WHERE ARE WOMEN DOING RESEARCH IN THE FIELD OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS)?

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Abstract

A great body of literature evidences the low representation of women in technology-related fields. However, few research lines have analyzed the role played by women in the field of research on ICTs. The main aim of this paper is to explore the participation and position of women in a group of public and private institutions doing research in the field of ICTs in Spain. After mapping all the private and public institutions doing research in field of ICTs in Spain, we carried out an analysis of the presence and position of women in the field of ICTs research in those institutions. Our findings show, on the one hand, a scarce representation of women in the research areas specialized in the field of ICTs. On the other hand, we have also observed that few women hold posts of responsibility in the research area of ICTs and have the required qualifications to promote professionally in those research areas. We discuss all our findings and the possible implications of our study.

Keywords: gender, research, ICTs, participation, position and qualifications.

1. Introduction

Literature on gender differences in career choice remarks that women do not pursue scientific and technology-related studies, even when they have the same qualifications than men to choose these studies or, in some occasions, higher (Eccles, [1], [2], [3], [4]; Sáinz, [5]).
In Spain, for example and according to data extracted from the Ministry for Education and Science (MEC, [6]), during the academic course 2005-2006 the percentage of women in technical studies reaches 27.4% and, more specifically, the rate of women in the studies of computer science reaches 17%. Nonetheless, the rate of women in university studies is of 53% (higher than the one reached by men) and also overpasses the percentage of 60% in the studies of Humanities and Social science (62.9% and 62.8 respectively).
At the same time, more men than women hold posts of responsibility, as full professors, directors of research or principal researchers, in the global research activity carried out in university and research centres –CSIC, CIEMAT, etc.–. In this sense, in Spain and according to data from the Spanish Ministry for Education and Science (MEC, [6]), the percentage of women holding posts of full professors is of 13.8%. Only 7% of 31.503 women working as university staff holds the position of full professor.
The low representation of women performing research activities in the fields of engineering and technology is also another example of the low participation of women in technology-related areas. As represented below in table 1, the percentage of female researches is lower than the one by men (about 35%) in the 25 EU-countries participating in the study. More specifically, the rate of female researchers working in the field of engineering and technology in Spain is lower than the rate of men (36%), but higher than the rate of women researchers in other European countries, such as Germany (13%), Denmark (17%) or Belgium (29%).

Table 1. Total and female researchers in the public sector by field of science (FOS) in some EU Member States and other countries, 2004

	Researchers													
	Natural sciences		Engineering and technology		Medical sciences		Agricultural sciences		Social sciences		Humanities		Total	
	Total FTE	Female %	Total FTE	Female %	Total FTE	Female %	Total FTE	Female %	Total FTE	Female %	Total FTE	Female %	Total FTE	Female %
EU-25	179 134 s	:	126 969 s	:	87 702 s	:	29 809 s	:	79 819 s	:	84 118 s	:	587 549 s	*35* s
EU-15	:	:	:	:	:	:	:	:	:	:	:	:	494 136 s	:
BE	3 192	*32*	2 983	*21*	2 614	*50*	1 547	*39*	2 552	*45*	1 528	*46*	14 416	38
BG	2 825	*52*	2 042	*29*	706	*54*	1 057	*50*	771	*47*	905	*63*	8 306	*47*
CZ	3 227	*30*	2 155	*23*	835	*44*	731	*39*	1 047	*41*	940	*41*	8 935	33
DK	2 341	*25*	1 403	*17*	2 390	*45*	1 065	*47*	1 370	*34*	1 565	*42*	10 133	*35*
DE	38 210	*20*	24 710	*13*	13 216	*35*	4 949	*31*	10 868	*32*	15 010	*33*	106 962	*24*
EE	946	*37*	516	*23*	181	*64*	151	*46*	418	*57*	436	*69*	2 648	*45*
IE	1 614	*34*	770	*22*	712	*53*	340	*32*	827	*45*	447	*45*	4 710	*38*
EL	:	:	:	:	:	:	:	:	:	:	:	:	11 208	:
ES	12 750	*40*	13 198	*36*	15 620	*47*	5 145	*46*	12 567	*40*	9 487	*42*	68 767	*42*
FR	:	:	:	:	:	:	:	:	:	:	:	:	:	:
IT	:	:	:	:	:	:	:	:	:	:	:	:	:	:
CY	154	*35*	17	*18*	6	*35*	38	*18*	101	*35*	49	*41*	365	*33*
LV	1 058	*54*	494	*54*	164	*54*	186	*54*	568	*54*	405	*54*	2 875	*54*
LT	1 784	*43*	1 162	*27*	741	*55*	321	*55*	1 072	*60*	1 084	*67*	6 164	*49*
LU	:	:	:	:	:	:	:	:	:	:	:	:	485 i	:
HU	2 990	:	1 284	:	1 352	:	1 026	:	1 696	:	2 247	:	10 595	:
MT	24	*18*	28	*14*	75	*27*	5	*28*	71	*41*	32	*29*	237	*29*
NL	:	:	:	:	:	:	:	:	:	:	:	:	19 002 ei	*14*
AT	2 486	*21*	1 159	*11*	1 603	*37*	363	*31*	1 248	*34*	1 117	*39*	7 975	*28*
PL	12 781	*38*	11 336	*20*	8 359	*54*	4 521	*47*	9 856	*46*	5 668	*46*	52 520	*40*
PT	4 185	*53*	2 644	*33*	1 324	*61*	1 455	*55*	2 756	*54*	1 139	*53*	13 502	*50*
RO	3 057	*45*	3 819	*41*	2 439	*60*	449	*37*	1 364	*49*	852	*42*	11 980	*47*
SI	802	*33*	611	*23*	301	*60*	260	*46*	712	*47*	173	*45*	2 859	*39*
SK	2 912	*37*	1 897	*33*	1 402	*59*	567	*45*	1 549	*50*	528	*50*	8 854	*43*
FI	:	:	:	:	:	:	:	:	:	:	:	:	17 237	:
SE	:	:	:	:	:	:	:	:	:	:	:	:	20 139	:
UK	:	:	:	:	:	:	:	:	:	:	:	:	9 126 e	:
IS	:	:	:	:	:	:	:	:	:	:	:	:	1 055	:
NO	2 112	:	1 126	:	1 954	:	819	:	2 497	:	1 001	:	9 509	:
EEA	182 463 s	:	129 300 s	:	89 239 s	:	30 379 s	:	81 170 s	:	85 537 s	:	598 087 s	*35* s
CH	:	:	:	:	:	:	:	:	:	:	:	:	12 760 ei	:
HR	1 108	*46*	1 160	*30*	1 503	*51*	480	*42*	1 225	*51*	649	*57*	6 125	*46*
TR	:	:	:	:	:	:	:	:	:	:	:	:	:	:
JP	:		:	:	:	:	:	:	:	:	:	:	:	:
RU	:		:	:	:	:	:	:	:	:	:	:	218 740	:
US	:		:	:	:	:	:	:	:	:	:	:	:	:

Source: Eurostat - R&D statistics

On the other hand and in accordance to Eurostat [7], the percentage of women in the labour force of computer science is higher than the one of women (2.6% versus 0.7%). This panorama has not improved in the period of time ranging between 2001 and 2006.
Keeping in mind the low rates of women in the field of Information and Communication Techologies, we handled the hypotheses about the existence of gender biases in the next processes:

The process of selection, election and promotion of research personnel
The organization and content of the research tasks and of scientific excellence
The implementation of recurring methods that benefit men and disfavour women

Taking into consideration the above mentioned hypotheses, the main aim of our research is to find evidences about the underrepresentation of women doing research in the field of ICTs. In order to reach such a goal, we would like to deeply investigate the mechanisms that could explain the mentioned underrepresentation of women doing research in the field of ICTs: number of female applicants for a job in this field; type of structure and of organization of the institutions where the research activity is being carried out; work conditions implemented in these institutions (is it the working-time flexible?), biases in the selection process and difficulties to achieve work and family balance.
In this regard, we will delve into the following concepts: Critical mass, gender stereotypes about strategic professions, uses of time, leaky pipeline, male bonus, homosociability, networking, promotion, equality of opportunities and mentorship.
At the same time, we would like to go beyond the study of the conceptualization of scientific and professional careers and, more concretely, the definition of scientific and professional excellence. Congruently with those conceptualizations, we would like to examine the extent to which the following aspects facilitate or hinder the professional path of women in this field. Some of the concepts we will handle will be: the masculine model of achieving a successful career; unpredictable working time, interrupted careers, proactive attitudes, homo-sociability, networking, publications with high impact factor and subject to peer review revisions.
Finally, we would like to explore some of the positive aspects that this field could entail: Entrepreneurship; Teleworking (is it a solution or a trap?); Best practices carried out in this field to promote equality between men and women; Barriers and opportunities.

1.1 Presence and position of women in the field of ICTs-related research

As a previous stage we wanted to map the presence of women researchers in the groups of research of all public (technical schools, faculties, research institutes or centres) and private (firms, companies and foundations, etc) institutions in Spain where research within the ICTs-related field is being carried-out. Simultaneously, we also wanted to enquiry about the position (in terms of position held and academic category) held by women in the research area related to ICTs.
Concerning the sample of public institutions, we analyzed approximately a total of 800 groups belonging to approximately 70 institutions (about 200 research centres) with research groups developing ongoing projects within the ICTs-related field. In order to eliminate research groups without current research activities, we decided to choose only those consolidated research groups with ongoing research projects.
As a previous task, we created a database with the most relevant contact information with the primary respondents of our research (those researchers who hold posts of responsibility in the research groups, directors of the research centres and some women holding the highest position or academic degree in their research groups). This database will be a key element for the design of the quantitative and qualitative analyses of the investigation.

Table2 . Main information contained in our database about information of our research groups in public institutions

LOCATION OF THE GROUPS	CONTACT INFORMATION	PRESENCE AND POSITION OF WOMEN	RESEARCH ACTIVITY
Autonomous Community	Telephone	Number of members of the group	Research lines
Organism	Fax	Number of women in the group	Ongoing research projects
Centre	Mailing address	Leader of the group, academic position and contact info	
Department	E-mail	Position of women in the research group	Type of ongoing research projects (European,
Name of the research	Website	Contact information with women	

group		holding the highest position in the group	National and Regional)

In the above table, we expose the whole information gathered in our database. We obtained information about the location of the research groups, their contact information, information concerning the position and presence of women in the research groups and also information about their current research activity.
Regarding the presence and position of women in the research groups, we had the following data:

-Name and surname of the person leading the research group (principal researcher)
-Academic position and contact information of the leading person
-Number of members composing the research group
-Number of women in the research group
-Academic position of women in the research group
-Contact information with women holding the highest position or academic degree in the research group.

One of the difficulties found in the seek of information about the research groups is associated with the great disparity observed in the information provided by the research groups in the different autonomous communities, which was a great barrier to identify the research groups and their composition (the directory of research activities of some autonomous communities, university portals, the websites of departments and research groups and general internet searching resources to get further information about the research groups and their members).

As the global analysis of the total sample is not complete yet, we will use the case of the autonomous community of Navarra as a mean to exemplify some of our findings.

As illustrated in figure 1, the presence of women is of 20%. In this community there were 25 groups of research in two research centres, composed by 322 members with 63 women. It is specially remarkable the lack of women holding the post of principal researcher in those research groups.

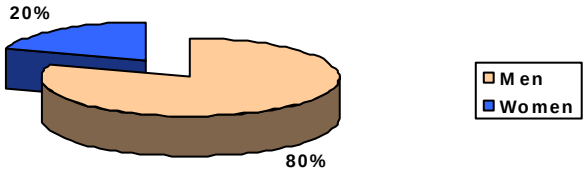

Figure 1: Representation of women in the Autonomous Community of Navarra

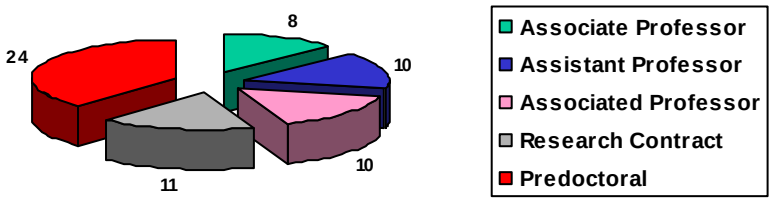

Figure 2. Distribution of women in accordance to their academic category

As exposed in figure 2, women are especially represented in the category “pre-doctoral” (students and scholarship holders and in the posts of associated professor (profesor asociado), assistant professor without doctoral degree (profesor ayudante). In this autonomous community, there are not women holding positions of full professors (catedráticos) or leading a research project (directoras de proyectos).
Regarding the private institutions with ongoing projects in the ICT-related fields, we have selected a total of approximately 300 institutions out of the information extracted from the public Official Bulletin (BOE), where it was detailed the number and name of private entities with financial support from the Spanish Ministry of Industry, Commerce and Tourism (Mityc) in the Profit public announcement. The

information contained in the database of public institutions was separated by sex and identified the type of research project with public funding by the Ministry, together with the amount of financial support given by the aforementioned Ministry.
In general terms and in line the findings extracted in the sample of public institutions, the number of women carrying out research projects in the field of ICTs is lower than the one of men.

1.2 Further analyses of the investigation

The information gathered in the database will help us identify directors of research, responsible people of the research groups and women of interest for our quantitative and qualitative analyses. We plan to apply a questionnaire to some of them or to interview to some of them.
In the quantitative part of the study we will use a self-elaborated survey with different questions concerning the participation of women in scientific and selective committees, the promotion of youth researchers, with specific measures to promote work and family conciliation and also with the implementation of equality measures. In this sense, the main objectives to be achieved with the quantitative study are the following:

-To Delineate the field of research on ICT's in Spain, in public and private institutions
-To Determine the position of women doing research in the field of ICT's
-To Quantify the implementation of gender equality measures

On the other hand and as regards the qualitative part of our study, we will use interviews and study cases in order to reach the following purposes:

-To Explore the cultural and institutional barriers to the entry, permanence and promotion of women to posts of responsibility in the field of ICT's.
-To Analyze the existence of gender biases in the research on ICT's
-To Study the typical feminine model to access to posts of responsibility in the area of research on ICTs

2. Discussion

In this preliminary analysis of some finding contained in our study, we have observed that women doing research in the field of ICTs are scarce and less represented than their male counterparts. They also seem to occupy posts of less responsibility and less prestige than their male counterparts (as scholars, assistant professors or with precarious research contracts). This result reinforces the idea that women do not hold posts of responsibility in this field of work.
We would like to enhance that this study opens a new research line in the study of the real presence of women doing research in the area of Information and Communication Technologies.
With the quantitative and qualitative analyses of our study, we expect to find more evidences about the situation of women who develop professionally in the field of ICTs. We also expect to shed some light on the study of the scarce participation of female researchers in the field of ICTs.
in Spain. This study could be the starting point for carrying out other studies within the European context.
We would also like to contrast whether some work conditions in thi field (such as lack of working time flexibility, unpredictable working hours, etc.), could discourage women from choosing to develop professionally in this field.
We also wonder whether young women could find some female mentors and also role models in this field. As some authors (Bandura [8]; Bandura, A., Barbaranelly, C., Caprana, C.V y Pastorelli, [9]; Volkman and van Eyck,[10]) state, the lack of female role models in the scientific and technology-related areas could provide explanation to the low interest of women in those areas traditionally male-dominated: such as computer science or engineering.

References
[Arial, 12-point, bold, centred and capitalize the first letter]

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