Gender profiles in patenting: analysing female inventorship

For many years the UK Government has been inspiring girls and women to study and build careers in STEM fields – science, technology, engineering and mathematics. Educational diversity statistics are comprehensive with the number of women attaining STEM qualifications in the UK increasing from 8% in 2011 to 24% in 2013. In industry, however, the statistics primarily rely on 'inputs' such as the number of women employed (in the UK, women account for 13% of the STEM workforce and only 5.5% of engineering professionals). Very little data is available on the 'outputs' of work undertaken by women within STEM industries.

Whilst absolute patent counts do not give a direct measure of innovation, they can be used to provide a measurable 'output' of STEM industries and it is highly desirable to analyse the inventor demographic in order to understand how inventor gender influences the patent system. Until now this data has been unobtainable but recent gender inference work[1,2] has changed this.

In 2016 the Intellectual Property Office (UK IPO) undertook a preliminary study, taking these baseline name-gender datasets and fusing them with GB patent data. The study shows that there has been a 16% increase in the proportion of female inventors on GB patent applications in the last 10 years (see Figure 1). It goes on to compare the proportion of British female inventors against comparator countries and a technology breakdown of female inventors reveals a number of traditional associations (see Table 1). Further investigations include the proportion of female inventors working alone or as part of a team.

Following the successful trial using GB patent data, the UK IPO has built on previous gender work[3] and expanded it to include all published patents worldwide using the EPO Worldwide Patent Statistics database, PATSTAT. It is now possible, with a high degree of confidence, to infer gender from inventor name data and provide statistical analysis about the patenting activity of female inventors. This research required the use of multiple datasets from disparate sources and used data cleaning and data manipulation techniques to provide a linked dataset that could be mined to provide useful intelligence on inventor gender. The results provide quantitative data to back up anecdotal evidence about female inventors within the IP industry, providing a sound basis for future evidence-based policy within government and industry.

The work further explores the nuances in the data and addresses more qualitative issues; for example, there are significant differences in the format and quality of names of inventors from different countries across the various patent jurisdictions and so certain groups require special consideration, which are discussed in more detail.

The study shows that patent data can be a good source of evidence to use in the wider gender debate. However, it should be used in conjunction with other data sources to form a bigger picture, which the paper also begins to explore.

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[1] Tang, C. (2011) What's in a Name: A Study of Names, Gender Inference, and Gender Behavior in Facebook. *Database Systems for Advanced Applications*. 6637. p. 344-356

[2] Matias, N. (2013) Open Gender Tracking, *https://github.com/OpenGenderTracking/globalnamedata*

[3] Sugimoto, C. *et al* (2015) The Academic Advantage: Gender Disparities in Patenting. *PLOS One* 10(5): e0128000

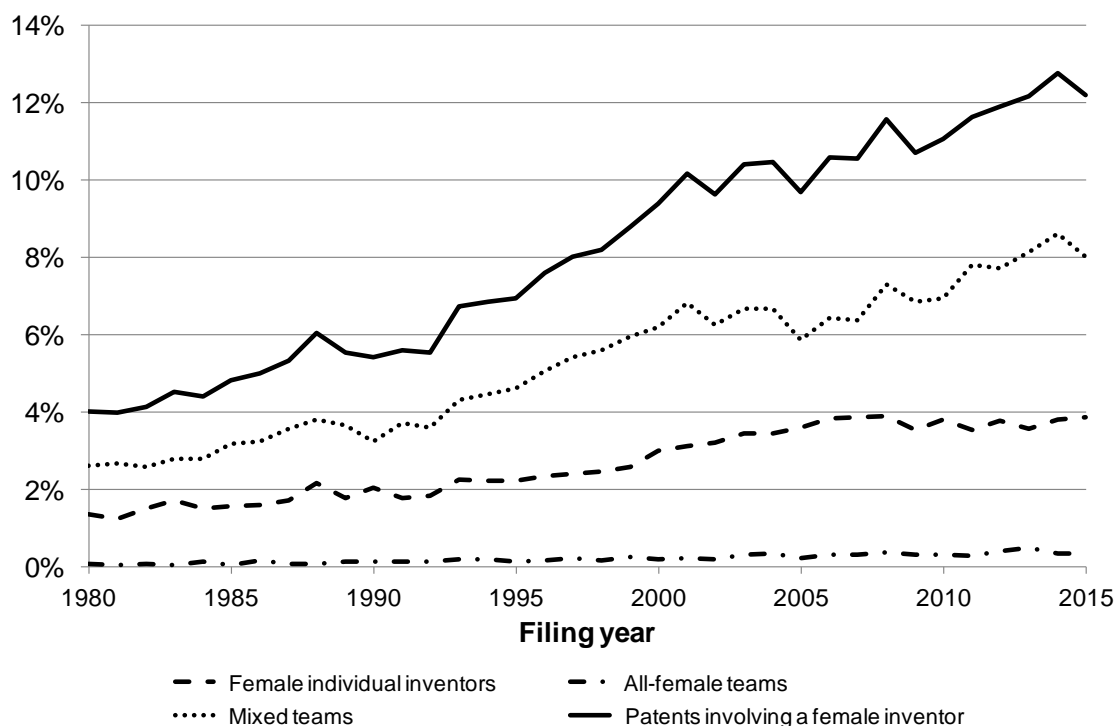Figure 1: Female inventors on GB patent applications by inventor type

Table 1: Top and bottom technology areas[4] by gender for GB patent applications 2000-2015

Technology area (top female)	Male inventors	Female inventors
Chemistry: Biotechnology	74.5%	25.5%
Chemistry: Pharmaceuticals	75.6%	24.4%
Chemistry: Organic fine chemistry	76.6%	23.4%
Chemistry: Food chemistry	80.8%	19.2%
Other fields: Other consumer goods	82.3%	17.7%
Technology area (bottom female)		
Mechanical engineering: Engines, pumps, turbines	95.9%	4.1%
Other fields: Civil engineering	96.1%	3.9%
Mechanical engineering: Machine tools	96.7%	3.3%
Mechanical engineering: Thermal processes and apparatus	96.7%	3.3%
Mechanical engineering: Mechanical elements	97.1%	2.9%

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[4] WIPO technology concordance

http://www.wipo.int/export/sites/www/ipstats/en/statistics/patents/xls/ipc_technology.xls