and cross tabulations to OLS regressions. Data is either collected ad-hoc,

but always with reference to specific institutions or professions or from existing national data. An important role is played by women's own perspectives and perceptions.

As regards the main features of the national contexts we highlight the following:

In **Portugal** empirical studies about women's situation in the scientific system are not only scarce but non-systematic. Particularly interesting is the presence of two theoretical contributions linking the level of development of a country which has integrated women. It would appear that countries that have entered the industrialisation phase relatively more recently show an improvement in women's integration into science (Amâncio, 2003; Perista & Silva, 2004)

In **Spain** the historical and biographical analysis of female scientists is a topic which has generated a large number (almost 50%) of the studies. Literature about gender discrimination in the academia is based on theoretical contributions, as well as on empirical research about women's situation in the universities or other public research institutions. Research in this field developed in the 1990s and, especially, in the 2000s, when literature analyses the causes and consequences of discrimination against women in their scientific careers compared to their male colleagues (de Vicente *et al.*, 2004; García de Cortázar *et al.*, 2006).

In **Italy** there has been a wealth of literature since the mid 80s, dealing with women in men's professions, which happens to be the title of a book: doctors, engineers, architects, cardiologists (see David 1994; Modena *et al* 1999; Vicarelli 2003). The interplay of class origins and gender was analysed, with studies looking at how the family of origin affects academic outcomes for people of both sexes. The issue of unpaid domestic work was directly faced, especially in the seminal work by A. Picchio (Picchio, 2003).

Box 11 - Gender relations in the Academic profession

Gender relations in the academic profession in Italy have been investigated by an ample and thorough research project, summarised in a book published under the sponsorship of the Italian Economic Association (Società Italiana degli Economisti). The essays in the book present the results of a research project aimed at identifying factors affecting men and women's careers and position in academic ranking. The first part is dedicated to the description of the career paths of women economists in Italian Academia, with articles by Francesca Bettio, Giuliana Campanelli, Maria Luigia Segnana e Anna Soci, Elisabetta Addis. The second part analyses the publications of women economists compared to those of men, with data from EconLit, from competitions to chairs, from an analysis of the gatekeepers in the Economic Journals. Contributions are by Maria Cristina Marcuzzo, Elisabetta De Antoni, Elisabetta Addis e Paola Villa, Franca Falcone Maria Musumeci e Palma Parisi. The last part is dedicated to the analysis of a questionnaire sent to all members of the Italian Economic Association. The survey collected information on family background, teaching activities, time spent abroad and on publications. The title of the book is a pun exploiting the fact that the English word kind and gender are both translated in Italian as 'genere' One interesting finding was that fertility rates of male professors are the same as in the population at large, while fertility rates of female professors are about half those in the population at large, showing that there is indeed a trade off between reproductive choices and career choices. Research also shows different patterns of interest i.e. that female researchers are more interested in history and labour economics, while males prefer mathematical theories, different patterns of tasks i.e. on average, women have higher teaching loads and different positions in the gatekeeping process e.g. women are absent from the Editorial Committees of the Economic journal in proportions far below their proportion in the discipline and their grade and different perceptions of those involved, with a disproportionate number of male professors saying that there is no discrimination, and the same number of female professors saying that there is gender discrimination in the field of economics.

Carabelli, A., Parisi, D. & Rosselli, A. (eds.) 1999, Che genere di economista? La professione di economista nell'Università italiana, Il Mulino, Bologna.

Box 12 - An overall appraisal of gender in the scientific profession in Italy

A study undertaken within the main Italian public research institution (CNR) deals with two elements that are particularly important for the study of women and science: it draws a quali-quantitative profile of male and female researchers and couples it with an in-depth and innovative reflection on the analysis of research as a profession, from a gender perspective. In fact, given the high skills the scientific profession requires and the difficulties of measuring its achievements, the research profession differs from the more traditional professions. The study is divided into three sections. The first identifies the methodological basis for an analysis of female work in research. In this respect it highlights the importance and implicit difficulty of assessing the quality and excellence of scientific production. The second part presents the results of a research-action in the form of a questionnaire and interview on a sample of CNR researchers, aimed at collecting quali-quantitative information, disaggregated by gender and field of research, i.e. the 'hard' sciences and humanities, on career paths and some of their determinants, self-fulfilment, expectations, role of the family and children, etc. Interestingly, it also builds two indicators to measure productivity on the basis of N. and types of publications as well as a degree of visibility on the basis of assignments and appointments received. In this respect, the findings confirm the existence of gender segregation, since for the same productivity indexes women tend to receive less visibility, and consequently less power in guiding research. The third section reflects on the different meanings of equality in positive actions. It highlights how the adoption of seniority criteria instead of merit or productivity for career advancement tends to favour men, since they were the 'first' to join the organisation, creating a sort of 'bottleneck' mechanism that leaves female researchers, who are, on average, younger out of the highest echelons of the hierarchy.

Benigni, L., Menniti, A. & Palomba, R. (eds.) 1988, 'Pubblici scienziati: la carriera imperfetta', *Sistemaricerca*, vol. Suppl to n.9

In **Greece** there is not extensive empirical research on women's situation in science. Existing research studies largely compile statistics and examine, mainly through qualitative methods, women researchers' attitudes and perceptions about the obstacles and difficulties they faced during their career development (Katsi, 2004; Periktion Female Researchers Network 2007).

Box 13 - Women's Position in the Academic Labour Market: objective difficulties and subjective barriers

A Greek dissertation, written in the context of a postgraduate studies programme, refers to the form of the contemporary labour market, its effects on the labour force and its structural changes in recent years, mainly stressing women's position in academia. Through empirical research on 138 academics, the author attempted to explore the following: a) men and women academics' professional choices, b) the demographic, social and psychological factors, which are associated with their educational and professional choices c) both sexes' views on these factors and the significance they attribute to influences on their career. According to the results, women's position in the Greek academic field is rather similar to that of the rest of Europe. Despite their equal professional qualifications, their participation in the highest echelons of the hierarchy and their development pace is slower in comparison to men. Although they think that they face more difficulties, in most cases, they seem satisfied with their pace of promotion, unlike men. Regarding 'promotion mechanisms', women believe that they did not receive significant help from their supervisors during the compilation period of their dissertation, they did not face any difficulties, however, with the publishers. A critical differentiation between men and women was outlined in relation to the dilemma of the professional career, neglect of the family, which only women have seriously taken into consideration, while men expressed that they had never thought about it. Finally, women presented more limited scientific productivity i.e. articles, etc. compared to men. Despite all the differences, men & women academics state satisfaction in their work, scientific productivity and time management regarding work and family. The thesis underlines the fact that the Greek academic field does not set up barriers against women's professional development, at least at an institutional level, although social patterns & stereotypes continue to influence both sexes' professional behaviours & choices.

Katsi, C. 2004 *I Thessi tis Gynaikas ston Akadimaiko Ergassiako Choro: Antikeimenikes Dyskolies kai Ypokeimenika Embodia*, Athens. [*Η Θέση της Γυναίκας στον Ακαδημαϊκό Εργασιακό Χώρο: Αντικειμενικές δυσκολίες και υποκειμενικά εμπόδια*].

In **Malta** this topic is addressed only in the form of descriptive data with some comments on the findings. There has not been any ad hoc longitudinal study on the topic.

In **Turkey** there has been a compilation of statistics on the rates of gender participation in the labour force in order to examine the extent to which men and women's educational assets are 'rewarded' by employment policies and practices.

In **Israel** a conceptual study has also been carried out in order to establish the emotional mechanisms used by women to face such conflicts or hardships. Quantitative research has been conducted in order to establish a connection between pay levels and the reconciliation of career and family, and to find out the influence that child care has on the number of publications of female scientists. (Etzion, & Bailyn, 2006)

2.5.3 Science as a labour activity – Research findings

First of all, this paragraph highlights the main findings of the literature analysed relevant to the topic of science as a labour activity, and afterwards focuses on some specific sub-issues.

What emerges in most countries analysed is that an important factor affecting gender segregation, at least with respect to the public research field which is mostly academic, is linked to the difficulty of reconciling time dedicated to scientific research with a personal life, including family life and especially parenting. This may lead some women to decide not to have children or to have children and 'disinvest' in their academic career, especially at a critical age for human capital formation i.e. at the early stages of their career. There are very few studies researching the impact of reconciliation issues in women working in the private sector. We would imagine that the situation in the contexts of private research might be even worse as a private employer would tend to accept long maternity leaves or more limited dedication to work in terms of time to an even lesser extent.

In several studies the social status of the women scientist is also taken into account as a facilitating factor in career progression. There seems to be a positive correlation between these factors, even if this correlation has recently weakened.

'Reconciliation' difficulties might have a different impact on women's careers and at different stages of their life course: they affect their educational choices, but, most importantly, their career choices such as whether to seek employment in the research sector or not. They are particularly important in the years between a first university degree and a first tenured position, which are the years in which parenthood and publishing come into conflict most. (Athanasiadou, 2002). This fact has often been cited as one of the reasons for the leaky pipeline phenomenon, the other being adverse discrimination in the cooptation processes. Reconciliation difficulties might also influence productivity variables and the career advancement of women who are already employed in research (Ecevit, Hosgör Gündüz & Tokluoglu, 2002; Vicente Mosquete & Trejo Jiménez, 2007; Workers Participation Development Centre, 2003; Ruiz Valero, 2002). On the basis of the empirical evidence produced across the SECs, however, findings on the impact of this determinant on career paths are not homogeneous: they apply to different sectors, and consider different variables.

Difficulty in harmonising working time and personal life duties, due to a total unbalance in the sexual division of housework, childcare and sometimes care for the elderly, is often pointed out as a barrier to career progression. Difficulty in reconciling personal and professional life courses is particularly difficult when young researchers need to move or relocate abroad in order to complete their PhDs since young women tend to give up this chance when they have children or their partners will not accompany them. (Perista & Silva, 2004 and Cutileiro Indias, 1987). Reconciliation difficulties are an important determinant in explaining the high number of women who do not continue their scientific career after having obtained a degree (Van den Eynde, A. 1994; Camilleri, 2005).

Family commitments seem to constitute barriers to scientific career development (Athanasidou, 2002; David, 1992), even though evidence is not conclusive: what seems to impede women's careers are:

- co-optation and networking mechanisms: even when they are more qualified, women have to wait longer to enter science, present fewer papers in public, are not asked to be referees in journals, have fewer opportunities of promotion to the upper echelons of their career; at the same time the adoption of seniority criteria instead of merit or productivity for career advancement tends to favour men, since they were the first to join the organisation, creating a sort of 'bottleneck' mechanism that leaves female researchers, younger on average, out of the highest echelons of the hierarchy (Giunta & Rosselli, 1999);
- selection processes *and the* power of tradition in professional choices (Cutileiro Índias, 87);
- the existence of gender segregation, since for the same productivity indexes women tend to receive less visibility, and consequently less power in guiding research (Benigni et al, 1988)

Discrimination and unequal treatment are associated with the issue of reconciliation. In Italy, especially, a book collecting different studies on the careers of women economists in Italian universities produced very interesting results (Carabelli et al, 1999). Male scientists had children at the same rate, i.e. over 80%, as the rest of the population, women scientists, instead, showed very low fertility with less than 50% having children. Moreover, the research showed that having a family was not an obstacle to having a career, although this may be due to the fact that for women having a colleague in the same field is advantageous, offsetting the disadvantage created by children. Similarly, Fubini (2007) believes that one of the main obstacles for women in science is their 'anticipated' uncertainty about the result of their investment due to reconciliation obstacles of discriminatory practices, especially in a phase of their life during which they are more likely to take decisions about having children. Women who had children and were not in an endogamous marriage fared the worst. Lack of adequate care services is another hinderance for the career development of female academics (Gaio dos Santos, 2002). When there were not enough public facilities to help the reconciliation of the family with employment, women feel that they faced more difficulties in their career development than their male counterparts due to family commitments (Teperoglou et al 2002; Periktionii Female Researchers Network 2007).

Empirical research on working time and work/life balance also produced data about the different coping strategies of women working in different positions in the same organisation. Women working in low-status jobs still continue to combine work and family commitments by retaining almost sole responsibility for domestic tasks, and thus define themselves primarily as mothers and home workers. In comparison, women working in high-status occupations do not exactly fit into the traditional family patterns in terms of their marital status and roles at home. Some women in this group opt to remain single. Those who are married use various strategies to overcome the role conflict they experience. Hiring paid help is the common strategy. Some choose to work from home. Others seek the benefits of informal support structures consisting of childcare offered by their mothers or mother-in-laws together with the availability of inexpensive domestic labour. For female academics, even when their husbands share all the other responsibilities, childcare is still considered to be a woman's responsibility along with professional or family support (Cutileiro Índias, 1987; Acar, 1991). Thus, models for the reconciliation of career and family success seem to be different for men and women (García-Molina et al 2009).

One factor that must be noticed in connection with the reconciliation problem is that many women although happy about their careers and satisfied with their job have to cope with a sense of frustration and uneasiness due to the difficult choices they have to make in their personal life course: on the one hand, they are happy about their careers, and on the other, they feel guilty because of the limited amount of time they dedicate to their families. This is perhaps the most subtle issue, which is difficult to capture objectively, but it is, nonetheless, particularly important and appears in numerous narratives and qualitative research (Etzion, 1988; Hablemitoğlu, Özmete & Gönen, 2004; Athanasidou, 2002).

Apart from obstacles and difficulties, empirical evidence in the SECs highlights the issues of **success** and **discrimination**.

Some biographical studies about past women in science explain their **success** in scientific careers in terms of social networks, help from the family, and the use of personal resting time in order to work. Family support and living in times of general cultural change seem to be factors conducive to women's greater integration into science. The issue of when women scientists succeed is related to the issue of feminism as a movement that comes in waves. Women's search for furthering their rights advances more quickly in times of social and cultural upheaval: the end of the eighteenth century and enlightenment, for example, saw the presence of women scientists of some reputation (Gibin, 1980) to such an extent that we had to wait till the twentieth century to see women scientists reach the same levels of presence and influence again. Interest in these women appears to be also linked with enhancing their visibility as women in science, providing female role models and avoiding the reproduction of stereotypes (Ortiz Gómez, 2005; Sanchís, 2002; Elena, 1993).

Findings concerning **discrimination** or the unequal treatment of women scientists are mainly based on the analysis of women's histories and own perceptions but sometimes male perceptions are also considered. The majority of studies touching this topic tend to confirm that, generally speaking, women 'in men's professions' experience discrimination with regards to their male colleagues. (López Sáez, Lisbona y Sainz, 2004). However, it is difficult to identify the specific patterns of discrimination, the mechanisms through which it is established and its effects on women's careers (Katsi, 2004; Ural, 2001; Facchini, 1996; Agudo Arroyo, 2006; David, 1994). Goncalves (2006) analysed women scientists' perceptions of their work conditions and career development and showed that a significant percentage of respondents feel discrimination.

A contribution by Menniti and Cappellaro (2000) examines the many possible reasons why women might not be present in the top echelons of the hierarchy in two important Italian research bodies. They show that: a) it is not because they are younger; b) nor is it because they choose to have a family instead, as a much higher percentage of women have no children than men and there are no differences in family status among women who reach the top and women who do not; c) it may not be because they publish less than their male counterparts; d) they may have a less proactive style of working; e) in general, despite the feminisation of the educational, training and employment systems, there is evidence of several different modalities of segregation and discrimination (see also Marcuzzo, 1999 for a discussion on higher standards for women than for men to reach to top).

When women are in traditionally, high profile male occupations, it is possible to identify a number of empirical studies, dealing with the health sector, engineering and forestry among others (López-Sáez, Lisbona, & Sáinz, 2004). As far as medical science is concerned, men outnumber women in pathology and surgery sectors, while women are mostly represented in laboratory and psychiatric sectors, as the last two have lower demands in terms of years of studies, working hours and work intensity. (Bekata Mardin *et. al*, 2000; Genç Kuzuca, 2007, Fakiolas 2000). Research has also indicated the power strategies men employed to keep women colleagues under control during the execution of service such as assignment to 'passive' jobs. The experiences of women who have been working in male dominated fields indicate the relationships between social and economic background and the survival strategies in their career path. Only a few women engineers filled intermediate managerial positions in the defence industry and those women challenged their organisations in various ways to cope with those barriers. (Arslantas, 2006; Maragoudaki, 1997)

2.5.4 Science as a labour activity – Gaps in research

The relationship between demographic variables i.e. the number of children, age at marriage, age of the children, age of spouse for both sexes, scientific productivity i.e. the number and quality of publications, rank achieved. Citations is a very interesting topic that requires the **collection of original data and a more coherent approach of analysis**, for example, an

important indicator of the difficulties of conciliation between personal and professional life is the number of scientists of both sexes who have children. This indicator was developed by one Italian study (Carabelli, Parisi and Rosselli 1999) and provides an interesting approximation of the difficulties encountered, especially by women, in the academia.

It would be extremely interesting to compare the results in different national academic and research systems, as a way of finding what the best organisational practices are to help women succeed in scientific research. The **systematic study of the interplay between the gender regime and the organisation of the research workplace** is one of the main keys to help formulate adequate policies and should be further analysed. Moreover, most countries notice greater attention being paid to analysis than to its effect on policies, especially with respect to 'conciliation' or 'work/life balance'.

There are still too few comparative empirical studies about the organisation of scientific work, the use of time or the work/life balance. The literature of some countries pays more attention to these studies, but they still lack a broader scope and a sound theoretical model that could systematise and explain empirical findings.

Studies dealing with the situation of women researchers in the industrial and private sector are almost non-existent in all the SECs.

2.6. Scientific excellence

2.6.1 Overview

There are a total number of 192 entries dealing with the topic of scientific excellence in the SEC countries. The distribution across the countries is the following:

Table 2.10 Scientific excellence - Number and percentage of publications

	n	%
Cyprus	40	18.3
Greece	62	15.6
Israel	4	5.3
Italy	78	17.4
Malta	60	24.2
Portugal	55	15.2
Spain	86	18.5
Turkey	34	14.9
Southern CS	192	17.1
All Cs	900	19.8

Source: GSD statistics.

The largest number of publications (68%) dealt with scientific productivity, the institutional practices of evaluation, or both issues. As is made evident in the table above, the topic is relatively underresearched both at the ACs level and in the SECs with respect to the ACs. The national reports of Spain, Portugal and Turkey make direct reference to this fact and lament the paucity of entries, especially of those related to the definition of excellence. It should be noted, however, that the topic of scientific excellence has been present in works that have appeared under other headings. Biographical research about the lives of excellent women scientists, aiming to recover from the oblivion of history the life stories of how these truly excellent women achieved prominence and overcame their difficulties, speaks of excellence, even though it does not refer specifically to scientific excellence and as such is not listed under this topic in the GSD. The studies on vertical segregation and of the reasons for women's leaky pipeline are studies dealing negatively with excellence.

Excellence was present for a long time in many different strands of research in gender and science as a concept, if only nominally. It then emerged as a separate issue in the last decade of the twentieth century, when excellence became a fashionable and trendy concept. The search for excellence slowly became an explicit goal first of private actions in managing enterprises, then of public intervention in science policies. Although excellence in management was defined by eight guiding principles discovered in Peters & Waterman's book (1982), excellence in science was not as clearly defined. This lack of clarity about the definition of excellence has been problematic from the gender viewpoint.

Given vertical segregation, i.e. the fact that the top of scientific institutions is occupied mostly by men, it is especially important to be very careful in defining what is meant by excellence when designing a policy. If we identify excellence with the existing top of the hierarchy, then the search for scientific excellence may boomerang into slowing down women's integration into science, and may be used to perpetuate the old mechanisms of cronism, lack of transparency in cooptation mechanisms, and gatekeeping that systematically favours male homosociability.

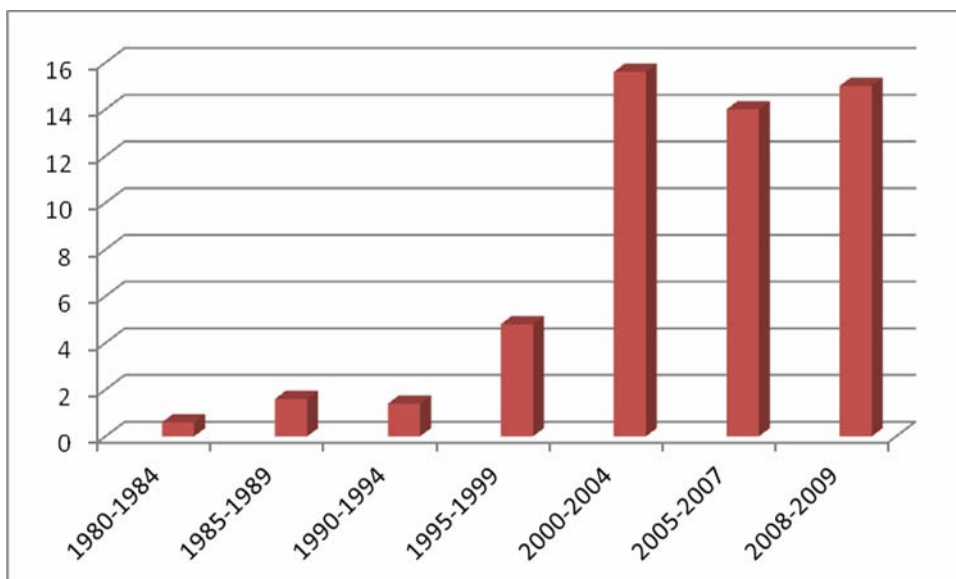
The Directorate General for research in 2004 published a report entitled *Gender and Excellence in the making*. The report contained the results of a workshop held at the European University Institute (EUI) in Florence in October 2003, jointly organised by the Women and Science Unit of the European Commission's Research DG (Nicole Dewandre), the Women and Science Network of the European Commission's Joint Research Centre (Delilah Al-Khudhairi), and the Robert Schuman Centre for Advanced Studies of the European University Institute (Helen Wallace) which, at the time, held an interdisciplinary women's studies weekly seminar, organised by Dawn Lyon.

The rationale for this workshop was developed from two observed trends: first, the increased formalisation of evaluation systems in some, but not all, countries of the European Union as well as in other parts of the world, this itself being part of a broader emphasis on accountability; secondly, direct attention to women's general underrepresentation or underpromotion in science, albeit with variations in the institutional sector, level, and scientific field. The processes which give rise to inequalities in scientific careers across the different social groups are multifaceted. There is evidence to suggest that evaluation systems of scientific work are only one factor and may interact with others of the processes which generate marked segregation between men and women in career trajectories. The aim of the workshop was thus to explore the mechanisms and to present modes for the evaluation of scientific excellence, and how gender operates within them.

Both this workshop and the Congress 'Gender bias and inequalities in the evaluation of academic quality' organised by the Equality Observatory of the UAB (Autonomous University of Barcelona) (Izquierdo Benito et al 2008) present the state of the art in measuring and evaluating scientific excellence, including what conceptualisations support different techniques, and how these techniques may be gendered. The role played by factors affecting evaluation such as role, criteria, and transparency is associated with the definition of excellence in a gender perspective. At the same time, funding distribution models paying special attention to equity group justice and meritocratic mechanisms are discussed, with an overview to the extent that they are applied across the countries, sectors, and fields in Europe and in other parts of the world.

In terms of time trend, it should be noted that the topic is also particularly 'new' in the SECs as it started to gain importance after the year 2000 and since then has been constant.

Graph 2.8 Scientific excellence - Average number of publications per year



Source: GSD statistics.

2.6.2 Scientific excellence – Research questions

The central question asked in the literature is: Why are there so few women among those considered excellent? Several studies try to answer this central question analytically, i.e. by breaking it into smaller pieces, and trying to understand each subsequent step of exclusion. The following list summarises such sub-research questions that appeared in the SEC reports, as well as in the *Gender and Excellence in the Making* report quoted above. The questions are related to:

Definition and measurement of excellence

- What is scientific excellence? Is it defined in a way which reproduces gender bias?
- How is excellence measured? Are indicators' uses unbiased? Is the choice of indicators unbiased?
- What do bibliometric studies say about men and women's scientific productivity?
- Which factors affect bibliometrically measured productivity?
- Does the definition of the boundaries of discipline affect the person who is considered excellent? How are boundaries gerrymandered to affect the person considered excellent?
- How does early recognition of excellence work? Does it affect the distribution of scholarships among the university students and postdoctoral fellowships of both sexes?
- Are there psychological factors involved? Are there factors found in men or women's behaviour, or in both, and what differences are there among the sexes?
- How is the creation of stereotypes connected to the recognition of excellence?
- What is excellence in women's studies?

Screening and selection mechanisms

- Who are the gatekeepers who admit more men than women through the gates of science?
- How do originality and excellence relate?

Excellent women scientists

- What were the achievements and awards /prizes won by exceptional women scientists? If these awards were fewer than those received by men of comparable achievement, why was this so?
- What can the examples of female scientific excellence tell us about feminine excellence in science?

Excellence and employment

- How does participation in the labour force by level of education affect women's participation in science and how does participation in science affect excellence?

2.6.3 Scientific excellence – Research approaches

The difficulties in achieving excellence are general and common to many disciplines, albeit to a different degree. Therefore, methodologies used were partly the methodologies of statistics, sociology and psychology, three disciplines that affect many fields of knowledge.

The Israeli Country report notes that the issue of scientific excellence is approached in national literature mostly from the point of view of measuring scientific productivity and was written by or in association with one single author (Toren, 1988, 1993, 2001).

Among the most interesting approaches that were indicated by the reports of different countries, the following are worth mentioning:

Measuring

- The statistical description of: women's presence in the top echelons of the profession and of men and women's proportion of scientific awards;
- Bibliometric studies of men and women's scientific production.
- Measuring the return of human capital accumulation by sex.
- Content analysis of documents and textual deconstruction of documents.

Box 14 - Studying the gender differentials in scientific production in Italy. Some examples

An article by D'Amico, R. & Di Giovanni, M. (2000) studies sex representation in the writing and editing of Italian psychology journals over the past two decades ('Psychology journals: An analysis of gender differences'). The authors categorised 3,410 articles in 7 Italian psychology journals and 266 articles in 21 international psychology journals published between 1978 and 1997 according to the gender and number of authors, year of publication, and journal name. The chi-square test was performed. The results indicate that women's publications have outnumbered those of men in Italian psychology journals over the last decade but, on the other hand, men's publications outnumber those of women regarding psychology journals published in other countries over the past two decades.

In a contribution by De Antoni (1999) the author analyses the productivity and the visibility of Italian female economists in Italian Journals in order to reconstruct some aspects of their participation in the profession. 48% of the women entered the profession in the 1970s, at a time when, due to the large need for professors, entry was much easier. There is only one woman economist, at the time of her work, under the age of 33, compared to 47 males, and 8 women economists under the age of 40, compared to 197 males. She finds that women's visibility is low but has a growing tendency. The author calculates a useful indicator of relative visibility that takes women's growing presence in the profession into account. This relative visibility indicator starts at 0.3% in 1970 and reaches 4.4%. There is also an increase from 0.6 to 2% in the percentage of articles co-authored by authors of both sexes. However, this improvement may disguise the fact that in the same period a growing tendency was noticed towards publications in English, which was led by male economists, so that women were left to guard an abandoned trench'.

Litido, M., Menniti, A. & Molinari, E. 2000, in their work on gender and publications examine publications produced by men and women working in the two main national research centres (CNR and INFM). There is evidence in studies about other sectors that women tend to publish less, and other evidence that they publish the same amount but different kinds of publications, as well as evidence that they publish less but their work is quoted more frequently. Data, however, is not standardised for the amount of technical help and financial resources that may affect publication rates. In the CNR the publication rate for women is 4.7 publications a year, while for men the average is 6.2. However, the number of publications increases with career level. The average by sector ranges from 6.9% in chemistry to 3.1% in socio-economics. 24% of the articles are published in JCR journals. The publication rates in INFM are also lower for women, however, the impact factor is the same for both sexes. An analysis done by using a 'decision tree' shows that gender is not an important predictive variable of publication rates but other events, which in turn are affected by gender, such as age and being a research coordinator of a project, are, nevertheless, paramount.

Collecting views and opinions

- Subjective views/narratives in the form of Interviews, questionnaires, etc. of the members of national academies or graduates of both sexes with the best records including the life stories of excellent women and collecting information and data about the context situation of women scientists in their families such as number of children they have, if they have their partner's support etc.

Conceptual approaches

- Conceptual studies dealing with conceptions of science linked to male patterns and the construction of role models by gender analysis of biographies.

2.6.5 Scientific excellence – Research findings

Findings about scientific excellence are rather homogeneous. Although not all country reports deal with the same issues and facts, the impression is given that the general mechanism governing the creation of excellence is similar in all countries. In the literature of the SECs, some issues can especially be identified that are associated with others previously found in the report.

- **Stereotypes**

The smaller the number of women among scientists, the easier it is to help create stereotypes. Most stereotypes concern the male assertion of being the only pattern of science and technological activity (Amâncio, 2003; Janeira, A. L. 1987). Evidence of gender biases is particularly evident at the top of scientific careers. Women in Spanish Royal Academies are a minority within a minority, since they are severely underrepresented in comparison with their presence amongst professors. Women's access to this elite is impeded by co-optation procedures that reinforce homosociability practices (Garcia de León 2005). The repeated application of a small biased standard creates a large bias at the end of many cycles.

Excellence is not a naturally inborn variable. It is produced by a social process of screening for specific abilities and using recognised standards to measure these abilities. The definition of excellence and its creation are the results of subjective as well as objective factors, and, therefore, a contested terrain. Who is considered 'excellent?' depends on gender relations in the scientific community and in society at large (Addis, E. 2008a). Once an unfavourable stereotype is established, this is likely to lead to double standards: a person who belongs to the group stereotyped as less competent will have to perform better in order to be recognised as 'excellent' (Addis and Pagnini, 2009).

Some studies highlight the difficulties and barriers women scientists experience in their workplace and the strategies they use in order to overcome these obstacles. Most of these impediments are related to the male-dominated structure and culture of the universities, in which women academics, despite the positive steps they have taken, continue to be 'outsiders' and 'intruders' (Maragoudaki, E. 2009). The world of science is dominated by men and this has its consequences: the scientific community does not value women's scientific work in the same way as men's, and sometimes rejects and penalises it (Poggio, 2003; Benigni, *et al*, 1988). Professional women usually find it harder to prove their occupational competencies to challenge existing prejudices and stereotypes (Tan Göğüş *et al*, 2009; Stratigaki, M. 1996), while stereotypes themselves are self-feeding, causing women's progress to be slower and harder (Rom Rivit and Schkolnik, 2009).

- **Standards and institutional barriers.**

Setting double standards is easier if the standards are unclear. If neither the judges nor those being assessed know exactly what is being measured and how, it is easier to set higher standards for a group such as women. Moreover, if some people are less optimistic, rather than less competent, they may avoid competition believing that standards are too high. According to some insights, women presented more limited scientific productivity e.g. articles etc compared to men, stressing the fact that the academic field does not set up barriers against women's professional development, at least at an institutional level, although social patterns and stereotypes continue to influence both sexes' professional behaviours & choices (Katsi, 2004).

A study analysing the science, engineering and technology disciplines of the Italian academic system, although confirming existing literature on gender research productivity by acknowledging a higher performance for men, brings to light significant differences. Males show a higher average productivity for all performance indicators considered. However, one of the new and interesting facts is that it is, above all, in the quantitative dimension of output where the major gap is recorded. In terms of quality index and contribution intensity, the gap between the sexes, though still present, seems less pronounced (Abramo *et al*, 2009). Other studies show a growing balanced presence of men and women among the authors (Santillán Rivero, & Valles Valenzuela, 2005; De Antoni, 1999; Álvarez-Marrón, & Campabadal, 2004; Menniti, & Cappellaro, 2000; Palomba, 2004), and focus more on symbolic inequalities. (Gimeno Torrent, 2005; Izquierdo Benito, *et al.* 2008). The same definition of excellence and its creation is the

result of subjective as well as objective factors, and, therefore, a contested terrain: Who are the men and women considered excellent?, depends on gender relations in the scientific community and in society at large (Addis, 2008b; González Ramos, 2009).

Hidden processes often inhibit the achievement of equality, despite recognised formal qualifications and adequate financial rewards among the female population. (Camilleri, 2005; Gimeno Torrent, 2005). Women's relatively higher level of participation rates in the academic professions do not necessarily reflect the actual practices and conditions of their participation in the academy. On the contrary, the personal experiences of academic women reflect the gendered characteristics of the academy in particular and the society at large. (Ural, 2001). Gender is a significant factor, as opposed to the publication rate, for example, in the probability of promotion of a faculty member, while female scientists' academic promotion takes longer and is harder (García de León & García de Cortázar, 2001; Rom Rivié & Schkolnik, 2009). The very definition of excellence and its creation are the result of subjective as well as objective factors, and, therefore, a contested terrain: Who are the men and women considered excellent? depends on gender relations in the scientific community and in the society at large (Solsona Pairó et al. 2008; Addis, 2008a,b).

- **Interdisciplinarity as a value**

The boundaries of the discipline are important: borderline, interdisciplinary, and very original work tends to be less visible, because it falls between the boundaries. However, feminism has produced a method of thinking which is fundamental for the reformulation of science, namely, with respect to what concerns the barriers between the disciplines (García de León, *et al.*, 2007; Amâncio, 2003; Ecevit, 1994).

- **Segregation**

Substantial segregation, both horizontal and vertical, is especially analysed in the Academy and in public research institutes (Eliou, 1988; Ruiz Valero, 2002; Palomba, 2000; Sciriha, 1999; Teperoglou, *et al.*, 2002). Women have a greater chance of reaching the higher academic positions in the Natural Sciences than in Humanities and the Social Sciences, although the number of women in the faculties of Humanities and the Social Sciences is greater. The percentage of women with an excellent academic record (60.53%) is higher than that of men (39.47%). However, even the women with the best academic records have more difficulties than their male colleagues in starting a professional career. They take longer to find a job and their employment status is more insecure (de Vicente et al. 2004; Fantone, 2008).

- **Reconciliation**

The relationship between scientific productivity and motherhood or the number of children a woman has is dealt with in several studies, but no single pattern has emerged. According to some studies measuring the number of publications, single women and women with one child publish slightly less than women with more than one child, as opposed to perhaps the common conception that women publish less due to a conflict between family and work. In general, previous research highlights how family commitments i.e. living with a partner and/or having children have a negative influence on research productivity (Alicchio, et al., 1987; Marcuzzo, 1999); while family commitments seem less significant in recent contributions (Sağlam, et al. 2006; Periktion Female Researchers Network 2007). the requirement of young researchers' mobility may act as a constraint for a balanced representation of gender and progression in the levels of scientific careers in the case of women who have young children and do not wish to leave them and their husbands/partners do not wish or are unable to accompany them. (Rodrigues Araújo, E. 2005; Baptista, I. 2000).

2.6.6 Scientific excellence – Gaps in research

Although important efforts have been made, **in general the topic of scientific excellence is largely underresearched in the SECs**, both from a methodological and conceptual point of view as well as from an empirical one. Attention to this topic is very recent, having mainly developed after the turn of the century, and there is, therefore, great scope to develop interesting and original analyses with respect to this issue.

A major gap in the analysis that, if touched on, could greatly help to improve and strengthen the debate on scientific excellence concerns the difficulties in defining the concept of excellence. Vagueness with respect to what excellence is makes it hard to ascertain whether it is defined in such a way as to reproduce gender bias and stereotypes and to identify appropriate and unbiased measurement and evaluation tools.

In general, the literature analysed shows an absence of studies questioning to what extent and by what mechanisms, i.e. male informal networks, homosociability and gatekeeping, gender bias is reproduced in the evaluation of scientific excellence. There are no consistent, systematic studies that analyse the barriers to women's career progression in scientific research. A number of hypotheses are given, but hard and fast findings have not been produced so far and the difficulties regarding progress in scientific careers still need to be studied.

In more detail, the literature assessed on scientific excellence presents a lack of studies that consider more specific aspects such as formal and informal **criteria of evaluation** and the methods for selecting candidates or employing/promoting university teaching staff and research staff, the procedures for establishing **peer evaluation panels** or the methods of selecting candidates at different levels. The policies aimed at evaluating and assessing female excellence require an effort of creativity. Furthermore, a distinct lack of such studies, and of related empirical evidence, makes it difficult to show the existence of gender discrimination in scientific excellence.

As in the case of the other topics, there are almost no studies about scientific excellence in research that takes place in the private sector. Studies on the modalities for the registration of patents, or the number of patents registered by women could give interesting insight into industrial research and this data should not be too difficult to find. Yet, only one study concerning the analysis of patents on the internet has been entered in the SECs G&SD (González-Albo Manglano et al, 2007).

No significant studies have been found on the representation and progression of female scientists in the top scientific academies or upper levels of scientific organisations, with the exception of the Royal Academies of Spain (García de León, 2005).

Attempts at carrying out bibliometric studies have been developed, but they are not spread out equally across the countries and do not necessarily cover all sectors or research institutions.

Since excellence is the outcome of a complex process of the setting of standards and selection mechanisms, **longitudinal studies** are necessary to understand how excellence 'comes about' as well as the determinants of differentials in scientific productivity by field of study. **Unfortunately, these studies have not been carried out.** Comparative longitudinal studies would be particularly relevant so as to understand the factors that lead to: a) the **production** of a greater amount of excellent research; b) a more equal distribution in **opportunities** to reach excellence for both sexes; c) the **recognition** of excellence when reached by both sexes.

The findings presented in SECs reports confirm that women's exclusion from the processes generating excellence can be attributed to a number of reasons, many of which are similar to the causes that also exclude them from leadership positions in other fields and which relate to how gender operates in structuring society. **A full theory of gender is, in that respect, still under construction.**

A point that must be stressed is that excellence in gender studies exists and, it should, therefore, be recognised, but, until the present time, this has never happened due to the fact that **gender studies are still relatively new and unsettled.**

2.7. Gender in research content

2.7.1 Introduction

In contributions that have gender as the content of their research, we classified works which may have one or more of the following characteristics:

1. Studying women with a problematic approach: works which use sex disaggregated data and other variables referring separately to men and women, rather than being gender blind. This way a publication gives recognition to an explicit account of women's presence, which would have been otherwise unseen, describes it and gives women, as well as to their issues and concerns, visibility as an object of enquiry.
2. Studying gender: i.e. studying the reciprocal relationships of the two sexes in society. The gender level assumes the basic level of study as a prerequisite: it is impossible to understand the relative position of men and women in society and in the economy unless variables are first collected by gender. It also requires the acceptance of the concept of 'gender', i.e. of the existence of a social and cultural phenomenon, separate and distinct from biological sex.
3. Feminist studies: a publication is feminist when a scholar uses his/her subjective value judgement, i.e. analyses an issue from the standpoint of wishing to change women's status in society for the better.

This distinction does not entail a classification from a more basic to more advanced form, nor evaluation of the relative merits of each strands of literature, nor a chronology. It is important in our opinion, however, to highlight by making this distinction that we are not talking about the study of gender in a narrow sense, the cultural relationship among people of different biological sex, as described under point 2 above, but in a broader sense to include works under number 3.

Some of the earlier contributions indexed as 'gender in research content' present in the GSD database are openly feminist, and descend from the feminist hypothesis of male dominance and female oppression, and from the need to challenge this status at all levels, including challenging male domination through science. In some countries, e.g. Italy, these earlier contributors to the literature produced a critical analysis of gender bias in the production and usage of scientific knowledge and contributed to the development of new concepts and lines of research, and the birth of a field of study that has been called 'gender studies'.

The concept of 'gender' developed within women's studies at large and also found fertile application to the study of science. 'Gender' is a social construction based on the fact that people are born in two sexes, determining activities people of each sex should do or not, what decisions are characteristic of each sex. This social and cultural construction is built upon sex differences, but, unlike biological differences, changes through time and space, so that being a man or a woman nowadays in Europe is different from what it was one hundred years ago in Europe or today in Japan.

The distinction between these three kinds of work should not be considered either a value judgement or a chronology.

Moreover, there are national peculiarities in the way in which the growth path of 'gender' studies occurred in different countries. For example, the analysis of the Turkish case shows that women's status and problems came into focus first in the village monographies and later in the compilation of data and empirical studies conducted within the context of modernisation studies. Together with the feminist movement and following the introduction of the feminist conceptualisations i.e. gender and patriarchy, feminist academicians began to introduce gender perspectives into the scientific areas in which they worked. They had a two fold purpose of a critical analysis of gender bias and the dissemination of new concepts and methods in their area of science. Therefore, in Turkey the direction of causality seems to be from data collected within modernisation studies of specific interest in gender issues.

It is possible to trace a temporal evolution, with the philosophical, philological and epistemological contributions coming at an earlier stage, and then progressively giving way to

more and more contributions that fit into the mould of standard science, with of course ample temporal overlapping: publications that belong to the first strand have been present until our present time.. The chronological order of these studies, therefore, is not from the simple studies containing data about women, to the concept of gender, to feminist approaches. Instead, the causal arrow, going from feminist activism which on the basis of evidence had not yet been scientifically collected, produced greater interest in looking at data of a basic woman's level and produced theories of how relationships between the sexes really work i.e. gender. This growth has led to an awareness of the importance of at least counting women so, nowadays, even researchers of both sexes who are neither feminists nor particularly interested in gender, produce research in which data is gender disaggregated.

As regards the statistical analysis of GSD entries concerning gender in research content in the SECs, some interesting facts can be observed.

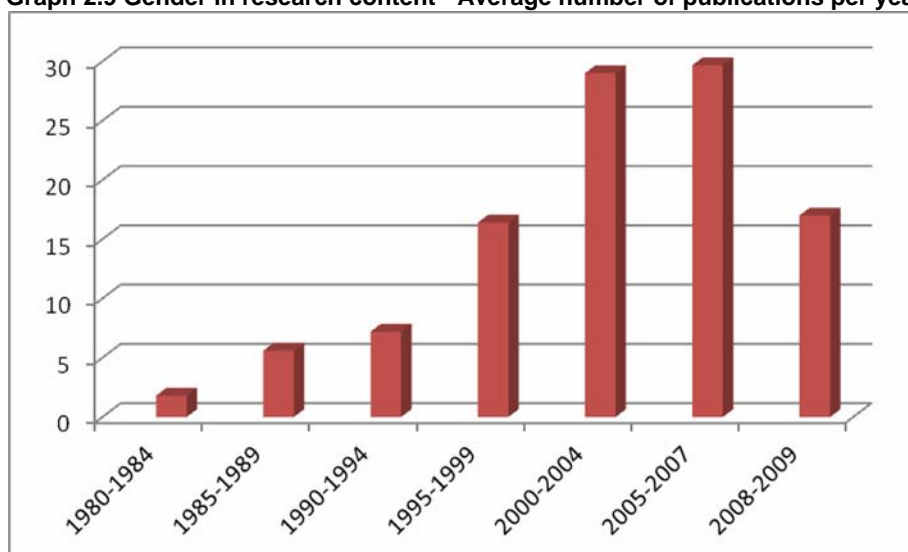
There are a total of 1,434 entries that have gender in the research content in the GSD, 423 of which are in the SECs. In Spain and Italy more than 44% of the total entries have gender in the research content. On closer examination, however, it appears that in Spain there are many contributions concerning medicine and pharmacology, i.e. with gender in research content, while in the Italian bibliography entries tagged as relating to the topic mainly relate to the debate spurred among Italian authors by the publication (and translation) of an American epistemological work. Malta is probably an outlier, with more than 55% of the entries dealing with gender in research content, which probably indicates a very broad interpretation of the concept of gender in research content.

Table 2.11 Gender in research content - Number and percentage of publications

	n	%
Cyprus	105	48.2
Greece	144	36.3
Israel	10	13.3
Italy	201	44.8
Malta	137	55.2
Portugal	159	44.0
Spain	206	44.4
Turkey	65	28.5
Southern CS	423	37.6
All Cs	1,434	31.5

Source: GSD Statistics

Graph 2.9 Gender in research content - Average number of publications per year



Source: GSD Statistics

Important information on the way the topic is dealt with in the literature analysed can also be found by studying the distribution of the topic across the different scientific fields. As we can see from the table below, the field most covered by studies dealing with gender in research contents is social sciences, business and law (63.95% of entries) followed by health and the social services (46.6%). This could be explained by the fact that the methodologies of the social sciences are traditionally more interdisciplinary and 'open' to investigating their own subjects of analysis acknowledging those socio-economic elements that provide key elements for the identification of gender issues relevant for research. Likewise, medicine and health services have been an elective field for the analysis of gender content analysis, as we will see in the following paragraphs.

Table 2.12 Gender in research content. Scientific field vs country of publication

Country	Educational	Hum and arts	Science, mathematics and computing	Agriculture and veterinary	Health and social services	Eng. Manuf. and constSocial	Social Science business and law	Specific scientific field	Services
Cyprus	-	-	-	-	-	-	-	-	-
Greece	4	4	5	3	4	4	5	2	3
Israel	-	-	-	-	-	-	-	-	-
Italy	39	39	55	34	40	40	57	9	31
Malta	16	7	2	1	1	1	30	-	2
Portugal	10	9	5	4	6	4	17	2	4
Spain	41	35	45	34	63	37	47	18	32
Turkey	19	21	21	15	23	18	32	13	14
Total	129	115	133	91	137	104	188	44	86
%	43.88	39.12	45.24	30.95	46.6	35.37	63.95	14.97	29.25

Source: GSD Statistics

2.7.3 Gender in research content – Research questions

The questions asked in the literature can be classified under three headings: i) epistemological questions on science, ii) questions related to the institution of gender studies, and iii) questions related to the study of the physiological, pathological and pharmacological differences between men and women. An example of these three typologies of questions is given as follows:

- Is science neutral or is it masculine? Is there a feminine way of producing knowledge? What are the limitations of a masculinised science? Are these limitations due to the fact that science is a masculine attempt to obtain power over other men, over nature and also over women? In what sense can we say that ICT, with its strict binary logic and its distinction hardware-software, is masculine rather than feminine?
- What determined the growth, or lack thereof, of women's and gender studies? Did the 'gender' culture, which aimed to subvert traditional paradigms of scientific research and claimed to have the potential for the radical transformation of accumulated knowledge affect knowledge transfer to new generations? Did it change research practices?
- How does the male and female physiology differ, other than by the functioning of the sexual organs? How does society's gendered structure affect men and women's health? How is medical practice including research and teaching affected by gender stereotypes?

2.7.4 Gender in research content – Research approaches

The national reports suggest a further distinction in approaches, all dealing with gender in research content.

- An **epistemological approach**, which analyses the orientation of the production of knowledge, the political dimension of knowledge and the contributions that women's studies and the feminist perspective have represented for the creation of a new scientific paradigm (Spain, Italy);
- An **epistemological-analytical approach** in scientific sub-fields such as the social sciences; life sciences; engineering and ICT

Parallel to this main distinction we shall also mention a **historical approach**, aiming to give, in an epistemological perspective, a biographical account of how the presence of past and present women scientists has changed the 'content' of scientific analysis..

Below we have provided a synthesis of the methodologies used in each of these approaches.

- **Epistemological approach**

The contributions following an epistemological approach are of a diverse nature. In some cases, the goal is to disseminate, within the scientific community inside a given nation, the international debate concerning the 'androcentric' character of science and the conceptual breakthroughs that imply the incorporation of the gender perspective. In other cases, the aim is to develop new concepts and lines of research which highlight the relevance of gender in a certain scientific field. In Spain the main contributions deal with the relevance of gender in the social sciences and the health sciences.

- **The epistemological-analytical approach**

1. **Social sciences:** In this field, a large effort has been put into the dissemination of the main conceptual breakthroughs related to the international debate on gender and work. There has been research development related to domestic work and care work, with contributions from both sociology and economics. The issues most developed are: a) the revision of the very concept of work, in order to incorporate not only paid work but also unpaid work; b) the development of studies about work/life balance, understood not as a private problem for women but as a societal issue; c) the analysis of gender bias in social and fiscal policies, related to the predominance of the male-breadwinner model; d) econometric studies to estimate the contribution of unpaid work in the GDP; e) the gender analysis of the welfare state, i.e. of the role that public expenditure has in shaping gender relations and the use of time of the two sexes; f) ad hoc surveys or informed debates about the situation, opinion polls and the expertise of practitioners of gender studies.
2. **Life sciences:** In this approach authors analyse both the state-of-the-art of pharmacological research techniques such as experiments, double blind experiments, and statistical analysis of the results and the intersection between society and human biology. In particular: a) studies on how society's gendered structure affects men and women's health; b) studies on how medical practice, including research and teaching, is affected by gender stereotypes and by women's lower societal value compared to men's; c) studies on how medicine acts as a conveyor of patriarchal ideology, by changing common prejudice and patriarchal ideas in society into pseudobiology, thereby providing pseudoscientific support for men's dominance over women and the restriction of women's power and freedom.
3. **Engineering and ICT:** This field is underrepresented in the SECs. Authors especially highlight the social representation that interconnects gender and technology, stressing the relationship between masculinity and technology as a part

of the process which leaves women out of the realm of power, by keeping them out of the realm of technology.

- **Historical approach**

The historical approach produced abundant literature studying the biographies of women in science and their contributions to different scientific fields. Its goal was to give visibility and recognition to the scientific contributions of women, which are often unrecognised. Nevertheless, they often emphasise that men and women have different priorities in the development of scientific knowledge, due to different socialisation and social position. These studies are most relevant to the topic of gender in research content when they deal with the gender dimension of scientific knowledge from an epistemological point of view. This 'under conceptualisation' of biographical studies may be due to the fact that many of these studies were written in the earlier stages of the existence of the 'gender and science' subfield and, therefore, could not make use of more sophisticated conceptualisation.

There are a number of entries that deal with women's and gender studies and their development over time. Some authors chronologically divide the history of women's studies into three periods: the 1970s, the 1980s and from the 1990s until the present time. Many of these contributions stress the fact that, from a gender perspective, the notion of the absolute objectivity of science cannot be taken for granted. These studies recognise the subjective involvement of the researcher and that this bears implications for his/her research; they assume that the object of analysis is not passive: on the contrary, it is constantly changing according to who the observer is. Thus, they stress the importance of context analysis of the relationships that are established between research agents and the person or groups where attention is focused, in the sense of seeing them in the light of power relationships which permeate the research projects.

2.7.5 Gender in research content – Research findings

- **Epistemological approach**

Relationships between science and gendered social organisation are analysed in several disciplines. Feminist studies have a clear interdisciplinary dimension: their new conceptual tools allow us to approach the whole production of knowledge and destabilise the universalistic pretensions of traditional foundations (Sánchez, 1999; Rothschild, 1986; Pérez Sedeño, 1995; Sanz González, 2005), in order to dispense with the androcentric bias of the different scientific disciplines. (Carrera Suárez, et al., 1999)

Epistemologists studying gender and science reconstruct many places in which science can be shown to be masculine, from the broader stroke of the study of the notion of 'nature' to the reflection on the approach to physics reflected in the Chernobyl disaster. (Arranz Lozano, 2006; Alicchio, & Pezzoli, 1987; Leonardi, 1986). In the field of the sociology of science itself, a line of research has been developed, which questions scientific practices and methods that produce the androcentric discourse of science (González García, 1999; Fonseca et al 2001; Karaduman, 2006; Arranz Lozano, 2006; Magallón Portolés, 1999; Amâncio, 2003; Donini, 1980; Gagliasso, 1987).

Box 15 Epistemology: a feminist and gender approach

In the epistemology of science, a profound conceptual debate has taken place, even though approaches are diverse and the theoretical framework is under discussion. It is possible to track a temporal evolution, with the philosophical, philological and epistemological contributions coming at an earlier stage, and then progressively giving way to increasing contributions that fit into the mould of standard science, with, of course, abundant temporal overlapping.

Two main epistemological approaches can be identified, namely: 1. a gender equality framework and 2 a feminist standpoint. The first approach includes research about the gendering of disciplines and professions, gender bias in the curricula and the gendered construction of identity. This approach aims at giving visibility to the female contributions and highlighting how the power relations between men and women have the ability to structure the hierarchy of knowledge and professions. The processes of socialisation which influence the construction of identity, the mechanisms of reproduction and transmission of gender roles and their impact on the attitudes that children and young people have towards science, are analysed, placing emphasis on the structures and processes which fail to provide both sexes with opportunities for equal participation in the different scientific realms. In addition, such researches analyse, from a critical perspective, specific scientific fields in which the supremacy of 'masculinity' and the subordination of 'femininity' is most evident. These studies stress the need to adapt structures and processes to women's interests or to integrate women's traditional knowledge into the scientific sphere. The notion of difference is often analysed from a theoretical point of view, but it does not necessarily involve any methodological shift; secondly, gender issues are further discussed from an 'equal opportunities' angle, with hardly any theoretical attempt to move beyond the descriptive significance of 'gender.'

However,, according to the feminist standpoint, science is a social and/or ideological construction in terms of power. In this way, the neutrality of science as such is questioned: science itself is a social construction, deeply rooted in power structures. This is a typical multidisciplinary field of research, with contributions from the philosophy of science, the sociology of knowledge and feminist theories, whose theoretical approaches highlight the existence of bias on gender grounds and power relations in the overall scientific methodology and scientific paradigms. The traditional positivist paradigm of science is viewed as biased, as its 'rationality' does not take diversity and reflexivity into consideration. Therefore, the object of research is not gender, but rather science itself: scientific claims to neutrality, the conceptuality and the relativity of science/knowledge are discussed and questioned. From this perspective, the object of analysis is passive; on the contrary, it is constantly changing according to the observer, and the relationships between research agents and targets are discussed in the light of power relationships which pervade the research projects.

- **Epistemological-analytical approach**

1. **Gender dimension in the social sciences**

There are many, important findings of the literature on gender in research content. An early success of this research lay in discrediting the stereotypical perceptions of women (Duarte Silva, 2005; Babini, et al 1986). For example, women were perceived as being more conservative than men, attributing their limited participation in elections to some natural gender differences in political attitudes, which characterised them as 'politically immature'. None of these perceptions are verified by empirical studies; on the contrary, changes are taking place in women's social and economic lives (Camilleri, 2001; Coruzzi, 1990). The sexual division of roles and of work has been given the dignity it deserves as a pervasive social phenomenon, rather than considering it a 'natural' aspect of society that does not require further investigation.

Following the seminal contributions by Diane Elson and Antonella Picchio, scholars first analysed the amount of time spent by women in unremunerated domestic work, then developed econometric techniques to measure its value according to two approaches: the replacement approach and the opportunity-cost approach (Addis, 1997; Addabbo, 2003). In the replacement cost method, evaluation is based on the cost of substituting unpaid domestic work with convenience food and commodities or the market acquisition of services. In the opportunity approach, the value of the time spent in domestic work is measured by the previous salary of the person who does it. With the replacement method, the value of unpaid domestic work by a

clerk or by a physician is the same. With the opportunity method, the value of time spent by the physician is considered higher, since the market value of one hour of a physician's work is higher, with respect to one hour of the clerk's work. The value produced by women's unremunerated work can be counted as from over one third to half of the GNP, according to the methodology adopted.

This evaluation method also leads to the re-evaluation of care work, whether done in the household or in the public sector. Care work, produces positive externalities: a well cared for child or spouse is more useful and productive for the overall society. The process of economic production and of social reproduction, therefore, appears to be based on care work. Some authors auspicate the revision of the very concept of work, in order to incorporate not only paid work but also unpaid work (Picchio, 2003). In general, macroeconomic policies, fiscal policies and social policies have been analysed to look for gender bias related to the predominance of the male-breadwinner model (Bonazzi, et al. 1991; Camilleri, 2005); feminist economists seek to question implicit assumptions about traditional gender roles, thus revealing the biases and distortions in the masculinist view of economics (Serdaroğlu, 2008; Borderías & Carrasco, 1994; Domínguez Martín, 2001). Within this approach, we can also register the development of studies about work/life balance, understood not as a private problem for women but as a societal issue (Moltó, & Uriel Jiménez, 2004).

A feminist critique of law has also been developed. In Italy, for example, starting with the pioneering work of Letizia Gianformaggio (2005), and independently in Turkey along very similar lines, feminist lawyers have questioned the traditional approaches to equality and difference and discussed the critical responses of feminist legal theorists. This line of research has also contributed to the legal debate concerning equal rights and the treatment of women, equal opportunity legislation and legislation dealing with issues related to the female body such as abortion or reproductive therapies (Çaçğlar, 2002; Ocağ, 2008; Martínez Pulido, 2004; Pérez Campos, 2005).

2. Gender dimension in life sciences

The GSD SECs bibliography is rich in entries dealing with the life sciences. Although there are many contributions from different perspectives e.g. neuroscience, bioethics, biology, medical contributions dominate. (Guerra Palmero, 1999; Medina Salem, 2001; Miqueo et al. 2003; Palazzani, 2007). Amongst the most relevant aspects worth emphasising are the following:

- Since the beginning of the 1990s, the need to take the gender variable in all areas of clinical research into consideration, has been established. Until this time, on many occasions, the results obtained from the male population were just extrapolated with respect to the female population without further research (Vijande Martínez, 2004; Ruiz Cantero, & Verdú Delgado, 2004).
- There has been a development of studies on how medical practice is affected by gender stereotypes and by women's lower societal value compared to men's. These studies emphasise the fact that among medical professionals there is deep-rooted prejudice towards women's excessive tendency of going to the doctor's surgery, conceived as a result of biological and psychological characteristics and not from their social situation. (Cascales Pérez, et al. 2003; Markez Alonso et al. 2004; Rosa Giménez, et al. 2005). Studies reveal the gender blindness of the health services and the health system as a whole, neither of which take women's problems and needs (Yazgan, 1985; Pérez, 2003) or the relevance of the gender dimension in men and women's biological, clinical and social specificities properly into account. (Muñoz Santamaría, 2003; Cabré Pairet, & Ortiz Gómez, 2008).

3. The gender dimension of engineering and ICT

According to different authors, the concern for integrating women into the field of science and technology implies both commitment to changes in ICT practice/management (González García, & Pérez Sedeño, 2002; Pérez Sedeño, 1999) and attention to gender interests as an important social factor in determining usage, especially of cyberspace as well as the design and selection of devices. (Binark, 1999; Sanz González, 2006; Uzuner, 2007; Reverter Bañón, S. 2001).

There is a lack of studies in engineering and the technical areas, except for contributions in the fields of urbanism and architecture. Architectural studies have analysed the relationships between gender and creativity, the creative process, design and styles, arguing that the environment, built as a social system, has historically functioned to contain, control, or exclude women (Dostoğlu Türkün, et al. 2001; Akgün, 2002). The gender perspective, however, also implies a new model of urbanism that considers reproductive work and women's double workload, which derives from the combination of productive and reproductive work. Women are the main users of public transport because of their role in social reproduction due to a weaker economic position and greater dependence on the public services, while they also live longer in bad physical conditions. Considering this situation, men and women have different needs as regards specific urban issues such as transport, safety in public spaces, housing, economic activity, shopping and leisure equipment, which have enabled authors to define new concepts, such as 'new everyday life' and 'infrastructures for everyday life' (Sánchez de Madariaga, 2004a; Sánchez de Madariaga, 2004b).

- **The historical approach**

The main findings of gender-oriented historical research has proved that women were, indeed, much more present in the social, economic, political and cultural life of their times than was acknowledged by historiographers (Muñoz Paez, 1996; Totaro, 1999; Durakbaşa, 1995; Elena, 1993; Pérez Sedeño, 2003). On this basis, history has been rewritten to include women, and the barycentre of this discipline, as a whole, has moved away from military and political issues towards social and historical factors. (Tugnoli Pàttaro, 2003). Important changes have taken place in the last 30 years, in particular, that many more women are active in research but the way of doing science is still built on male models (Fubini, 1987). The influence of the literature which has gender as research content is, therefore, greater than the number of entries in the database shows.

2.7.6 Gender in research content – Gaps in research

There are two possible ways to find what the gaps in this topic of research are: one is to compare each SEC country with the others, and see what is missing. The second, is to compare the SEC group with other groups, and check whether there is something missing in the group as a whole. This second technique has not been used yet, due to the stage of the overall research.

Looking at the SECs in order to assess the gaps in research we must first notice the absence of an appraisal of the development of women and gender studies in the Academic Systems of the countries, and of the factors explaining why in some countries e.g. Spain they have developed more than in others e.g. Italy.

While history has been rewritten due the birth of women's history, the history of science does not appear to be under deconstruction because of the epistemological analysis of the consequences of women's exclusion elaborated in the literature on gender and science. Some branches of science appear more permeable than others: some great women scientists who have been 'rediscovered' within this literature have become part of the official history of science. Some others remain within the boundaries of gender studies. It would be important to systematically attempt to 'mainstream' women scientists of the past into the histories of the disciplines as they are being rewritten, and/or to check whether they have been mainstreamed into the histories that are being produced by contemporary scholars.

In general, **many authors discuss epistemology and the relevance of new methodologies, which do not seem to have a great impact on other fields of research, except in the social sciences.** In the field of natural sciences and engineering, the debate on this issue is almost non-existent., with the only relevant exception of urbanism and architecture in Spain. Conceptual contributions are fragmentary, focusing more on the impact of women's exclusion and segregation from science.

PORTUGAL	Gender epistemology and methodology do not seem to have a great impact on other fields of research. Besides, contributions do not 'venture' to go deeply into this issue and are not developed towards approaches like the Complex Systems Approach or even systemic approaches, since the social systems are highly complex and fail to be 'captured' by mere positivist approaches.
SPAIN	<p>The epistemological debate about gender bias in scientific knowledge has little relationship with the development of new ideas, approaches and lines of research, except in some specialties of the social sciences. However, it is necessary to highlight that even relevant contributions in this field have a limited impact beyond the small circle of specialists in 'women's and gender studies'.</p> <p>In the area of health sciences, what it means to introduce the gender dimension into scientific contents has not been clearly outlined. The conceptual contributions are fragmentary and the development of new lines of research and their clinical application is very unequal. Even so, in different branches, from preventative medicine and general practice medicine to bioethics, there seems to be growing interest in the analysis of how gender inequality in society affects men and women's health.</p>
ITALY	The most important gap in the literature is related to the gap in reality. The institutional immobility of the last 15 years in Italy has prevented the development of women and gender studies at levels comparable with other countries. This, in turn, has prevented the transfer of the epistemological critique to the generation of younger scholars.
GREECE	<p>The conceptual contributions are fragmentary and the impact of the exclusion and segregation of women from science is not analysed. No studies were identified about the assessment of the gender impact in the research area in terms of how the gender dimension has been incorporated into the content of national programmes and projects.</p> <p>Most research is limited to a sex-counting approach of gender, which merely addresses issues of male/female equity and equal opportunities. However, a true integration of gender into research would affect the way in which scientific knowledge is defined.</p> <p>No health related research from the gender perspective was identified. The gender dimension in research methods is not clearly constructed, and levels of data analysis are often aggregated resulting in a lack of attention to gender dimension.</p>
MALTA	The main problem in this area is that the studies which have been conducted are micro-studies and no attempt has been made to synthesise the findings and to construct an epistemological framework to holistically understand, the developments in Malta compared to those taking place outside the country.
TURKEY	<p>Although gender is a widely utilised variable in research in many areas, gender bias in science often goes unexplored. Gender mainstreaming in that sense is still far from being achieved.</p> <p>There are no cross sectional or longitudinal studies about the growth of interest as measured by the number of publications on gender. It is, therefore, not possible to discuss for example, if the increasing number of women in a specific area is accompanied by increased interest in gender issues.</p>

2.7.7. Gender in research content – Conclusions and policy recommendations

The analysis of the time trends in the database suggests that the new interdisciplinary field of study, consisting of women, gender, and feminist studies, synthetically denominated gender studies has grown. Gender and science, is by definition, an interdisciplinary and autonomous subject and it should be recognised as such.

Box 16 The institutionalisation of women's studies. Description vs. analysis

University courses, subjects and seminars about gender issues from a multidisciplinary perspective started to grow in the SECs in the 1990s, when women's studies were institutionalised in some universities as a 'specific area' of the academic sector. The process of the institutionalisation of women's studies, both at a governmental, non governmental and academic level takes different forms: carrying out studies about gender issues and equal opportunities; offering graduate/postgraduate courses and seminars from a multidisciplinary perspective; providing a gender sensitive education to professionals; contributing to policy formation and mainstreaming a gender perspective within the academia and state institutions. This growth was more marked in some countries such as Turkey and Spain but much less marked in other countries such as Italy and Malta.

One of the major problems in the SECs seems to be the shortage of expertise on gender issues. Due to this critical shortage, the opportunities offered by programmes, funding and active policies for promoting gender equality are not fully exploited. The social relevance of women's studies research and its epistemological stance had a dynamising effect on the current processes of the redefinition of research on gender and science in the SECs, even though there are no overall evaluations of their implementations and impact. In addition, it is necessary to highlight that even relevant contributions have a limited impact outside the small circle of specialists in this field. At the same time, there is no evaluation or assessment research about the impact of women's commissions which have grown in the public organisations, unions and business sector, etc.

Some general outcomes of assessments in the SECs is that women's studies and gender oriented research still suffers from an unfriendly cultural climate, where old structures and practices prevent a broader knowledge of gender themes, given the persistent asymmetry of relationships between gender, power and scientific knowledge. The institutionalisation of women's studies, in some way, seems to have added significantly to the description of women's situation in science i.e. the state of the art, if not to the analytical explanation of the different factors that influence the scientific realm more decisively from a gender point of view, for example, the gender biased construction of scientific knowledge. In this sense, scientific institutions seem to be the object of study rather than the subject or realm of innovative patterns. Despite the fact that equal opportunities formally exist, latent organisational and symbolic forces result in the existence of inequalities, which have hitherto not been researched.

2.8. Policies towards gender equality in science

2.8.1 Introduction

By policies on gender equality in science we refer to positive measures, aimed at facilitating and directly promoting women's representation in all fields and at all levels of scientific careers, as well as to gender mainstreaming strategies to introduce a transversal gender perspective across the different policy fields and stages, thus being more varied in scope and having an indirect effect on women's presence in the scientific world. In addition, the presence of gender studies in the social sciences is an important indicator of the academic community's wish to acknowledge the problem posed by gender differences.

From the literature classified in the database as related to *excellence* and to *gender as a labour activity* it appears that many of the problems that women scientists encounter are built into the organisational structure of the academia and of other research establishments. Rules for promotion and for funding that are written to distinguish the brilliant male scientist from the one who is not as brilliant finish by selecting brilliant women who do not wish to perform at the same level in the same time, given their commitment to family duties; alternatively, the competitive climate in the scientific community discourages scholars who do not enjoy confrontation, even if they are good scientists, and they may be more likely to be women. Notwithstanding the fact that it is an official European policy to introduce 'gender mainstreaming' into all policies, including those related to science, there is no evidence of this having happened in most of the SECs. Turkey appears to be the leader in this field, as the only SEC to entertain a systematic gender mainstreaming of educational policies (Tan, 2007). Spain and Greece also have distinguished positions, as described in Box 18.

Overall in the Secs, the literature dealing with policies towards gender equality in science is relatively scarce, in comparison with the amount of research on other topics and in comparison with other GSD countries. The main reason for this is that, with a few exceptions, these policies have not yet been fully developed since they were introduced relatively recently. Of all the countries inspected it seems that only Spain, Greece and Israel have set specific targets for improving women's presence in the world of scientific research. This also explains the little evidence available about the impact of these policies.

Therefore, it is also the case that out of all the entries that were classified as dealing with the topic of policies on gender and science, only a small proportion dealt with specific policies that had already been implemented. In Greece for example, many of the documents classified in the database as dealing with the issue of Policies are documents containing proposals and participating in a debate about what will then become law (Maratou Alipranti, 2008, Vaiou & Vosniadou, 2005). Moreover, in all countries many entries deal with the issue of policies only marginally, as part of another main issue, rather than as a central concern (e.g. Bustelo García del Real, 1988).

Box 17- Gender analysis of policies towards mobility

In Portugal the only study that has been identified as related to policies is an analysis of the mobility of Ph.D. students, their motivation and interests (Rodriguez Araujo, 2005). By policies towards mobility we mean: a) provisions made to allow transfer from one university to another for a male or female professor. b) provisions made to allow family members to follow a scholar of either sex if and when he/she moves or goes abroad. Policies about mobility are not directly aimed either for or against gender equality, yet if they are analysed from a gender viewpoint, we find that mobility has strong gender implications.

a) Mobility is a requirement for scientific advancement. The need for movement may create cost asymmetries between scientists of different sexes and scientists with or without children. The unattached scientist moves with the least cost; on average, the married scientist moves at a higher cost for the family if she is a female, because males on average earn more, while for male scientists with a higher probability of having a low-earning or non-earning partner, the cost of moving for their families is relatively lower. Parents have higher costs than non-parents, since they have to move their children, and the cost is supported especially by the parent who dedicates more time to bringing up the children. Data show that this parent is still, to a much greater extent, the mother. Therefore, the cost of mobility is highest, on average, for scientists who are also mothers.

Because of this asymmetry in mobility costs, proposals to enhance competitiveness in the academic labour market by introducing short term contracts may be particularly costly for women scientists. The underlying idea of those who are in favour of such proposals is that the non-performing academic, at the end of the contract will have to move to another, lower level institution. This threat should enhance the performance of the system.

It is supposed that the probability of being a non-performer is the same for all scientists, whether male and female, parents or non-parents. Scientists who are mothers pay a higher cost for the resulting mobility. Therefore, scientists who are mothers will pay disproportionately more for this systemic enhancement of the performance. The result is even truer if female and parents perform relatively less. The cost of enhancing the productivity of the academic system will be supported less by the unattached scientist, of either sex, at one end of the spectrum, and more by the scientist who is a mother, at the other end of the spectrum. This is coherent with the findings of an Italian research (Carabelli et al, 1994) who found that male full professors are parents at the same rate as the rest of the population, while female full professor are parents at a rate of 45%, which is approximately half that of the general population.

b) in a) we analysed the cost of movement as a positive cost for movement; there is, however, also a cost due to 'severing' ties. There are ties between spouses and ties between scientists and their original families, and scientists and their young children. The cost of severing ties may create more asymmetries, of the same sign of those in a)

c) scientists are homogamous, like many other professions. When is employing a husband and wife in the same academic institution an act of nepotism, and when is it a legitimate recognition of a socially significant bond? Clearer guidelines are needed to avoid the first, and at the same time, recognise that scientists also have emotions.

2.8.2 Statistical analysis of the entries in the database

In this section we proceed to the statistical analysis of the entries in the database. Table 2.13 below, listing the number of entries for each of the southern countries in absolute and percentage values, shows how on average the number of entries relating to policies are 28.5% for all GSD countries, while the average for southern countries is 24.2%. If we look at country level differences we note that besides Malta, where all of the small number of entries are very general and multitopical, the countries for which we have the higher number of policy entries are Cyprus with 38.5% of the total country entries, followed by Greece with 34.8% and Spain

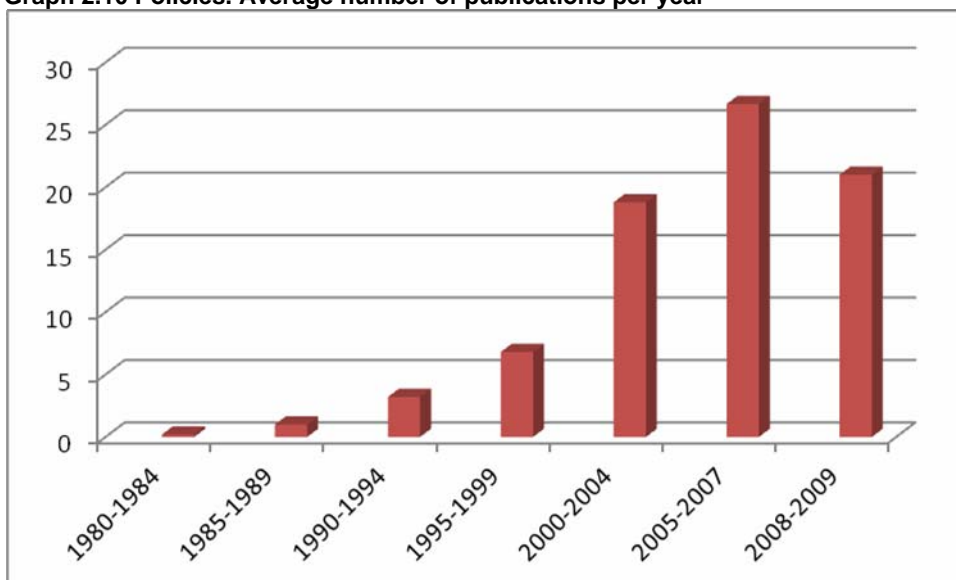
with 33.6%. The percentage decreases to approximately to 13% for Turkey and is almost negligible for Israel with 9.3%.

Table 2.13 Policies. Number and percentage of publications

	N	%
Cyprus	84	38,5
Greece	138	34,8
Israel	7	9,3
Italy	142	31,6
Malta	117	47,2
Portugal	117	32,4
Spain	156	33,6
Turkey	31	13,6
Southern CS	272	24,2
All Cs	1.296	28,5

Source: GSD Statistics

Graph 2.10 Policies. Average number of publications per year



Source: GSD Statistics

As regards the main similarities and differences across the southern countries, the following points can be highlighted:

Spain and Greece are the countries which seem to have relatively richer and more comprehensive literature relating to the issue of gender policies.

Spain especially covers different aspects of this issue, dealing with policies aimed both at increasing women's presence at all scientific levels, and taking the gender dimension into account in scientific knowledge. Several entries covering Spain also deal with equality plans in universities, including an elaboration of gender equality indicators that could serve as reward mechanisms and policies' evaluation (Martínez Costa, et al. 2005; Izquierdo Benito et al. 2004; Silvestre et al 2008; Alcalá Cortijo, et al. 2005) and medicine and healthcare (Castaño López, Plazaola Castaño, Bolívar Muñoz, & Ruiz Pérez, 2006). These entries, in particular, have not been found in the other countries.

In **Greece**, in spite of the fact that attention towards gender and science is a rather recent issue, several entries have been found, relevant to the topic of gender policies. (e.g. Pantouli & Fotakopoulou 2008). This is also due to the involvement of several universities and research bodies which are active in the field and produce relevant research.

In **Italy** the number of entries is relatively small and most of the relevant entries have been elaborated outside the country in the framework of international studies. The question that is still open is therefore: what policies might help women to gain ground in science and in the academic system? (Palomba, 2004 Saraceno, 2004) A similar situation can be found in Portugal. Italian and Portuguese authors who considered the subject are generally favourable to active policies, and refer to other European experiences as a model.

In **Malta**, even if the number of entries that selected the topic of gender policies is relatively high, the relevant entries are rather small in number.

In **Turkey** we find that the focus of gender policies in research is directed towards the issue of equal access to education for boys and girls. There is, however, also an effort to introduce mainstreaming measures to ensure that a gender perspective is adopted in school curricula and textbooks.

In **Israel** the number of policies entries is marginal. Nonetheless, it would seem that the policy issue is high on the agenda (Eden, 2000) as several initiatives for the advancement of women in academia have been undertaken, including the establishment of departments for women's studies in Israel's top universities.

Box 18- Gender equality in science legislation and infrastructure in Southern Countries

*Gender equality policies have been significantly reinforced in recent years in **Spain**. The first General Secretary for Gender of the Ministry of Labour and Social Affairs was appointed in 2004. In 2005 and 2008, respectively, the Unit of Women in Science of the Ministry of Education and the Ministry of Equality were created. Furthermore, the Spanish government passed a law on Equal Rights in March 2007, setting the goal of gender equality in all social domains, with specific objectives and measures. Special attention is being paid to the equal presence of men and women in science and in the economy. The Law on Equal Rights states that companies have eight years as from 2007 to obtain equal proportions i.e.40% at least of each sex, of men and women on boards of directors and selection committees, while the Reformed University Law (2007) states that all university and scientific committees must be gender-balanced.*

Over the past years several observatories on Equal Opportunities were set up in different universities. Furthermore, the 'Women in Science and Technology' association (AMIT) plays a relevant role in the promotion of the inclusion of gender in scientific political agenda.

*In **Portugal** the creation of the Ministry of Science and Technology (1995) offered the possibility of updating the institutional framework of the Portuguese scientific and technological policy. Accordingly, the responsibilities of funding and assessment of international scientific and technological co-operation, information collection and dissemination have all been allocated to three new institutions: the Fundação para a Ciência e a Tecnologia (FCT), Instituto de Cooperação Científica e Tecnológica Internacional (ICCTI) and Observatório das Ciências e das Tecnologias (OCT). Furthermore, under the auspices of the Presidency -Ministry, a Commission for the Equality of Women's Rights (CIDM) and a Commission for Equality in Work and Employment, which has a more specific role but is, nevertheless, important on this area, have been created.*

*In the **Italian** juridical system, positive actions were introduced in 1991 with the purpose of giving substantial equality between men and women in the labour market, by creating the National Committee on Equality and the Equality Counsellors as bodies with surveillance and control tasks. Nonetheless, in the field of scientific research, the interest and the attention paid to gender issues and to the equal opportunities issues lack an organic and political reference and intervention framework. Most universities and public research institutions have set up equal opportunities committees with the aim of monitoring the situation, promoting studies, publications and reports. Some of these committees are particularly active and have produced interesting initiatives and relevant interventions.*

Even if **Greece** does not have a strong tradition in establishing gender equality policies, over the past few years on the impetus of the European Union it has made relevant advances, even though the impact of such progress cannot yet be assessed. A law was passed in 2006 on equal treatment of men and women in the access fields to employment, vocational training and conditions of work which fills a significant gap in the Greek legal order. The Law requires a minimum of 1/3 of each sex to be represented in all the decision-making bodies such as boards of government at national and local levels.

As regards university institutions, a law passed in 2007 on the reform of Higher Education Institutions foresees the promotion of equality between men and women even if the enforcement of this regulation is questionable. The most important legislative initiative was undertaken very recently in 2008 by the Perikitioni Network with the collaboration of the Research & Technology Committee, proposing suggestions for the improvement of the draft law on the 'Legal framework for research and technology.' The law specifically foresees the implementation of a quota of at least 1/3 participation of each sex in all National Scientific Committees, on the preconditions that candidates have the necessary qualifications in order to obtain the post. This provision is supposed to enhance women researchers' representation and their equal participation on scientific boards and committees. The law entered into force on 1/1/2009.

In 2008 the 'Observatory for the Monitoring of Gender Equality in Education' PIE was established by the Research Centre for Gender Equality, KETHI and the General Secretariat for Equality.

In 1999 **Israel** joined the EU cause of working towards the advancement of women's participation in science by setting the goal of a 40 % female participation in the European Research and Development project and since 2000 the advancement of women in science and technology has been part of official government policy, with a specific council established for this purpose. This council serves as an official basis for organisations active in these fields. The Israeli Defence Force (IDF), a body often blamed for the Israeli society's male chauvinism, has been making an effort, since the beginning of the millennium, to encourage female enlistees to choose technological professions, obtain science education and pursue the positions of high army rank.

Turkey does not report legislation and official policies dedicated towards gender equality specific to science in science, although it reports gender studies courses and university-level interventions

2.8.3 Policies – Research questions

The main issues addressed by research on the topic of policies on gender equality relate to the following points:

- **An overview of the existing country-specific equality policies** often in comparison with those of other countries either at the country or institution level, such as the university. In this subtopic particularly relevant is the issue of the analysis of **specific programmes/actions** on equality which aim to promote women's participation in science mostly in Spain, Greece and Portugal;
- Evaluation /discussion of the introduction of a **gender perspective into the education system**, especially relevant for Spain, Malta and Turkey: either through the set up of gender studies courses at the university level or through awareness raising initiatives for teachers, and also the establishment of gender-sensitive curricula/approaches/textbooks in basic and higher education. Gender studies are seen as a way of bringing the issue of gender and science into the world of academia. Even if they do not deal with the issue of women's segregation in research as a subject per se, they, nonetheless, provide a theoretical background for analysis and are thus a powerful instrument for mainstreaming. They give academic 'status' to the gender issue. As such the introduction of specific gender studies programmes at the university level is seen as a policy for promoting the issue of gender equality. This issue also touches on the question

of whether a gender perspective is adopted in the evaluation of research excellence (Palasik & Papp (eds) 2008).

- An overview and analysis of **equality policies/plans in universities and public research institutes**, most relevant for Spain and Greece, but also considered in Italy and Portugal. In the southern countries, academic institutions are the main centres of research production. As such, ensuring equality policies in staff recruitment or membership of managerial boards is seen as a valid instrument for promoting equality in the science careers.

Box 19 - Gender aspects of policies to reward merit

Is the exclusion of women from the top levels of the academia, even if they have merit, the result of the fact that the promotion system is riddled with bias and nepotism or, are the criteria chosen to define merits based on the lifestyles and attitudes of males? The policy implication of the first hypothesis is that we need to ask for strictly merit-based policies to improve women's status in the sciences; while the policy implication of the second hypothesis is that being strictly merit-based, it may have the result of increasing vertical segregation rather than decreasing it.

This is a false dilemma. Science can only progress by rewarding creative and productive people. It is also true that scientific production is a function of many characteristics e.g. the availability of funding, acceptance into networks, willingness to accept challenges and confrontations, fairness of judgement proceedings. Therefore, judgement of merit, the gatekeeping process, can be streamlined so as to become gender symmetric, i.e. to give the same chances and opportunities to people of both sexes and respect all life choices.

2.8.4 Policies – Research approaches

As we have already mentioned, only a fraction of the entries marked as dealing with the topic of 'policies' truly focus on this subject: in the majority of cases the policy issue is an addendum to a quali-quantitative study on women's situation in science in a particular country or institution. This means that only seldom is the policy issue analysed in depth.

For this reason, the selected literature is also mostly of a descriptive or comparative nature, in several cases presented within the framework of multi-country studies collecting information on existing policies and identifying best practices in different European countries. This is particularly the case of Portugal, Italy and Greece. See for example Silius (2002) and (2004); Mischau (2001).

Very few entries attempt an evaluation of the positive actions or mainstreaming measures. In Turkey Pusch, (2003) and Tan, (2005 respectively, evaluated the primary education curriculum and the experiences of the course entitled 'Sociology of gender'. Otherwise, no rigorous evaluation was carried out, except for a few qualitative assessment exercises.

Over the past few years, the creation of equality observatories at the university level has brought about the promotion of studies about women's situation within the universities or research institutions, which have led, in some cases, to the setting up of equality plans and periodic monitoring reports. This is particularly the case of Spain and Greece. In Italy equality observatories within the university and public research bodies publish data on the gender equality situation, but this data is not part of a periodic attempt to monitor the situation and does not have a relevant policy component.

As concerns policy proposals for improving gender equality within the research institutions, we find an interesting entry in Spain by Silvestre et al (2008) building gender equality indicators for universities, proposing the ranking of the institutions according to this parameter. Also in Spain, a publication by IFAPA 2007 studies the new model of financing for the period 2007-2011 of the public universities of Andalusia and the public organisms which include a gender parameter to reward the universities with the highest number of feminine professors and main feminine research workers, this being analysed as a project to promote change in the inequality of women in science.

Likewise, the introduction of a gender perspective into the education field has prompted several studies to collect information on gender studies courses offered by universities and evaluate their quality and relevance; analysis of school curricula and textbooks and training programmes for teachers; analysis of initiatives aimed at encouraging girls to undertake non-traditional training paths. The more relevant within the academic contexts these specialised courses or degrees are, the more they should be able to challenge the “male bias” of science, raising awareness of this bias and its consequences among students and staff (Acar, 1991). In this case, the approach adopted focuses on analysing the development of gender studies within the university system, quality, consistence and visibility of these studies, along with recommendations about how they can be improved and spread. Gender studies are seen as a way of promoting gender sensitive research.

In **Turkey** at least three publications have been reviewed in the introduction about the feminist perspective in undergraduate education, two of which (Tan et al., 1998 and 2001) were about the experiences of a team of feminist instructors who were engaged in designing and collectively teaching an undergraduate course on gender to prospective teachers. In one article the latest Primary Education Curriculum was evaluated from the gender perspective and the implications of its positive emphasis on girls and science were analysed.

In **Greece** within the framework of the Operational Programme: ‘Education and Initial Vocational Training,’EPEAEK II’, started relatively recently between 2000 and 2008 with the establishment of undergraduate and postgraduate Gender Studies Programmes in universities and technological education institutions (TEI). Gender studies are an important area of research in Greece not only because they are an instrument in gender mainstreaming, but because they have also contributed to covering the shortage of expertise on gender issues. The specific funding allocated for developing undergraduate and postgraduate courses in women’s and gender studies marked the beginning of the end of the shortage of expertise on gender issues in Greece.

Box 20. Gender policies, equality machineries and scientific structure / infrasstructure

Profiles of national policies and institutional machineries relating to women and gender issues are strictly related to the changing framework of gender and science. All SECs have equal treatment legislation, a national and sub-national Gender Equality Department or Agency and offer women’s or gender studies courses within their universities. Their specific functions include: Setting the gender equality agenda through campaigns and the promotion of good practices; investigating institutions where gender inequalities exist; commissioning and publishing research into issues related to gender equality. Yet, until now, this ‘institutional turn’ of gender issues results in a promotional role: machineries address a broad gender agenda rather than specific policy areas, which, in turn, rarely focus on science issues. Yet, there has been little research into the extent to which increased institutionalisation has made real progress in reducing gender inequalities in science.

There are neither systematic efforts to do research into the evaluation in the field of science nor comparison studies of different policies towards gender equality in science. Furthermore, in the SECs, policies deal more with equality in access rather than with gender differences and power asymmetry, and their contribution to the process of mainstreaming gendered perspectives into all policy-making is much harder to discern. In addition, a large part of the SECs’ policy regulations has been made by adapting to international agreements such as the CEDAW and European Union directives.

Nevertheless, the existence of European funds to finance gender research appears of paramount importance in the development of research on the topic of gender and science. It is a matter of fact that most studies that provided results on the topic were the result of opportunities offered by European projects. National political agenda of equity does not seem to affect the strategic use of public resources, even though the presence of certain equality measures correlates positively with the growing rates of women’s participation in science. At the same time, while not modifying the epistemological framework, equality policies and machineries provided the opportunity for research into a topic that would have been, otherwise,

non-existent. There still remains a strong case for equality policies to be monitored and evaluated from the point of view of quality, effectiveness or impact. Another theme, conspicuously absent, is the theme of funding, and further research of this topic is needed in order to get better insight into gender segregation and inequality in science.

Finally, there would be a need to examine the connection between policy-making, outcomes and gender regimes of each country: empirical research on this topic is limited and further research should be conducted dealing with institutional constraints for the development of women in science related to the gender division of labour and the analysis of the institutional practices of work organisations. For example, there is a lack of empirical studies about the correlation between the organisation of scientific work, the use of time and the work/life balance: they are all aspects dealing with studies about gender inequalities at work, but hardly interpreted in the analysis of the scientific realm as such. There are limited studies exploring the institutional changes and structures that reproduce gender differentiations and those especially found in the scientific field.

To sum up, there is a clear discrepancy between a good level of theoretical and empirical insight, which has produced innovative conceptualisations, and a lack of policy analysis from a gender perspective, when it comes to correlating institutional constraints, organisational practices and cognitive dimensions: on one hand, few studies were identified using tools such as gender impact assessments, or on the issue of mainstreaming gender into the content of national programmes and projects; on the other hand, few studies address a correlation between organisational mechanisms i.e. male informal networks, homosociability, gate keeping gender bias and the evaluation of scientific excellence. For example, women's difficulties in achieving academic progression cannot only be explained by work-life constraints: subtle gender biases are also at work. Women's access to the scientific elite is hindered by cooptation procedures that reinforce homosociability practices. The related question of who the gatekeepers of science are, those who decide about excellence, received some consideration, as well as the mechanisms of promotion. These are issues that require methodological innovation, both in data collection and in modelling.

2.8.5 Policies – Research findings

Overall, we could say that the findings derived from the literature analysed in the SECs refer to what type of policies are implemented or could be implemented, rather than on assessing their impact and effectiveness. There is very little evidence on the impact of such policies.

Most of the research approaches the topic through the quantitative evaluation of the presence of women in science, by measuring the progress done in the field of gender equality, and through investigating the reasons for poor standing in the statistics on gender equality, despite the formal legislative assessments. This is done by comparing available statistics and appropriate indicators; highlighting the relevance and role of women's and gender studies and Equal Opportunities Committees in a European high education framework and raising public awareness of the potential for a gender dimension to research (Cantù & Serina, 2004; Litido, et al 2009; Vaiou & Vosniadou, 2004 and 2005; de Pablo, 2006; Abela, 1998; Kalaycıoğlu, & Toprak, 2004; Azzario Chiesa, 2006; Karamessini, 2004; Maratou Alipranti, 2006).

Among the findings of the studies that were focused on evaluating gender equality policies in research, we find those of the Spanish research quoted in previous paragraphs, as well as an assessment of gender mainstreaming in Turkey concerning documents and programmes that design the primary goals, essential policies and priorities of education or the syllabi and textbooks. The assessment highlights that, broadly speaking, they seemed to have failed to materialise 'gender mainstreaming' (Tan, 2007).

Among the findings related to the drafting of equality plans in universities we find some relevant material in Spain and Greece, especially on gender policies within the universities (Martinez et al., 2006; Vaiou & Vosniadou, 2004 and 2005; Silvestre et al 2008; de Vicente y Royo de San Martín, et al. 2004; Maratou Alipranti, 2008).

In 2004, the UAB (Universidad Autonoma de Barcelona), a pioneer in the field, issued a study entitled 'Sexism in the UAB: proposals for action and information for a diagnosis' approved in 2005. 'The First Plan for the Equality of men and women at the University Autonoma of Barcelona 2006-2007', aimed particularly at the policies in the areas of teaching, research and working conditions. The study provides a critical review of the university's current policies, discussing their alleged 'gender-neutrality': the report claims that many of them are in fact 'positive measures' that favour men. As examples of gender bias in university policies, the report analyses 1) the allocation of teaching hours and the degree of experimentality among fields of study; 2) the awarding of the Quality Mention to PhD programs; 3) the evolution of the legal framework of scientific and academic careers between 1970 to 2003 4) the process for evaluating and accrediting academic staff. It is suggested that the teaching staff should be the object of preferential attention for two reasons. On the other hand, it is considered that the action directed at this group has a positive impact on the whole university, and, namely, on the students. The report also presents a detailed set of recommendations for eradicating sexism and promoting gender equality, establishing specific objectives for students, administrative staff and academic staff (Izquierdo Benito, et al. 2004).

An interesting finding of a research project (Pantouli, & Fotakopoulou, 2008), carried out by the Aristotle University of Thessaloniki, which aimed to explore the effect of the incorporation of the gender perspective into different scientific fields of Greek tertiary education, was the limited presence of gender courses in the physical sciences and technology faculties in comparison with the faculties of social sciences.

In one of the few comprehensive empirical studies carried out in Greece (Teperoglou, 2002) regarding the promotion of female participation in research, the respondents identified as useful strategies: conciliation policies e.g. child care facilities, summer camps: training e.g. scholarships, funding trips & exchanges with other EU countries: working conditions e.g. a rise in salaries, common incentives, meritocracy.

A comprehensive reference on gender equality policies in universities can be found in the Palasik Papp 2008 report 'Beyond the Glass Ceiling. University Careers of Female Academics in Engineering, Technology and Life Sciences', synthesising the findings of a pilot survey across six countries including Italy and Turkey and aimed at extending existing knowledge on the career patterns of the female scientists in the universities. A specific section of the report is dedicated to analysing existing policies at the university level focusing also on good and bad practices. In general, the SECs available statistical data reveals women's unequal position in all ICT-related fields: education, employment and research (Castaño Collado, & González Ramos, 2008; CNEL 2004; Alcalá Cortijo, *et al.* 2005).

Very little attention is paid to the world of business and private research. Entries have been found to specifically deal with gender equality policies in the private sector, the Perikitioni Network (2007) and Martinez Costa et al (2007). The research by the Perikitioni network that was carried out in Greece and surveyed 160 businesses active in R&D, found out that only 7% set targets or quotas for the promotion of women's participation and the percentage of businesses (12%) that implemented policies for the enhancement of women researchers' participation was also small such as flexible time arrangements, tele-working, further training. However, those policies were adopted segmentally, and were primarily connected with the business culture of the enterprise. Other research on the private sectors focuses primarily on projects/best practices at national and local levels (Poggio & Cozza, 2006).

2.8.6 Policies – Gaps in research

As we have already mentioned in the opening paragraph research on the topic of policies towards gender equality is a relatively new area of analysis in the southern countries and as such there is no truly consolidated line of research on this issue.

What is particularly lacking, across all the countries analysed, is a consistent effort and methodology for evaluating gender equality policies. This may be due to the difficulties inherent in the evaluation of policies, a lack of data, a lack of an evaluation culture, but also to the fact

that the gender equality policies dealing with science and research are still, where they exist, in the early stages of their implementation in most countries analysed.

It would seem that in the southern countries research efforts still focus on collecting data and information and producing monitoring reports, which only in a few cases seem to have a recurrent nature. Collection of disaggregated data is certainly a necessary step that should be followed by the elaboration of ad hoc policies and intervention strategies.

An important gap in policy research directed towards gender equality in science is the lack of analysis using a **gender mainstreaming approach**, at a national level followed by the European level. Such a report should analyse the effects on men and women's careers of the legislative framework of each country, and how it is applied. The devil is often found in the details: the selection procedures that scientists of both sexes must face are not the same in all countries. In some countries, the selection process and the funding of projects is carried out by the university itself, in others it is done by the community of professors of the same discipline, in others by only the older professors. In all countries there is some sort of council or central public entity to which researchers must apply to receive funding, and, in turn, a body may be appointed by the profession or may be politically appointed, or somewhere between the two. As in the example in Box 17 'Gender analysis of the policies towards mobility', many policies towards science may be considered in themselves policies that affect gender equality, and may be compared on the basis of their effect on gender relations in the academia. Some policies of promotion and funding may be more favourable but others less so, to increasing women's presence among those who practise science.

This exercise in gender mainstreaming should be done in comparative terms, by analysing the effects of the way each country organises its scientific community in order to be able to promote the sharing of best practices. This comparative study of the organisation of Academia as well as of the rest of the scientific establishment should be carried out with the aim of checking whether women have access to the scientific community, and is, in the opinion of this rapporteur, a gap that needs to be mentioned in this paragraph.

2.8.7 Policies – Conclusions and recommendations

The general overview of the literature in the data base can identify what policies have been implemented in the Southern European Countries with the specific aim of achieving greater gender equality in science. Very few policies were reported by the national countries, and there is great variance among the countries under examination. As related in more detail in Box 19, many countries mention an improvement in the general framework of Equal Opportunity Policies at the national level, with the creation, starting in the nineties, of the creation of national bodies in charge of equal opportunities at the governmental level.

Besides, some countries mention more direct interventions specific to science and academia, or at least regarding the education sector, namely:

1. The creation of dedicated units in the Ministry of Education (Spain 2005), or Councils (Israel)
2. The creation of observatories for the monitoring of gender equality in education at the national level (Greece 2008) and at the university level (Spain)
3. The creation of Equal Opportunity Commissions at the university level: consultative bodies with some funds but not many for cultural initiatives (Italy)
4. The creation of Gender studies courses within the science curricula, at the national level (Greece), at the university level (Turkey),
5. The creation of dedicated gender research centres (Spain)
6. Gender quotas in some scientific committees (Israel, 40%, Greece, 33%), thus not always binding, as in the Spanish case 40% as a general recommendation to keep a balanced gender composition
7. earmarked funds, either as scholarships- (Eurydice project Greece) or as a system of evaluation giving women a small bonus of 5% in the evaluation for grants (Greece)
8. improvement in gender statistics on education and science (Greece)

All these kinds of intervention reported in the Southern European countries have a common aim of preventing bias and discrimination, rather than giving special support to women.

Only Greece mentioned a specific programme to fund young women's research.

No specific programme to ease the re-entry of women who had previously trained in the sciences and may want to re-enter the scientific pipeline after dedicating time to building their families has been reported.

An inability to sanction perpetrators of discrimination, attributed to equal opportunity observatories or committees has been reported. No solution to the problem posed by finding a correct method of women's selection in the quotas has been mentioned.

Box 21 - A policy to think about

In Israel, postdoctoral training abroad is a necessary condition for achieving a position in one of Israel's research universities. Women often fail to do this training abroad and so leave their academic career as they or their spouses consider the family's financial security 'the husband's duty' and do not venture to risk their careers.

For a long time the Council for the advancement of Women in S&T has been trying to increase the number of female scientists in Israeli universities. In order to do so, the council tried to find a way for women to overcome the first impediment in their academic career, namely, the postdoctoral training abroad, either by changing the criteria for obtaining a position or by helping the excellent female student to go abroad.

In order to encourage excellent female PhDs to take a postdoctoral position abroad, the Weitzman Institute (Israel) is holding a special mobility programme on a competitive base for women with a recent PhD degree who receive an offer from a foreign university for a postdoctoral fellowship. The Institute pays 20,000 USD a year to the husband who follows his wife abroad for this period. Wives of male postdoctoral fellowships who receive a similar offer do not get this financing.

From the viewpoint of strict gender equality, the idea of a financial incentive for men in order to help women towards equality sounds peculiar, yet the policy is quite realistic. It accepts as a given fact that moving husbands is difficult, while many wives are inclined to follow their husbands, in any case.

Some countries especially Greece, Spain and Turkey mentioned non-governmental political factors, networks and associations that were instrumental in the establishment of important policies and legislation. A census of the existence of such organisations and the creation or strengthening of their networking capacity may be an additional gap to fill in research on gender and science.

Finally, this year (2010) it is ten years since the publication of the ETAN Report (Osborn et al, 2000) which was seminal in starting the analysis of women's status in European Academia, and made an impact, that cannot be underestimated. The analysis of data, carried out for the report, needs to be repeated in order to monitor the pace of advances in monitoring: the report also needs extending to represent the overall gender mainstreaming of academic practices. Submitting academic practices to a detailed quantitative evaluation of how old and new provisions affect men and women and their relationships in the academia is of paramount importance in the Southern European countries, as is the sharing of best practices between the SECs themselves.

3. Conclusions

3.1. Methodological conclusions

Except for the biographical research, studies in the SECs often result from the analysis of existing statistics and/or qualitative fieldwork. Research across the different topics mainly focuses on description, concentrating on the state of the art, showing women's under-representation in certain scientific areas and senior positions. Nevertheless, a more analytical approach is adopted when linking different focuses, such as the reproduction mechanisms of the gender stereotypes and power dynamics in scientific infrastructures.

The main deficit of gender and science research in the SECs is the fact that the conceptual debate has not sufficiently driven empirical research on many relevant issues: a large part of the research effort was concentrated both on the field of vertical and horizontal segregation and on the socio-cultural dimension i.e. stereotypes, due to the difficulty in obtaining sex-disaggregated data. Nevertheless, research concerning the mechanisms that analytically explain different patterns of discrimination is far from conclusive. The same holds true for the development of alternative methodologies and teaching tools to avoid the reproduction of gender stereotypes. In addition, the effort to compile data has not sufficiently driven the development of gender indicators.

Studies often prioritised women's condition and relative deprivation, especially in the 1970s, but they failed to deal both with the problems related to the relationships between men and women and the power asymmetry in the historic process, as well as with the analytical connection within science, economic growth and power.

Quantitative research, based on representative samples and on governmental and educational system statistical data, was mainly conducted, with a generally descriptive aim. At times, the limited studies available adopt a more analytical approach and consider the social factors that have historically resulted in the current state of affairs. When it comes to the socio-cultural dynamics e.g. stereotypes research follows a qualitative approach, based on sociological or ethnographic methods, mostly interviews, and biographic research. Descriptive research appears to be aimed at the attainment of formal equality between the sexes, and it benefits from women's increasing participation as well as from the legitimisation of the idea of equality. Empirical research is often transformed into a sex-counting approach, which addresses issues of male/female equity and equal opportunities, but does not address an epistemological debate, which would affect the way in which scientific knowledge is defined. The partiality of this methodological approach results in some overlapping of the gender analytical framework and quantitative empirical research using 'formal equality' indicators, the latter carrying more weight in the SEC scenario.

The first important gap is the lack of a comprehensive set of publicly available data, both in the university system, and in other institutions. Available data is included in the documentation produced by the same authorities that disburse the funds, i.e. the Ministry of Education, University and Scientific Research. Secondly, qualitative and conceptual research is lacking in the field, with the result that the current situation, though very elaborately described, is very scantily explained. Thirdly, the existence of some excellent reports and research has had very little impact on the situation or on policies.

Finally, longitudinal studies are non-existent. Most studies draw on the compilation of statistics which typically relate just to a time period of one year. Rare cross-sectional quantitative and qualitative research has been conducted on topics such as choices, distribution, socialisation processes, gender ideology in the professional context, attitudes and educational practices and teaching. Longitudinal analysis is hindered by a shortage of statistical information especially the lack of sex-disaggregated historical series, the absence of regular official surveys with rare updating research being encountered due to the shortage of funding, and the lack of panel surveys which make longitudinal analysis possible.

From the methodological viewpoint, one can identify gaps and action that are recommended, namely:

- Most of the research and analysis centres on educational institutions and academia. There is a need for research in the private sector.
- A need for the improvement of data, to document, assess and analyse the characteristics of the obstacles as well as the dimensions of change and developments in the field. Regular, official and updated surveys would also make longitudinal analysis possible.
- A need for harmonised data, collected systematically across the countries.
- A need for the development of gender indicators and gendered quality indicators
- Despite interest in the study of the reproduction of stereotypes, the proposal of methodologies and alternative tools is incomplete and its establishment is almost non-existent. There is a need for innovative methods towards the deconstruction of gender stereotypes.
- A need for a more systematic conceptual debate in the field, rather than statements to promote equality.
- A need for implementation of the gender mainstreaming approach.
- A need for increasing contiguity among equal opportunities policies, women's politics and antidiscrimination politics in a broader sense, targeted not only at gender differences but including ethnicity, religion, sexual orientation, age and disability i.e. 'intersectionality'.

3.2. General conclusions

This third draft of the report summarised the findings of the National Reports and considered the relationship of the research produced in the SECs with the research produced in all GSD countries. It is quite difficult to make categories and aggregation that refer to the Southern European Countries that we have analysed, as a whole, distinct from the rest of the countries. This, however, is by itself an indicator. The Southern European Countries do not seem to have strong dishomogeneity, and seem to be integrated into the social trend that includes at least some women in the scientific community and they have begun to explore why it is that there are so few women, why they enter so late, and why it is so difficult for them to be accepted on equal terms. It is true that in some countries women's relative strong presence is the result of historical trends: in Portugal, in the 1960s and early 1970s, women entered the university system as a consequence of the massive number of men that were sent to Africa to fight in the colonial war during the dictatorship.

The international feminist debate about the epistemology of science reached Southern Europe. In two countries, (Italy and Turkey) in particular, most of the English-language books on the topic were translated in the national language. In other countries (Spain, Greece) the literature contain references to the English versions. . We evidenced a relative scarcity of entries on the topics of Pay and funding, Scientific Excellence, and Policies towards equality, and a relative abundance of entries on Gender in Research Content and in Stereotypes and Identity. The methodological approaches and techniques used in the studies were also comparable to those used in the entire sample. The findings are also rather homogeneous among the SECs, to indicate that the problems women encounter are not specific to the research systems of any single country but systemic to the scientific community in its relationship to women in all countries.

Horizontal segregation is present in all the countries analysed and is reflected both in different study choices in secondary education and at the university level as well as in different professional careers and specialisations. Vertical segregation and the existence of the glass ceiling is also documented by an overwhelming amount of evidence. As has been discussed the two are inter-related. When a sector is feminised, it loses positioning in the vertical hierarchy of the sectors. Men in feminised sectors have a greater chance than men in integrated sectors to rise in the hierarchy of the sector. There is also evidence that a desegregation process is indeed taking place, partially as a result of women's improved enrollment and education attainment levels, and partly as a result of a generalised egalitarian trend. However, there is still

no general agreement that this is part of an incremental, constant process and several authors still argue that the gap, albeit slowly, is far from closing both at the horizontal and vertical level. Mention is made of the fact that the glass ceiling has not been broken, but that it has simply moved upwards.

Stereotyping is a consequence of the fact that women have been excluded from science, and at the same time, a mechanism of its reproduction. The topic of stereotyping and identity of the scientist are studied in the SECs as much as in the other countries. Of particular interest are the studies in applied psychology about the effects of stereotype threats. However, there is very little research on how to overcome stereotype-created biases.

Science is a labour activity, and, therefore, it may risk undergoing the sexual division of labour within the laboratory or the institution. In addition, women scientists have to deal with a double problem of conciliation and codivision. They must find a conciliation of their paid work for science and unpaid work in the household. This is particularly hard for a job like research, which easily eats into their private lives and time that should be allocated to leisure. And they must find a way to share family commitments with their male partners, who are also often scientists, knowing that this attempt to codivision may be harmful to them in the competition with male colleagues who can fully exploit a structure of domestic support.

These problems are recurrent in all countries, as recurrent is the problem of mobility: scientists need to be able to move, to follow research opportunities, families need to stay together, and between these ties it is often women, who, for reasons related both to stereotypes and to their lower monetary returns, make the sacrifice of moving or staying according to the men's needs.

The issue of pay strictly correlates with the issue of vertical segregation, since in most countries there is no individual variation in pay among people with the same job title and seniority in the position. There has been relatively little research into the issue of funding.

The topic of Scientific Excellence is severely underresearched in the SECs. This may be due to the fact that the search for excellence is a relatively new phenomenon. The existence of horizontal as well as vertical segregation suggests that there are forces operating in society as well as in science that segregate men from women. The search for excellence is determined by many factors, among which is the desire to compete in technology advancement with other countries and economies. This is based on the premise that women may not be able to reach the same level of excellence as men.

There are many strategies that may be proposed to counteract the second aspect, and proceed to a search for excellence devoid of gender bias, therefore, able to release the entire potential of the human brain, in its male and female versions. However, these strategies only emerge as possibilities as a result of the findings about why women do not reach excellence. Such policies as:

- to revise the mechanisms by which excellence is produced: avoiding double standards, unclear standards, stereotypical judgements, cumulative biases.
- to start programmes which restore rights to women who have been discriminated against.
- to insulate women's excellence by financing projects proposed by women, avoiding competition with male scientists, and/or projects in which a given percentage of women scientists participate.
- to define and reward excellence in gender studies.
- to start mentoring programmes for young women scholars.

The sheer size of our database shows that gender is a field of study that has been growing in southern Europe in the last 30 years, with no sign of abating. What initiated as an epistemological critique of science has produced hypotheses about the social construction of science and about identity, and promoted empirical analyses generating new puzzles which are still in search of an explanation. The gender division of labour has been described but not explained in such a way as to allow forecast and intervention. The work of creating a gender theory and the way it operates in many areas of society, such as in science, is in progress.

Finally, with regard to policies dealing with women in science, progress has been made in many countries, although at a different pace between the countries. The systematic comparison of the results obtained in each country is one of the gaps of the research on policies. Such a comparison should identify appropriate benchmarks for evaluation. For example, we still do not know whether there is a positive, null or negative correlation between the institutional innovation, originating gender studies programmes, and women's presence in science in a given country. The correlation could go either way: positively, if both are signs of an underlying evolution of women's presence in society; negatively, if gender studies programmes attract women scientists who would otherwise be in other programmes; null, if the two processes are driven by different underlying forces.

Research on Gender and Science in the SECs has evolved along patterns not dissimilar to those in Europe, overall. The analysis of the problem has developed further than its remedy policies and the research on such policies. The institutional evolution of the legislative framework of equal opportunities played an important role in stimulating the study of the relationship between gender and science. Further work needs to be done especially in the sharing of best practices and evaluation of results of affirmative policies.

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