Women in Industrial Research

Entrepreneurs: The lifeblood of an innovative economy

The situation of women entrepreneurs

Apart from research in established companies, economies depend to a large extent upon the creativity and innovation of entrepreneurs starting new businesses. Although relatively few researchers turn into entrepreneurs, they play an important role, frequently providing cutting edge innovations, which sometimes have the potential of triggering developments of new industries. This chapter reviews the role of women entrepreneurs in industrial research, focusing in particular on information and communication technologies and biotechnology.

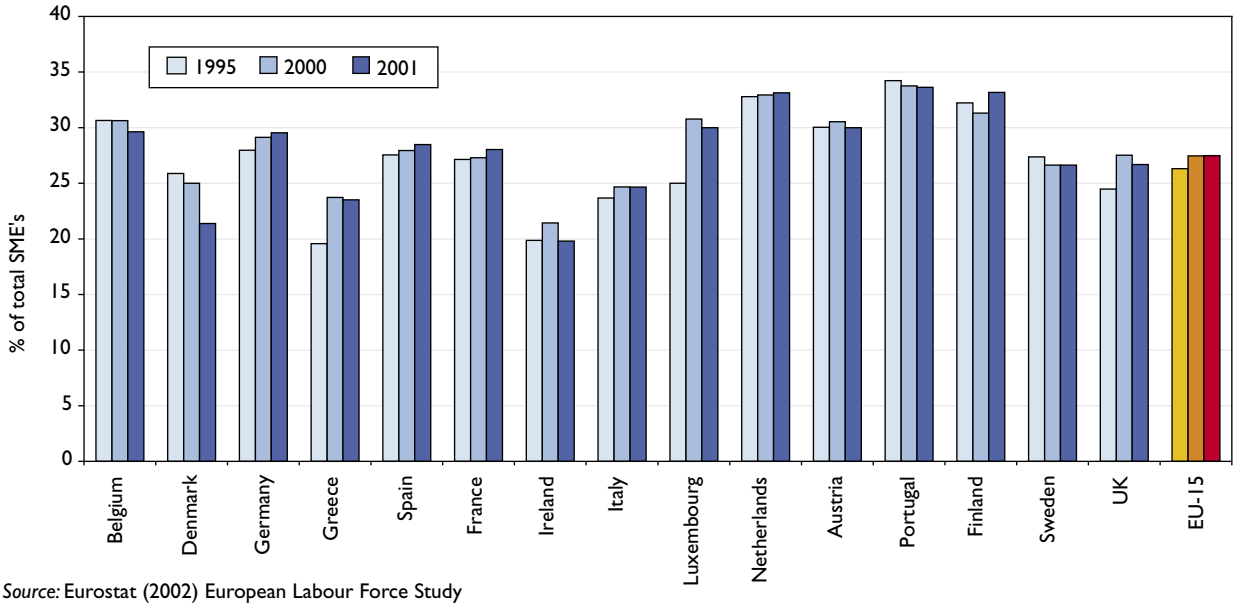
Setting the scene: an overview

The number of women who are self-employed or running their own businesses has grown substantially in the past twenty years. Although they remain a minority of business owners, ranging from 25% to 35% in most countries, their share of business ownership appears to be increasing. This share varies considerably across sector. Structural characteristics may partly explain country differences (see Figure 5.1). In Sweden, for example, women now represent 23% of all business start ups and account for around 25% of all private firms, a proportion common to many other northern European states (Nilsson, 1997). Although firms that are wholly female-owned are a minority of all enterprises, women's participation in business ownership is wider than this. Indeed, a recent study of 18,500 small and medium size enterprises (SMEs) in the UK found that 42% were co-owned by men and women. Co-ownership of businesses by a family often masks the numbers of women who are involved in SME ownership and management.

However, when compared with the US, where a fast growth has been apparent for some time, the EU lags behind in the number of women owned businesses. In 1970, women accounted for only 5% of all small businesses in the US (Brush and Hisrich, 1999); it is now estimated that there are 6.2 million privately held women-owned businesses. These firms generate $1.15 trillion in sales and employ 9.2 million workers. In the last five years, the number of women-owned firms grew at twice the rate of all US firms,

employment grew at 1.5 times the national average, and sales rose at the same rate. The growth in the number of medium-sized women-owned firms is even stronger. In the past five years, the number of 100 plus employees women-owned firms grew by 44%, and women-owned firms with a turnover of over $1 million increased in number by 32%, both nearly twice the rate of all comparably sized firms (Centre for Women's Business Research, 2002).

Figure 5.1: Proportion of female entrepreneurs in the EU Member States, 1995-2001



Source: Eurostat (2002) European Labour Force Study

Profile of women entrepreneurs

Box 5.1

'There is considerable unused potential among young women, who in many respects better meet modern requirements in engineering than those typically encountered in technological courses to date.'

Source: Karl-Heinz Minks, Department of Socio-empirical Studies on Education Choices of Students and Graduates, Higher Education Information System GmbH (HIS)

Women-owned firms in Europe can be distinguished from those owned by men in a number of ways. While men start firms across a wide variety of industries, proportionally more women than men set up businesses in the service sector. This contrasts with the US, where, although there is a concentration in services and retailing, women have broken into non-traditional sectors such as construction, wholesaling and transportation. Between 1987 and 1992, the number of women-owned businesses operating in these sectors in the US grew by 94%, 87% and 77% respectively (Brush and Hisrich, 1999). Women-owned businesses are more likely to be smaller and younger than those owned by men, and women business owners tend to be younger than their male counterparts. Women are more likely to operate one-person businesses (sole traders) while men more commonly own incorporated firms or partnership businesses. Women business owners also tend to start their businesses using personal and informal sources of finance, rather than bank credits and venture capital.

A report for the European Commission (IfGH, 2002) referred to the use of support services granted by public policy initiatives, with non-commercial, non-financial conditions. It is noted that women entrepreneurs are generally more willing (27%) to make use of such support services than are male entrepreneurs (17%). These gender differences are even stronger in the case of mature enterprises: 30% of women compared with 10% of men owning enterprises used these services. Additionally, highly educated entrepreneurs are more likely to use support services than are entrepreneurs with just elementary education.

Information and communication technologies (ICTs)

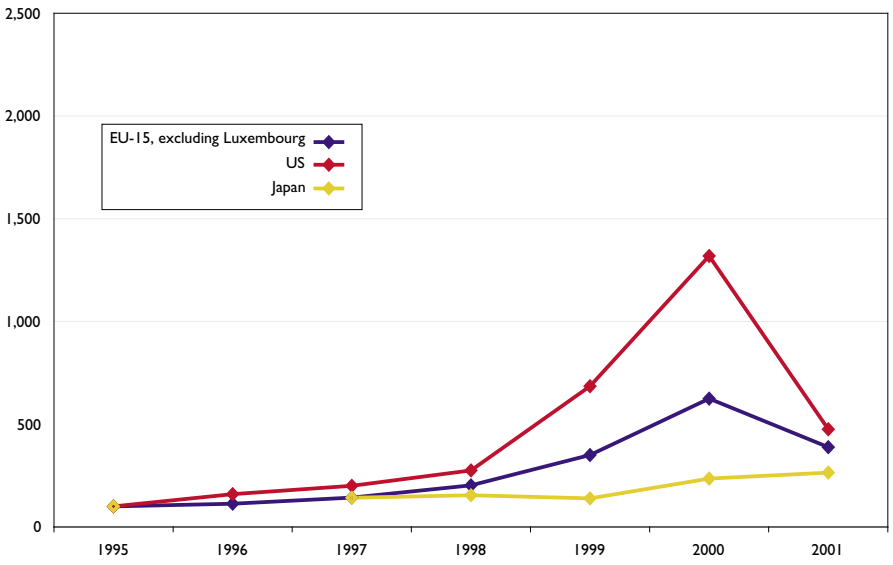
The ICT market has been identified as one of the top business and employment opportunities. However, total R&D expenditure on ICT in the US is three times higher than in Europe. Indeed:

> The EU's under-specialisation in ICT is particularly worrying, due to the underpinning role of ICT in all fields of science and technology, and its important impact on productivity gains in all sectors of the economy. (EC (11.09 2002) More Research for Europe: Towards 3% of GDP, Commission Staff Working Paper COM(2002)499 final)

ICT enterprises, especially in the software field, are still operating in immature markets. However, they offer plenty of R&D opportunities, many in areas where there is considerable expertise and qualifications among women. To mention just a few, e-learning, content and knowledge management, collaboration and workflow tools are all developing, but standards have not yet emerged. However, while ICTs have led to the start up of large numbers of internet-based companies, not all SMEs are enthusiastic about using ICTs, or, more precisely, the internet. (In the US: 61% of women business-owners report using it, about the same of men-owned enterprises). Women entrepreneurs are more likely than men entrepreneurs to find the internet beneficial for opening up a wider range of business opportunities (Centre for Women's Business Research http://www.nfwbo.org/)

Although 41% of all graduates in science, mathematics, and computing in 2000 were women (ISCED 5 and 6), in general, the level of participation of women in this sector is no better than in other high-tech areas (see Table 3.1). In 2000, 19% of those earning a Ph.D. in computing were women. An even lower percentage of women has made it either to the top or has become visible in other ways in the ICT field. Again only a hand-full, like Carly

Figure 5.2: Growth of venture capital investment* in Eu, US and Japan, 1995-2000



Source: DG Research
Data: EVCA, 1996-2002; NVCA, 2002; NISEP
Note: *Venture Capital includes investment in seed, start-up and expansion stages

Fiorina at Hewlett Packard, have made it to the top in R&D-intense large firms.

Women are under-represented when it comes to venture capital (VC) activities. They have had only a marginal participation in VC-financed start-up companies. The reasons for women not being able to take up their share of these opportunities seem to be no different than in other markets and situations. In view of the fact that these opportunities match the qualifications of women well, this is somewhat disturbing.

Biotechnology

There are a number of reasons why recent developments in the biotechnology industry might be regarded as making it an ideal niche for a good gender balance, or at least, a sector where gender discrimination might be less of a problem. For example:

- biotechnology is a natural career choice for life science students, a discipline which for some years has shown higher percentages of female than male students;
- biotechnology is a recent industry and thus free from past burdens and patterns of gender segregation.

In spite of this, an analysis of the data available to date – mainly from the US – reveals traditional patterns. The number of women in management positions is very low both in start-ups of up to 10 employees as well as in companies established over 20 years ago. An analysis of the presence of women in the 17 companies quoted on the American Stock Exchange Biotechnology Index (BTK) shows that only 16.4% (29 out of 141) of middle to top management positions are held by women. Out of the 17 companies that have most recently completed Initial Public Offerings (IPO) in the US, only 8 out of 124 company directors were women (6.5%) and there were no women board chairs.

The number of women occupying middle to senior management positions is however increasing and could serve as a pool on which to draw in the future. Nevertheless, today the presence of female entrepreneurs or even chief executive officers in biotechnology companies continues to be insignificant in Europe.

Challenges faced by women entrepreneurs

Research investigating women's experiences of starting and running businesses (generally, rather than specifically in industrial research) suggests that although their motivations are very similar to those of male entrepreneurs, many of the barriers and constraints that they experience are gender-specific (Carter and Allan, 1997). Indeed, gender differences are apparent in many aspects of entrepreneurship. When women enter self-employment, they do so with fewer financial assets, less experience in management and their enterprises tend to be under-resourced.

Women entering self-employment generally lack both hard resources (finance, assets etc) and soft resources (management experience, training etc). They experience difficulties accessing finance both for start-up and business growth. Women tend to use only one third of the starting capital that men do, irrespective of sector, and money to finance growth may be less available to women owned firms largely due to women's difficulty in gaining access to financial networks.

As a consequence of these and other factors, business ventures owned by women tend to under-perform across a variety of different business measures. Not only is it arguably more difficult for women to start in business, but their growth rates tend to lag behind those of equivalent male-owned firms. Women's businesses employ fewer staff, are less likely to grow substantially in employment (more than twenty employees) after twelve months in business, have a lower sales turnover, and are valued at a lower level than male owned businesses. Men are significantly more likely to own other businesses (19.6% compared with 8.6% for women) and also to have strong growth ambitions in so far as they want to expand their businesses 'as far as they could' (43%, compared with 34% of women) (Rosa et al, 1996).

A Danish longitudinal analysis of new enterprises started in 1994 shows, however, that in all sectors except the wholesale trade, women entrepreneurs have a higher survival rate than men entrepreneurs (Nielsen, 2002), which may mean that measuring success by growth may not always be correct.

Although there has been a great deal of research focusing on technology based SMEs and particularly those that have spun out of academic institutions and large research establishments, little account has been taken of the gender based factors associated with the **high-tech based entrepreneur**. Similarly, although there has been a great deal of research investigating women's experiences of business ownership, this has been conducted from samples

Box 5.2: The number of women in top jobs grows – at a snail's pace

Women hold 15.7% or 2,140 out of 13,673 corporate officer positions in the Fortune 500 companies. Up from 8.7%, in 1995 when Catalyst first started counting and 12.5% in 2000.

Source: Dennise Duclaux, Nov 19, 2002 (Reuters)

Box 5.3: Top five barriers to women's advancement in organisations

	% Women
Stereotypes and preconceptions of women's roles and abilities	66%
Lack of senior or visibly successful female role models	64%
Lack of significant general management or line experience	63%
Commitment to family or personal responsibilities	62%
Lack of mentoring	61%

(Per cent who strongly agree/agree)

Source: Catalyst (2002) Women in Leadership: A European Business Imperative (www.catalystwomen.org)

Box 5.4

Burkhardt & Greif (2001) analysed the participation of women in regard to patents in Germany 1995-1999 and found clear gender differences:

- The number of women participating in patent applications increased by about 60%, twice as high as the increase of the total.
- However, number of women involved remains very small: they were only involved in 7.5% of all patents and only 4.3% of all patents registered referred to women.
- While companies registered 72% of patents, universities and research institutes registered 4% and individual persons 24%. Women's participation in patents from industry is much lower than of public research.
- While 31% of all 'women patents' were in chemistry, chemistry only accounted for 11% of all patents.
- Women are more involved in group patents: only 18% of all patents involving women were registered by a women alone, by comparison 50% of patents involving men were registered by single man.

Source: Burkhardt, D. and Greif, S (2001) *Frauen im Patentgeschehen in der Bundesrepublik Deutschland*, Ergebnisbericht im Auftrag des Bundesministeriums fuer Bildung und Forschung (BMBF)

derived largely from traditionally 'female-type' sectors. Little is yet known about women starting and owning technology based ventures or those moving into entrepreneurship from an academic background in science, engineering or technology. As a special sub-group of entrepreneurs, they are likely to differ from women entrepreneurs operating in other sectors.

In particular, their pre-venture experience of the labour market will be different. Women working in science and engineering in the private sector and in academic institutions have often been found to experience lower levels of pay and remuneration. This may on the one hand reduce resources that they can take into business ownership, but may also spur them into venture start-up in order to avoid institutional inequalities.

The ability of women researchers to access institutional (bank) finance may be somewhat improved by their experience and educational background compared to women starting other businesses. However, the type of ventures that they start in many cases requires significantly more resources than start ups in the traditional sectors usually favoured by women entrepreneurs, such as retailing and low-order services. It is likely that they will require venture capital to start and sustain their business. Current estimates suggest that in the US, less than 5% of the $73 billion venture capital pool is awarded to women-owned firms.

Greene et al (1999) suggest three reasons why women experience difficulties in raising equity capital: women choose not to seek this type of external investment; women encounter structural barriers which preclude their access to equity capital; and women lack the knowledge and capabilities to obtain equity capital. In addition, it has also been argued that women choose to start their businesses in sectors or locations that do not match the preferences of external lenders (Brush et al, 2001). Women operating technology based ventures may provide capitalists with business ideas in a preferred sector, but may still have to overcome structural barriers when accessing this type of finance.

Based on existing data, it is difficult to determine causes and effects of this imbalance. When interviewed, women entrepreneurs confirm great difficulties in accessing venture capital. Venture capitalists on the other hand claim that they receive a very low number of investment requests from companies founded or headed by women. The proportion of woman-lead companies that receive venture funding is lower than the proportion of women among entrepreneurs.

What should be done?

One trend among venture investors might turn out to be conducive towards finding a solution. Venture investors are increasingly looking for management teams in the companies in which they invest. Too many negative and costly experiences have proven that time for the 'strong and lonely cowboy-type entrepreneur' is running out. The skills required by any company – and particularly a capital intensive, high-tech venture – to be successful, by far exceed the capabilities of any single person. Therefore, investors more and more often insist on a capable management team, and in many cases supplement the entrepreneur with one or two additional team members as part of the investment package.

The many arguments for the higher rate of productivity and innovation of teams with diversity, including gender diversity, which are cited elsewhere in this report, are particularly true of management teams in new ventures. This means that there is a reason to trust that venture investors will increasingly tend to point to the need for women to be members of management teams. By the same token, prejudices among venture capitalists (VCs) against women entrepreneurs might be overcome, as they also tend to be part of teams rather than stand alone propositions.

The fact that women do not seem to apply to venture funds needs to be addressed. It will be relatively easy to give women access to manuals and instructions on how to approach VCs, and such skills should be included in university based entrepreneurship programmes (in some instances, this is already the case). The inclusion of mentors in first meetings with VCs is another obvious way to overcome hesitations.

Part of the solution might be evolving within the financial sector itself. One of the areas where female professionals have achieved a relatively high penetration in most countries is within financial services. This means that quite a few of the analysts, investment bankers, investment advisors, managers within institutional investors and private equity firms, and indeed investment directors in VC firms, are now women and the number is clearly growing. It seems fair to assume that this will help provide a bridge to the disconnected.

Another positive development is the growing number of virtual networks, like 'High-TechWomen.com' and 'DigitalEve.com', together with an increasing number of websites dedicated to providing women with business advice. These activities provide evidence of women's desire to network and make the most of new technology to achieve their business objectives.

However, there is a need to catalyse the processes already in motion (in particular see paragraphs above). If the number of women entrepreneurs who receive venture funding does not soon show a dramatic increase, there needs to be an awareness-raising exercise. It should target VCs, as well as young women scientists, technologists and engineers, making them familiar with VC expectations and with the present reasons for the disadvantages they face. As Brush (1997:22) states:

> ... women are less welcome in social networks ... and are left out of some of those loops, meaning they do not have access to as much information. So social structures and the way that women socialise influence the human and social capital endowments with which they start their businesses.

There is a clear need for improved statistics and more research on women entrepreneurs in research-intensive sectors. The focus of attention should be on companies in 'high potential' sectors. The evidence we have suggests that enterprises starting off with a combination of male and female founders have an increased probability of success. Individuals and organisations involved in supporting entrepreneurs, such as venture capitalists and finance houses should be educated and trained to better understand the needs of women entrepreneurs and to be able to support them more effectively.

Box QUIN: Women Inventors in the Nordic Countries

The goals of QUIN:

- to make female innovators visible and noticeable to society
- to give female innovators contacts with other female innovators in other countries
- to encourage women to develop their creativity and realize their ideas - both social and technical ones - for the benefit of society.

Source: Maila Hakala, August 2002, http://www.quin.biz

Action points

- Throughout Europe, sex-disaggregated statistics are needed on the participation of women entrepreneurs in the high technology sectors.
- Research should be commissioned to assess the impact of women's perceived own limitations, societally imposed limitations and structural limitations imposed by framework conditions.
- Women's successes in high-tech business need to be made more visible.
- Business networks should be identified that could provide mentors and coaches to women entrepreneurs in particular.
- Grants need to be provided for science and technology graduates that allow specialised part-time, distance learning business education.
- Universities need to be encouraged to provide obligatory minimum tuition in business skills to all science and technology students at undergraduate level.
- Specialised (incubator) facilities need to be provided for undergraduate S&T students who wish to try out innovative proposals while they are still in undergraduate programmes.
- Public funds should be provided to match private sources of finance for entrepreneurs.
- Catalyse the processes already in motion.