

Inter-Gender Differences in Technological Activity: Male and Female Contribution to Patents in the Spanish OEPM Database

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Abstract

Women involvement in Spanish patent applications at the Spanish Patent Office during the period 1990-2005 is analysed. Female inventors were present in 16% of the patents, increasing their participation from 10% in 1990 to 19% in 2005. Women activity was higher than average in the academic public sector (universities and Spanish National Research Council) and in specific thematic areas (Human Necessities and Chemistry). Female patents showed higher collaboration than male ones, as measured through their lower percentage of single-inventor patents and their higher co-inventorship index. The higher increase in female involvement was observed in universities, followed by individual applicants, while the lowest growth corresponded to industry.

Introduction

In the context of the current world-wide economic crisis scientific and technological innovation is being reconsidered as an essential element that needs to be taken into account to overcome the serious difficulties and restrictions existing in the global economy. Bolstering and increasing the transfer of technological and scientific knowledge to the production sector will open up new possibilities for the commercial exploitation of research results contributing to the recovery of countries' competitiveness within the international panorama of the crisis.

To reach this goal, every country needs to take advantage of all their human resources, both men and women, in research. The under-representation of women in activities related to technological innovation has been described as a barrier to the economic growth of countries (OECD, 2006). Therefore, identifying the disciplines and production sectors with a dangerous deficit of female activity and implementing specific strategies to raise their attractiveness for women are current objectives to be pursued worldwide.

In this study, we will focus on patents as indicators of innovative performance and technological progress. Although including sex-disaggregated indicators on patent analyses is an arduous task, it is strongly recommended by international bodies (She Figures, 2006; ETAN, 2001), since it will allow us to assess the participation of women in technological and innovative activities and how it has evolved over the years. Among the studies which have faced this challenge we can mention the work of Naldi (2004), Bunker Whittington and Smith-Doerr (2005) and Frietsch et al (2008).

Objectives

The objective of this study is to analyse the participation of women in the technological activity developed in Spain and detect the main trends over the years. With this aim, this paper analyses the presence of women as inventors in patent applications, with Spanish applicants or inventors, at the Spanish Patent and Trademark Office (OEPM) during the period 1990-2005. The main aspects addressed are the following:

- What is the involvement of women in patent activity?
- Is there any sign of horizontal segregation? Do women tend to concentrate on specific subjects?
- Are there differences in the presence of female inventors by institutional sectors?

- What are the trends over time? Have women increased their presence as inventors in the 15-year period analysed? Are we moving towards a situation of greater equality between men and women?

Methodology

Patent records with Spanish applicants or inventors applied for during the period 1990-2005 were downloaded from the Spanish OEPM database. Names of inventors were normalised and their gender was recorded according to first names (full names are included in the patents). Around 10% of patents –concentrated at the beginning of the period- had no data on inventors. Only in 3% of the remaining patents the sex of the inventors was unknown. Institutional names were codified and grouped in different institutional sectors: University, Industry, Spanish National Research Council (CSIC) and other Public Research Centres, Individuals and others.

Men and women involvement in Spanish technological activity was analysed by means of various indicators:

a) Measures of technological activity

- Participation: the percentages of patent applications with only male inventors, only women inventors and both, men and women together, were calculated.
- Contribution (fractional counting): measures the involvement of each gender in the production of patents. It is based on fractional counting and assumes that all inventors have the same level of implication in the development of an invention. For instance, in a patent with n inventors, the contribution of each one will be $1/n$, so that the sum of all contributions will be equal to 1, and the individual contributions will take values between 0 and 1.
- Presence: Total number of men and women as inventors in each patent application.

b) Collaboration indicators

- Ratio participation/contribution by gender. Participation is always higher than contribution, but differences by gender may reveal differences in collaborative practices between men and women.
- Co-inventorship index in male and female patents.
- % male and female patents with a single inventor

The involvement of men and women in the patents analysed was explored as well as inter-gender differences by institutional sector or thematic sections following the International Patent Classification (IPC). To detect trends over time, the application year of the patents was considered.

Results

A total of 21,077 patents were applied for at the OEPM during the period 1990-2005 by Spanish applicants or inventors. Women participated as inventors in 16% of the patents, mostly as co-inventors with men. This figure was reduced to 9% if fractional counting was used (contribution). 13% of inventors were women.

An upward trend in female participation and contribution was found throughout the years. Female inventors were present in 10% of the patents in 1990, increasing this figure to 19% in 2005 (Figure 1). Female contribution increased from 5% in 1990 to 10% in 2005, whilst the percentage of female inventors rose from 8% in 1990 to 15% in 2005.

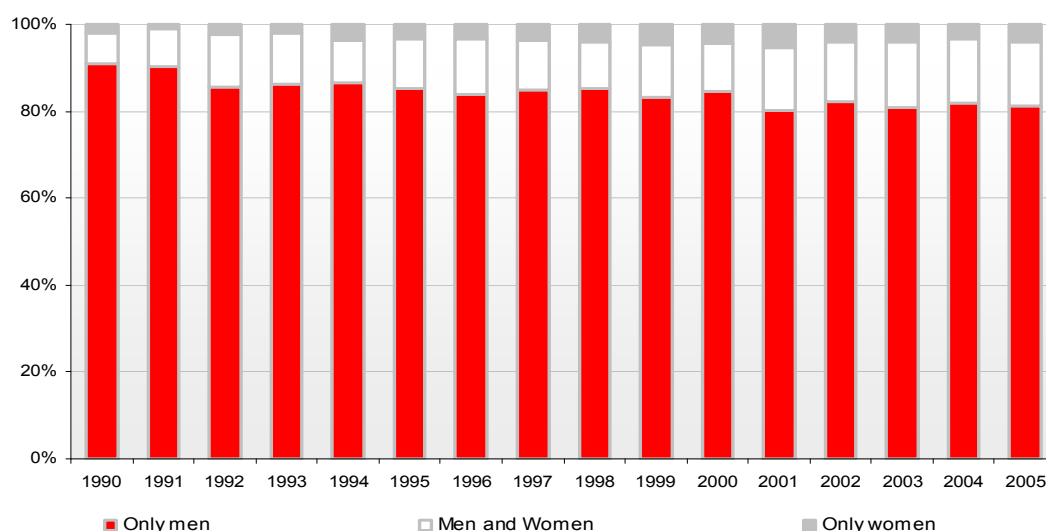


Figure 1. Female participation by years (OEPM, 1990-2005)

More than half of the patents came from industry (54%), followed by individuals (30%), universities (10%) and Spanish National Research Council (CSIC) (4%). The latter two institutional sectors showed the highest participation of women, who were present as inventors in 42% of university patents and in 55% of those of CSIC (Figure 2), well above the average of 16%.

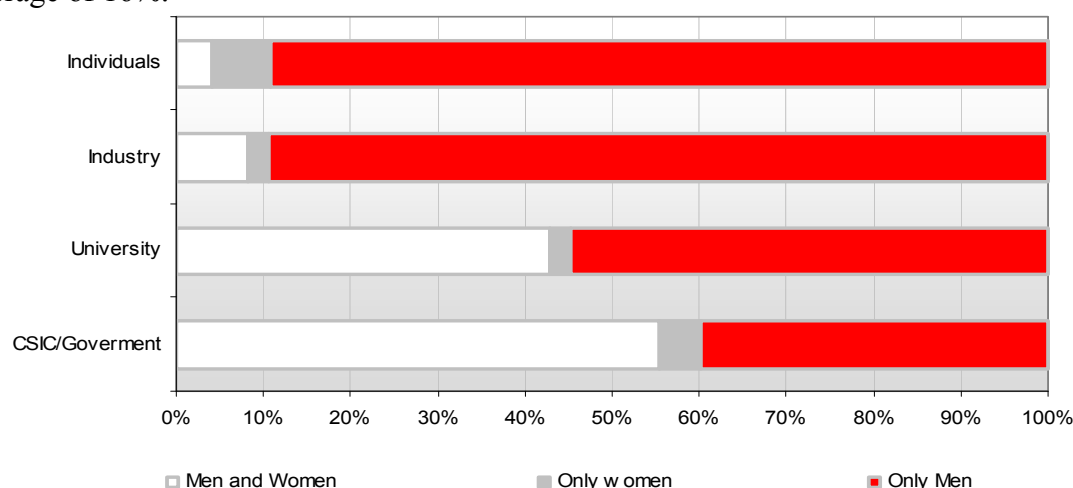


Figure 2. Participation of men and women by institutional sectors (OEPM, 1990-2005)

The highest number of patents applied for corresponded to sections B (Performing Operations, Transporting; 29%) and A (Human Necessities; 28%), followed by C (Chemistry, Metallurgy), G (Physics)(16% each), E (Fixed Constructions; 12%), F (Mechanical Engineering; 11%), H (Electricity; 10%) and D (Textiles, Paper; 2%). The participation of women was unequally distributed by thematic sections. It ranged from 6% (sections E and F) to 23% (section A) and 44% (section C). Female contribution varied from 4% (sections E and F) to 21% (section C) (Figure 3).

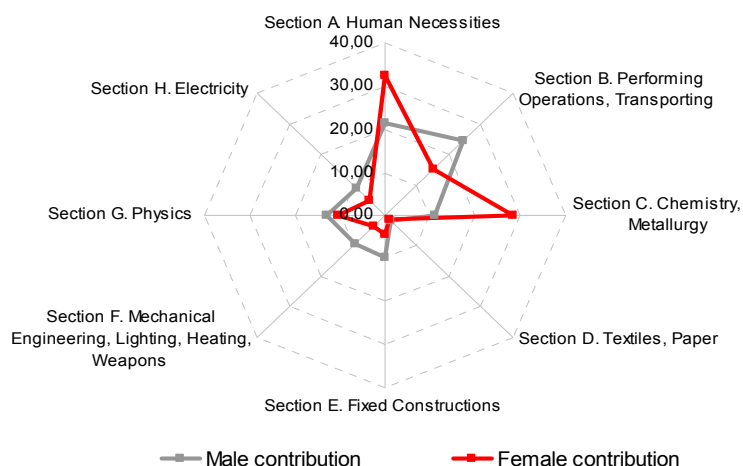


Figure 3. Thematic specialisation of male and female inventors (OEPM, 1990-2005)

Trends over time

The number of patents showed a pronounced increase from 1990 to 2005 (50%). However, important differences among institutional sectors and thematic areas were observed: the highest growth rate corresponded to individual applicants (600%), followed by university ones (480%), while the increase of the thematic sections A and E was the most remarkable (over 100%).

The increase of female participation and contribution was higher than that of men in all institutional sectors, but it was especially relevant for university and individual applicants. Concerning thematic sections, the highest increase in female participation and contribution was observed in section F, followed by E and H.

Participation and contribution

Women obtained higher values than men in the participation/contribution ratio in all institutional sectors and thematic sections. Various factors may explain these results: first, the fact that women were less often single inventors of patents (in this case participation=contribution). Secondly, not only did women tend to appear with a higher number of co-inventors, but also male collaborators tended to predominate among them. The fact that out of 6 male inventors one is a woman contributes to explaining this finding. The highest participation/contribution ratio (the largest difference between participation and contribution) was observed with university and CSIC patents. In fact, these were the sectors with larger groups (higher number of inventors per patent) and the increasing participation of women at these institutions was mainly achieved by means of a rising number of patents in which they collaborated with male inventors.

Collaboration habits

The average number of inventors per patent was 1.8. It increased from 1.54 in 1990 to 1.92 in 2005. Female patents presented a higher number of inventors per patent than the male ones, although the increasing trend was observed for both sexes. The number of inventors per patent increased from 3.07 in 1990 to 3.75 in 2005 in the case of women, and from 1.55 in 1990 to 1.95 in 2005 in the case of men. Men played the role of single inventor more frequently than women. Around 60% of male patents and 19% of the female patents had a single inventor. As the number of inventors increased, also did female participation (Figure 4).

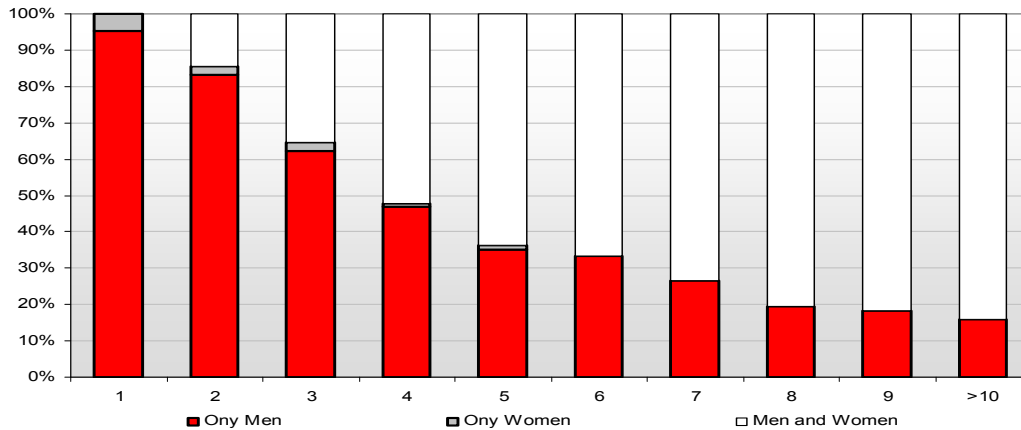


Figure 4. Participation of men and women by co-inventorship index (OEPM, 1990-2005)

Concluding remarks

The data shown are preliminary results of an on-going research project aimed at analysing the contribution of women to technological activity in Spain through the national database OEPM and the international EPO. In-depth analysis of these data, compared to those obtained from EPO, and discussion in the context of the existing literature on the subject is on-going. Different reasons can be argued to justify the interest of this research: to draw conclusions on women's contribution to the production of technical knowledge in an advanced country such as Spain and to monitor how this female participation has evolved over a 15-year period. The development of this type of study has been recommended by national governments and international bodies (She Figures, 2006) since it will provide essential information for the development of specific policies to foster female involvement in technology, as well as further assessment of their effectiveness.

Acknowledgments

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